Tres Rios North Levee

Floodplain and Floodway Re-Delineation Study

Salt and Gila Rivers, Maricopa County, Arizona

Technical Data Notebook

Volume 1 of 2

Contract Number: FCD 2010C027 Assignment #6 with Amendment #6A, and Contract Number FCD 2012C005 Assignment #1

Prepared for:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Registered Professional Engineer (Civil)
CERTIFICATE NO. 41980
BRIAN THOMAS WAHLIN
Date Signed 09-14-2012
ARIZONA, U.S.A.
Expires 3/31/2014

Prepared by:

WEST Consultants, Inc.

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September 2012

Baker

Michael Baker Jr., Inc.

2929 North Central Avenue
Suite 800
Phoenix, AZ 85012
Phone: 602-279-1234
FAX: 602-279-1411

December 4, 2012

Subject: Review and Approval of Technical Flood Study Data for the Tres Rios FDS, Contract FCD 2010C027 and FCD 2012C005

To whom it may concern,

In relation to the FEMA Region IX Grant: EMF-2009-GR-0909, Physical Map Revision (PMR)/Map Maintenance for Maricopa County, AZ., we have reviewed the data submitted in the application package (with appendices) entitled Tres Rios North Levee Floodplain and Floodway Re-Delineation Study, prepared for the Flood Control District of Maricopa County by WEST Consultants, Inc., dated September 2012. Based upon our review, it is our finding that the technical data and supporting documentation for this study should satisfactorily meet criteria set forth in FEMA's "Guidelines and Specifications for Flood Hazard Mapping Partners", 2002 and revisions. We have found that the submitted data, which will be submitted to FEMA for their review, concurrence, and acceptance, should meet the minimum floodplain management criteria of the National Flood Insurance Program (NFIP). The Preliminary Map Products and Flood Insurance Study data, being prepared by Michael Baker Jr., Inc., Phoenix, will be submitted to FEMA for their review, concurrence, and acceptance for use and incorporation into effective map products.

Sincerely,

Geoff Brownell

Geoff Brownell, P.E., CFM

Copies to:

Mr. Brian Cosson, CFM
NFIP Coordinator
Office of Dam Safety and Flood Mitigation
Arizona Department of Water Resources

Robert J. Bezek
Risk MAP Regional Engineer
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

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Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: July 12, 2012

To: Timothy S. Phillips, P.E., Chief Engineer and General Manager

From: Richard P. Harris, P.E., CFM

Subject: Tres Rios North Levee Floodplain and Floodway Re-delineations Study (FRDS), Including TDN and Maps, Contracts FCD 2010C027 and FCD 2012C005

The floodplain and floodway re-delineation study for the Tres Rios North Levee FRDS is ready for use as the best available technical information. The study documentation was transferred to Michael Baker Junior Engineering on July 3rd, 2012. This Contractor currently serves as the District's local Physical Map Revision (PMR) Contractor for technical review and finalization, before the technical data can be sent to FEMA for incorporation into the County's FIRM panels.

The background for the study includes the following:

> The study produced updated Hydrology and re-delineated approximately 5.2 linear miles of Zone AE floodplain with floodway. The topographic basis for the study was primarily 1-foot contour interval mapping with supplemental 2-foot and 4-foot contour interval mapping used in some floodway fringe areas. The study area was flown in October of 2001. The study Consultant was WEST Consultants. The project manager for the Consultant was Dr. Brian Wahlin, PhD., P.E., D.WRE. The project manager for the District was Richard P. Harris, P.E., CFM.

Please concur and authorize below the use of this new study.

Project Manager Date: 7/12/12	Timothy S. Phillips, P.E., Chief Engineer and General Manager Date: 7/23/12
	Assistant Project Manager Date:
7/19/12 Hydrology/Hydraulics Branch Manager Date:	Assistant Project Manager Date:
Floodplain Management & Services Division Manager Date: 7/23/12	Assistant Project Manager Date:
12/3/2012 Eng. Division Manager Date:	Assistant Project Manager Date:
File Copies: 1. _____ 2. _____	Yes Pending ☑ GIS Posted (Pending Floodplain Only) Date: N/A

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Tres Rios North Levee

Floodplain and Floodway Re-Delineation Study

Salt and Gila Rivers, Maricopa County, Arizona

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September 2012

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Exhibit B	Study Work Maps, 1" = 500' scale (folded full size set provided)
Exhibit C	Annotated Flood Insurance Rate Maps
Exhibit D	CD Containing Electronic Files

1 Introduction and Coordination

WEST Consultants, Inc. (WEST) has prepared this floodplain and floodway re-delineation study (FRDS) as a Physical Map Revision (PMR) request package in support of the newly constructed Tres Rios North Levee (TRNL). During this effort, WEST was assisted by the Los Angeles District of the US Army Corps of Engineers (LACOE) and the Flood Control District of Maricopa County (District). Mr. Robert Upham and Dr. Hasan Mushtaq represented the City of Phoenix, while Mr. Charles Andrews represented the City of Avondale for areas under their city's jurisdictions. WEST personnel included Dr. Brian Wahlin, Mr. Chuck Davis, Mr. Riley Asburry, and Ms. Sarah Valenta. District personnel included Mr. Richard Harris and Mr. Don Rerick. LACOE personnel included Ms. Jody Fischer, Mr. John Drake, Mr. David Pham, Mr. Paul Beaver, Mr. Van Crisostomo, Ms. Mylene Perry, Mr. Joe Goldstein, and Mr. Reuben Sasaki, among others.

This Technical Data Notebook (TDN) has been prepared according to the standards as specified in the Arizona Department of Water Resources (ADWR) State Standard SS1-97 (Arizona Department of Water Resources, 1997). Supporting technical information has been prepared as specified in Appendix C of the Federal Emergency Management Agency's (FEMA) *Guidelines and Specifications for Flood Hazard Mapping Partners* (Federal Emergency Management Agency, 2003).

The TRNL is one part of the Tres Rios Environmental Restoration Project. The term "Tres Rios" refers to the junction of three rivers in central Arizona: the Salt, Gila, and Agua Fria Rivers. Phases 1 through 4 of the Tres Rios Environmental Restoration Project are being completed jointly between the City of Phoenix and the LACOE (with support from the District). When completed, all of the project features will be maintained by these local jurisdictions.

Phase 1A and 1B: Tres Rios North Levee. This approximately 2.3-mile-long structure was built to protect homeowners and businesses on the north bank of the rivers from the Salt and Gila River flood events from approximately 105th Avenue to El Mirage Road. Phase 1A of the levee construction was completed in May 2007. Phase 1B of the levee construction was completed in June 2008.

Phase 2A: Effluent Pump Station. In order to get this water to the emergent wetlands, a 300 million gallon per day pump station was constructed within the 91st Avenue Wastewater Treatment Plant. Along with providing water to sustain the wetlands, the pump station will also ensure that the Treatment Plant can operate when water is flowing in the river.

Phase 2B: Emergent Wetlands. The full-scale Tres Rios project consists of the construction of approximately 480 acres of emergent wetlands. These wetlands will help further clean the highly-treated effluent from the 91st Avenue Wastewater Treatment Plant, provide wildlife habitat, and create a public amenity unique to this area which will include multi-use trails, picnic areas, and an environmental education center for visitors to experience the spirit of the historic river. The emergent wetlands phase was completed in December 2010.

Phase 3A, 3B, and 3C: Riparian and Open Water Features in the River. To reverse the process of salt cedar intrusion, Phase 3 will involve removing large tracts of salt cedar and replanting native cottonwood/willow riparian corridors.

Phase 4: South Side Projects. Phase 4 comprises of well water distribution systems, conveyance channels, riparian corridors and open water marsh on the south side of the Salt River.

This study focuses on the effects of Phases 1A and 1B of the Tres Rios North Levee along the Salt and Gila Rivers. The Salt River flows from east to west in the upper portion of the project reach. It is then joined by the Gila River, and the lower portion of the project reach maintains the name of the Gila River. This segment of the Gila River is also known as the Lower Gila River with respect to the overall watercourse alignment. Phases 1A and 1B consist of a new Tres Rios North Levee and the modified existing Holly Acres Levee along the north bank of the Salt-Lower Gila River system that begins at approximately the 105th Avenue alignment and extends to El Mirage Road (123rd Avenue). The entire project area consists of the river north bank between 91st Avenue and approximately El Mirage Road, with the area between 91st Avenue and the 107th Avenue alignment being comprised of constructed wetlands for environmental restoration. The hydraulic study limits are approximately 1,500 feet downstream from 83rd Avenue along the Salt River extending downstream to approximately 2,000 feet downstream of the El Mirage Road crossing of the Salt River. The project is within the Salt and Gila Rivers 100-year regulatory floodplain with over 65 percent of the constructed levee encroaching into the FEMA defined floodway as shown on the Flood Insurance Rate Map (FIRM) panels published September 30, 2005. A vicinity map showing the route of the levee embankment, the location of the existing bridge in the study reach, and the location of the primary constructed wetlands feature (that has been graded as of November 2010) is shown in Figure 1-1.

The purpose of this study is to re-delineate approximately 5.2 linear miles of the 100-year floodplain and floodway of the Salt and Gila Rivers with the constructed Tres Rios North Levee and related features in place for submittal to FEMA through a PMR request package. One complicating factor in this study is that there are other floodplains on the land side of the Tres Rios North Levee resulting from other flooding sources. These other floodplains are from the Buckeye Feeder Canal (BFC) and the Sunland Avenue Tributary (SAT) flooding sources. It should be noted that these flooding sources do not drain directly to the area adjacent to the TRNL; therefore, these flooding sources are not considered within the interior drainage analysis for the TRNL. Instead, these were treated as entirely separate flooding sources that are now being mapped due to the removal of the Salt/Gila floodplain on the landward side of the levee. The BFC and SAT floodplains were mapped as part of Dibble Engineering's (Dibble) floodplain delineation studies performed for the Durango Area Drainage Master Plan (ADMP); this work was performed for the District under contract FCD 99-41 (Dibble, 2004). The floodplains from the BFC and SAT will remain in place once the floodplains from the Salt/Gila River have been removed from behind the levee. No new work was done on either the BFC or SAT floodplains. However, the BFC and SAT floodplains are shown on the work maps and annotated FIRM panels because they represent a change in flood zone categorization.

The hydrologic data (100-year event discharge) for this project were obtained from the LACOE report titled *Section 7 Study for Modified Roosevelt Dam, Arizona: Hydrologic Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam* (U.S. Army Corps of Engineers, 1996). The Maricopa County Flood Insurance Study (FIS) dated September 30, 2005 (Federal Emegency Management Agency, 2005) also relies on the LACOE Section 7 Report (U.S. Army Corps of Engineers, 1996) for its hydrologic data. However, there is a slight discrepancy between the flows reported in the Section 7 Report (U.S. Army Corps of Engineers, 1996) and the FIS (Federal Emegency Management

Agency, 2005) as explained in detail in Section 4. Water surface elevations in the upstream and downstream model limits were tied-in to those in the HEC-RAS model developed by Michael Baker (Michael Baker, Jr., Inc., 1999) for the District (contract FCD 92-01, completed 1999). The Baker model is currently the basis for the effective FIS data for the Salt/Gila River system in the vicinity of the Tres Rios North Levee.

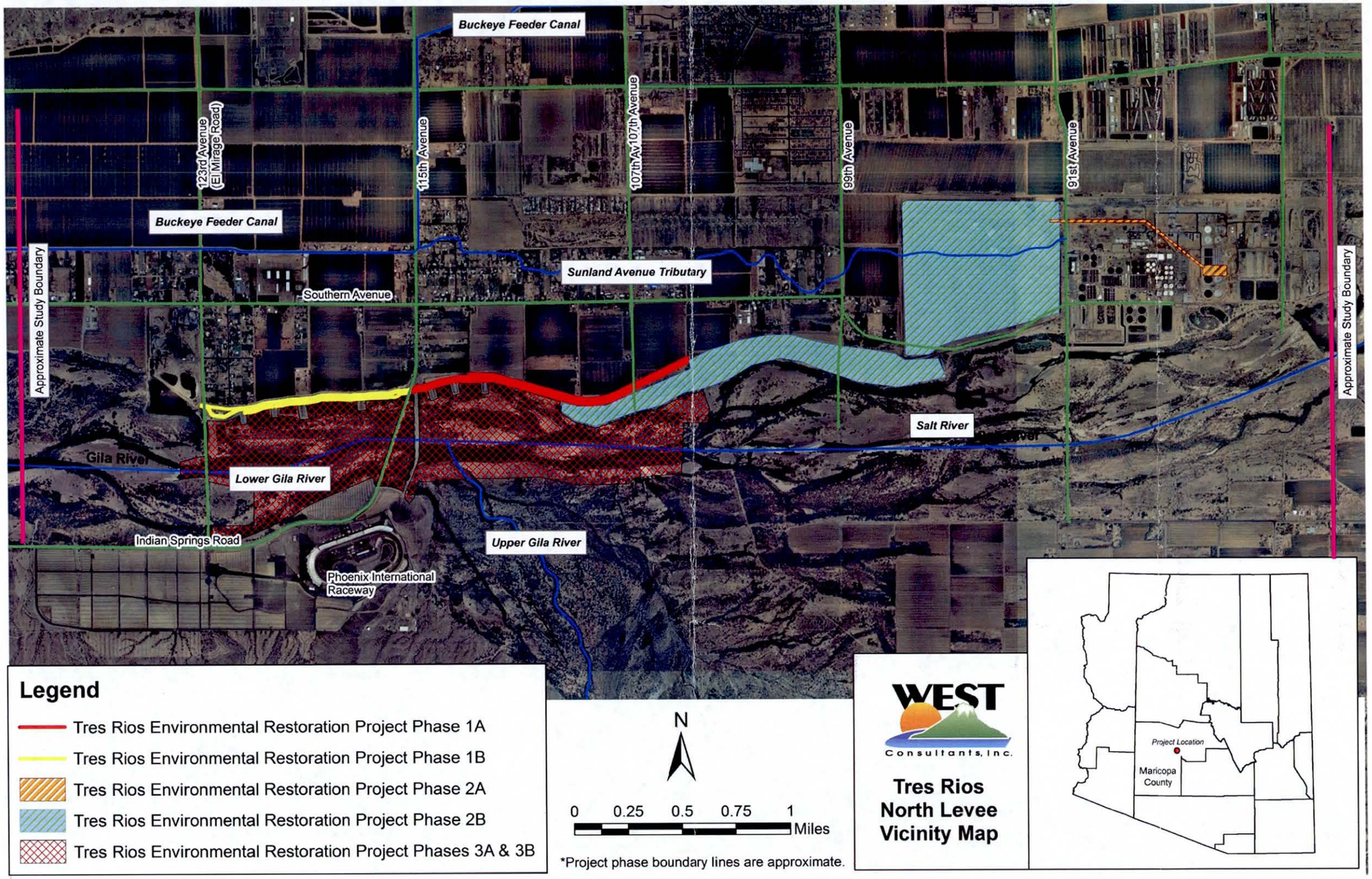

Figure 1-1. Project Location Map

2 ADWR/FEMA Forms

2.1 Study Documentation Abstracts for FEMA Submittals

Information related to Sections 2.1.1 through 2.1.10 of the Arizona State Standard Attachment SS1-97 (Arizona Department of Water Resources, 1997) is included following this page.

2.2 FEMA Forms

FEMA MT-2 forms are not required for a PMR request.

Study Documentation Abstract for FEMA Submittals	Initial Study		Restudy		CLOMR		LOMR		Other	X

2.1.1	Date Study Accepted	TBD
2.1.2	Study Contractor Contact(s) Address Phone Internal Reference Number	WEST Consultants, Inc. Brian Wahlin, Ph.D., P.E., D.WRE 8950 S. 52nd Street, Suite 210 Tempe, Arizona 85284 (480) 345-2155 FCDM001013
2.1.3	CTP Technical Review Contractor Contact(s) Address Phone Internal Reference Number	Michael Baker, Jr., Inc. Teri George, P.E., CFM, PMP 2929 N. Central Ave, Suite 800 Phoenix, AZ 85012 (602) 294-2257
2.1.4	FEMA Regional Reviewer Phone	Robert Bezek (510) 627-7274
2.1.5	State Technical Reviewer Phone	Arizona Department of Water Resources (602) 417-2400
2.1.6	Local Technical Reviewer Phone	Richard Harris, P.E., CFM Flood Control District of Maricopa County (602) 506-4528
2.1.7	Reach Description	Salt/Gila Rivers - FIRM Panels 2070G, 2090H, 2095F, 2115G, and 2555F Buckeye Feeder Canal - FIRM Panels 2090H and 2095F Sunland Avenue Tributary - FIRM Panel 2095F
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	N/A
2.1.9	Unique Conditions and Problems	Levee certification
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)	Utilized 1996 LACOE hydrology report for peak discharges. This is the same hydrology used for the FIS. Details on the hydrology can be found in Section 4.

3 Surveying and Mapping Information

The final topography used for this study was developed using four different topographic data sources (see Figure 3-1). These sources are summarized below:

1. The main parts of the Salt/Gila Rivers upstream of El Mirage Road were mapped using 1-foot contour interval topography developed in 2001 by Towill, Inc. for the LACOE.
2. The main Salt/Gila River channel and the overbanks downstream of El Mirage Road were mapped using 2-foot contour interval topography developed in 2008 for the District's Gillespie ADMS.
3. The north overbanks of the Salt/Gila River on the landward side of the TRNL were mapped using 2-foot contour interval topography developed in 1994 as part of the District's Maryvale ADMS (Wood, Patel and Associates, 1997).
4. The rest of the overbank areas were mapped using 4-foot contour interval topography developed in 1991 as part of Baker's effective FIS study (Michael Baker, Jr., Inc., 1999).

Each of these data sources has been reviewed in terms of national mapping accuracy standards. As will be shown following this section, they all are sufficient for this type of study individually, and the final merged product is sufficient for this type of study as well.

3.1 Field Survey Information

Primary data regarding the field survey information was delivered by the LACOE. Supporting documentation for the survey data can be found in Tres Rios North Levee Design Documentation Report (DDR), an electronic copy of which can be found in the electronic data for Appendix G.2 on disc in Exhibit D of this document. The survey data for the 116th Avenue Bridge (also called the 115th Avenue Bridge or the Avondale Boulevard Bridge) was provided in HEC-RAS format by the LACOE. An electronic copy of the as-built plans for this bridge can be found in the electronic data for Appendix E.4 on disc in Exhibit D of this document.

The 2-foot contour interval topography used in the right overbanks on the landward side of the TRNL was collected in 1994 as part of the Maryvale ADMS (Wood, Patel and Associates, 1997). This was prior to the time that the District required Root Mean Square Error (RMSE) values to be calculated and delivered with a mapping product. Therefore, to verify that the 1994 topography was still valid, District survey personnel conducted a mapping check on March 20, 2012 using a Trimble R8 and 5800 Rover with AZGPS virtual reference base station. Profiles were collected along the major roads and various random points collected in the adjacent fields and streets. The total sampling involved 64 points with 36 being in the roadways and 28 randomly selected locations on the natural ground. The RMSE between the newly collected data and the 1994 topography is ± 0.43 feet in the vertical. This RMSE value is below the maximum accepted RMSE value for 2-foot contour mapping (i.e., 0.6 feet). Supporting documentation for this field survey can be found in Appendix C.1.

3.2 Mapping

In the main channel area of the Salt/Gila River, topography was developed as 1-foot contour interval mapping using photogrammetric methods based on aerial photography collected by Towill, Inc. on behalf of the LACOE on October 23, 2001. The vertical datum of this mapping was the National Geodetic Vertical Datum of 1929 (NGVD29), and the horizontal datum of this mapping was the North American Datum of 1983 (NAD83) projected in Arizona State Plane Central Zone coordinates. The LACOE specified that all mapping, hydraulic analysis, and delineation be performed in the NGVD29 datum to match the design documentation for the TRNL. It should be noted that this topographic data source, and all other ones used in this study, have horizontal projections using a High Accuracy Reference Network (HARN). A certification statement for the 1-foot contour interval topography collected by Towill and provided by the LACOE for use in the development of hydraulic models and mapping of the hydraulic modeling results for the main Salt/Gila River channel is located in Appendix C.1.

The most recent topography dataset utilized for this study was developed by the District in 2008 and covers the area downstream of El Mirage Road (i.e., to the west of El Mirage Road). This topography is referred to as the Gillespie mapping and was developed for the District by Sanborn Mapping Company as part of the Gillespie ADMS (District contract FCD 2009C039). Documentation for the Gillespie mapping was provided by the District. The corresponding RMSE for the Gillespie mapping product in this area is ± 0.49 feet in the vertical. This RMSE value is below the maximum accepted RMSE value for 2-foot contour mapping (i.e., 0.6 feet). Supporting documentation for the Gillespie mapping can be found in Appendix C.1. The Gillespie mapping was developed as 2-foot contour interval mapping using photogrammetric methods based on aerial photography collected in June and July of 2008. The horizontal datum of this mapping was NAD83 projected in Arizona State Plane Central Zone coordinates. The vertical datum of this topography was the North American Vertical Datum of 1988 (NAVD88); the conversion factor used to adjust this data back into the NGVD29 datum for hydraulic modeling and mapping was -2.10 feet (i.e., elevation data referencing the NAVD88 datum were decreased by 2.10 feet to develop the corresponding NGVD29 elevation data). This shift value was developed using the VERTCON program; more information regarding the development of this single shift value can be found in an email dated 06/17/2011 between WEST and the LACOE in Appendix C.1 of this document.

The 4-foot contour interval topography used in the remaining overbank areas not covered by the previously discussed topography products was developed as part of the currently effective Flood Insurance Study (FIS) for FEMA in 1999 (Michael Baker, Jr., Inc., 1999). This topography has already been accepted by FEMA as it was used for the effective FIS HEC-RAS model (Michael Baker, Jr., Inc., 1999). The vertical datum of the effective study is the NGVD29 according to the published flood insurance profiles for the Salt and Gila Rivers (Federal Emegency Management Agency, 2005). This 4-foot contour interval topographic mapping was developed using photogrammetric methods based on aerial photography collected by Baker in 1991 and 1992. The horizontal datum of this mapping was the NAD83 projected in Arizona State Plane Central Zone coordinates.

As part of the Durango Area Drainage Master Study (ADMS), hydraulic models were created for the both the BFC and SAT using a 2-foot contour-interval topography dataset (Dibble, 2004). This 2-foot topography was collected by Wood, Patel and Associates beginning in March of 1994 as part of the Maryvale ADMS (District contract FCD 93-29, completed 1997). The horizontal datum of this mapping

was the NAD83 and the vertical datum referenced was NGVD29. This topography was verified using field survey techniques as part of the study herein, as discussed in Section 3.1 above.

As discussed above, several mapping products were merged together in order to have complete topographic coverage for the area of inundation for this study. For hydraulic modeling of the study reach upstream of El Mirage Road, the 2001 1-foot contour interval topography was used in the main channel. The 1991-1992 4-foot contour interval topography was used in the left overbank area and the 1994 2-foot contour interval topography was used in the right overbank area for the model upstream of El Mirage Road. Downstream of El Mirage Road, the 2008 2-foot contour interval topography was used for both the main channel and the overbanks. As previously described, a single topographic data set was created by merging the various sources of topography. A Triangulated Irregular Network (TIN) was generated from the merged datasets in ArcGIS v. 9.3.1 (Environmental Systems Research Institute, 2009). The TIN was used to cut channel cross-sections for the hydraulic model using the HEC-GeoRAS v. 4.3.93 extension (U.S. Army Corps of Engineers, 2011) of ArcGIS. It should be noted that no flooding extent for the 1% annual chance flood was mapped on the 1991 4-foot contour interval mapping; it was all contained in the newer topography north of the 4-foot contour interval mapping that was used in the final TIN. Therefore, the need to review this topographic data source is not necessary. WEST included the 4-foot contour interval mapping in the TIN for future analysis in case larger flood events were to be modeled and subsequently mapped with the model and TIN developed herein.

Data regarding the mapping information have been delivered by the LACOE and the District. The merged topographic mapping product including all four of these topographic data sources that was used to delineate the final floodplains for this study has been delivered to the District. The extents of the various topographic data sets are shown in Figure 3-1.

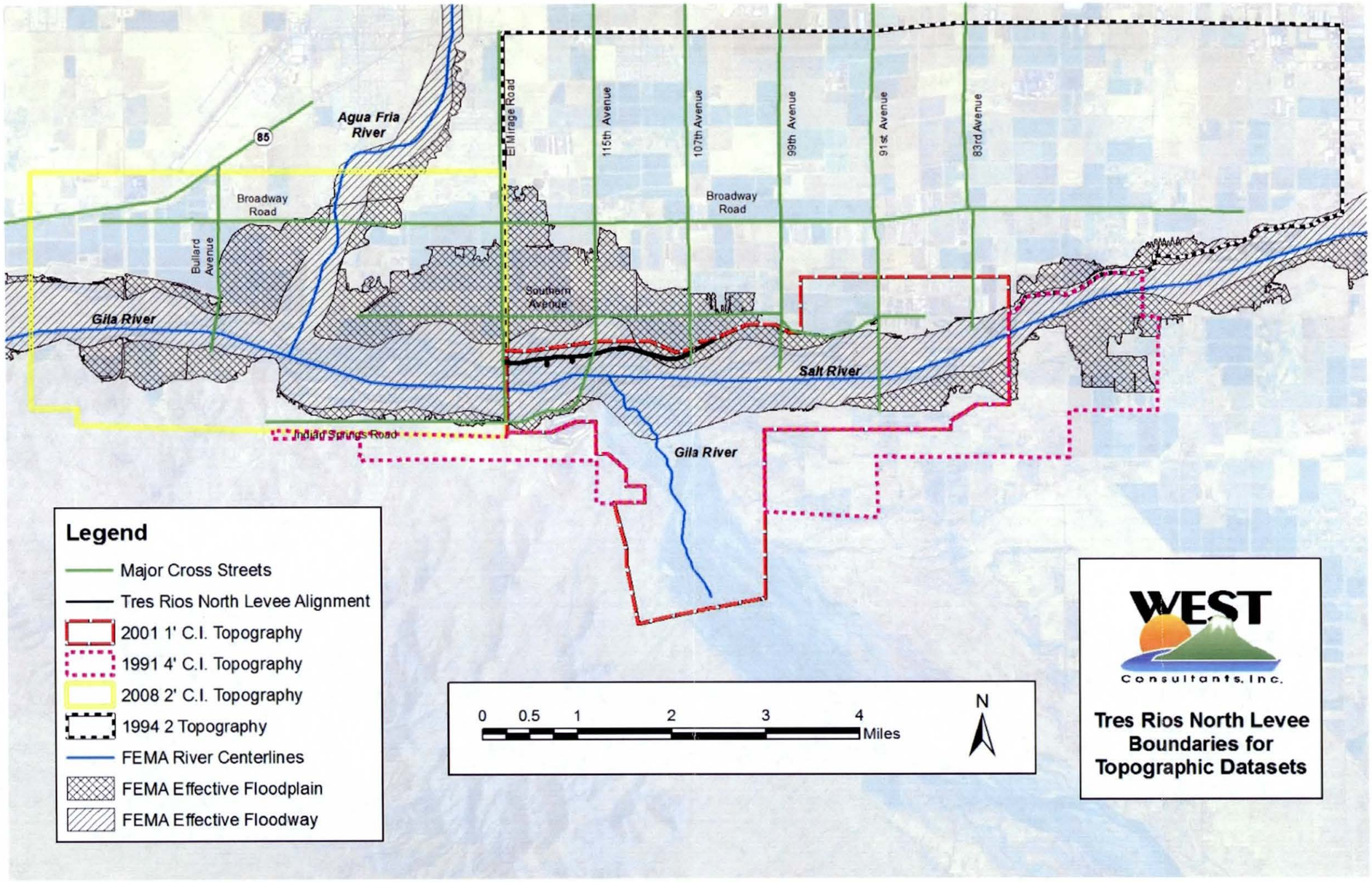

Figure 3-1. Extents of the Topographic Datasets Used for the Study

4 Hydrology

This study does not propose any significant changes to the FIS discharges through the study reach. However, a slight discrepancy was found between published discharge values as discussed below.

The current FEMA regulatory 100-year discharge for the Salt River study reach immediately above the confluence with the Gila River is 164,000 cfs with a drainage area of 12,962 square miles (Federal Emegency Management Agency, 2005). The current FEMA regulatory 100-year discharge for the Gila River study reach below the Salt River confluence is 227,000 cfs with a total drainage area of 42,900 square miles (i.e., including the drainage areas of the Gila and Salt Rivers). The Gila River upstream of the Salt River confluence drains approximately 29,200 square miles. Of this 42,900 square miles, approximately 60% of the drainage area (25,400 square miles) has regulated and controlled runoff, primarily due to the operation of Roosevelt Dam on the Salt River and Coolidge Dam on the Gila River (US Army Corps of Engineers, 2012).

The current FIS hydrology for the Salt/Gila hydraulic model is based on Baker's analysis of the 100-year flood for the Salt and Gila Rivers (Michael Baker, Jr., Inc., 1999), which relies on an older LACOE report titled *Section 7 Study for Modified Roosevelt Dam, Arizona: Hydrologic Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam* as the basis for the hydrology (U.S. Army Corps of Engineers, 1996). The pages of this report outlining the flow changes in the study reach can be found in Appendix D.6, and an electronic copy of this report in its entirety can be found in the electronic data for Appendix D.6 on disc in Exhibit D. Table 4-1 lists the 100-year discharges at flow change locations under the current effective and the proposed pre-project and post-project conditions. As can be seen from this table, the flows are equivalent for both the proposed pre-project and post-project conditions. After carefully reviewing the LACOE hydrology report (U.S. Army Corps of Engineers, 1996) and the documentation for the current FIS study data (Michael Baker, Jr., Inc., 1999), it was discovered that the Salt River flows reported in the FIS do not account for an additional flow change reported in the LACOE hydrology report (U.S. Army Corps of Engineers, 1996). In the current FIS study, the flow in the Salt River is 164,000 cfs at 67th Avenue, and the flow does not change again until increasing to 227,000 cfs below the confluence with the Gila River. However, the LACOE report lists another flow change downstream of 67th Avenue from 164,000 to 162,000 cfs; the location of this flow change is titled "above confluence with Gila River." Therefore, the proposed 100-year flow for the Salt River from the upstream end of the model herein (approximately the 83rd Avenue alignment) to the confluence with the Gila River, as reported by the LACOE (U.S. Army Corps of Engineers, 1996) and based on input from LACOE personnel, is 162,000 cfs. The current FIS study documentation (Michael Baker, Jr., Inc., 1999) discusses this additional flow change in the LACOE report (U.S. Army Corps of Engineers, 1996) and the reasons it was decided during the original study not to use the additional flow change for the effective model. However, based on conversation with FEMA Region IX staff (specifically, Bob Bezek), FEMA agrees with the LACOE interpretation of this flow change and will support the proposed change to the effective discharge for the Salt River from the upstream end of the study reach herein to the confluence of the Gila River from 164,000 cfs to 162,000 cfs. Correspondence supporting this decision can be found in Appendix B.4 of this TDN (an email dated 05/07/012). Additionally, a copy of Table 2 from the report used as basis for the proposed hydrology change (U.S. Army Corps of Engineers, 1996) showing the final flow changes suggested by the LACOE has been provided in Appendix D.6 of this TDN, and an

electronic version of the entire report has been provided in the electronic data for Appendix D.6 on disc in Exhibit D.

Table 4-1. 100-Year Discharges Used in the Main Channel of the Hydraulic Model for the Salt/Gila River

Flow Change Location (HEC-RAS Cross-Section ID Number)	Current Effective Discharge in the Study Reach (cfs)	Proposed Pre-Project and Post-Project FIS Discharge (cfs)
203.08 (River: Salt, Reach: Salt)	164,000	162,000
199.44 (River: Gila, Reach: Lower Gila)	227,000	227,000

5 Hydraulics

5.1 Method Description

Several hydraulic models for the TRNL project area are provided for the Salt/Gila River and include the effect of the TRNL in containing Salt/Gila River flows from inundating the floodplain north of the TRNL. The following is a brief description of the hydraulic models mentioned in this report and submitted for the Salt/Gila River flooding source:

1. Effective Model: The hydraulic engineering model that was used to produce the current effective Flood Insurance Study.

2. Duplicate Effective Model: A copy of the hydraulic analysis used in the effective FIS and run in the latest version of HEC-RAS (v. 4.1.0).

3. Corrected Effective Model: A hydraulic engineering model that corrects any errors that occur in the Duplicate Effective Model, adds any additional cross sections to the Duplicate Effective Model, or incorporates more detailed topographic information than that used in the current Effective Model.

4. Pre-Project Conditions Model: A modification of the Duplicate Effective Model or Corrected Effective Model to reflect any man made modifications that have occurred within the floodplain since the date of the effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective Model or Duplicate Effective Model.

5. Post-project Conditions Model: A modification of the Existing or Pre-Project Conditions Model, Duplicate Effective Model or Corrected Effective Model to reflect revised or post-project conditions.

5.1.1 Effective Models

The effective flood insurance model of the Salt and Gila Rivers is based on four HEC-RAS (v. 2.1) models, each consisting of a reach of the river either with or without "levees" included (Michael Baker, Jr., Inc., 1999). These "levees" reflect non-certifiable roadway embankments in the reach that act as levees, and the models analyze hydraulic conditions in the reach either with those embankments in place or assuming the embankment washes out during a flood. The original HEC-RAS files have the names Reach2, Reach3, R2wlevee, and R3wlevee. The most upstream reach with the 91st Avenue crossing was found in the second reach, labeled as Reach3. The downstream portion of the study reach herein (i.e., downstream of El Mirage Road) was found in the first reach, labeled as Reach 2. All four of the effective models can be found in the electronic data for Appendix E.5 on disc located in Exhibit D. The 100-year water surface elevations obtained from the effective Salt/Gila River model in the vicinity of the levee system can be seen in Table 5-1.

5.1.2 Duplicate Effective Models

The effective Salt/Gila River model was imported into HEC-RAS v. 4.1.0 and re-run. The current study spans Reaches 2 and 3 from the effective Salt/Gila River study. There were minimal differences between the water surface profiles calculated using the effective models and the duplicate effective models for the Salt/Gila flooding source as shown in Table 5-1.

5.1.3 Corrected Effective Models

The Corrected Effective Model for the Salt/Gila River was developed from the hydraulic model created as part of the Pre-construction Engineering and Design (PED) for the Tres Rios North Levee (WEST Consultants, Inc., 2004). This model was originally used to evaluate design alternatives for the TRNL. The LACOE specified that all mapping, hydraulic analysis (including all HEC-RAS models), and delineation be performed in the NGVD29 datum to match the design documentation for the TRNL. The PED model used updated topography from 2001 in the main channel and the 1991 effective topography in the overbanks. The cross-sections locations were updated in the PED model compared to the effective model, and other modeling parameters were updated as well including roughness values and bridge information. Modifications to the roughness values for the Corrected Effective Model were done as part of the Phase 3 of the Tres Rios Environmental Restoration Project (JE Fuller Hydrology and Geomorphology, Inc., 2010). Further modifications of these roughness values were then made by HNTB (HNTB, December 15, 2010). The end result from these modeling efforts was what was termed by the LACOE as the "Phase 3 pre-project conditions" model, which corresponds to the post-project conditions model for this study (i.e., including the levee and all attendant features). WEST further modified the Phase 3 pre-project conditions model to develop the Corrected Effective Model representing the study reach prior to the construction and finalization of the TRNL. Modeling tasks to accomplish this included:

1. Updating the topography to include the Gillespie topography as well as the Maryvale topography;
2. Removing the levee and attendant features that had been included in the geometry of the "Phase 3 pre-project conditions model" to represent the conditions before construction of the TRNL; and
3. Trimming the model to correspond to the tie-in locations for the effective floodplain on the Salt/Gila River (note that the upstream river station is 203.08 and the downstream river station is 197.92).

The Corrected Effective Model of the Salt/Gila River was reviewed and approved by the LACOE.

5.1.4 Pre-Project Conditions Models

The Pre-Project Conditions Models for the Salt/Gila River is the same as the Corrected Effective Model.

5.1.5 Post-Project Conditions Models

Two Post-Project Conditions Models were created for the Salt/Gila River. Both of these models started with the Pre-Project Conditions Model (i.e., Corrected Effective Model) and added the features of the TRNL. The as-built geometry of the levee and attendant features were added to the HEC-RAS geometry by altering the station/elevation records of the ground points on a cross-section by cross-section basis by

the LACOE. Additionally, the levee elevations using the 'levee feature' of HEC-RAS were defined by the LACOE as well. It should be noted that the levee elevations defined in the final post-project model appear to be below the top of the constructed as-built features reflected in the station/elevation records of the cross-section ground points for all cross-sections that include the levee feature. This was done by the LACOE to reflect the lowest point along the top of the levee not including any riprap height above the earthen mass of the embankment; the lowest point for this levee feature corresponds to the break in slope from the riverward levee face to the top of the embankment. The top of the levee was built with a 2% slope from the landward edge of the top of the levee embankment down to the riverward edge of the top of the levee embankment. By defining the levee height below the top of the constructed features, the LACOE was able to account for additional possible erosion processes that could affect levee freeboard during a flood event, such as wave action eroding some amount of the top of the levee. WEST also corrected the levee heights to agree with the as-built drawings provided by the LACOE for the small portion of the levee near El Mirage Road that was raised in March 2012 (see technical memorandum in Appendix B.4 dated 05/18/2012). Finally, it should be noted that the LACOE provided a signed letter on July 11, 2012, stating that the model provided by WEST to the LACOE on February 20, 2012, had been fully reviewed and approved by the LACOE towards FEMA mapping (see a copy of this letter in Appendix B.4 dated 07/11/2012). This approval date of 02/20/12 postdates all major revisions to the model made by WEST after receiving the model from the LACOE, including downstream reach length adjustment and station renaming to agree with the FEMA baseline stationing, removal of the Upper Gila River reach, and all edits to cross-section lengths (i.e., extensions or reductions to cross-section length).

The first Post-Project Conditions Model (Model 1) also includes the Overbank Wetlands (OBW) features. Water shown to the north of the OBW embankment in Model 1 was treated as ineffective flow area. The second Post-Project Conditions Model (Model 2) does not include the OBW features. The Post-Project Conditions Model 2 was created because FEMA requires that the embankment for the overbank wetlands be removed from the model because the OBW embankment is not being certified as a levee, and with it in place, could have possibly removed a portion of the floodplain from the mapped inundation area. A worst-case floodplain boundary scenario therefore involves modeling the area both as-constructed and as-failed (in some cases as-failed can be defined as embankment overtopping and not embankment removal, depending on flooding conditions). In this study, the models including and not including the OBW embankment showed almost no difference in water surface elevation (WSEL), with a maximum difference at a cross section less than +/- 0.2 feet. The differences in WSEL at these cross-sections showed no discernible difference in horizontal inundation extents at the scale of the 1" = 200' work maps. For example, the cross-section showing the maximum difference in WSEL between the two plans was RS 202.43 which showed a WSEL increase of 0.17 feet for the plan with the OBW compared to the without OBW plan. This vertical difference of 0.17 feet in WSEL at RS 202.43 showed a difference in horizontal inundation extent of 0.27 feet in the right overbank. These very minimal differences led to the use of only the with OBW plan (Model 1) as the final hydraulic model for floodplain mapping and FIS data development. Results for the without OBW model (Model 2) are included in the tables in Section 5 of this TDN for information purposes, but results from Model 2 are not included in the FIS data of Section 7.

Table 5-1 shows the 100-year water surface elevations for five different models for the Salt/Gila River referencing the NGVD29 vertical datum; Table 5-2 shows the same results referencing the NAVD88 vertical datum. Plots of the annotated flood profiles showing the post-project conditions water surface elevations are shown in the Exhibits Section at the end of this TDN.

Table 5-1. Water Surface Elevations for the Various Salt/Gila River Models (NGVD29 datum)

Cross-Section (RM)	Equivalent FIS Section*	FIS XS Shift	Effective Model (ft)	Duplicate Effective Model (ft)	Pre-Project Conditions Model (ft)	Post-Project Conditions Model 1 (ft)	Post–Project Conditions Model 2 (No OBW) (ft)
202.94	H	190 ft downstream	971.5	971.5	971.25	971.18	971.25
202.49	G	115 ft upstream	967.66	967.66	967.55	967.26	967.55
201.96	F	125 ft downstream	963.29	963.29	962.24	962.19	962.24
201.5	E	65 ft downstream	960.42	960.42	959.05	959.05	959.05
201.06	D	95 ft upstream	956.58	956.58	954.35	954.35	954.37
200.56	C	60 ft downstream	954.05	954.05	950.76	950.83	950.81
200.07	B	105 ft downstream	950.82	950.82	947.82	947.78	947.87
199.83	A	90 ft upstream	949.63	949.63	946.72	946.72	946.75
199.36	BO	140 ft upstream	945.29	945.29	943.18	942.95	943.05
198.83	BN	80 ft downstream	940.74	940.74	939.32	939.29	939.29
198.48	BM	less than 10 feet	939.53	939.53	937.51	937.68	937.68
198.20	BL	less than 10 feet	936.54	936.54	934.95	934.95	934.95

*Note: The horizontal alignment of the pre-project cross-sections and the equivalent FIS cross-sections may differ by as much as 190 feet

Table 5-2. Water Surface Elevations for the Various Salt/Gila River Models (NAVD88 datum)

Cross-Section (RM)	Equivalent FIS Section*	FIS XS Shift	Effective Model (ft)	Duplicate Effective Model (ft)	Pre-Project Conditions Model (ft)	Post-Project Conditions Model 1 (ft)	Post–Project Conditions Model 2 (No OBW) (ft)
202.94	H	190 ft downstream	973.6	973.6	973.35	973.28	973.35
202.49	G	115 ft upstream	969.76	969.76	969.65	969.36	969.65
201.96	F	125 ft downstream	965.39	965.39	964.34	964.29	964.34
201.5	E	65 ft downstream	962.52	962.52	961.15	961.15	961.15
201.06	D	95 ft upstream	958.68	958.68	956.45	956.45	956.47
200.56	C	60 ft downstream	956.15	956.15	952.86	952.93	952.91
200.07	B	105 ft downstream	952.92	952.92	949.92	949.88	949.97
199.83	A	90 ft upstream	951.73	951.73	948.82	948.82	948.85
199.36	BO	140 ft upstream	947.39	947.39	945.28	945.05	945.15
198.83	BN	80 ft downstream	942.84	942.84	941.42	941.39	941.39
198.48	BM	less than 10 feet	941.63	941.63	939.61	939.78	939.78
198.20	BL	less than 10 feet	938.64	938.64	937.05	937.05	937.05

*Note: The horizontal alignment of the pre-project cross-sections and the equivalent FIS cross-sections may differ by as much as 190 feet

5.2 Work Study Maps

Topographic work study maps were developed at a scale of 1" = 200' to provide sufficient detail of the revised Zone AE Floodplain and Floodway mapping along the Salt/Gila River. Contour mapping depicted on the work study maps is based upon the combined topography described in Section 3. It should be noted that the HEC-RAS geometry for the post-project conditions model varies from the contour mapping as it appears on the work study sheets in the area of the TRNL and attendant features (including the OBW) due to the inclusion of the as-built features of the TRNL and attendant features into the HEC-RAS model by the LACOE.

Due to the long lateral extents of the model cross-sectional cut lines along the Salt/Gila River reach, it was not feasible to capture the entire extents of those cut lines using the 1" = 200' scale maps. Therefore, smaller-scale and less detailed work study maps were developed at 1" = 500' for flood-boundary scaling from cross-section endpoints (see the Exhibits Section of this TDN).

Additional work study maps were developed to show the effective Zone AE and Zone A mapping for BFC and SAT completed by Dibble (2004) and others (FEMA Case No. 04-09-0933P, and FEMA Case No. 10-09-0146P). The effective mapping for the BFC and SAT was not modified as part of this study and are thereby noted by these FEMA case numbers. These floodplains will emerge once the Salt/Gila floodplain is removed from behind the TRNL.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients (Pre-Project and Post-Project Conditions)

The roughness coefficients for the Pre-Project Conditions Model of the Salt/Gila River were developed during Phase 3 of the Tres Rios Environmental Restoration Project [(JE Fuller Hydrology and Geomorphology, Inc., 2010) and (HNTB, December 15, 2010)]. Roughness coefficients represent the resistance to flow in channels and overbank areas. HEC-RAS accounts for this roughness by use of the Manning's *n*-value (*n*-value). The *n*-value is determined from the values of the factors that affect the roughness, such as vegetation type and density, bed material, and channel irregularities. The following resources were used to assign *n*-values to land-use areas applicable to pre-project conditions: aerial photographs, site photographs, and previous reports (JE Fuller Hydrology and Geomorphology, Inc., 2010). In addition, it was assumed that a reduction in flow resistance would occur as flow depth increased. Therefore, the HEC-RAS "Vertical Variation in Manning's *n*-Values" option was utilized based on a change in flow rate (JE Fuller Hydrology and Geomorphology, Inc., 2010). Finally, the original roughness values assigned in the HEC-RAS model initially (JE Fuller Hydrology and Geomorphology, Inc., 2010) were later modified to better correlate to other hydraulic analyses in the study reach (HNTB, December 15, 2010). The report that discusses the initial assignment of roughness coefficients for the study reach as defined by JE Fuller Hydrology and Geomorphology, Inc. (2010) can be found on the electronic data deliverable disc accompanying this TDN in Appendix E.5. Hard copies of the technical memorandum provided by HNTB (December 15, 2010) can be found in Appendix E.5 of this TDN. This study did not modify the final Manning's roughness coefficients used for the "Phase 3 pre-project conditions" model delivered by the LACOE. It should also be noted that the letter provided by the LACOE approving the updated model provided by WEST to the LACOE on February 20, 2012, included approval of the final Manning's n values used in the model (see a copy of this letter in Appendix B.4 dated 07/11/2012).

5.3.2 Expansion and Contraction Coefficients

Expansion coefficients for the Salt/Gila River are set at 0.3 while contraction coefficients are set at 0.1 to account for normal variations in the channel flow hydraulics. Because flow through 115th Avenue Bridge openings is not subject to significant contraction and expansion, the contraction and expansion coefficients for cross-sections immediately upstream of the two bridge crossings were set at the HEC-RAS default values of 0.1 and 0.3, respectively (JE Fuller Hydrology and Geomorphology, Inc., 2010). This study did not modify the final expansion and contraction coefficients used for the "Phase 3 pre-project conditions" model delivered by the LACOE.

5.4 Cross-Section Descriptions

The cross-sections for the Salt/Gila River were set up as part of the PED project (WEST Consultants, Inc., 2004). The cross-sections were arranged perpendicular to the flow and are spaced between 100 and 800 feet apart, which is appropriate given the hydraulic conditions of the reach. Cross-section descriptions in the HEC-RAS model indicate those cross-sections that incorporated as-built information in the development of the cross-section geometry.

5.5 Modeling Considerations

This section discusses various modeling considerations as per the Arizona Department of Water Resources State Standard SS1-97 (Arizona Department of Water Resources, 1997). Additionally, this section provides a discussion of the downstream boundary conditions for the model. The Salt/Gila River model utilizes a known water surface elevation at the downstream tie-in location of RS 197.92 of 933.52 feet, the water surface elevation from the FEMA effective data at this cross-section (NGVD 29 datum). Note that this water surface elevation was obtained from linearly interpolating between two effective cross-sections. It should be noted that the horizontal tie-in of the floodplain for the lowermost cross-section along the Salt/Gila River model required artificial widening in the left overbank on the order of hundreds of feet beyond the containment of the water surface elevation by the final topographic product used herein for mapping purposes. This type of inconsistency in horizontal extents is due to the differences in topographical mapping products between the effective and the proposed delineations, with the effective mapping being based on 4-foot contour interval topography while the proposed mapping is based on 1-foot contour interval topography with assumed better accuracy than the effective study. Additionally, artificial widening of the floodplain at the tie-in location provides a conservative measure of floodplain mapping methodology. The full PED model was trimmed at the upstream end at RS 203.08 based on agreement of the calculated water surface elevation at this location and the effective flood profile within 0.5 foot. The floodway profile for the Salt/Gila model utilized a known water surface elevation for the downstream boundary condition as well; a value of 934.52 feet (exactly 1.0' higher than the base profile boundary condition) was used for the floodway profile downstream boundary condition.

Note that the original study for the Tres Rios PED (WEST Consultants, Inc., 2004) was performed using NGVD 29 datum. The LACOE continued using this datum throughout the levee design process and all of the as-built drawings are in NGVD 29. As such, the decision was made by the District to continuing

using NGVD 29 as the datum for the hydraulic modeling to maintain a consistent vertical datum throughout all aspects of the TRNL project. For convenience, many of the results have been converted to NAVD 88 in various tables throughout this report.

5.5.1 Hydraulic Jump and Drop Analysis

None identified.

5.5.2 Bridges and Culverts

One bridge crossing is present in the Post-Project Conditions Model: the 115th Avenue Bridge downstream of the confluence of the Salt and Gila Rivers (note that the 115th Avenue Bridge is sometimes referred to as the 116th Avenue Bridge or the Avondale Boulevard Bridge). In addition, several paved low-flow roadway crossings with small pipe culverts that are nearly at grade lie within the study reach. Considering their low profiles with respect to the relatively large FIS discharges, they are considered insignificant to the hydraulic analysis results and were therefore not included in the hydraulic model. However, these low water crossings are still labeled on the work maps.

Information on the 115th Avenue Bridge is provided in Table 5-3. Table 5-4 shows the freeboard for the proposed 100-year water surface profile at the 115th Avenue Bridge under the post-project conditions model referencing the NGVD29 datum; Table 5-5 shows the freeboard for the proposed 100-year water surface profile at the 115th Avenue Bridge under the post-project conditions model referencing the NAVD88 datum. The 115th Avenue Bridge was entered into the HEC-RAS model using the as-built plans as part of the original PED study for the LACOE (WEST Consultants, Inc., 2004). As-built plans for the 115th Avenue Bridge are located in the electronic data for Appendix E.4 on disc in Exhibit D.

Table 5-3. Bridge Data for the Salt/Gila River

Bridge ID	Roadway	Structure No.	Bridge Type	Agency
115th Avenue Bridge	115th Avenue (Avondale Blvd)	10163	Steel Girder	MCDOT

Table 5-4. Freeboard for the 115th Avenue Bridge under 100-year Non-Encroached Flow Conditions (NGVD29)

Cross-Section (RM)	Description	Water Surface Elevation (ft)	Low Chord Bridge Elevation (ft)	Freeboard (ft)
199.19	115th Avenue Bridge, upstream face	941.92	948.24 (lowest low chord elevation)	6.32
			966.28 (highest low chord elevation)	24.36

Table 5-5. Freeboard for the 115th Avenue Bridge under 100-year Non-Encroached Flow Conditions (NAVD88)

Cross-Section (RM)	Description	Water Surface Elevation (ft)	Low Chord Bridge Elevation (ft)	Freeboard (ft)
199.19	115th Avenue Bridge, upstream face	944.02	950.34 (lowest low chord elevation)	6.32
			968.38 (highest low chord elevation)	24.36

5.5.3 Levees and Dikes

The primary feature of the TRNL is the levee embankment along the north bank of the Salt/Gila River. The LACOE provided documentation regarding the as-built features of the TRNL and attendant features in the Design Documentation Report (DDR) for the Tres Rios North Levee (US Army Corps of Engineers, 2012). Documentation included in the DDR that will meet the requirements of the FEMA levee certification process includes engineering design and as-built drawings, geotechnical analysis, interior drainage analysis and design, seepage prevention, and other pertinent information. These primary items are discussed in greater detail below.

Levee freeboard design (i.e., distance from the computed water surface elevations in the HEC-RAS model to the top of the coarse aggregate base cap on the riverward edge of the levee crest) for the TRNL was set based on risk and uncertainty analysis completed to ensure the required combination of freeboard and assurance were met. U.S. Army Corps of Engineers' Flood Damage Reduction Analysis software, HEC-FDA, was used to obtain necessary freeboard for the proposed levee at a minimum 95% reliability level (i.e., a non-exceedance probability of 0.95) for levee overtopping. Stage uncertainty was computed using the methodology described in *Risk-based Analysis for Flood Damage Reduction Studies*, EM 1110-2-1619 (U.S. Army Corps of Engineers, 1996). More detailed information for the freeboard risk and uncertainty calculations (i.e., the risk and uncertainty Analysis) is given in the DDR for the Tres Rios North Levee (US Army Corps of Engineers, 2012). A copy of the DDR is located in Appendix G.2. Refer to Section 3.4 of the DDR for additional detail regarding the risk and uncertainty analysis. While there are short reaches of the levee where the freeboard is less than 3 feet, the successful risk and uncertainty analysis allows for removal of the mapped flood hazard area due to the Gila River on the landward side of the levee (see Title 44 Code of Federal Regulations Section 65.10 for details regarding required freeboard and related analyses). The final freeboard values are discussed in the DDR document (US Army Corps of Engineers, 2012) which can be found in Appendix G.2 of this report.

For all of the bank protection along the levee, the toe-down elevations of the bank protection were designed to withstand scour from the 100-year event. These toe-down depths varied throughout the length of the levee alignment as indicated in the DDR (US Army Corps of Engineers, 2012) which can be found in Appendix G.2 of this report.

An embankment stability analysis was performed by the LACOE. Their analysis indicates that the proposed embankment slopes are globally stable. Other analyses for the levee structure included a seepage analysis and a settlement analysis. A copy of the geotechnical report including all of these analyses is provided as an appendix to the DDR (US Army Corps of Engineers, 2012). The DDR can be found in Appendix G.2 of this report.

An interior drainage study was performed from the landward side of the levee, and the interior drainage analysis can be found as an appendix to the DDR (US Army Corps of Engineers, 2012). The results of this analysis identified possible flooding conditions on the landward side of the levee due to local runoff that would otherwise pass directly to the Salt/Gila River but would be prevented from so doing by the construction of the TRNL. This analysis provided the information required to design several interior drainage features to prevent these flooding conditions due to the construction of the levee. These features are summarized in the following list:

- Two catch basins to store the local runoff volume of the interior drainage areas, one located at 115th Avenue and the other at El Mirage Road;
- Collector channels, four of which direct water into the catch basins and one which is located on the west side of the overbank wetlands area upstream of the levee embankment and directs flows south directly into the Salt/Gila River; and
- Two outlet culverts (one per catch basin) sized to pass the design peak discharge from the catch basin's associated drainage area and fitted with a flap gate to prevent additional flooding on the landward side of the levee from water in the Salt/Gila River during high stage.

More detailed information regarding the location, sizing, and final design of the interior drainage features can be found in the DDR (US Army Corps of Engineers, 2012). A copy of the DDR can be found in Appendix G.2 of this report.

5.5.4 Islands and Split Flows

None identified.

5.5.5 Ineffective Flow Areas and Blocked Obstructions

Ineffective flow areas (IFA) in the HEC-RAS model for the Salt/Gila River were set at the regime bank stations to elevations high enough such that the 5-year discharge was completely contained within the channel, but low enough to allow the 20-year discharge to flow uncontained (WEST Consultants, Inc., 2004). Additional IFAs for higher return interval flows were defined outside of the regime bank stations using the blocked ineffective flow area setting of HEC-RAS. These additional ineffective flow limits along the north bank were developed based on the 100-year event. IFAs were also added in the Upper Gila River portion of the Salt/Gila River confluence. IFAs were used to model the area behind the 115th Avenue roadway embankment near the Phoenix International Raceway (see Section 5.7.1 for details). All cross-sections were inspected for ineffective flow areas. A maximum of 4:1 expansion was maintained in

developing these areas, where necessary. The ineffective flow heights were vertically raised enough to contain high flows. It should be noted that some cross-section plots show ineffective flow areas that are not mapped within the final floodplain boundaries because there is no significant flow-connectivity along such areas for any considerable length.

The finger dikes protruding perpendicular from the TRNL were modeled using blocked obstructions in HEC-RAS.

5.5.6 Supercritical Flow

Subcritical flow regime was used in HEC-RAS for the Salt/Gila River. No supercritical condition was considered with regards to ADWR modeling standards.

5.6 Floodway Modeling

The original floodway boundary for the Salt/Gila River was determined as part of the effective study (Michael Baker, Jr., Inc., 1999) so that the encroached water surface elevations would not be more than one foot higher than the un-encroached elevations, per FEMA regulations. For this study's Post-Project Conditions Model of the Salt/Gila River, the effective floodway encroachments were kept the same wherever possible. In places where the effective floodway went behind the TRNL, the floodway stationing was moved to align with the TRNL. Downstream of the TRNL, the floodway was smoothed for a uniform transition between the end of the levee and the effective floodway. The increase in the encroached post-project conditions water surface elevations compared to the pre-project conditions was less than or equal to one foot everywhere in the project reach. There are a few cross-sections where the computed floodway water surface profile dips slightly below the unencroached flood profile (i.e., there is a negative surcharge condition). However, efforts were made to keep the new floodway coincident with the effective floodway. Thus, eliminating these small negative surcharges was not possible. In addition, these negative surcharges become zero when rounded to the nearest tenth. A summary of the floodplain and floodway water surface elevations for the various models at the location of the effective cross-sections referecing the NGVD29 vertical datum is provided in Table 5-6, and a summary of the floodplain and floodway water surface elevations for the various models at the location of the effective cross-sections referencing the NAVD88 vertical datum is provided in Table 5-7. A summary of the floodway water surface profiles for the various models for all the cross-sections referencing the NGVD29 vertical datum is provided in Table 5-8, and a summary of the floodway water surface profiles for the various models for all the cross-sections referencing the NAVD88 vertical datum is provided in Table 5-9.

Affected landowners will be notified regarding the proposed floodway changes per FEMA requirements. As a result of the PMR processing method of study data, most of the notification for changes in Base Flood Elevations (BFE) is expected to be done by FEMA. Copies of public notice(s) required to announce the study and proposal to change the floodway are provided in Appendix B.6.

Table 5-6. Summary of Floodway (Encroached) Water Surface Profiles for the Salt/Gila River with Direct Comparisons to the Effective Encroached Profile (NGVD29)

Cross-Section (RM)	Pre-Project Conditions Model (ft)	Post-Project Conditions Model (ft)	Effective (FIS) Encroached Profile (ft)	Encroached Pre-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Minus Base Flood Post-Project (ft)	Allowable Encroached rise (ft)
202.94	971.25	971.18	971.87	971.54	971.49	0.3	1.0
202.49	967.55	967.26	967.77	967.65	967.45	0.2	1.0
201.96	962.24	962.19	963.38	962.24	962.18	0.0	1.0
201.50	959.05	959.05	960.53	959.06	959.05	0.0	1.0
201.06	954.35	954.35	956.74	954.4	954.37	0.0	1.0
200.56	950.76	950.83	954.23	950.95	950.93	0.1	1.0
200.07	947.82	947.78	951.11	947.9	947.82	0.0	1.0
199.83	946.72	946.72	949.90	946.8	946.75	0.0	1.0
199.36	943.18	942.95	945.66	943.31	943.07	0.1	1.0
198.83	939.32	939.29	941.57	939.41	939.39	0.1	1.0
198.48	937.51	937.68	940.35	937.67	937.86	0.2	1.0
198.20	934.95	934.95	937.36	934.93	935.45	0.5	1.0

Table 5-7. Summary of Floodway (Encroached) Water Surface Profiles for the Salt/Gila River with Direct Comparisons to the Effective Encroached Profile (NAVD88)

Cross-Section (RM)	Pre-Project Conditions Model (ft)	Post-Project Conditions Model (ft)	Effective (FIS) Encroached Profile (ft)	Encroached Pre-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Minus Base Flood Post-Project (ft)	Allowable Encroached rise (ft)
202.94	973.35	973.28	973.97	973.64	973.59	0.3	1.0
202.49	969.65	969.36	969.87	969.75	969.55	0.2	1.0
201.96	964.34	964.29	965.48	964.34	964.28	0.0	1.0
201.50	961.15	961.15	962.63	961.16	961.15	0.0	1.0
201.06	956.45	956.45	958.84	956.5	956.47	0.0	1.0
200.56	952.86	952.93	956.33	953.05	953.03	0.1	1.0
200.07	949.92	949.88	953.21	950	949.92	0.0	1.0
199.83	948.82	948.82	952	948.9	948.85	0.0	1.0
199.36	945.28	945.05	947.76	945.41	945.17	0.1	1.0
198.83	941.42	941.39	943.67	941.51	941.49	0.1	1.0
198.48	939.61	939.78	942.45	939.77	939.96	0.2	1.0
198.20	937.05	937.05	939.46	937.03	937.55	0.5	1.0

Table 5-8. Summary of Floodway (Encroached) Water Surface Profiles for the Entire Post-Project Salt/Gila River Model (NGVD29)

Cross-Section (RM)	Post-Project Conditions Model (ft)	Encroached Post-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Minus Base Flood Post-Project (ft)	Allowable Encroached rise (ft)
203.08	972.33	972.77	0.44	1.0
202.94	971.18	971.49	0.31	1.0
202.82	970.2	970.55	0.35	1.0
202.75	969.42	969.79	0.37	1.0
202.65	968.54	968.98	0.44	1.0
202.57	967.8	968.06	0.26	1.0
202.49	967.26	967.45	0.19	1.0
202.43	966.68	966.82	0.14	1.0
202.35	965.86	965.96	0.1	1.0
202.26	965.29	965.24	-0.05	1.0
202.19	964.5	964.52	0.02	1.0
202.12	963.81	963.83	0.02	1.0
202.06	963.1	963.11	0.01	1.0
202.01	962.75	962.75	0	1.0
201.96	962.19	962.18	-0.01	1.0
201.91	961.6	961.61	0.01	1.0
201.84	961.38	961.39	0.01	1.0
201.77	961.07	961.07	0	1.0
201.66	960.2	960.23	0.03	1.0
201.58	959.81	959.78	-0.03	1.0
201.50	959.05	959.05	0	1.0
201.44	958.39	958.39	0	1.0
201.37	957.67	957.67	0	1.0
201.29	956.5	956.51	0.01	1.0
201.22	955.53	955.54	0.01	1.0
201.16	955	955.02	0.02	1.0
201.12	954.77	954.79	0.02	1.0
201.06	954.35	954.37	0.02	1.0
200.97	953.56	953.6	0.04	1.0
200.91	953.03	953.07	0.04	1.0
200.84	952.59	952.63	0.04	1.0
200.79	952.27	952.33	0.06	1.0
200.71	951.75	951.82	0.07	1.0
200.64	951.35	951.43	0.08	1.0
200.56	950.83	950.93	0.1	1.0
200.48	950.39	950.49	0.1	1.0
200.43	950.13	950.26	0.13	1.0

Table 5–8. Summary of Floodway (Encroached) Water Surface Profiles for the Entire Post-Project Salt/Gila River Model (NGVD29) (cont'd.)

Cross-Section (RM)	Post-Project Conditions Model (ft)	Encroached Post-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Minus Base Flood Post-Project (ft)	Allowable Encroached rise (ft)
200.36	949.78	949.91	0.13	1.0
200.27	949.31	949.36	0.05	1.0
200.18	948.55	948.62	0.07	1.0
200.07	947.78	947.82	0.04	1.0
199.98	947.42	947.4	-0.02	1.0
199.94	947.25	947.25	0	1.0
199.83	946.72	946.75	0.03	1.0
199.66	945.48	945.53	0.05	1.0
199.52	944.41	944.49	0.08	1.0
199.44	943.93	944.03	0.1	1.0
199.36	942.95	943.07	0.12	1.0
199.29	942.6	942.73	0.13	1.0
199.20	942.3	942.45	0.15	1.0
199.16	941.56	941.59	0.03	1.0
199.09	940.88	940.93	0.05	1.0
199.02	940.25	940.33	0.08	1.0
198.98	939.92	940	0.08	1.0
198.95	939.7	939.79	0.09	1.0
198.93	939.6	939.7	0.1	1.0
198.88	939.49	939.59	0.1	1.0
198.83	939.29	939.39	0.1	1.0
198.78	939.03	939.14	0.11	1.0
198.75	938.89	939.01	0.12	1.0
198.70	938.73	938.85	0.12	1.0
198.64	938.53	938.66	0.13	1.0
198.59	938.21	938.36	0.15	1.0
198.54	938.02	938.17	0.15	1.0
198.48	937.68	937.86	0.18	1.0
198.43	937.47	937.66	0.19	1.0
198.38	936.88	937.11	0.23	1.0
198.34	936.21	936.52	0.31	1.0
198.27	935.6	935.99	0.39	1.0
198.20	934.95	935.45	0.5	1.0
198.14	934.58	935.15	0.57	1.0
198.09	934.28	934.92	0.64	1.0
198.02	933.83	934.57	0.74	1.0
197.97	933.65	934.44	0.79	1.0
197.92	933.52	934.34	0.82	1.0

Table 5-9. Summary of Floodway (Encroached) Water Surface Profiles for the Entire Post-Project Salt/Gila River Model (NAVD88)

Cross-Section (RM)	Post-Project Conditions Model (ft)	Encroached Post-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Minus Base Flood Post-Project (ft)	Allowable Encroached rise (ft)
203.08	974.43	974.87	0.44	1.0
202.94	973.28	973.59	0.31	1.0
202.82	972.3	972.65	0.35	1.0
202.75	971.52	971.89	0.37	1.0
202.65	970.64	971.08	0.44	1.0
202.57	969.9	970.16	0.26	1.0
202.49	969.36	969.55	0.19	1.0
202.43	968.78	968.92	0.14	1.0
202.35	967.96	968.06	0.1	1.0
202.26	967.39	967.34	-0.05	1.0
202.19	966.6	966.62	0.02	1.0
202.12	965.91	965.93	0.02	1.0
202.06	965.2	965.21	0.01	1.0
202.01	964.85	964.85	0	1.0
201.96	964.29	964.28	-0.01	1.0
201.91	963.7	963.71	0.01	1.0
201.84	963.48	963.49	0.01	1.0
201.77	963.17	963.17	0	1.0
201.66	962.3	962.33	0.03	1.0
201.58	961.91	961.88	-0.03	1.0
201.50	961.15	961.15	0	1.0
201.44	960.49	960.49	0	1.0
201.37	959.77	959.77	0	1.0
201.29	958.6	958.61	0.01	1.0
201.22	957.63	957.64	0.01	1.0
201.16	957.1	957.12	0.02	1.0
201.12	956.87	956.89	0.02	1.0
201.06	956.45	956.47	0.02	1.0
200.97	955.66	955.7	0.04	1.0
200.91	955.13	955.17	0.04	1.0
200.84	954.69	954.73	0.04	1.0
200.79	954.37	954.43	0.06	1.0
200.71	953.85	953.92	0.07	1.0
200.64	953.45	953.53	0.08	1.0
200.56	952.93	953.03	0.1	1.0
200.48	952.49	952.59	0.1	1.0
200.43	952.23	952.36	0.13	1.0

Table 5–9. Summary of Floodway (Encroached) Water Surface Profiles for the Entire Post-Project Salt/Gila River Model (NAVD88) (cont'd.)

Cross-Section (RM)	Post-Project Conditions Model (ft)	Encroached Post-Project Conditions (with proposed floodway) (ft)	Encroached Post-Project Minus Base Flood Post-Project (ft)	Allowable Encroached rise (ft)
200.36	949.78	949.91	0.13	1.0
200.27	949.31	949.36	0.05	1.0
200.18	948.55	948.62	0.07	1.0
200.07	947.78	947.82	0.04	1.0
199.98	947.42	947.4	-0.02	1.0
199.94	947.25	947.25	0	1.0
199.83	946.72	946.75	0.03	1.0
199.66	945.48	945.53	0.05	1.0
199.52	944.41	944.49	0.08	1.0
199.44	943.93	944.03	0.1	1.0
199.36	942.95	943.07	0.12	1.0
199.29	942.6	942.73	0.13	1.0
199.20	942.3	942.45	0.15	1.0
199.16	941.56	941.59	0.03	1.0
199.09	940.88	940.93	0.05	1.0
199.02	940.25	940.33	0.08	1.0
198.98	939.92	940	0.08	1.0
198.95	939.7	939.79	0.09	1.0
198.93	939.6	939.7	0.1	1.0
198.88	939.49	939.59	0.1	1.0
198.83	939.29	939.39	0.1	1.0
198.78	939.03	939.14	0.11	1.0
198.75	938.89	939.01	0.12	1.0
198.70	938.73	938.85	0.12	1.0
198.64	938.53	938.66	0.13	1.0
198.59	938.21	938.36	0.15	1.0
198.54	938.02	938.17	0.15	1.0
198.48	937.68	937.86	0.18	1.0
198.43	937.47	937.66	0.19	1.0
198.38	936.88	937.11	0.23	1.0
198.34	936.21	936.52	0.31	1.0
198.27	935.6	935.99	0.39	1.0
198.20	934.95	935.45	0.5	1.0
198.14	934.58	935.15	0.57	1.0
198.09	934.28	934.92	0.64	1.0
198.02	933.83	934.57	0.74	1.0
197.97	933.65	934.44	0.79	1.0
197.92	933.52	934.34	0.82	1.0

5.7 Problems Encountered During the Study

5.7.1 Special Problems and Solutions

Approximately 650 feet south of the southern abutment of the 115th Avenue Bridge along the centerline of the roadway, a large, non-valved flow inlet/outlet structure exists in the 115th Avenue roadway embankment that provides pedestrian access from auxiliary parking for the Phoenix International Raceway (PIR) on the north (riverward) side of the roadway embankment to the main racetrack on the south side of the roadway embankment. Were it not for this non-valved, non-regulated flow inlet/outlet structure, the 100-year floodplain would be contained by the roadway embankment, and a with and without embankment analysis would have been required to determine the mapping conditions for the FEMA floodplain in the vicinity of the PIR racetrack. However, due to the existence of this structure, flow can freely pass through the embankment during a flooding event occurring in the Salt/Gila. As such, the water surface extents behind the ineffective flow areas defined south of the roadway embankment in this area were mapped as proposed floodplain, since the flow in this area will be truly ineffective, but flooding can still occur in this area freely.

Also, there appears to be a slight modification to the BFC floodplain immediately east of El Mirage Road when compared to the Dibble study (Dibble, 2004). However, this apparent modification to the BFC floodplain is not a modification to any of the BFC technical data; instead it is a modification to the flooding inundation in that area due to the impacts of the Gila River overtopping El Mirage Road north of Southern Avenue. This occurs due to the assumption that the floodplain expands to its full width immediately downstream of El Mirage Road, and the water surface elevation of the cross section immediately downstream of El Mirage Road for the Salt/Gila HEC-RAS model is slightly higher than a dip in El Mirage Road north of Southern Avenue (this dip is coincident to the location where the BFC floodplain crosses El Mirage Road flowing to the west). The figure below shows this exercise of mapping the inundation area for a constant water surface elevation of 935.60 feet (NGVD29), coincident to the base flood elevation of cross section 198.27 in the Salt/Gila HEC-RAS model. Figure 5-1 below shows the proposed mapping extents of the BFC as defined in the Dibble study (Dibble, 2004) with a black line. The extents of the flat backwater profile of 935.60 feet (NGVD29) mapped across El Mirage Road from the Salt/Gila flooding source is shown with a red line. The higher of the two flooding depths between the flat backwater of the Salt/Gila mapping exercise or the BFC modeling results were chosen at all locations, and this analysis lead to the final inundation extents mapped and delivered with this package. The area shown within the red lines but outside of the black lines in Figure 5-1 accounts for the inundation area that appears to have been modified from the BFC mapping completed by Dibble (2004). However, this is not a modification to the BFC boundary; it is actually the result of a mapping exercise from the Salt/Gila flooding source.

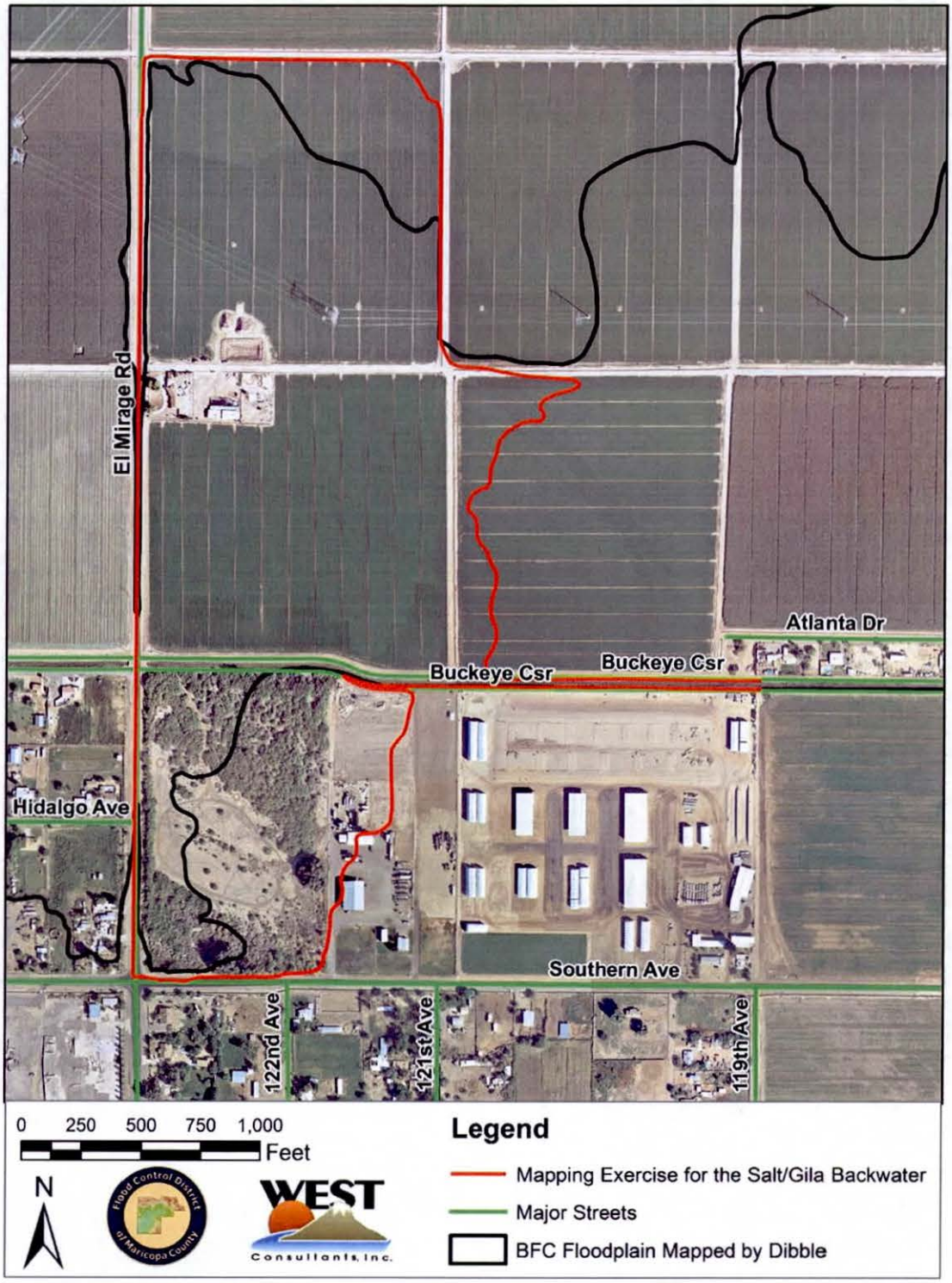

Figure 5-1. Final Floodplain Mapping for the Salt/Gila and the BFC East of El Mirage Road and North of Southern Avenue

5.7.2 Modeling Warning and Error Messages

This section discusses the results of the CHECKRAS program for the Salt/Gila model.

The CHECKRAS results for the Salt/Gila model and explanations of these messages are discussed below:

- Structure Check
  - In the "INEFFECTIVE FLOW CHECK" section of the structure report, the following errors were reported:
    - "ST IF 05" was reported 4 times (twice at RS 199.2 and twice at RS 199.16, the two cross-sections upstream and downstream of the 115th Avenue Bridge over the Gila River). This error states that the left (right) ineffective flow station of is greater than (less than) the left (right) abutment station and should therefore be adjusted to be outside of the abutment stations. However, this warning should be ignored as the choice of ineffective flow areas in the model is defensible for several reasons. First, the 115th Avenue Bridge is very wide relative to the low-flow channel. There will be large areas of ineffective flow between the abutments, especially considering the dense growth of salt cedars and other vegetation in the cross-sections upstream and downstream of the bridge. Second, this HEC-RAS model geometry was built initially to represent multiple return interval flows in a single geometry file; therefore, the use of blocked ineffective flow areas is extensive throughout the model and accurately represents the active flow area for multiple return interval flows and stages. Finally, the locations of ineffective flow areas have been extensively reviewed and approved by the LACOE.
    - "ST IF 06" was reported 4 times (twice at RS 199.2 and twice at RS 199.16, the two cross sections upstream and downstream of the 115th Avenue Bridge over the Gila River). This error states two things: (1) that the velocity head at the cross-section is more than 0.5 and (2) that the computed left (right) ineffective flow station is less than (greater than) the selected left (right) ineffective flow station. However, this warning should be ignored as this error has occurred due to the use of blocked ineffective flow areas. Since the blocked ineffective flow areas developed for this model are meant to represent multiple return interval flows in a single geometry file, the ineffective flow areas closer to the channel are set at the lowest elevation and the subsequent blocked ineffective flow area elevations are higher moving away from the main channel generally. Additionally, the locations of ineffective flow areas have been extensively reviewed and approved by the LACOE.
    - "ST IF 07" was reported 2 times (at RS 199.29 and RS 199.09). This error states that ineffective flow options were considered at these two cross-sections, but they should both be fully expanded cross-sections due to their distance upstream and downstream of the bridge. This warning goes on to say that ineffective flow stations and elevations should be cleared from this section, unless the areas beyond the ineffective flow stations are not within the flow path of the stream. Since the areas beyond the ineffective flow area stations are not within the flow path of the stream for both of these cross-sections, this error can be ignored.

- In the "FLOODWAY CHECK" section of the structure report, the following errors were reported:
  - "ST FW 01" was reported one time at RS 199.19 which is the internal bridge river station developed by HEC-RAS for the bridge structure. This error states that an Encroachment Method was not specified at this river station, and further states that for flood insurance studies, Encroachment Methods 4 and 1 should be used. However, HEC-RAS v. 4.1.0 does not allow for encroachment stations to be set at an internal bridge cross-section generated by HEC-RAS. This is an error in CHECKRAS, and should be ignored. As can be seen viewing the cross-section plots in the output reporting of the model, encroachments are specified at the internal bridge cross-sections by setting the BR U and BR D encroachment stations equal to the encroachment stations for the upstream and downstream cross-sections (i.e., cross-sections 3 and 2, respectively).
  - "ST FW 08" was reported 2 times (at RS 199.16 and RS 199.2). This error states the following: (1) that the right station effective for the natural profile is greater than the right channel bank station, (2) that the right encroachment station is outside the channel, (3) that the right encroachment station is greater than the right station effective for the natural profile, and (4) that the right encroachment station should be adjusted. However, the floodway encroachment station was set equal to the levee at these two stations, and no encroachment was allowed past the levee itself. This error should be ignored.

- Floodway Check
  - In the "FLOODWAY WIDTH CHECK" section of the floodway report, the following errors were reported:
    - "FW FW 03" was reported 26 times (RS 203.08, 202.94, 202.65, 202.43, 202.26, 201.96, 201.77, 201.58, 201.44, 200.97, 200.64, 200.18, 199.94, 199.66, 199.29, 199.16, 199.16, 198.83, 198.59, 198.54, 198.27, 198.09, 198.09, 198.02, 197.97, and 197.97). This error states that the left (or right) channel bank station may not be at the proper location. However, this warning should be ignored as the choice of bank stations in the model are defensible and have been extensively reviewed and approved by the LACOE.
    - "FW FW 04" was reported 91 times. It was reported at a cross-section for the right encroachment station 17 times (RS 203.08, 202.94, 202.26, 202.19, 202.06, 202.01, 201.91, 201.37, 201.16, 201.06, 199.44, 199.36, 199.29, 199.09, 198.88, 198.27, 198.14), the left encroachment station 12 times (RS 200.71, 200.64, 200.56, 200.48, 200.43, 200.36, 200.27, 200.18, 200.07, 199.98, 199.94, 199.83), and both encroachment stations 31 times for a total of 62 errors (RS 202.35, 202.12, 201.96, 201.84, 201.58, 201.5, 201.44, 201.29, 201.22, 201.12, 200.97, 200.91, 200.84, 200.79, 199.66, 199.52, 199.02, 198.98, 198.95, 198.93, 198.83, 198.78, 198.75, 198.7, 198.64, 198.59, 198.54, 198.48, 198.43, 198.38, 198.34). This error states the following: (1) that the left (right) station effective for the 1% annual chance floodplain is less than (greater than) the left (right) channel bank station, (2) that the 1% annual chance floodplain is outside the channel, (3) that the left (right) encroachment station is outside of 1% annual chance floodplain, and (4) that the right encroachment station should be adjusted. However, the reason this error occurs so often in this model is that the effective floodway was maintained as much as

possibly throughout the study reach. Since this study lowered water surface elevations at most locations in the reach, the floodplain widths were less, creating "dry" encroachment stations. To maintain consistency with the previously defined FEMA floodway, however, this error should be ignored.

- In the "STARTING WATER-SURFACE ELEVATION CHECK" section of the floodway report, the following errors were reported:
  - "FW SW 04" was reported 1 time at the downstream end of the model in regards to the selected boundary condition. This error states the following: "The name of the stream is Salt-Gila. Encroachment method 1 is used. Total conveyance for the natural profile is 8969398. Total conveyance for the floodway profile is 1.045389E+07. The difference in conveyance between the floodway profile and the natural profile is more than 1%. Normal Depth option with the same energy slope as the natural profile must be used for the floodway profile and rerun the plan. This message is not applicable for the revisions." The water surface elevation for the base conditions run and for the encroached run is based on the tie-in with the existing FEMA base conditions flood elevation and encroached conditions flood elevation (determined from the effective models and from the FIS floodway data table). These boundary conditions meet normal FEMA practices.

- NT Check
  - In the "ROUGHNESS COEFFICIENT CHECK" section of the Manning's *n*-value and transition loss coefficient report, the following errors were reported:
    - "NT RC 01" was reported 73 times (at every cross-section in the model except for RS 199.2 and RS 199.16, the two cross-sections bounding the 115th Avenue Bridge over the Gila River). This error states (1) that the right overbank *n*-value is less than 0.035, (2) that the *n*-value for overbank is usually larger than 0.035, and (3) that the *n*-value should be reevaluated. However, this model incorporated the use of vertical variation of Manning's roughness coefficients by flow value based on input from the LACOE. CHECKRAS cannot recognize Manning's *n*-values when this feature of HEC-RAS is used and assumes all the roughness coefficients are 0, which is a limitation of the CHECKRAS program. In addition, the Manning's *n*-values used herein are defensible and have been extensively reviewed and approved by the LACOE. Therefore, this error was ignored.
    - "NT RC 03" was reported 73 times (at every cross-section in the model except for RS 199.2 and RS 199.16, the two cross-sections bounding the 115th Avenue Bridge over the Gila River). This error states (1) that the channel *n*-value is equal to or less than 0.025, (2) that the *n*-value of the channel is usually larger than 0.025, and (3) that the *n*-value should be reevaluated it if is not representing a concrete lined channel. However, this model incorporated the use of vertical variation of Manning's roughness coefficients by flow value based on input from the LACOE. CHECKRAS cannot recognize Manning's *n*-values when this feature of HEC-RAS is used and assumes all the roughness coefficients are 0, which is a limitation of the CHECKRAS program. In

addition, the Manning's *n*-values used herein are defensible and have been extensively reviewed and approved by the LACOE. Therefore, this error was ignored.

- "NT RC 05" was reported 73 times (at every cross-section in the model except for RS 199.2 and RS 199.16, the two cross-sections bounding the 115th Avenue Bridge over the Gila River). This error states (1) that the left overbank *n*-value of 0 and the right overbank *n*-value of 0 are less than or equal to the channel *n*-value of 0, and (2) that the overbank *n*-values should be reevaluated. However, this model incorporated the use of vertical variation of Manning's roughness coefficients by flow value based on input from the LACOE. CHECKRAS cannot recognize Manning's *n*-values when this feature of HEC-RAS is used and assumes all the roughness coefficients are 0, which is a limitation of the CHECKRAS program. In addition, the Manning's *n*-values used herein are defensible and have been extensively reviewed and approved by the LACOE. Therefore, this error was ignored.
- The reason that RS 199.2 and 199.16 did not show up in the Manning's *n*-value and transition loss coefficient report because the bridge at RS 199.19 is represented as a multiple opening in the model as opposed to a normal bridge structure, and multiple openings do not allow for the upstream and downstream bounding cross sections to have vertical variations in Manning's roughness values.

- In the "TRANSITION LOSS COEFFICIENT CHECK" section of the Manning's *n*-value and transition loss coefficient report, the following errors were reported:
  - "NT TL 01" was reported 3 times (at RS 199.29, 199.2, and 199.16, corresponding to bridge cross sections 2, 3, and 4 around the 115th Avenue Bridge over the Gila River). This error states (1) that the contraction and expansion loss coefficients at these cross-sections are 0.1 and 0.3, and (2) that the contraction and expansion loss coefficients at these cross-sections should be equal to 0.3 and 0.5, respectively. However, flow does not contract or expand significantly due to the very wide span of this bridge. In addition, the contraction and expansion coefficients utilized herein are defensible and have been extensively reviewed and approved by the LACOE. Therefore, this error was ignored.

- XS Check
  - In the "INEFFECTIVE FLOW CHECK" section of the cross-section location and alignment report, the following errors were reported:
    - "XS IF 01" was reported 33 times (RS 200.48, 200.43, 200.36, 200.27, 200.18, 200.07, 199.98, 199.94, 199.83, 199.66, 199.52, 199.44, 199.36, 199.29, 199.2, 199.16, 199.09, 199.02, 198.98, 198.95, 198.93, 198.88, 198.83, 198.78, 198.75, 198.7, 198.64, 198.59, 198.54, 198.48, 198.43, 198.38, and 198.34). This error states the following: (1) that the right levee option is used at this river station, and (2) that the modeler should please investigate whether the NFIP requirements for levees are met. This error was ignored, as the TRNL does meet the requirements for an NFIP levee.

- In the "BOUNDARY CONDITION CHECK" section of the cross-section location and alignment report, the following errors were reported:
  - "XS BC 02" was reported 2 times at the downstream end of the model in regards to the selected boundary condition for the two different plans (the base 100-year and the encroached 100-year). This error states the following: "Known WS is specified as the downstream boundary for this profile." This error was ignored, as the downstream boundary condition was specified as a known water surface elevation to tie into the effective FEMA model for the base conditions and for the encroached conditions 100-year flood elevations (determined from the effective models and from the FIS floodway data table), as per FEMA's general guidelines.
  - "XS BC 03" was reported once for the model. This error states the following: "Maximum number of iterations is 0. It should not be less than 20." This error was ignored, as the number of iterations defined in the steady flow analysis editor of HEC-RAS showed a maximum setting of 20 for all iterative calculations. It was assumed that this is a bug in CHECKRAS.

5.8 Calibration

No calibration data were available. Thus, calibration was beyond the scope of this project.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

A summary table of the Post-Project Conditions (without floodway encroachment) hydraulic modeling results for the Salt/Gila River for the 100-year event referencing the NGVD29 vertical datum is presented in Table 5-10, and a summary table of the Post-Project Conditions (without floodway encroachment) hydraulic modeling results for the Salt/Gila River for the 100-year event referencing the NAVD88 vertical datum is presented in Table 5-11. These tables summarize the following variables by cross-section: peak discharge, water surface elevation, critical water surface elevation, average channel velocity, top width, hydraulic depth, Froude number, and stations for left and right edges of water surface. For comparative purposes, the floodplain and floodway elevations of the effective models and those calculated for this analysis referencing the NGVD29 vertical datum are presented in graphical form in Figure 5-2. Additionally, the floodplain and floodway elevations of the effective models and those calculated for this analysis referencing the NAVD88 vertical datum are presented in graphical form in Figure 5-3.

5.9.2 Verification of Results

The input parameters for each of the HEC-RAS models were applied in a manner consistent with standard engineering practices for floodplain delineation studies. The floodplain study results appear to be reasonable for flooding sources of this nature. There is no reason to doubt the accuracy or validity of the floodplains and the floodway delineated in this study.

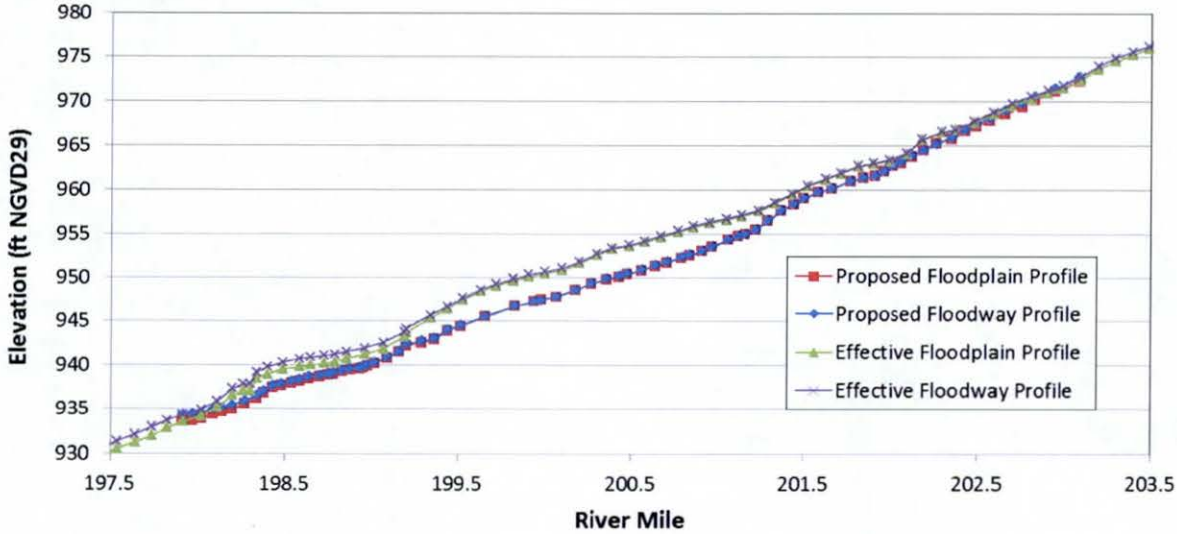

Figure 5-2. Comparison of Water Surface Elevations for the Study Reach of the Salt/Gila Model (referencing the NGVD29 datum)

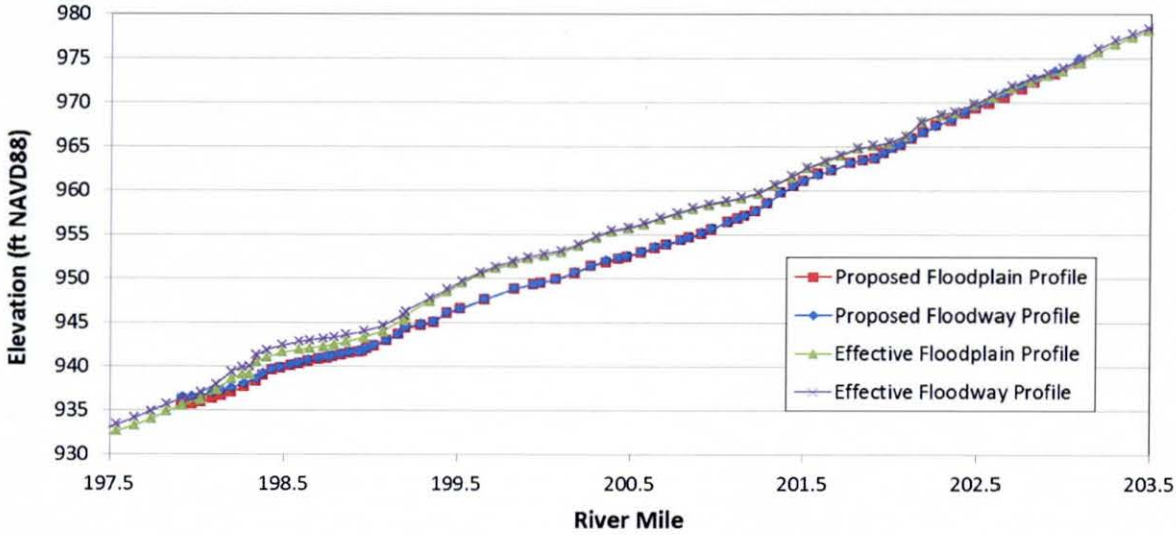

Figure 5-3. Comparison of Water Surface Elevations for the Study Reach of the Salt/Gila Model (referencing the NAVD88 datum)

Table 5-10. HEC-RAS Floodplain Summary Output for the Salt/Gila Post-Project Conditions Model (NGVD29)

River	River Sta	Q Total (cfs)	W.S. Elev (ft)	Crit W.S. (ft)	Vel Chnl (ft/s)	Top Width (ft)	Hydr Depth (ft)	Froude # Chl	Sta W.S. Lft (ft)	Sta W.S. Rgt (ft)
Salt-Gila	203.08*	162,000	972.33	968.83	7.04	3,951	7.61	0.4	1,277	7,134
Salt-Gila	202.94	162,000	971.18	967.92	8.06	3,306	7.33	0.47	3,668	6,974
Salt-Gila	202.82	162,000	970.2	966.66	8.29	3,495	7.46	0.48	1,000	6,818
Salt-Gila	202.75	162,000	969.42	966.79	8.93	3,512	6.52	0.5	3,234	6,782
Salt-Gila	202.65	162,000	968.54	966.34	7.07	3,562	6.15	0.43	657	6,039
Salt-Gila	202.57*	162,000	967.8	965.01	7.49	4,533	6.36	0.46	1,869	7,356
Salt-Gila	202.49	162,000	967.26	964.31	6.54	3,864	6.88	0.39	1,701	7,091
Salt-Gila	202.43	162,000	966.68	963.38	7.28	4,009	6.55	0.43	129	6,867
Salt-Gila	202.35	162,000	965.86	962.77	6.97	3,760	6.48	0.4	1,477	5,441
Salt-Gila	202.26	162,000	965.29	962.01	7.12	4,175	6.43	0.39	1,099	5,414
Salt-Gila	202.19*	162,000	964.5	964	6.8	5,214	5.71	0.41	915	7,336
Salt-Gila	202.12*	162,000	963.81	961.11	7.32	4,925	6.06	0.44	802	7,157
Salt-Gila	202.06	162,000	963.1	959.91	6.04	4,039	6.22	0.38	801	5,468
Salt-Gila	202.01	162,000	962.75	959.71	4.8	4,044	7.44	0.27	548	6,099
Salt-Gila	201.96*	162,000	962.19	959.74	4.84	4,187	7.84	0.26	598	6,716
Salt-Gila	201.91*	162,000	961.6	959.27	5.18	3,447	7.17	0.28	616	4,430
Salt-Gila	201.84	162,000	961.38	957.87	3.86	3,526	8.65	0.2	539	4,383
Salt-Gila	201.77	162,000	961.07	957.09	5.12	3,761	8	0.26	495	4,336
Salt-Gila	201.66	162,000	960.2	958.53	8.35	3,543	7.61	0.46	581	4,638
Salt-Gila	201.58	162,000	959.81	957.69	7.16	3,374	8.62	0.39	504	3,879
Salt-Gila	201.5	162,000	959.05	956.65	7.35	3,274	7.78	0.41	398	3,699
Salt-Gila	201.44*	162,000	958.39	956.58	6.25	3,916	7.48	0.37	372	4,460
Salt-Gila	201.37	162,000	957.67	955.13	6.54	3,443	7.25	0.41	346	4,486
Salt-Gila	201.29	162,000	956.5	955.26	7.47	3,347	6.45	0.5	426	4,512
Salt-Gila	201.22	162,000	955.53	953.92	7.87	3,439	6.15	0.53	388	4,554
Salt-Gila	201.16	162,000	955	952.47	6.65	3,732	7.13	0.42	325	4,698
Salt-Gila	201.12	162,000	954.77	951.71	6.19	3,713	7.57	0.38	363	4,775
Salt-Gila	201.06	162,000	954.35	951.26	6.41	3,886	7.01	0.39	274	4,842
Salt-Gila	200.97	162,000	953.56	950.3	6.79	3,738	7.2	0.41	285	4,917
Salt-Gila	200.91	162,000	953.03	949.52	7.57	4,198	7.23	0.43	274	4,915
Salt-Gila	200.84	162,000	952.59	948.33	6.57	3,877	7.27	0.36	310	4,866
Salt-Gila	200.79	162,000	952.27	947.98	7.09	3,871	7.66	0.38	263	4,801
Salt-Gila	200.71	162,000	951.75	947.24	7.47	3,650	7.71	0.42	220	4,628
Salt-Gila	200.64*	162,000	951.35	946.13	7.02	3,577	8.03	0.35	205	4,421
Salt-Gila	200.56	162,000	950.83	945.67	7.63	3,843	7.91	0.36	-263	5,497
Salt-Gila	200.48*	162,000	950.39	944.93	7.14	3,782	7.67	0.33	-52	4,229
Salt-Gila	200.43*	162,000	950.13	944.64	7.44	3,642	8.06	0.34	92	4,211
Salt-Gila	200.36	162,000	949.78	944.56	7.44	3,882	7.97	0.34	-47	3,998
Salt-Gila	200.27†	162,000	949.31	944.03	7.62	8,189	8.65	0.35	-4,672	3,634

*Values extracted from RAS vary from the mapped floodplain due to the exclusion of flow behind IFAs

†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

Table 5–10. HEC-RAS Floodplain Summary Output for the Salt/Gila Post-Project Conditions Model (NGVD29) (cont'd.)

River	River Sta	Q Total (cfs)	W.S. Elev (ft)	Crit W.S. (ft)	Vel Chnl (ft/s)	Top Width (ft)	Hydr Depth (ft)	Froude # Chl	Sta W.S. Lft (ft)	Sta W.S. Rgt (ft)
Salt-Gila	200.18†	162,000	948.55	943.1	8.85	7,750	8.76	0.4	-4,689	3,221
Salt-Gila	200.07†	162,000	947.78	942.23	8.97	7,609	9.08	0.42	-5,003	2,737
Salt-Gila	199.98†	162,000	947.42	941.61	8.19	7,294	10.26	0.39	-4,834	2,560
Salt-Gila	199.94†	162,000	947.25	941.85	7.92	6,821	9.83	0.39	-4,391	2,518
Salt-Gila	199.83†	162,000	946.72	941.45	7.75	6,661	10.13	0.38	-4,117	2,544
Salt-Gila	199.66†	162,000	945.48	941.44	9.42	6,164	9.34	0.47	-3,780	2,384
Salt-Gila	199.52†	162,000	944.41	939.97	8.98	5,855	9.69	0.47	-3,731	2,156
Salt-Gila	199.44	227,000	943.93	939.88	8.48	3,025	9.74	0.45	129	3,154
Salt-Gila	199.36	227,000	942.95	939.49	9.79	2,861	9.37	0.53	81	2,942
Salt-Gila	199.29	227,000	942.6	937.21	8.46	2,709	11.55	0.41	59	2,873
Salt-Gila	199.2	227,000	942.3	936.01	7	3,186	13.52	0.33	1,765	5,215
Salt-Gila	199.16	227,000	941.56	936.18	8.25	3,105	11.97	0.41	1,724	5,221
Salt-Gila	199.09	227,000	940.88	935.13	8	2,901	12.32	0.39	1,921	5,072
Salt-Gila	199.02	227,000	940.25	935.07	9	2,867	11.04	0.45	2,189	5,055
Salt-Gila	198.98	227,000	939.92	935.15	8.96	2,887	11.23	0.45	2,190	5,078
Salt-Gila	198.95	227,000	939.7	934.96	8.78	2,970	11.13	0.45	2,163	5,240
Salt-Gila	198.93	227,000	939.6	934.71	8.48	2,991	11.11	0.43	2,359	5,456
Salt-Gila	198.88	227,000	939.49	934.41	7.58	3,067	11.15	0.38	2,266	5,446
Salt-Gila	198.83	227,000	939.29	933.97	7.34	3,090	11.45	0.37	2,234	5,441
Salt-Gila	198.78	227,000	939.03	933.71	7.31	3,176	11.41	0.37	2,202	5,424
Salt-Gila	198.75	227,000	938.89	933.51	6.85	3,172	11.63	0.34	2,168	5,379
Salt-Gila	198.7	227,000	938.73	933.26	6.34	3,159	12.04	0.32	2,180	5,374
Salt-Gila	198.64	227,000	938.53	933.4	6.3	3,206	12.08	0.32	2,151	5,380
Salt-Gila	198.59	227,000	938.21	933	7.03	3,287	10.93	0.36	1,941	5,329
Salt-Gila	198.54	227,000	938.02	932.71	6.89	3,278	10.86	0.35	1,889	5,278
Salt-Gila	198.48	227,000	937.68	932.58	7.27	3,260	10.46	0.36	1,975	5,235
Salt-Gila	198.43	227,000	937.47	931.86	6.87	3,304	10.77	0.33	1,794	5,184
Salt-Gila	198.38	227,000	936.88	931.29	8.88	3,184	9.51	0.44	1,776	5,047
Salt-Gila	198.34	227,000	936.21	931.86	10.35	3,165	8.53	0.54	1,872	5,037
Salt-Gila	198.27Δ	227,000	935.6	931.13	9	6,514	8.39	0.48	1,664	11,238
Salt-Gila	198.2	227,000	934.95	929.89	6.53	8,792	9.59	0.34	2,058	11,637
Salt-Gila	198.14	227,000	934.58	928.83	6.38	9,084	9.81	0.34	2,134	11,642
Salt-Gila	198.09	227,000	934.28	928.06	6.09	9,016	9.95	0.32	2,117	11,650
Salt-Gila	198.02	227,000	933.83	928.17	7.24	8,775	9.45	0.37	2,302	11,704
Salt-Gila	197.97	227,000	933.65	927.47	6.9	9,053	9.76	0.36	2,301	11,586
Salt-Gila	197.92‡	227,000	933.52	927	5.93	9,016	9.79	0.3	2,242	11,458

†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

ΔValues extracted from RAS vary from the mapped floodplain due to conservative mapping downstream of the TRNL

‡Values extracted from RAS vary from the mapped floodplain due to the tie-in to the effective floodplain

Table 5-11. HEC-RAS Floodplain Summary Output for the Salt/Gila Post-Project Conditions Model (NAVD88)

River	River Sta	Q Total (cfs)	W.S. Elev (ft)	Crit W.S. (ft)	Vel Chnl (ft/s)	Top Width (ft)	Hydr Depth (ft)	Froude # Chl	Sta W.S. Lft (ft)	Sta W.S. Rgt (ft)
Salt-Gila	203.08*	162,000	974.43	970.93	7.04	3,951	7.61	0.4	1,277	7,134
Salt-Gila	202.94	162,000	973.28	970.02	8.06	3,306	7.33	0.47	3,668	6,974
Salt-Gila	202.82	162,000	972.3	968.76	8.29	3,495	7.46	0.48	1,000	6,818
Salt-Gila	202.75	162,000	971.52	968.89	8.93	3,512	6.52	0.5	3,234	6,782
Salt-Gila	202.65	162,000	970.64	968.44	7.07	3,562	6.15	0.43	657	6,039
Salt-Gila	202.57*	162,000	969.9	967.11	7.49	4,533	6.36	0.46	1,869	7,356
Salt-Gila	202.49	162,000	969.36	966.41	6.54	3,864	6.88	0.39	1,701	7,091
Salt-Gila	202.43	162,000	968.78	965.48	7.28	4,009	6.55	0.43	129	6,867
Salt-Gila	202.35	162,000	967.96	964.87	6.97	3,760	6.48	0.4	1,477	5,441
Salt-Gila	202.26	162,000	967.39	964.11	7.12	4,175	6.43	0.39	1,099	5,414
Salt-Gila	202.19*	162,000	966.6	966.1	6.8	5,214	5.71	0.41	915	7,336
Salt-Gila	202.12*	162,000	965.91	963.21	7.32	4,925	6.06	0.44	802	7,157
Salt-Gila	202.06	162,000	965.2	962.01	6.04	4,039	6.22	0.38	801	5,468
Salt-Gila	202.01	162,000	964.85	961.81	4.8	4,044	7.44	0.27	548	6,099
Salt-Gila	201.96*	162,000	964.29	961.84	4.84	4,187	7.84	0.26	598	6,716
Salt-Gila	201.91*	162,000	963.7	961.37	5.18	3,447	7.17	0.28	616	4,430
Salt-Gila	201.84	162,000	963.48	959.97	3.86	3,526	8.65	0.2	539	4,383
Salt-Gila	201.77	162,000	963.17	959.19	5.12	3,761	8	0.26	495	4,336
Salt-Gila	201.66	162,000	962.3	960.63	8.35	3,543	7.61	0.46	581	4,638
Salt-Gila	201.58	162,000	961.91	959.79	7.16	3,374	8.62	0.39	504	3,879
Salt-Gila	201.5	162,000	961.15	958.75	7.35	3,274	7.78	0.41	398	3,699
Salt-Gila	201.44*	162,000	960.49	958.68	6.25	3,916	7.48	0.37	372	4,460
Salt-Gila	201.37	162,000	959.77	957.23	6.54	3,443	7.25	0.41	346	4,486
Salt-Gila	201.29	162,000	958.6	957.36	7.47	3,347	6.45	0.5	426	4,512
Salt-Gila	201.22	162,000	957.63	956.02	7.87	3,439	6.15	0.53	388	4,554
Salt-Gila	201.16	162,000	957.1	954.57	6.65	3,732	7.13	0.42	325	4,698
Salt-Gila	201.12	162,000	956.87	953.81	6.19	3,713	7.57	0.38	363	4,775
Salt-Gila	201.06	162,000	956.45	953.36	6.41	3,886	7.01	0.39	274	4,842
Salt-Gila	200.97	162,000	955.66	952.4	6.79	3,738	7.2	0.41	285	4,917
Salt-Gila	200.91	162,000	955.13	951.62	7.57	4,198	7.23	0.43	274	4,915
Salt-Gila	200.84	162,000	954.69	950.43	6.57	3,877	7.27	0.36	310	4,866
Salt-Gila	200.79	162,000	954.37	950.08	7.09	3,871	7.66	0.38	263	4,801
Salt-Gila	200.71	162,000	953.85	949.34	7.47	3,650	7.71	0.42	220	4,628
Salt-Gila	200.64*	162,000	953.45	948.23	7.02	3,577	8.03	0.35	205	4,421
Salt-Gila	200.56	162,000	952.93	947.77	7.63	3,843	7.91	0.36	-263	5,497
Salt-Gila	200.48*	162,000	952.49	947.03	7.14	3,782	7.67	0.33	-52	4,229
Salt-Gila	200.43*	162,000	952.23	946.74	7.44	3,642	8.06	0.34	92	4,211
Salt-Gila	200.36	162,000	951.88	946.66	7.44	3,882	7.97	0.34	-47	3,998
Salt-Gila	200.27†	162,000	951.41	946.13	7.62	8,189	8.65	0.35	-4,672	3,634

*Values extracted from RAS vary from the mapped floodplain due to the exclusion of flow behind IFAs

†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

Table 5–11. HEC-RAS Floodplain Summary Output for the Salt/Gila Post-Project Conditions Model (NAVD88) (cont'd.)

River	River Sta	Q Total (cfs)	W.S. Elev (ft)	Crit W.S. (ft)	Vel Chnl (ft/s)	Top Width (ft)	Hydr Depth (ft)	Froude # Chl	Sta W.S. Lft (ft)	Sta W.S. Rgt (ft)
Salt-Gila	200.18†	162,000	950.65	945.2	8.85	7,750	8.76	0.4	-4,689	3,221
Salt-Gila	200.07†	162,000	949.88	944.33	8.97	7,609	9.08	0.42	-5,003	2,737
Salt-Gila	199.98†	162,000	949.52	943.71	8.19	7,294	10.26	0.39	-4,834	2,560
Salt-Gila	199.94†	162,000	949.35	943.95	7.92	6,821	9.83	0.39	-4,391	2,518
Salt-Gila	199.83†	162,000	948.82	943.55	7.75	6,661	10.13	0.38	-4,117	2,544
Salt-Gila	199.66†	162,000	947.58	943.54	9.42	6,164	9.34	0.47	-3,780	2,384
Salt-Gila	199.52†	162,000	946.51	942.07	8.98	5,855	9.69	0.47	-3,731	2,156
Salt-Gila	199.44	227,000	946.03	941.98	8.48	3,025	9.74	0.45	129	3,154
Salt-Gila	199.36	227,000	945.05	941.59	9.79	2,861	9.37	0.53	81	2,942
Salt-Gila	199.29	227,000	944.7	939.31	8.46	2,709	11.55	0.41	59	2,873
Salt-Gila	199.2	227,000	944.4	938.11	7	3,186	13.52	0.33	1,765	5,215
Salt-Gila	199.16	227,000	943.66	938.28	8.25	3,105	11.97	0.41	1,724	5,221
Salt-Gila	199.09	227,000	942.98	937.23	8	2,901	12.32	0.39	1,921	5,072
Salt-Gila	199.02	227,000	942.35	937.17	9	2,867	11.04	0.45	2,189	5,055
Salt-Gila	198.98	227,000	942.02	937.25	8.96	2,887	11.23	0.45	2,190	5,078
Salt-Gila	198.95	227,000	941.8	937.06	8.78	2,970	11.13	0.45	2,163	5,240
Salt-Gila	198.93	227,000	941.7	936.81	8.48	2,991	11.11	0.43	2,359	5,456
Salt-Gila	198.88	227,000	941.59	936.51	7.58	3,067	11.15	0.38	2,266	5,446
Salt-Gila	198.83	227,000	941.39	936.07	7.34	3,090	11.45	0.37	2,234	5,441
Salt-Gila	198.78	227,000	941.13	935.81	7.31	3,176	11.41	0.37	2,202	5,424
Salt-Gila	198.75	227,000	940.99	935.61	6.85	3,172	11.63	0.34	2,168	5,379
Salt-Gila	198.7	227,000	940.83	935.36	6.34	3,159	12.04	0.32	2,180	5,374
Salt-Gila	198.64	227,000	940.63	935.5	6.3	3,206	12.08	0.32	2,151	5,380
Salt-Gila	198.59	227,000	940.31	935.1	7.03	3,287	10.93	0.36	1,941	5,329
Salt-Gila	198.54	227,000	940.12	934.81	6.89	3,278	10.86	0.35	1,889	5,278
Salt-Gila	198.48	227,000	939.78	934.68	7.27	3,260	10.46	0.36	1,975	5,235
Salt-Gila	198.43	227,000	939.57	933.96	6.87	3,304	10.77	0.33	1,794	5,184
Salt-Gila	198.38	227,000	938.98	933.39	8.88	3,184	9.51	0.44	1,776	5,047
Salt-Gila	198.34	227,000	938.31	933.96	10.35	3,165	8.53	0.54	1,872	5,037
Salt-Gila	198.27Δ	227,000	937.7	933.23	9	6,514	8.39	0.48	1,664	11,238
Salt-Gila	198.2	227,000	937.05	932	6.53	8,792	9.59	0.34	2,058	11,637
Salt-Gila	198.14	227,000	936.68	930.93	6.38	9,084	9.81	0.34	2,134	11,642
Salt-Gila	198.09	227,000	936.38	930.16	6.09	9,016	9.95	0.32	2,117	11,650
Salt-Gila	198.02	227,000	935.93	930.27	7.24	8,775	9.45	0.37	2,302	11,704
Salt-Gila	197.97	227,000	935.75	929.57	6.9	9,053	9.76	0.36	2,301	11,586
Salt-Gila	197.92‡	227,000	935.62	929.1	5.93	9,016	9.79	0.3	2,242	11,458

†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

ΔValues extracted from RAS vary from the mapped floodplain due to conservative mapping downstream of the TRNL

‡Values extracted from RAS vary from the mapped floodplain due to the tie-in to the effective floodplain

6 Erosion and Sediment Transport

WEST completed a sediment transport analysis as Chapter 5 of the initial PED study for the LACOE (WEST Consultants, Inc., 2004). This report is included in the DDR document (US Army Corps of Engineers, 2012). Chapter 5 of the PED study (WEST Consultants, Inc., 2004) has been extracted from the DDR and reproduced in Appendix F.1 of this TDN for convenience during the FEMA review process. Refer to the DDR in Appendix G.2 of this report for more information regarding erosion and sediment transport analysis completed for the TRNL project.

7 Draft FIS Report Data

7.1 Summary of Discharges

Table 7-1 below provides a summary of discharges in FEMA format for the Salt/Gila River. Correspondence supporting the proposed hydrology changes for the Salt River upstream of the Gila River confluence can be found in Appendix B.4 of this TDN (dated 05/07/2012). Additionally, a copy of Table 2 from the report used as basis for the proposed hydrology change (U.S. Army Corps of Engineers, 1996) showing the final flow changes suggested by the LACOE has been provided in Appendix D.6 of this TDN, and an electronic version of the entire report has been provided in the electronic data for Appendix D.6 on disc in Exhibit D.

Table 7-1. 100-Year Discharges for the Salt/Gila River

Flooding Source and Location	Drainage Area (Square Miles)	Current Effective FEMA Discharge (cfs)	Proposed FEMA Discharge (cfs)
203.08 (River: Salt, Reach: Salt)	12,962	164,000	162,000
199.44 (River: Gila, Reach: Lower Gila)	42,900	227,000	227,000

7.2 Floodway Data

The draft floodway data for the Salt/Gila River in FIS format referencing the NGVD29 vertical datum is listed in Table 7-2. The draft floodway data for the Salt/Gila River in FIS format referencing the NAVD88 vertical datum is listed in Table 7-3. These tables summarize the following variables for the floodway by cross-section: width, section area, and mean velocity. These tables also list by cross-section the base flood water surface elevations for floodway and floodplain, and the corresponding water surface elevation increases.

Table 7-2. Floodway Data Table for the Salt/Gila Post-Project Conditions Model (NGVD29)

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt-Gila	203.08	2,442	21,919	7.4	972.33	972.33	972.77	0.4
Salt-Gila	202.94	2,475	21,562	7.5	971.18	971.18	971.49	0.3
Salt-Gila	202.82	2,560	23,278	7.0	970.20	970.20	970.55	0.4
Salt-Gila	202.75	2,639	21,482	7.5	969.42	969.42	969.79	0.4
Salt-Gila	202.65	2,491	20,834	7.8	968.54	968.54	968.98	0.4
Salt-Gila	202.57	2,473	19,990	8.1	967.80	967.80	968.06	0.3
Salt-Gila	202.49	2,654	22,103	7.3	967.26	967.26	967.45	0.2
Salt-Gila	202.43	2,810	21,354	7.6	966.68	966.68	966.82	0.1
Salt-Gila	202.35	3,041	22,620	7.2	965.86	965.86	965.96	0.1
Salt-Gila	202.26	3,158	23,574	6.9	965.29	965.29	965.24	0.0
Salt-Gila	202.19	3,590	23,292	7.0	964.50	964.50	964.52	0.0
Salt-Gila	202.12	3,606	23,913	6.8	963.81	963.81	963.83	0.0
Salt-Gila	202.06	3,603	23,661	6.9	963.10	963.10	963.11	0.0
Salt-Gila	202.01	3,438	27,418	5.9	962.75	962.75	962.75	0.0
Salt-Gila	201.96*	3,197	26,415	6.1	962.19	962.19	962.18	0.0
Salt-Gila	201.91*	3,395	24,653	6.6	961.60	961.60	961.61	0.0
Salt-Gila	201.84	3,528	30,550	5.3	961.38	961.38	961.39	0.0
Salt-Gila	201.77	3,646	29,844	5.4	961.07	961.07	961.07	0.0
Salt-Gila	201.66	3,314	25,463	6.4	960.20	960.20	960.23	0.0
Salt-Gila	201.58	3,287	28,222	5.7	959.81	959.81	959.78	0.0
Salt-Gila	201.50	3,201	24,902	6.5	959.05	959.05	959.05	0.0
Salt-Gila	201.44	3,290	24,609	6.6	958.39	958.39	958.39	0.0
Salt-Gila	201.37	3,297	24,090	6.7	957.67	957.67	957.67	0.0
Salt-Gila	201.29	3,313	21,412	7.6	956.50	956.50	956.51	0.0
Salt-Gila	201.22	3,408	21,007	7.7	955.53	955.53	955.54	0.0
Salt-Gila	201.16	3,527	25,342	6.4	955.00	955.00	955.02	0.0
Salt-Gila	201.12	3,680	27,924	5.8	954.77	954.77	954.79	0.0
Salt-Gila	201.06	3,843	27,101	6.0	954.35	954.35	954.37	0.0
Salt-Gila	200.97	3,729	26,829	6.0	953.56	953.56	953.6	0.0
Salt-Gila	200.91	3,757	27,312	5.9	953.03	953.03	953.07	0.1
Salt-Gila	200.84	3,844	28,132	5.8	952.59	952.59	952.63	0.1
Salt-Gila	200.79	3,835	29,609	5.5	952.27	952.27	952.33	0.1
Salt-Gila	200.71	3,631	28,167	5.8	951.75	951.75	951.82	0.1
Salt-Gila	200.64	3,558	28,996	5.6	951.35	951.35	951.43	0.1
Salt-Gila	200.56	3,338	29,233	5.5	950.83	950.83	950.93	0.1
Salt-Gila	200.48	3,234	28,929	5.6	950.39	950.39	950.49	0.1
Salt-Gila	200.43	3,312	29,493	5.5	950.13	950.13	950.26	0.1
Salt-Gila	200.36	3,466	30,837	5.3	949.78	949.78	949.91	0.1
Salt-Gila	200.27†	2,982	33,047	5.7	949.31	949.31	949.36	0.1

*Values extracted from RAS vary from the mapped floodway due to the OBW as-built features in the RAS model
†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

Table 7-2. Floodway Data Table for the Salt/Gila Post-Project Conditions Model (NGVD29) (cont'd.)

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt-Gila	200.18†	2,528	31,822	6.4	948.55	948.55	948.62	0.1
Salt-Gila	200.07†	2,009	29,509	7.5	947.78	947.78	947.82	0.0
Salt-Gila	199.98†	1,857	32,978	7.3	947.42	947.42	947.40	0.0
Salt-Gila	199.94†	2,002	37,062	7.2	947.25	947.25	947.25	0.0
Salt-Gila	199.83†	2,447	41,864	6.4	946.72	946.72	946.75	0.0
Salt-Gila	199.66†	2,378	37,517	7.3	945.48	945.48	945.53	0.1
Salt-Gila	199.52†	2,155	33,561	7.7	944.41	944.41	944.49	0.1
Salt-Gila	199.44	3,016	29,715	7.6	943.93	943.93	944.03	0.1
Salt-Gila	199.36	2,800	26,932	8.4	942.95	942.95	943.07	0.1
Salt-Gila	199.29	2,622	30,801	7.4	942.60	942.60	942.73	0.1
Salt-Gila	199.20	2,602	35,571	6.4	942.30	942.30	942.45	0.2
Salt-Gila	199.19 BR US	2,278	30,589	7.4	941.92	941.92	942.08	0.2
Salt-Gila	199.19 BR DS	2,272	27,310	8.3	941.58	941.58	941.60	0.0
Salt-Gila	199.16	2,518	30,085	7.6	941.56	941.56	941.59	0.0
Salt-Gila	199.09	2,470	30,540	7.4	940.88	940.88	940.93	0.1
Salt-Gila	199.02	2,480	28,338	8.2	940.25	940.25	940.33	0.1
Salt-Gila	198.98	2,482	29,675	8.1	939.92	939.92	940.00	0.1
Salt-Gila	198.95	2,517	30,899	8.0	939.70	939.70	939.79	0.1
Salt-Gila	198.93	2,635	31,821	7.7	939.60	939.60	939.70	0.1
Salt-Gila	198.88	2,960	33,566	6.8	939.49	939.49	939.59	0.1
Salt-Gila	198.83	2,941	34,028	6.7	939.29	939.29	939.39	0.1
Salt-Gila	198.78	2,921	33,658	6.7	939.03	939.03	939.14	0.1
Salt-Gila	198.75	2,910	34,199	6.6	938.89	938.89	939.01	0.1
Salt-Gila	198.70	2,948	35,870	6.3	938.73	938.73	938.85	0.1
Salt-Gila	198.64	3,039	37,102	6.1	938.53	938.53	938.66	0.1
Salt-Gila	198.59	3,157	34,953	6.5	938.21	938.21	938.36	0.1
Salt-Gila	198.54	3,232	35,603	6.4	938.02	938.02	938.17	0.2
Salt-Gila	198.48	3,260	34,682	6.6	937.68	937.68	937.86	0.2
Salt-Gila	198.43	3,285	35,995	6.3	937.47	937.47	937.66	0.2
Salt-Gila	198.38	3,166	30,855	7.4	936.88	936.88	937.11	0.2
Salt-Gila	198.34	3,165	27,992	8.1	936.21	936.21	936.52	0.3
Salt-Gila	198.27	3,058	30,466	8.1	935.60	935.60	935.99	0.4
Salt-Gila	198.20	3,274	34,247	6.8	934.95	934.95	935.45	0.5
Salt-Gila	198.14	3,515	37,368	6.2	934.58	934.58	935.15	0.6
Salt-Gila	198.09	3,687	40,834	5.7	934.28	934.28	934.92	0.6
Salt-Gila	198.02	3,818	39,950	5.7	933.83	933.83	934.57	0.7
Salt-Gila	197.97	3,911	42,458	5.4	933.65	933.65	934.44	0.8
Salt-Gila	197.92	4,029	45,334	5.0	933.52	933.52	934.34	0.8

†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

Table 7-3. Floodway Data Table for the Salt/Gila Post-Project Conditions Model (NAVD88)

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt-Gila	203.08	2,442	21,919	7.4	974.43	974.43	974.87	0.4
Salt-Gila	202.94	2,475	21,562	7.5	973.28	973.28	973.59	0.3
Salt-Gila	202.82	2,560	23,278	7.0	972.30	972.30	972.65	0.4
Salt-Gila	202.75	2,639	21,482	7.5	971.52	971.52	971.89	0.4
Salt-Gila	202.65	2,491	20,834	7.8	970.64	970.64	971.08	0.4
Salt-Gila	202.57	2,473	19,990	8.1	969.90	969.90	970.16	0.3
Salt-Gila	202.49	2,654	22,103	7.3	969.36	969.36	969.55	0.2
Salt-Gila	202.43	2,810	21,354	7.6	968.78	968.78	968.92	0.1
Salt-Gila	202.35	3,041	22,620	7.2	967.96	967.96	968.06	0.1
Salt-Gila	202.26	3,158	23,574	6.9	967.39	967.39	967.34	0.0
Salt-Gila	202.19	3,590	23,292	7.0	966.60	966.60	966.62	0.0
Salt-Gila	202.12	3,606	23,913	6.8	965.91	965.91	965.93	0.0
Salt-Gila	202.06	3,603	23,661	6.9	965.20	965.20	965.21	0.0
Salt-Gila	202.01	3,438	27,418	5.9	964.85	964.85	964.85	0.0
Salt-Gila	201.96*	3,197	26,415	6.1	964.29	964.29	964.28	0.0
Salt-Gila	201.91*	3,395	24,653	6.6	963.70	963.70	963.71	0.0
Salt-Gila	201.84	3,528	30,550	5.3	963.48	963.48	963.49	0.0
Salt-Gila	201.77	3,646	29,844	5.4	963.17	963.17	963.17	0.0
Salt-Gila	201.66	3,314	25,463	6.4	962.30	962.30	962.33	0.0
Salt-Gila	201.58	3,287	28,222	5.7	961.91	961.91	961.88	0.0
Salt-Gila	201.50	3,201	24,902	6.5	961.15	961.15	961.15	0.0
Salt-Gila	201.44	3,290	24,609	6.6	960.49	960.49	960.49	0.0
Salt-Gila	201.37	3,297	24,090	6.7	959.77	959.77	959.77	0.0
Salt-Gila	201.29	3,313	21,412	7.6	958.60	958.60	958.61	0.0
Salt-Gila	201.22	3,408	21,007	7.7	957.63	957.63	957.64	0.0
Salt-Gila	201.16	3,527	25,342	6.4	957.10	957.10	957.12	0.0
Salt-Gila	201.12	3,680	27,924	5.8	956.87	956.87	956.89	0.0
Salt-Gila	201.06	3,843	27,101	6.0	956.45	956.45	956.47	0.0
Salt-Gila	200.97	3,729	26,829	6.0	955.66	955.66	955.70	0.0
Salt-Gila	200.91	3,757	27,312	5.9	955.13	955.13	955.17	0.1
Salt-Gila	200.84	3,844	28,132	5.8	954.69	954.69	954.73	0.1
Salt-Gila	200.79	3,835	29,609	5.5	954.37	954.37	954.43	0.1
Salt-Gila	200.71	3,631	28,167	5.8	953.85	953.85	953.92	0.1
Salt-Gila	200.64	3,558	28,996	5.6	953.45	953.45	953.53	0.1
Salt-Gila	200.56	3,338	29,233	5.5	952.93	952.93	953.03	0.1
Salt-Gila	200.48	3,234	28,929	5.6	952.49	952.49	952.59	0.1
Salt-Gila	200.43	3,312	29,493	5.5	952.23	952.23	952.36	0.1
Salt-Gila	200.36	3,466	30,837	5.3	951.88	951.88	952.01	0.1
Salt-Gila	200.27†	2,982	33,047	5.7	951.41	951.41	951.46	0.1

*Values extracted from RAS vary from the mapped floodway due to the OBW as-built features in the RAS model
†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

Table 7-3. Floodway Data Table for the Salt/Gila Post-Project Conditions Model (NAVD88) (cont'd.)

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt-Gila	200.18†	2,528	31,822	6.4	950.65	950.65	950.72	0.1
Salt-Gila	200.07†	2,009	29,509	7.5	949.88	949.88	949.92	0.0
Salt-Gila	199.98†	1,857	32,978	7.3	949.52	949.52	949.50	0.0
Salt-Gila	199.94†	2,002	37,062	7.2	949.35	949.35	949.35	0.0
Salt-Gila	199.83†	2,447	41,864	6.4	948.82	948.82	948.85	0.0
Salt-Gila	199.66†	2,378	37,517	7.3	947.58	947.58	947.63	0.1
Salt-Gila	199.52†	2,155	33,561	7.7	946.51	946.51	946.59	0.1
Salt-Gila	199.44	3,016	29,715	7.6	946.03	946.03	946.13	0.1
Salt-Gila	199.36	2,800	26,932	8.4	945.05	945.05	945.17	0.1
Salt-Gila	199.29	2,622	30,801	7.4	944.70	944.70	944.83	0.1
Salt-Gila	199.20	2,602	35,571	6.4	944.40	944.40	944.55	0.2
Salt-Gila	199.19 BR US	2,278	30,589	7.4	944.02	944.02	944.18	0.2
Salt-Gila	199.19 BR DS	2,272	27,310	8.3	943.68	943.68	943.70	0.0
Salt-Gila	199.16	2,518	30,085	7.6	943.66	943.66	943.69	0.0
Salt-Gila	199.09	2,470	30,540	7.4	942.98	942.98	943.03	0.1
Salt-Gila	199.02	2,480	28,338	8.2	942.35	942.35	942.43	0.1
Salt-Gila	198.98	2,482	29,675	8.1	942.02	942.02	942.10	0.1
Salt-Gila	198.95	2,517	30,899	8.0	941.80	941.80	941.89	0.1
Salt-Gila	198.93	2,635	31,821	7.7	941.70	941.70	941.80	0.1
Salt-Gila	198.88	2,960	33,566	6.8	941.59	941.59	941.69	0.1
Salt-Gila	198.83	2,941	34,028	6.7	941.39	941.39	941.49	0.1
Salt-Gila	198.78	2,921	33,658	6.7	941.13	941.13	941.24	0.1
Salt-Gila	198.75	2,910	34,199	6.6	940.99	940.99	941.11	0.1
Salt-Gila	198.70	2,948	35,870	6.3	940.83	940.83	940.95	0.1
Salt-Gila	198.64	3,039	37,102	6.1	940.63	940.63	940.76	0.1
Salt-Gila	198.59	3,157	34,953	6.5	940.31	940.31	940.46	0.1
Salt-Gila	198.54	3,232	35,603	6.4	940.12	940.12	940.27	0.2
Salt-Gila	198.48	3,260	34,682	6.6	939.78	939.78	939.96	0.2
Salt-Gila	198.43	3,285	35,995	6.3	939.57	939.57	939.76	0.2
Salt-Gila	198.38	3,166	30,855	7.4	938.98	938.98	939.21	0.2
Salt-Gila	198.34	3,165	27,992	8.1	938.31	938.31	938.62	0.3
Salt-Gila	198.27	3,058	30,466	8.1	937.70	937.70	938.09	0.4
Salt-Gila	198.20	3,274	34,247	6.8	937.05	937.05	937.55	0.5
Salt-Gila	198.14	3,515	37,368	6.2	936.68	936.68	937.25	0.6
Salt-Gila	198.09	3,687	40,834	5.7	936.38	936.38	937.02	0.6
Salt-Gila	198.02	3,818	39,950	5.7	935.93	935.93	936.67	0.7
Salt-Gila	197.97	3,911	42,458	5.4	935.75	935.75	936.54	0.8
Salt-Gila	197.92	4,029	45,334	5.0	935.62	935.62	936.44	0.8

†Values extracted from RAS vary from the mapped floodplain due to the Gila confluence model approach

7.3 Annotated Flood Insurance Rate Maps

Annotated Flood Insurance Rate Maps (FIRMs) show the revised 1% annual chance event floodplains and floodway boundaries. As can be seen from these drawings, the revised boundaries tie into the effective boundaries smoothly. These annotated FIRMs are designed to inform FEMA how the requester anticipates the FIRMs will be revised. Copies of draft annotated Flood Insurance Rate Maps for the Salt/Gila and for the BFC/SAT are included in the Exhibits Section of this TDN.

7.4 Flood Profiles

FEMA-format draft annotated flood profiles were not generated as part of this deliverable, as the review contractor for FEMA has recommended that they generate these products for PMR map change requests. Instead, HEC-RAS export files (DXF) are provided in the electronic data for Appendix E.5 on disc located in Exhibit D.

Appendix A: References

A.1 Data Collection Summary

DATA COLLECTION SUMMARY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS NORTH LEVEE PMR PROJECT

Date: May 18, 2012

To: Richard Harris – District

Cc: Don Rerick – District

From: Brian Wahlin – WEST
Chuck Davis – WEST

Data collected for this project was primarily completed under Contract FCD 2010C027 Assignment #2. The final product of this original scope of work was the Final Summary Data Collection report (which was fashioned after a TDN for eventual conversion into this document). The Final Summary Data Collection Report resulting from that contract has been included in this appendix as an electronic document on disc.

Additional data collection tasks included the research done regarding all Letters of Map Change (LOMCs) issued by FEMA impacting the study area herein. The email and table on the following pages summarize the results of this data collection effort. In addition, all of the LOMCs collected as part of this data collection task have been provided on disc in this appendix.

Chuck Davis

Subject: FW: Letters of Map Amendment for TRNL
Attachments: LOMC_Summary.xlsx

From: Chuck Davis
Sent: Tuesday, May 08, 2012 2:43 PM
To: Richard Harris (rph@mail.maricopa.gov)
Cc: Brian Wahlin
Subject: Letters of Map Amendment for TRNL

Richard,

Please find attached the list of all of the LOMC's affecting the FIRM panels that will be affected by the TRNL study (04013C2070G, 04013C2090H, 04013C2095F, 04013C2115G, and 04013C2555F). Each of these PDF files have been downloaded by WEST from the FEMA map service center, and they have all been placed in a zip file titled "TRNL_Letter_Amendments.zip". This zip file has been placed on the WEST ftp site for your retrieval.

Thanks,

Chuck Davis, P.E., CFM
Hydraulic Engineer

WEST Consultants, Inc.
8950 South 52nd Street
Suite 210
Tempe, AZ 85284-1043
ph: (480) 345-2155
fx: (480) 345-2156
email: cdavis@westconsultants.com
www.westconsultants.com

Map Item ID 04013C2070G

File Name	Type of LOMC	Community	Project Description	Basis of Request	WEST Notes
08-09-0929P-040037.pdf	LOMR (Aug 10, 2009)	Maricopa County, Unincorporated Areas	No Project – Vista Norte / King Ranch Floodplain Redelineation	Hydraulic Analysis, Natural Changes, New Topographic Data	Effects FEMA XS BF on the Gila, the most downstream cross sections listed in the FEMA_WEST_XS_Key spreadsheet
08-09-0929P-040046.pdf	LOMR (Aug 10, 2009)	City of Goodyear, Maricopa County	No Project – Vista Norte / King Ranch Floodplain Redelineation	Hydraulic Analysis, Natural Changes, New Topographic Data	Effects FEMA XS BF on the Gila, the most downstream cross sections listed in the FEMA_WEST_XS_Key spreadsheet

Map Item ID 04013C2090H

File Name	Type of LOMC	Community	Project Description	Basis of Request	WEST Notes
04-09-1791V-040037.pdf	LOMR-Fs and LOMAs (9/20/2005)	Maricopa County, Unincorporated Areas			Revalidation of previously submitted LOMR-Fs and LOMAs. All of the areas affected are on the north side of the Gila River.
04-09-1791V-040038.pdf	LOMR-Fs and LOMRs (9/20/2005)	City of Avondale, Maricopa County			Revalidation of previously submitted LOMRs and LOMR-Fs. All of the areas affected are on the north side of the Gila River.
06-09-0014X-040037.pdf	LOMRs, LOMR-Fs, and LOMAs (10/11/2005)	Maricopa County, Unincorporated Areas			Revalidation of previously submitted LOMRs, LOMR-Fs, and LOMAs. All of the areas affected are on the north side of the Gila River.
06-09-B029X-040038.pdf	LOMR (2/06/2006)	City of Avondale, Maricopa County	No Project – Reissuance of Channelization of Southern Pacific Railroad	Reissuance	Southern Pacific Railroad Ditch is the flooding source, no effect on the Tres Rios
07-09-0025A-040037.pdf	LOMR-F (10/12/2006)	Maricopa County, Unincorporated Areas			Structure removed from the SFHA from the Gila River, structure is on the north side of the Gila River.
10-09-0688P-040037.pdf	LOMR (03/29/2010)	Maricopa County, Unincorporated Areas		Reissuance	Reissuance of LOMR from flooding sources Sunland Avenue Tributary and Buckeye Feeder Canal

Map Item ID 04013C2095F

File Name	Type of LOMC	Community	Project Description	Basis of Request	WEST Notes
04-09-1791V-040037.pdf					See Map Item 04013C2090H
04-09-1791V-040038.pdf					See Map Item 04013C2090H
06-09-0014X-040037.pdf					See Map Item 04013C2090H
06-09-0014X-040051.pdf	LOMRs, LOMR-Fs, and LOMAs (10/11/2005)	City of Phoenix, Maricopa County			Revalidation of previously submitted LOMRs, LOMR-Fs, and LOMAs. All of the areas affected are on the north side of the Gila River.
06-09-B029X-040037.pdf	LOMR (2/06/2006)	Maricopa County, Unincorporated Areas	No Project – Reissuance of Channelization of Southern Pacific Railroad	Reissuance	Southern Pacific Railroad Ditch is the flooding source, no effect on the Tres Rios
06-09-B029X-040038.pdf					See Map Item 04013C2090H
07-09-0900A-040037.pdf	LOMA (06/14/2007)	Maricopa County, Unincorporated Areas	Lot 53, Glenhurst		Flooding source: Southern Pacific Railroad Ditch
08-09-0655P-040037.pdf	LOMR (02/27/2009)	Maricopa County, Unincorporated Areas	Channelization Fill (Identifier: Roy's Place)	Hydraulic Analysis, Hydrologic Analysis	Flooding source: Southern Pacific Railroad Ditch
08-09-0655P-040038.pdf	LOMR (02/27/2009)	City of Avondale, Maricopa County	Channelization Fill (Identifier: Roy's Place)	Hydraulic Analysis, Hydrologic Analysis	Flooding source: Southern Pacific Railroad Ditch
08-09-0655P-040055.pdf	LOMR (02/27/2009)	City of Tolleson, Maricopa County	Channelization Fill (Identifier: Roy's Place)	Hydraulic Analysis, Hydrologic Analysis	Flooding source: Southern Pacific Railroad Ditch
10-09-0146P-040051.pdf	LOMR (04/28/2010)	City of Phoenix, Maricopa County	Channelization Fill (Identifier: Lion's Gate)	Hydraulic Analysis, New Topographic Data	Flooding source: Buckeye Feeder Canal
10-09-0688P-040037.pdf					See Map Item 04013C2090H
10-09-0688P-040038.pdf	LOMR (03/29/2010)	City of Avondale, Maricopa County		Reissuance	Reissuance of LOMR from flooding sources Sunland Avenue Tributary and Buckeye Feeder Canal
10-09-0688P-040051.pdf	LOMR (03/29/2010)	City of Phoenix, Maricopa County		Reissuance	Reissuance of LOMR from flooding sources Sunland Avenue Tributary and Buckeye Feeder Canal

Map Item ID 04013C2115G

File Name	Type of LOMC	Community	Project Description	Basis of Request	WEST Notes
04-09-1791V-040037.pdf					See Map Item 04013C2090H
06-09-0014X-040037.pdf					See Map Item 04013C2090H
06-09-0014X-040051.pdf					See Map Item 04013C2095F
06-09-0111A-040051.pdf	LOMR-F (11/01/2005)	City of Phoenix, Maricopa County	Laveen Farms		Flooding source: Salt River
07-09-0629A-040051.pdf	LOMR-F (01/30/2007)	City of Phoenix, Maricopa County	Laveen Farms		Flooding source: Salt River
08-09-0614A-040051.pdf	LOMR-F (03/06/2008)	City of Phoenix, Maricopa County	Laveen Farms		Flooding source: Salt River

Appendix A: References

A.2 Referenced Documents

Arizona Department of Water Resources. (1997). *Instructions for Organizing and Submitting Technical Documentation for Flood Studies.* Phoenix, AZ.

Dibble. (2004). *Durango ADMP Floodplain Delineation: Final Report and Technical Data Notebook for the Buckeye Feeder Canal and the Sunland Avenue Tributary.* FCD #99-41.

Environmental Systems Research Institute. (2009). *ArcGIS Desktop: Release 9.3.1.* Redlands, CA.

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Federal Emergency Management Agency. (2003). *Guidelines and Specifications for Flood Hazard Mapping Partners. Appendix C: Guidance for Riverine Flooding Analyses and Mapping.* FEMA.

HNTB. (December 15, 2010). *Revised Draft Tres Rios Phase 3 Pre-Project Hydraulic Analysis Review Technical Memorandum.* Prepared for the US Army Corps of Engineers, Los Angeles District.

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U.S. Army Corps of Engineers. (2011). *HEC-GeoRAS 4.3.93 GIS Tools for Support of HEC-RAS using ArcGIS User's Manual.* Davis, CA: Hydrologic Engineering Center.

US Army Corps of Engineers. (2012). *Tres Rios Environmental Restoration Project: Design Documentation Report (DDR) for the Tres Rios North Levee.* Los Angeles District.

WEST Consultants, Inc. (2004). *PED Hydraulic Design of Tres Rios North Levee, Volume II Pre-Final Project Analysis Final Report.* Completed for the U.S. Army Corps of Engineers, Los Angeles District.

Wood, Patel and Associates. (1997). *Maryvale Area Drainage Master Study.* FCD 93-29.

Appendix B: General Documentation and Correspondence

B.1 Special Problem Reports

(None for this TDN)

Appendix B: General Documentation and Correspondence

B.2 Contact (Telephone) Reports

(None for this TDN)

Appendix B: General Documentation and Correspondence

B.3 Meeting Minutes or Reports

Date: October 18, 2010

A teleconference was held on October 12th at 9:30 a.m. with Cory Brunsting, Stephen Brown, and Paul Beaver of the Los Angeles office of the US Army Corps of Engineers (COE) with regards to producing hydraulic modeling and supporting documentation that will be the basis for pending FEMA flood map revisions of the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris. Mr. Chuck Davis of WEST Consultants, and Gwendolyn Meyer of the Phoenix COE office also attended. The focus of the discussion was primarily to re-visit the issue of what materials were going to be made available in what time-frame and by whom in relation to a draft work schedule produced by the District and sent to the Corps on 8/12/10.

Paul said that the recently submitted DDR (listed at 90%) is not close to being finalized because data still needs to come in for phases 1b and 1c. Paul said that David Pham will be responsible for the finalization of that document. Richard said that the District will review only the part that will be applicable to the LOMR package. However, review at this time may be only cursory. Paul said that the office is still staffing up for activities related to the DDR and LER. The COE has recently finalized their process for Levee System Evaluations in their document EC 1110-2-6067. This document formalizes evaluations with regards to the NFIP, and may require deviations from the known process of the Levee Evaluation Report (LER). The document lists a report as a NFIP Levee System Evaluation (NLSE) rather than certification. It may turn out that the new document does not present any great differences from what has already been expected in the LER.

The Levee Safety Officer (LSO, per EC...6067) has the authority to sign-off the LER/NLSE, as the authority approving of the document contents. It was not known whether the LA office would have to adhere to the newly finalized document's methods for the Tres Rios Levee project or not. Paul said that the office may be told to do so, later. Paul said that a Levee Safety Officer (LSO) had not been officially designated yet – but he was acting as such at this time. Paul also mentioned that the COE is actively in the hiring process for a LSO.

The issue of the work schedule came up again and Paul said that without knowing when the needed information for finalizing the DDR would be available, he couldn't estimate completion dates for that document and subsequent others. Therefore, he couldn't provide an updated schedule at this time. Paul estimated that it would take 6 weeks to finalize the Geotechnical report [appendix] for the project.

The issue of topography certification to meet National Mapping Standards (NAMSAs) came up again, and Richard said we need to arrive at a Yes or No statement regarding the certification issue, so we may move forward and not lose any time over it. He added that it seems to be a No statement at this time, but asked the COE to continue their search for documentation. Check from WEST said he did not feel there was any record of it in their work done previously for the COE. Richard said that he would work with Eric of the District's GIS to see if there is certification of the 4' topo from the Salt/Gila FDS project. This 4' topo is likely part of the merged product. He will start with topo from contract 92-01 and investigate any updates the District may have had done.

Richard asked Chuck if he has seen the Phase 1C O & M manual, and as-built plans. Chuck said he will check into it.

Merging of the topographical data is ongoing, along with the hydraulic modeling. However, there was no progress by the COE last week due to an office move/renovation. Instructions from Van on moving forward with the modeling are still pending. Steve said he would discuss the topo mapping accuracy issue with Van, once he returns to the office. Richard mentioned a need to be able to define COE points-of-contact for any upcoming reviews. In context with the COE not knowing time-frames for submittals it appears that the COE has not formalized role responsibilities amongst it's staff at this time to establish permanent points-of-contact. The issue will be raised again once a draft hydraulic model is available for review by the District.

Chuck described a LOMR "data needs list" WEST had prepared that outlines the documentation requirements for LOMR submittals. The COE staff said they would like a copy and Chuck said he would enhance the list and then Richard would send it to them.

Paul said he expected that the hydraulic modeling would be ready in draft form by the 1st of next year. He said that David Pham was in charge of packaging up all the appendices for the DDR, and that he was in charge of only the Geotechnical part [each part is the responsibility of different people, so a coordinated effort for compiling it is necessary but sometimes slow].

Paul said that it might end up being worthwhile to use the "new" process [involving the EC...6067] anyway. He said he was in charge of the LER/NLSE. He also said that he would like to call Richard independently between the current and next scheduled call. Richard gave Paul his phone number.

Action Items:

1. Richard to send the LOMR Needs list to the COE when it becomes available
   Update: Richard sent the Data Needs List prepared by WEST to all teleconference participants on 10/18/10.

2. The COE will continue to investigate the 1' topo product for documentation proving certification.

   Update per WEST: (i) Flight date = October 23, 2001, (ii) Towill Surveying, Mapping, and GIS Services collected the aerial photography, (iii) WEST has the DTM files available on our server for the entire coverage of the 2001 topo (these files are in the DTM format for Microstation Inroads), (iv) WEST has contacted Towill regarding the mapping scale, and (v) the vertical datum of the mapping was NGVD29 and the horizontal projection was listed in our final report as being Arizona State Plane coordinates (central region), NAD 83 (this is also being confirmed with Towill).

3. COE to continue working on the hydraulic modeling
4. COE to continue working on the LER and updating the DDR draft.

5. Richard and WEST Consultants to review the DDR draft H & H appendices for the internal drainage section, and may provide the COE review comments before the next teleconference.
6. Chuck to check on the Phase 1C O & M manuals and as-built plans, and then report to Richard.

   Update: Neither the District nor WEST have the Phase 1C O & M manuals. We do have several as-built plans PDF documents (11 total PDFs) and DGN files (12 total DGNs). We also have several as-built plans for phase 1B (79 PDF documents), but we do not have the Phase 1B O & M manuals either.

7. Richard to continue investigating the 4' topo mapping that apparently came from the District (and is now part of the merged topo product) for evidence of certification.

   Update: Document titles and shape files have been given to the District's surveyor John Stock for he and his staff to determine accuracy of the 4' product.

8. Steve to discuss the 1' topo mapping accuracy issue with Van.
9. The COE to consider points of contact and otherwise role responsibilities for addressing upcoming review comments.

The next call will take place on November 2, 2010 at 9:30 a.m. Arizona time. A formal invitation will be forthcoming.

PHONE CALL LOG

Date: November 1, 2010

To: Richard Harris (FCDMC)

From: Chuck Davis (WEST)

RE: **Cancellation of Conference Call with LACOE on 11/02/2010**
Other salient issues relating to the Tres Rios LOMR

FCDMC informed WEST that due to a lack of availability from the Los Angeles District of the U.S. Army Corps of Engineers (LACOE), FCDMC would reschedule the conference call originally planned for 11/02/2010 between FCDMC/WEST and LACOE to 11/09/2010 at 1:00PM. That time will allow Don Rerick (FCDMC) to be on the call. Brian Wahlin (WEST) should be available for this call.

Additional items discussed by FCDMC and WEST are provided below.

- WEST has completed the comparison of the PED study design elevations for the top of the levee to the final AS-BUILT elevations of the levee provided by LACOE. A summary of this analysis has been provided to Richard Harris as a separate Technical Memorandum. To summarize the findings of that memorandum, the minimum freeboard of the final levee elevations compared to the design levee elevations from the cross sections utilized in the original hydraulic analysis is estimated to be 2.8 feet.
- Richard was concerned about paragraph 14 in Appendix B of the 90% DDR (page 287 of 568 in the PDF document). This paragraph and Richard's concerns are reproduced below.

  14. <u>Least Damage Levee Overtopping Location</u>. The most feasible location would be downstream of the existing mining pit located along the north bank downstream from the 116th Avenue Bridge (River Mile 197.87 through 198.08). At these locations, the levee height was reduced to a level so flows in excess of the 100-year flow could inundate the floodplain on the north bank. This location is preliminary but will be finalized in the next project phase.

  - Is having a "least damage levee overtopping location" standard practice for USACE levee designs?
  - When they say that "the levee height was reduced to a level so flows in excess of the 100-year flow could inundate the floodplain on the north bank," are they referring to the 100-year water surface elevation or the 100-year water surface elevation plus some amount of freeboard (2.0' as required by FEMA or 3.0' as recommended in the PED study by WEST)?

8950 S. 52nd St., Suite 210, Tempe, AZ 85284
(480) 345-2155 (480) 345-2156 *fax*

- If this is reduced all the way down to the 100-year water surface elevation, what will FEMA do about that? Will they allow for a shaded zone X mapping if there is no freeboard at this least damage location?

- WEST inquired if they should follow up with Hoskin-Ryan or with MCDOT regarding the newer topographic data available for the study reach. Richard indicated that he suspects this topography is not as extensive as was first expected. We may only have a few hundred linear feet of the river with new topography as opposed to the several thousand feet we originally expected. Richard will follow up with his contacts regarding this information.

Action items from the phone call:

- Chuck will research the "least damage levee overtopping location" and Richard's concerns with this portion of the DDR.
- Richard will follow up with his contacts regarding the updated topography information.

Date: November 11, 2010

A teleconference was held on November 9th at 1:00 p.m. Mountain Standard Time (noon Pacific Standard Time) with Paul Beaver and David Pham of the Los Angeles District of the US Army Corps of Engineers (LACOE) with regards to producing hydraulic modeling and supporting documentation that will be the basis for pending FEMA flood map revisions of the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris and Don Rerick. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants, and Bob Upham of the City of Phoenix also attended. The focus of the discussion was primarily to re-visit the issue of what materials were going to be made available in what time-frame and by whom in order to eventually request floodplain and floodway map changes from the FEMA at the Tres Rios Levee. Discussions generally followed the below numbered list of items from the meeting invitation:

1. POCs for the upcoming reviews by District/WEST?

David Pham will be the POC for the DDR, and therefore he will receive any future comments about it, and already had received some from Don Rerick. Richard and Chuck both had a few more minor comments regarding the 90% DDR. Paul said that if we had questions about the H & H, the POC will be Van Crisostomo, and David Pham should be copied on all direct communications to Van regarding the H & H sections of the DDR since David is the POC for the entire DDR. Paul also suggested that Richard write a separate email to Van explicitly defining the models in terms of what features should be included and the modeling extents. This will be done separately.

David said that the DDR will be resubmitted in December with revisions per Don's and other District/WEST review comments. Paul said that the DDR may be finalized in January or February of 2011 (with perhaps the As-built plans for Phase 1C to be added later).

2. Status of LER or equivalent Levee Certification package. When will a draft be available for review?

Paul said he is still in the process of writing up the NLSER, which is the new document "EC…6067" acronym for LER. Paul said it will probably only consist of 5-10 pages when done, with most documentation through referencing the DDR. He said that the DDR will need to be finalized before the NLSER can be finalized. In other words, the documentation that will be referenced in the NLSER must be completed first.

3. Discussion about the LOMR Needs list from WEST – does the LACOE have any questions?

Paul asked that we go over the list and we did, writing the names of the agencies who will be expected to provide the various materials. Richard volunteered to send them the written version and then did so.

4. Status of As-builts and O & M manual for the Overbank Wetlands, and the O & M manual for Phase 1B? We need to get these – when can the LACOE provide them? Status of the Flood Wall planned for El Mirage RD? Construction to begin when?

Paul said that the wall design is near final, and that the construction was being delayed due to some difficulty regarding the right-of-way. However, he said it was going to get started soon.

5. Status of topographic mapping merged product to deliver to District? Will the LACOE provide documentation regarding certification and documentation about the way the products are being merged?

Richard discussed the accuracy standards for certification as outlined in FEMA's document: Guidelines and Specifications for Flood Hazard Mapping Partners (http://www.fema.gov/library/viewRecord.do?id=2206). The factor stated therein is the RMSE (Root-Mean Square Error), used to check accuracy, but that if the LACOE had documentation that proved accuracy otherwise we will consider it. Richard mentioned that the LACOE might have their own surveying manager or similar authority that could have checked for accuracy. Richard suggested the LACOE contact their surveying authority.

6. DDR Questions for the Interior Drainage:

   Which study includes the Rio Salado Interior Drainage Study?

   An aside conversation with Chuck led to him being assigned to investigate the above study for documentation in our library, and Don later said that there may be documentation in the local LACOE office.

   How was the "8-drain sampling procedure" developed for the Rio Salado Interior Drainage Study modified to reflect greater agricultural land use in the interior drainage area of the Tres Rios levee?

   LACOE will report back on how the 8-drain sampling procedure was modified.

   Status – time frame: when will the DDR be finalized?

Paul said possibly in January of 2011.

7. Schedule by the District updated by LACOE to fit LACOE?

8. Other?

Action Items:

1. Richard to send the LOMR Needs list to the LACOE again, but this time with the noted agency/company responsible for providing the data listed. He will also re-send the MT-2 forms and MT-2 Instructions.

   Update: Richard sent the Data Needs List prepared by WEST to all teleconference participants on 11/09/10. The list included the responding agency name for each type of needed documentation. Also included were the MT-2 forms with instructions and a State of Arizona standard for flood study documentation.

2. The LACOE will continue to investigate the 1' topo product for documentation proving certification of accuracy. David Pham of the LACOE said he will look for it by contacting the surveying manager for the LACOE.

3. LACOE to continue working on the hydraulic modeling.

4. District/WEST to send a small list of review comments to the LACOE regarding the 90% DDR.

5. LACOE to continue working on the NLSER and updating the DDR draft.

6. Richard to prepare an email for Van regarding specifics of the modeling, including what features to include and extents.

Update: The email was prepared Wednesday November 10th. The email requests Van's presence during a teleconference to be held the week of the 15th to discuss expectations and gain better information about what has been done with the H & H modeling, and what remains.

7. David to provide Richard/the District/WEST with the O & M manuals for the Overbank Wetlands, Phase 1B, and the Phase 1C floodwall. When ready he will also send the District As-built plans for both the Over-bank wetlands and Phase 1C.

8. David to investigate 1' topo mapping certification documentation by contacting head of the LACOE Survey unit.

The next call will take place with Van, hopefully as soon as November 15, 2010. A formal invitation will be forthcoming based upon Van's availability.

Date: November 16, 2010

A teleconference was held on November 15th at 2:30 p.m. Mountain Standard Time (1:30 p.m. Pacific Standard Time) with Van Crisostomo of the Los Angeles District of the US Army Corps of Engineers (LACOE) with regards to producing hydraulic modeling and supporting documentation that will be the basis for pending FEMA flood map revisions of the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris and Don Rerick. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants also attended. The focus of the discussion was the status of the hydraulic modeling products being developed by LACOE and in what time-frame these products would be made available for the request of floodplain and floodway map changes from the FEMA at the Tres Rios North Levee. Discussions generally followed the list of items below:

1. Current status of the hydraulic model.

   Model Extents: The model extends from approximately 83rd Avenue on the upstream end to below the Agua Fria/Gila confluence on the downstream end. There is also an approximately 1-1/2 mile section of the Gila River upstream of the Gila/Salt confluence included in the model.

   Levee: The entirety of the levee (Phase 1A AS-BUILT, Phase 1B AS-BUILT, and Phase 1C design drawings) have been incorporated into the hydraulic model. It is difficult to include a floodwall perpendicular to flow as Phase 1C has been designed in a 1-D hydraulic model, but this feature has been included. The Phase III Environmental Restoration features (i.e., low-flow channel and plantings) are not included in the current hydraulic modeling deliverable because the LOMR is concerned with the "with levee only" geometry. However, the previous grade work completed for the overbank wetlands should be included in the topography of this hydraulic model. Van confirmed that the current grade work for the overbank wetland has been included in the topography for this hydraulic model.

   Additional structural features: The guide dikes are currently not in the model. The District has requested that LACOE include these structures in the current model.

   Estimated delivery date: Van indicated that HNTB, the A/E firm working on the Phase III Environmental Restoration hydraulic model, is currently reviewing the final hydraulic model that the LACOE has developed for two reasons: (i) to validate and modify Manning's n values in the model based on recent aerial photography and field conditions and (ii) to validate and modify ineffective flow areas based on the updated levee geometry and recent aerial photography. LACOE had them complete this review to ensure that the final hydraulic model for the LOMR package with the "with levee only" geometry was identical to the starting hydraulic model for the Phase III modeling effort before adding in the low-flow channel and plantings associated with the Phase III design plans. Van indicated that HNTB should have this review completed soon, and the final model should be available for the District within 3 weeks.

2. Least Damage Levee Overtopping Location

   In the DDR, the discussion of the least damage overtopping location is a remnant of the PED report and the original design alignment, because the DDR indicates that the least damage overtopping location is in a portion of the levee downstream of El Mirage road that was never constructed. This should be corrected in the DDR. Van indicated that off-line storage within the overbank wetlands upstream of the 105th Avenue alignment and within the sand and gravel mining pit downstream of El Mirage Road would provide enough hydrograph attenuation that the river stage would be less likely to overtop the final levee alignment; therefore, a least damage overtopping location along the levee alignment was not constructed.

   In the AS-BUILT plans for Phase 1A and Phase 1B, there seems to be a discrepancy in the amount of freeboard along the levee downstream of the 116th Avenue Bridge (between stations 150+40 and 115+40). In this section, the freeboard is shown on the AS-BUILTS to be approximately 2.3 feet or less, but the levee elevations match the levee design elevations from the PED report. Was the water surface elevation drawn incorrectly on the AS-BUILTS?

3. Status of topographic mapping merged product to deliver to District? Will the LACOE provide documentation regarding certification and documentation about the way the products are being merged?

   Van indicated that David Pham and Paul Beaver would be handling the certification of the topographic mapping product, but he said that he would discuss this topic with both David and Paul again.

4. Discussion about the LOMR Needs list from WEST – does the LACOE have any questions?

   Van said that he has been working on the data needs requests that he has been sent. Richard asked if the LACOE would be providing Work Maps, and Van indicated that his group was not planning to provide these. Richard also said that these are typically provided for Floodplain studies during the review process. Additional questions regarding the specific needs for the LOMR submittal can be discussed once the hydraulic model is completed and delivered to the District.

   Another issue that was mentioned regarding LOMR data needs is the conversion from the current hydraulic model cross sectional numbering scheme to match the effective model cross sectional numbering scheme. WEST volunteered to complete this task.

5. DDR Questions for the hydrologic methodology incorporated for the Interior Drainage Design: Which study includes the Rio Salado Interior Drainage Study? And how was the "8-drain sampling procedure" developed for the Rio Salado Interior Drainage Study modified to reflect greater agricultural land use in the interior drainage area of the Tres Rios levee?

   Van said that he would post the technical appendices document for the Rio Salado Feasibility Report which includes the discussion of the 8-drain methodology to the LACOE ftp site.

   Update: Van posted this PDF document to the LACOE ftp site on the afternoon of November 15th. WEST retrieved a copy of this report at that time.

Action Items:

1. Van and LACOE to ensure that the guide dikes are included in the hydraulic model either with ineffective flow areas or blocked obstructions. These may turn out to be "shadow" applications if the existing cross sections fall near but not exactly along guide dike crests.

2. Van to follow up with HNTB to ensure the estimated delivery of the hydraulic model in 3 weeks is met.

3. Van to post the technical appendices document for the Rio Salado Feasibility Report to the LACOE ftp site. *Update: Van posted this PDF document to the LACOE ftp site on the afternoon of November 15th. WEST retrieved a copy of this report at that time.*

4. Chuck to send Van and Richard red-lined versions of the AS-BUILT drawings showing the locations of lower freeboard downstream of the 116th Avenue Bridge.

5. Van to remind David and Paul to investigate 1' topo mapping certification documentation.

The next call will take place on Tuesday, November 30, 2010. A formal invitation will be forthcoming from Richard.

Update: The invitation has been sent.

Date: December 7, 2010

A teleconference was held on November 30th at 9:30 a.m. Mountain Standard Time (8:30 a.m. Pacific Standard Time) with Greg Dombrosky, David Pham, and Van Crisostomo of the Los Angeles District of the US Army Corps of Engineers (LACOE) with regards to the status of producing hydraulic modeling and supporting documentation as the basis for pending FEMA flood map revisions for the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris and Don Rerick. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants also attended. Bob Upham of the City of Phoenix was present.

The focus of the discussion was the status of the hydraulic modeling products being developed by LACOE with regards to previous discussions, and in what time-frame these products would be made available by the LACOE for a LOMR request package of floodplain and floodway map changes from the FEMA at the Tres Rios North Levee. Discussions generally followed the list of items below:

What is the Current status of the hydraulic model and related products?

Van said that HNTB is finishing up their review of the modeling input parameters such as the roughness values and ineffective flow areas in relation to existing conditions. Don verified that the model the District will receive from the LACOE will not include any Phase III design (clearing with low flow channel and environmental restoration), and Van confirmed. Van said that once the modeling is returned to the LACOE, there will be an internal review before transferring it to the District in a few weeks.

The group discussed the list of up to five hydraulic models and who will provide each, per previous discussion. It turned out the WEST is going to provide the majority of the models, with this being possible since they worked on the PED and it already included modeling the existing condition. Therefore, it is apparent that the LACOE may provide only the "with project" modeling scenario.

Richard brought up the study work maps, an item which is normally required for such studies, and Van said that the LACOE will provide these. Brian reminded us that WEST has already sent the LACOE examples of the work maps for reference.

Richard asked David Pham about the status of the DDR revisions, and David said they were underway. David expected to be able to resubmit the revised report by 1/31/11.

There were questions about the status of As-built (AB) plans and the O & M manual for the Overbank Wetlands (OBW), located east of the levee between @105th avenue and 91st avenue. While this is part of Phase II, it will still be included because there has already been considerable grading in the main Salt/Gila conveyance area as a result and therefore it is considered part of the existing condition. Bob Upham of the City said that the City"owns" it, in terms of maintenance. However, the AB plans should still come from the LACOE, and it is assumed that the LACOE have already created an O & M manual for it. The District has not received either the AB plans or the O & M manual for the OBW, yet.

> Update: David Pham of the LACOE posted the OBW and FRW O & M manuals on ftp @ 12/06/10. The document has since been downloaded.

Van initiated discussion about the freeboard (FB) depiction on the AB plans that WEST prepared, and Van said that between 115th avenue and 123rd avenue the FB depicted was not accurate. Van said he will discuss this with David, and will ask him to revise the AB plans and re-scan them.

Richard asked the status of any new documentation for certification of the topographic mapping. David said he had found the surveying report and will send it this week.

> Update: David uploaded the Survey report and alleged AB plans for the OBW to an ftp on 12/01/10. The survey report is for the 1' topo only, and has since been downloaded. Per contract, the District is having WEST review it in context with national mapping standards, and to check for product accuracy in context with floodplain/floodway delineation study requirements. It turned out that the OBW plans were not the AB plans and David has subsequently said the AB plans will be ready in about two weeks (@ 12/16/10).
>
> Note from teleconference 11/15/10: Van indicated that David Pham and Paul Beaver would be handling the certification of the topographic mapping product, but he said that he would discuss this topic with both David and Paul again.

The WEST review of the survey report is not expected to constitute certification of either the 1' topo or the merged product. The WEST review has only to do with reviewing the 1' CI mapping documentation product to determine if it contains basic certification documentation. The LACOE should continue to be regarded as the certifying authority for these products. The survey report may contain certification documentation by Towhill (the originating photogrammetry company), but the merged contour mapping product may require a separate certification. The LACOE is expected to remain responsible for this.

David said he will make sure to include the AB plans for the OBW by 12/23/10 .

A question came up about the Emergency Action Plan and if it had been prepared by the LACOE, yet. Don remarked that the District had previously sent the LACOE examples of EAPs for their reference. Don said that Gwendolyn Meyers will have to be contacted about this, after hearing the LACOE say they are awaiting authorization for funding before they start preparing the document.

> Update: Gwendolyn has since been contacted and she said that the LACOE has prepared similar documents for structures that they operate (maintain), but that the entire TRL project is being or has been turned over for operation to the District and/or the City. By deduction this means that one or both of those entities may have to prepare the EAP.

Richard asked about the status of the LER/NLSER, aka Levee Certification. Greg said he would have to talk to Paul about it.

Action Items:

1. Once the LACOE receives the hydraulic modeling from HNTB, the LACOE to check the model input values and ensure that the guide dikes are included. The LACOE to then send the hydraulic modeling package to the District/WEST for further review. This is expected to happen within a few weeks.

2. The LACOE to continue working on the AB plans for the OBW and provide them by 12/23/10.
3. Van to remind David and Paul to investigate 1' topo mapping certification documentation.
4. WEST to review the survey report for the 1' topo product from the LACOE, and make comments by 12/10/10.
5. The LACOE to revise the AB plans for the levee and re-scan them in terms of the Freeboard plot. David Pham to be the lead. This product may be sent to the District ahead of other revisions but will not be received later than 12/23/10.
6. THE LACOE to continue with revisions to the DDR and work on the LER/NLSER. The updated DDR should be delivered to the District by 1/31/11.
7. The District and the City to look into who will do the EAP production.
8. Update: LACOE uploaded OBW O&M Manual on its FTP site on Monday morning 6 Dec 10. The next call will take place on Monday, December 13, 2010. At 9:30 AZ time (8:30 CA time).A formal invitation has been sent.

Date: December 13, 2010

A teleconference was held on December 13th at 9:30 a.m. Mountain Standard Time (8:30 a.m. Pacific Standard Time) with David Pham of the Los Angeles District of the US Army Corps of Engineers (LACOE) with regards to the status of producing hydraulic modeling and supporting documentation as the basis for pending FEMA flood map revisions for the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris and Don Rerick. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants also attended.

The focus of the discussion was topographic survey certification, the status of the hydraulic modeling products being developed by the LACOE with regards to previous discussions, and in what time-frame these products would be made available by the LACOE for a LOMR request package of floodplain and floodway map changes from the FEMA at the Tres Rios North Levee. Discussions generally occurred as follows:

What is the current status of the hydraulic model and related products?

David said that he couldn't speak for Van about the status of the modeling work, and that Van will be back on the 3rd of January. Don had a question about whether Van is planning on sealing and signing the study work maps. David said another teleconference call will be needed to discuss this with Van.

Richard asked the status of certification for the topographic mapping. David mentioned a need to discuss this topic with the Survey Section Chief, Alan Nichols. Don suggested Richard write to Alan to seek certification or ask him to seek certification. The LACOE should continue to be regarded as the certifying authority for this product. The merged 1' and 4' contour mapping product may require a separate certification. The LACOE is expected to remain responsible for this.

Update: The extent of topographic mapping products with regards to effective FEMA FP/FW boundaries was evaluated during a post-conference call discussion with WEST Consultants. It appears that the 1' topographic mapping extends well beyond those boundaries in most locations except along the north bank both above and below the ends of the levee structure as constructed. The potential for the updated FP/FW to exceed the 1' topographical mapping boundary in those areas will be brought up with Van for future discussion during the next call.

Update: David sent Alan Nichols email address to Richard, and Richard sent an email sent to Alan Nichols on 12/13/10 explaining our request and inviting him to call Richard directly, and to attend the next teleconference to be held Wednesday, 01/05/11, at 9:00 a.m. Pacific time.

Richard asked David Pham about the status of the DDR revisions, and David said they were underway. David expected to be able to resubmit a revised report by 1/31/11.

Discussion about the EAP came up and David related his knowledge about an EAP for a LACOE levee system called the Santa Maria Levee (SML) in Santa Barbara County, California. David said that that levee was operated by the local FCD, there, and he thought that the EAP had been prepared by the LACOE. This seemed in contradiction to what Gwendolyn Meyers of the COE said in a previous email. She stated that it is the responsibility of the owner/operator to produce the EAP. This issue is not

settled, and David was asked to investigate the SML production and send/post a pdf copy of the SML EAP for FCDMC review. This will be a topic of further discussion.

David said that the AB plans for the OBW will be finished between now and the end of the year.

Discussion continued regarding the final design plans and construction of the phase 1C floodwall. David said that the final design plans will be ready sometime this week, and that the time frame for starting construction is still around April, 2011. He said the construction pace should be rapid once it has begun. Richard said that the hydraulic modeling should not be held up but should proceed using the final design plans. The DDR, however, may have to contain the As-built (AB) plans, so that the DDR (and related LER) finalization may not occur until the AB plans are finished.

Richard asked about the status of the LER/NLSER. David referred to a time frame from a teleconference held several weeks ago, saying that the LER should still be ready in March, 2011. However, as described above the LER may not be complete until all AB plans and therefore the DDR are completed. The LER preparation remains the responsibility of Paul Beavers.

Action Items:

1. The LACOE to continue working on the AB plans for the OBW and provide them by the end of this year (2010).
2. The LACOE to continue work towards certifying the topographical mapping. The LACOE to consider topographical mapping certification in context with the email Richard sent to Alan Nichols, LACOE Survey Section Chief on 12/13/2010.
3. The LACOE to continue with revisions to the DDR and work on the LER/NLSER. An updated DDR should be delivered to the District by 1/31/11. The LER may come in March or even later.
4. David to investigate the Santa Maria Levee EAP and upload a copy for downloading by the District and WEST consultants. The LACOE to revise the AB plans for the levee and re-scan them in terms of the Freeboard plot. David Pham to be the lead. This product may be sent to the District ahead of other revisions but will not be received later than 12/23/10.
5. The next call will take place on Wednesday, January 5, 2011. At 10:00 MS time (9:00 PS time).A formal invitation has been sent.

Date: January 5, 2011

A teleconference was held on January 5th at 10:00 a.m. Mountain Standard Time (9:00 a.m. Pacific Standard Time) with Paul Beaver and Alan Nichols of the Los Angeles District of the US Army Corps of Engineers (LACOE) with regards to the status of producing hydraulic modeling and supporting documentation as the basis for pending FEMA flood map revisions for the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris and Don Rerick. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants also attended.

The focus of the discussion was topographic survey certification, and the status of the hydraulic modeling products being developed by the LACOE with regards to previous discussions, and in what time-frame these products would be made available by the LACOE for a LOMR request package of floodplain and floodway map changes from the FEMA at the Tres Rios North Levee. Discussions generally occurred as follows:

What is the Current status of the hydraulic model and related products?

Paul said that he couldn't speak for Van about the status of the modeling work (there had been discussion amongst WEST and the District ahead of the call about the latest deliverable by HNTB, and it was agreed that there is an immediate need to discuss the item with Van).

Update: WEST Consultants personnel spoke with Van on 1/6/11 in regards to the primary question related to the latest HEC-RAS model deliverable by HNTB: what portions of Phases I and II were included in the topography for this HEC-RAS model? Van stated that only the grading completed by November 2010 for the Overbank Wetlands (OBW) was included for the Phase II features; in-channel vegetation clearing and plantings were not included in this model. However, the HNTB technical memorandum indicated that the model represented all project features for Phases I and II. This should be clarified in the technical memorandum. Van asked WEST to forward their review comments on the HNTB technical memorandum to himself.

The Survey Section Chief, Alan Nichols, joined in regarding the topographic mapping certification issue. There was discussion over past emails from Alan that included a draft survey certification letter that Harvey Beverly, former survey chief, would sign stating the mapping met national mapping standards. Further discussion occurred over whether or not such a letter would need to be sealed by an RLS per FEMA requirements, and Alan stated he would only do it if it were 100% necessary. Alan said that the mapping project manager at Towill, the mapping company, had died and the company was not readily going to provide certification documentation without him. Brian said he and his staff will look into what are the FEMA requirements by contacting Ray Lenaburg of FEMA Region IX and Michael Baker Jr. Engineering staff (Region IX reviewer). Paul discussed some related verbiage that may be needed for the LER with Alan, and Paul said once obtained he will send a draft to us for review (this verbiage may be useful in fine-tuning a certification statement letter, also). Paul questioned if there might be caveats to the regular FEMA requirements that gave Federal Agencies some leeway for their own projects.

Update: Alan has provided a letter signed by Harvey Beverly that the topography developed by Towill meets the USACE standards for vertical accuracy.

Update: WEST Consultants personnel spoke with two FEMA reviewers, Stephanie Routh from Dewberry and Mark Delorey from Baker, on 1/6/11 regarding this issue. They both agreed that the letter provided by Alan and Harvey from the LACOE will be sufficient to certify the topography because it comes from the LACOE, a federal agency. Stephanie and Mark both said that if a county or city tried to submit a similar letter, it would not be accepted. They also both stated that for non-FEMA funded projects, such as this one, FEMA does not tend to look at the topography with the strictness that it does with FEMA funded projects. In non-FEMA funded projects, FEMA realizes that the topography used is probably better than the existing topography; thus, they have a tendency to be a little lax on the certification requirements for the non-FEMA funded projects. Note that this information is from an informal conversation and does not reflect "official" FEMA policy. In addition, the FEMA reviewers will be looking for a PE or RLS stamp on the MT-2 forms, the workmaps, and the As-builts. Of course, if the LACOE does the As-built plans, there does not have to be a stamp because they are the LACOE. As long as the stamps for the MT-2 forms and workmaps are in the right place and the letter signed by Harvey is provided, there should be no issue with the topography in regards to LOMR acceptance for the Tres Rios North Levee.

Richard asked Paul about the status of the DDR revisions, and Paul said they were still planning to resubmit a revised report by 1/31/11.

Discussion about the EAP came up and Brian said he did not believe it was necessary for a LOMR package. He said he will review the FEMA standards/MT-2 forms to determine this for good.

Update: WEST Consultants personnel reviewed the MT-2 forms, and no mention of an EAP requirement for a levee is made in these forms. The MT-2 forms request a copy of the Operations and Maintenance Plan for the levee, but there is no request for an EAP.

Paul said that a discussion regarding the status of the AB plans for the OBW would have to wait until David Pham could join the conversation, and Paul said he will send David an email regarding this. Paul said that internal discussion had resulted in the re-organization of the DDR so that the As-built plans may not be included in it, but with an understanding that the LOMR package will need them.

Discussion continued regarding the final design plans and construction of the phase 1C floodwall. Don said that the City was still maneuvering to obtain right-of-way construction easements from Mr. Harper, property owner on the West side of El Mirage Road where the wall will be constructed. Don said Mr. Harper was not happy with the current design and he didn't feel the current design could be "put out" for construction yet. Richard asked Paul to contact David Pham about the status of the final phase 1C design.

Paul said he will send us a draft of the LER for review.

Next conference call is scheduled for Tuesday, January 25 at 9:00 am California time, 10:00 am Arizona time.

Action Items:

1. WEST to contact Region IX and Baker for topographic mapping certification requirements.
   Update: WEST Consultants completed this task on 1/6/11 as mentioned above.
2. Paul will ask David Pham about the As-built plans status for the Overbank Wetlands.

3. WEST to send Richard an e-file of the EAP proposal.
   Update: WEST Consultants completed this task on 1/7/11.
4. WEST to verify whether or not an EAP is needed for the LOMR package.
   Update: WEST Consultants completed this task on 1/6/11 as mentioned above.
5. WEST to contact Van at the LACOE regarding the JE Fuller report/modeling that apparently has been developed and preceded the recent revision and deliverables by HNTP. Also to discuss the HNTB deliverable.
   Update: WEST Consultants contacted Van on 1/6/11 as mentioned above. A technical memorandum commenting on the HNTB deliverable will be sent to Van the week of 1/10/11.
6. WEST to review the HNTB deliverables and provide comments by next call 01/25/11 at 9 a.m., PST (10 MST). Preferably these will be prepared in advance and transferred to Van for his review before the call.
7. Paul to contact David Pham regarding the status of the final design for Phase 1C.
8. Paul to send a draft of the LER for review when ready. It is understood that it may be very basic initially.

Date: January 26, 2011

A teleconference was held on January 25th at 10:00 a.m. Mountain Standard Time (9:00 a.m. Pacific Standard Time) with Gwendolyn Meyer of the Phoenix office of the US Army Corps of Engineers and Bob Upham of the City of Phoenix, with regards to the status of producing hydraulic modeling and supporting documentation as the basis for pending FEMA flood map revisions for the Tres Rios Levee project. Unfortunately no one from the LACOE attended. Flood Control District of Maricopa County (District) staff included Richard Harris. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants also attended.

Bob told us that the final design and construction for Phase 1C, the floodwall along El Mirage Rd., was on hold because the design had been rejected by an S & G operator who currently owns the needed land. The floodwall is a feature necessity to ensure that flows will not back up behind the levee along the western end of it.

We asked Bob if he could meet with us regarding the floodwall issue (in relation to Don Rerick's recent email regarding the City's key role) but he said he would have to determine who else at the City may need to attend such a meeting and will get back to us, later.

Gwen tried to contact Paul and left a voice message for him. She also said that David Pham is being deployed to Afghanistan. Paul Beaver later confirmed this by email and said that he will have to determine who will fill-in for David in LA. David has been in charge of finalizing the DDR, so it may be that another person will accomplish this instead while David is gone.

Update from David Pham per email: Ms. Roxanne Vidaurre was designated to continue my work on the DDR. She can be reached at (213) 452-3643 or Roxanne.R.Vidaurre@USACE.Army.Mil. Please keep her in your future emails.

Post-call discussion occurred between Richard and WEST regarding their preliminary findings during review of the JE Fuller hydraulic model, and the draft Summary Report they are revising for the District (the Final Summary Report will outline what has been made available to them and what remains to be done towards preparation of the LOMR package).

Update: Today, 01/26/11 Richard spoke with Paul and he said he will be sending the District the Geotechnical Appendix of the DDR for review. It is at a 90-95% completion, and Richard told Paul that Don Rerick should receive it and Richard would like to be copied. Paul also suggested Richard send an email to David regarding the issue of any certifiable levee-like structures east of the main levee (@ the OBW), and another email to Roxanne Vidaurre of the LACOE regarding the OBW as-built plans status.

Update: The Geotechnical report has since been received and transferred to WEST for review. See further update below in Action Items.

Action Items:

1. Bob will notify Richard about having a meeting over the Phase 1C floodwall feature once it is known who from the City should attend other than himself.
2. WEST to finalize the draft Final Summary Report for the District to better reflect the form and general content of an Arizona State Standards Technical Data Notebook, and to provide initial cost estimates for TDN development tasks.
   Update: A draft of these materials has been provided to Richard, who is currently reviewing it.
3. Richard to send an email to David regarding a question of any levee-like structures to be certified east of the main levee, and to send an email to Roxanne regarding the status of the Overbank Wetlands as-built plans.

   Update: The two above-described emails were sent, and David referred Richard to Van insofar as understanding the LACOE intentions about the levee-like structures east of the main levee. This resulted in an email forward to Van, resulting in a total three emails. Also, per Don's request Richard have re-sent teleconference invitations to stress the importance of discussions regarding the OBW features and floodplain containment in and around them. Richard forwarded the Geotechnical appendix of the DDR to WEST requesting their review and comment.

   Second Update: WEST has reported that the Geotechnical appendix appears to be a revision of another project and still apparently contains remnants of that project in the text. They have also declined to review the Geotechnical data aspects of the document.

Date: February 15, 2011

A teleconference was held on February 15, 2011 at 10:00 a.m. Mountain Standard Time (9:00 a.m. Pacific Standard Time) with Paul Beaver, Van Crisostomo, and Roxanne Vidaurre of the LACOE, Gwendolyn Meyer of the Phoenix office of the US Army Corps of Engineers, and Bob Upham of the City of Phoenix, with regards to the status of producing hydraulic modeling and supporting documentation as the basis for pending FEMA flood map revisions for the Tres Rios Levee project. Flood Control District of Maricopa County (District) staff included Richard Harris and Don Rerick. Dr. Brian Wahlin and Mr. Chuck Davis of WEST Consultants also attended.

Richard confirmed with Van that the model recently obtained from the HNTB ftp site is the same as the one Van sent yesterday. Van said it was. Richard commented that some minor issues still remained such as the use of artificial levees in non-certifiable embankment areas, but that WEST will review the model and later provide review comments. Van reaffirmed that they will provide study work maps in conjunction with modeling, and he said that the maps should be ready by the next call (@ 2-3 weeks). Richard asked about the geometry used in the Overbank Wetlands (OBW) area in the HNTB model and Van said it was based upon design information. Richard asked if WEST could check the effects of the as-built (AB) geometry for that area once it becomes available. Roxanne said the AB plans for the OBW should be ready by tomorrow.

Richard brought up what AB plans remain, including the update to the phase 1B plans to show a more accurate plot of the water surface based upon a comment made during past calls. WEST will send the related "blurb" to Richard, who will in turn send it to the LACOE. Don asked who is going to show Roxanne what needs to be changed and someone mentioned David, and that there were ways to still contact him....

Update: WEST forwarded an email sent previously to Van regarding the discussion of the seemingly erroneous water surface elevations on the Phase 1B as-builts to Roxanne on 2/17. This email included the original Phase 1B as-builts in PDF format with comments from WEST provided electronically within the PDF files.

There was a discussion about what was partially reviewed of the Geotechnical appendix to the DDR, and Paul clarified it was extracted from a project near Tucson that also had "Tres Rios..." as part of its name. Paul said that revisions to that appendix and therefore the entire DDR are occurring within the LACOE and it will be reviewed internally. He estimated the DDR, and shortly thereafter the LER, to be completed by late spring this year (end of May). He reminded all that the phase 1C must be finalized before the DDR is complete, and at present this phase is in limbo due to apparent design issues that the respective land owner has with the City and the LACOE. Bob said that the City needed to have a conversation with Tim Phillips of the District and MCDOT regarding the option to raise the profile of El Mirage road as a design alternative to the flood wall. This may prove difficult given the perception of a flood control structure in the form of a road, with attendant Operations issues. Also, under such a scenario the road may have to become a certified embankment. This may not appeal to MCDOT but Don said he will manage setting up a meeting. Bob explained later that the current design has resulted in the

land owner seeking to move a batch plant, and this is not acceptable to the City. Don told Bob that MCDOT will want to see that "every rock has been turned over" first, before they will accept the design idea of raising the roadway, and Bob said he is ready for such a challenge.

At this point Richard referred to a list he had made of six critical items that must be provided for the project to move forward:

1. There must be two post-project models provided by the LACOE, one with all AB features, and a second without the non-certifiable features. This second model will not likely provide the results that the LOMR request will be based upon, but must be provided in order to satisfy FEMA requirements to investigate structure failure scenarios.
2. Study work maps, described above.
3. Supporting documentation for all AB features, described above.
4. Levee Certification documentation, described above.
5. Phase 1C feature construction – Don reminded LACOE and the City that they must be responsible for getting this feature, or its alternative, built. The District will facilitate meetings towards that end.
6. DDR report and LER, described above.

Van restated that the LACOE still intends to provide the modeling and related documentation, and Richard mentioned a need to obtain electronic drawing files along with the study sheets. Brian said he will provide a list of files that will be needed, and it was decided that the LACOE will not be responsible for conforming to the District's HIS standards of file format – WEST will eventually provide this. Richard mentioned a need to also get FIS data, and Van asked more about what that was. Brian mentioned the flood profiles, and Van said he will have to check on who in his unit will provide that. Van said they have new interns that are going to be charged with producing this type of information. Richard re-stated that the artificial levee routine should not be used for non-certifiable structures, but AB geometry and ineffective flow areas are more acceptable modeling approaches, such as along the south embankment of the Salt/Gila @ the 115th Avenue Bridge.

Richard asked it the LACOE were going to commit to having a team set up to handle District and FEMA review comments over a period of time that may last up to 2 years. Paul said they will be formulating an internal team for this. Richard asked if it might be an advantage for the LACOE to hire a consultant to provide the bulk of study documentation and respond to comments because the experience the District has had shows a consultant team may be more cohesive over the long term. The LACOE declined the idea, and Don mentioned that this project is to be a learning opportunity for them to produce things in-house. Paul asked about what is the process for FEMA review and Richard described that the FEMA headquarters is in Virginia, but reviews may take place in Maryland or Colorado. Paul mentioned a desire to "sit down and talk" to FEMA either at the time of submittal or when their review comments are first available. Richard said such a talk may likely be by phone, and Don recalled a talk with FEMA some months ago wherein some people were not in attendance – an ongoing issue. Paul asked for a type of list of what to provide FEMA, and Richard asked WEST to provide such a list again and he will

forward it on to the LACOE. WEST will also send Richard the Data Collection Report and Summary Report once the AB plans for the OBW are received and recorded in it.

The point-of-contact issue regarding future FEMA review comments was brought up by Richard, and Don clarified that the LACOE will serve in this role because they are going to provide the data to support the LOMR.

Don told Bob he will set up the meeting regarding the phase 1C feature alternative designs. Richard asked WEST to review the latest RAS models from HNTB and to provide comments to the District. He also asked that they report on their findings using the AB OBW information @ 105th avenue, and note any changed boundary effects @ El Mirage road. WEST will provide review comments regarding this.

Action Items:

1. WEST to review HNTB models in context with responding to their comments, and check the effects of the AB OBW plans and any notable conditions @ El Mirage Rd (both sides of the river).
2. WEST to send comments and FEMA study document requirement list to Richard, along with the Data Collection Report and Summary Report, and he will forward all on to the LACOE staff Van, Alan, Roxanne, and Paul.
3. WEST to send a list of GIS files that will be required in the review of the study maps to Richard, and he will forward on to the LACOE staff Van, Alan, Roxanne, and Paul.
4. Don to set up meeting between the Corps and MCDOT to consider what to do next regarding the phase 1C flood wall.
5. WEST to send Richard the "blurb" about updating the phase 1B plans, and Richard will forward to the LACOE.
6. Roxanne to check on the AB plans for the OBW and make sure they are available soon.

The next call is planned for March 8th, 10:00 a.m, MST, and 9:00 a.m., PST. A formal invitation will follow.

Date: March 11, 2011

A teleconference was held on March 8, 2011 at 10:00 a.m. Mountain Standard Time (9:00 a.m. Pacific Standard Time) with Van Crisostomo, Roxanne Vidaurre, Mylene Guron, and Joseph Goldstein of the LACOE; Bob Upham of the City of Phoenix; Richard Harris and Don Rerick of the Flood Control District of Maricopa County (District); and Brian Wahlin with Chuck Davis of WEST Consultants regarding the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

Richard said he wanted to follow the agenda already sent in the invitation but jumped to asking about the status of the OBW as-built plans. Roxanne said they were being prepared and Brian clarified with Roxanne that the labeling was the only thing that needed revisions. This is important in understanding the status of the recent model from HNTB.

Richard asked if there were any questions about the Guidance documents sent to the LACOE, and it sounded like they had none, but may look closer at them and possibly have questions, later. The issue of filling out the MT-2 forms came up and Brian asked Van why the LACOE did not normally fill them out. Van said that in the past the LACOE simply wrote a letter in lieu of MT-2 forms. Van said he didn't know who internally will be filling out the forms. Don said he remembered that Paul Beaver (not present on the call) had said he and associated staff would. Richard mentioned that there would be plenty of opportunity for exchanging information between the District, WEST, and the LACOE towards completing the forms, but there were some items on the forms that would best be filled out by the LACOE, especially in the Levee section.

Van asked Don if Don will be at the "MCDOT Meeting" over proposal to raise El Mirage Road in lieu of the phase 1c floodwall, in two weeks. Don said "Yes", but that the floodwall may not now be necessary. (This was based upon preliminary information WEST has discussed with the District regarding report WSEL's from the HNTB model in context with surveyed/mapped elevations along El Mirage Rd. There appears to be such a drop in the WSEL that the floodwall may not be necessary, but WEST sent the LACOE an image to show the elevations and topo and LACOE was asked to review it so that there can be further discussion about omitting the floodwall, later.)

Richard mentioned that WEST had been reviewing the HNTB model, and turned the discussion with the LACOE over this to Brian of WEST. Brian said that at the moment they only had hand-written comments but will formalize them and send them before the next call on the 29th of March (hopefully much sooner). Brian said that the HNTB model looked relatively good but that there remained some areas where ineffective flow areas (IFAs) must still be added (replacement for levee modeling in locations not associated with the LACOE levee structure). Richard asked for clarification from the LACOE regarding the OBW, and Van said Joe Goldstein

will be working on this (modeling the IFA's at the OBW). Brian asked Van if he had looked at the HNTB model. Van said the IFAs are not finalized. Van and Brian seemed to agree with the n-value changes in the latest HNTB model, but Van said there was a need for more documentation. Brian said that during the WEST review they had uncovered cross sections with Vertical Extensions. He suggested that the LACOE trim those sections. Then he talked about horizontally extending some cross sections @ the junction between the Salt and Gila Rivers. This was because the WSEL at some locations exceeded those nearby cross section plots, and Richard told him that for areas where no previous delineation has been done, the final product can truncate proposed floodplains with Limit of Study labels where no previous floodplains were already established. In other words, no one will be obligated to update floodplain zoning where there hasn't been any before, such as the Gila River above the confluence with the Salt River. This is the area where Brian thought the cross sections would need to be extended, but if the area has no floodplain already, this isn't so. Brian went into further detail about what WEST had done to check the HNTB model results using the 1' and 4' topography. Don discussed the results of dropped WSEL @ El Mirage Rd. with Bob and Van, saying it appears we way be able to forego the Floodwall. Don said the LACOE will have to review the model results against the topo images WEST sent them, and Van said he thought they might have more recent topo than the 4' C.I. topo, in this area, to add/consider. Don suggested that the checking by the LACOE should be moved to the top of the "to do" list, and hoped the preliminary results don't significantly change. Richard said that written documentation of the LACOE verifying that the floodwall will not be needed from them will be needed. Bob said the City will meet with MCDOT on Monday, March 21st. Van said a LACOE representative or local representative might be there, too.

Update: WEST's formal review comments were forwarded to Richard and Van via email on Monday, March 14.

Richard asked about any time frame when the LACOE could provide a draft final post-project conditions model, and Van said within a couple of months – May 1st sounded acceptable. Richard asked Van if he had any of the effective FIS study data, and if he anticipated attending a public Open House meeting and Van said he would have to go through Paul and Gwen to define the LACOE level of participation (in terms of providing draft FIS update information related to the project and attending the meeting). Don said that local branch COE participation would suffice for the Public Notification activities.

Richard asked Van if they had any questions about the list of GIS files that WEST sent them, and Van said they are preparing the files now.

Regarding the status of forming a project team for the extended FEMA review period, Van said there has not been an update – the team is not yet identifiable. He said he didn't know if the team would be the same as the new Dam and Levee section being formed.

Following the call there was the following post-call discussion by the District and WEST:

A. Direction for WEST to be in contact with Van to see if he can send the District or WEST the additional topo he described may be available in the vicinity of the Phase 1C floodwall north of the boundary between the 1' C.I. and 4' C.I. topography already available.
B. WEST to work on pre-project condition model after LACOE finalizes the post-project condition model. The idea is it will be easier to "back into" a pre-project condition model by removing structural features AFTER the LACOE finalizes their model, than it would be to update the roughness values and other hydraulic parameters in the existing pre-project conditions model to match the hydraulic parameters in the final post-project conditions model.

Action Items:

1. Van to discuss with Paul and Gwen who will be teamed together for the FEMA review process.
2. Brian to send written formalized comments for the HNTB model review to Richard and Van. *Update: WEST's formal review comments were forwarded to Richard and Van via email on Monday, March 14.*
3. WEST will send the LACOE additional data regarding the phase 1C area. *Update: WEST forwarded an updated Phase 1C floodwall and topography figure to Van via email on Thursday, March 10.*
4. Van will review the HNTB model and then review the elevations @ El Mirage Road using the information WEST sent them and their own updated survey data.
5. Bob said he would ask Gwen to attend the MCDOT meeting regarding the phase 1C feature/El Mirage road meeting on the 21st of March.
6. Van to discuss the Public Notification issue with Gwen to develop who will be available to participate when the time comes for a Public Open House meeting to show the proposed re-delineation boundaries before sending the package to FEMA.

Paul Beaver called Richard Harris later the same day to discuss the call since he couldn't attend, and Richard briefed Paul on the specifics as described above. In addition, Paul said:

1. If a team is going to be formed for the FEMA review process he thought it will likely consist of Van, himself, Roxanne, Gwen Myers, and Mylene Guron. Richard mentioned that the LACOE had also brought in Joe for the call so Joe may also become a team member.
2. He will call Gwen about the Emergency Action Plan (EAP) requirement since the latest COE document (EC 1110-2-6067) specified a need for one. Richard said that Gwen had earlier remarked the LACOE was not going to provide one. Paul later sent an email to Gwen about this, asking for clarification.

Richard told Paul that it had already been determined that an EAP is not required by FEMA as part of the LOMR/TDN package.

The next call is planned for March 29th, 10:00 am, MST and PST. A formal invitation will follow.

Date: March 29, 2011

A teleconference was held on March 29, 2011 at 9:30 a.m. Mountain Standard Time and Pacific Daylight Time with Paul Beaver and Joe Goldstein of the LACOE; Gwen Myers of the Phoenix COE Branch; Richard Harris and Don Rerick of the Flood Control District of Maricopa County (District); Jeff Bradley, Brian Wahlin, and Chuck Davis of WEST Consultants regarding the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

There was a brief pre-call conference between District and WEST staff regarding the phase 1C issue and the overall modeling being finalized by the LACOE. It was clarified that WEST will review what the LACOE is doing right now with the HNTB model to make sure the modeling results will be acceptable in context with re-plotting the flood boundary using the newer topography. The topography may be checked separately against the model geometry in select locations to investigate the level of parity between the two. There was also discussion over what Mylene said earlier in response to WEST comments regarding channel extensions for several cross sections west of El Mirage Rd. WEST said they will clarify what the LACOE needs to do for model finalization in that area by conferring with Mylene. Unfortunately, Mylene could not attend the call. Richard mentioned that Ed Curtis of Region IX will have to be informed of proposed map changes and FIS updates for this project, and that the team should make arrangements to brief him, soon.

Once the LACOE was on the call, Richard said he wanted to follow the agenda he had already sent in the invitation, and so the first question he asked was to provide an update of who will be on the LACOE team for producing documentation. Paul said it will be himself, Mylene, and Roxanne. Joe said he will assist upon Mylene's direction. Don asked who will be the primary point-of-contact, and Paul said it will be himself. Don asked about improving the attendance consistency for calls, over which Paul said he will communicate this concern to his staff.

Brian asked Joe and Paul to clarify what differentiated the two folders that Roxanne placed on the ftp site for the as-builts of the Overbank Wetlands. Joe said that Roxanne is in training all this week, but that he will contact her and get back to the team. Brian said that initial observation is that the District has received the OBW as-builts (AB) files. It remains to check the upcoming HNTB model to make sure the AB information has been correctly modeled and that there will not be any potential for flows to go north around the east end of the levee.

Don discussed the overall importance of the re-delineation project, and then said to Paul that he would talk to Gwen and Bob Upham about this (neither of them present at the time – Gwen joined in later). There was considerable discussion at this point about the phase 1C floodwall and the issue that it may not be necessary given a closer look at modeling results in relation to local topography. Joe said that Mylene was in the process of finalizing a memo regarding the

LACOE's position on the necessity of the Phase 1C floodwall, and that he will ask Mylene for a separate call to the District about finalizing the overall model. Later Brian said he will make a direct contact with Mylene to ascertain the level of model completion. Richard asked about what may be needed if the floodwall is removed in terms of revisions to the DDR, and Paul said the feature documentation would be removed and possibly just an internal review of that change may be needed since most of the project phase is already constructed. A non-construction change should not require third party review.

Paul asked if there were a list of items other than the LER/DDR and modeling that would have to be included in the TDN/LOMR package, and Richard mentioned the Summary Report he had sent to Paul yesterday, and that Appendix A of that document lists what is needed. At this point Brian extracted and read to the LACOE what that Appendix A said, particularly the MT-2 forms. Don suggested to Paul that it would be to his own benefit to take a shot at filling out the forms himself, and Paul agreed.

Paul mentioned that there was a new policy in the USACE, and that the DDR may require an additional internal review by the LACOE and an external review by a second party based on this new policy. This external review may hold up the process of finalization for the DDR by up to 45 to 60 days. Both Paul and Gwen were uncertain as to whether or not this review was necessary for this project. Don asked Gwen if there is a possibility to obtain a waiver for the external review, and her response was maybe. The LACOE is supposed to check into this. Don requested that this item be a focus of the next call.

Richard asked Gwen about a possible discussion she may have had with Van about the public information aspect of the project, specifically possible LACOE attendance at a Public Open House. Since the flood mapping changes are being done by the sponsor, Gwen said she felt it was the sponsor's responsibility. Richard said that FEMA required some public notification regarding changes in base flood elevations and floodways by individual mailing and newspaper advertising, and the District had customarily done more with the meetings. Gwen said she may be able to attend a meeting, herself.

Don said that there had been discussion about the height of El Mirage Rd. in context with it being a feature itself that FEMA may require to be certified. There had been some discussion about the 3' height of the embankment, that anything less may not be a "trigger" to FEMA to request certification. Emily of the LACOE had said she would look into this. (need to state who Emily is). Gwen said that the recommendation on how to treat the situation for the roadway will be done by agency concession, but that an internal meeting will be needed first. Don asked Gwen to provide closure on this issue. Paul said he will check with Emily for clarification. Jeff asked Chuck to look into the related statutes.

Richard asked Paul if there were any idea about the time frame expected for completion of the DDR/LER, and Paul said this hinges on the phase 1C issue resolution. Therefore the completion time can't be estimated for now.

Action Items:

1. Richard will send Ed Curtis a request to discuss this project face-to-face. The time may be difficult to schedule and it may turn out to be during the month of June when Ed is expected to attend the AFMA conference in Tucson.
2. Don to talk more to Gwen and Bob regarding the importance of the floodplain and floodway re-delineation aspect of this project.
3. Paul to communicate with his staff regarding the attendance issue, to try to improve on consistency and uniformity.
4. Brian to call and talk to Mylene about finalization of the HNTB model. Once the model is received, WEST to review and comment. This also applies to any re-delineation and supporting documentation around the El Mirage Rd./phase 1C floodwall area.
5. Paul to check with Emily about the 3' elevation vs. structure certification issue for El Mirage Rd. Gwen to provide closure on the issue.
6. Joe to contact Mylene and get back to the team regarding the status of the modeling.
7. Joe to contact Roxanne to clarify what are the contents of the two folders on the ftp site for the Overbank Wetlands, and get back to the team about it.
8. LACOE to check into the second-party review waiver possibility in terms of any alterations to the DDR such as removing the phase 1C floodwall, and get back to the team about it.

The preferred time for the next call is planned for April 18th, 10:00 am, MST and PDT. This may change due to availability of technical staff at the LACOE. A formal invitation will follow.

Date: April 19, 2011

A teleconference was held on April 18, 2011 at 10:00 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE)

1. Van Crisostomo
2. Paul Beaver
3. Mylene Guron
4. Roxanne Vidaurre

U.S. Army Corps of Engineers, Phoenix Branch of the Los Angeles District

1. Gwen Meyer

City of Phoenix (COP)

1. Bob Upham

WEST Consultants

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

The first item discussed, as per the agenda developed by the District prior to the call, was the viability of removing the Tres Rios North Levee Phase 1C floodwall from the project. Based on the results of the mapping analysis conducted internally by LACOE and the independent mapping analysis conducted by WEST Consultants, Van stated that the LACOE has tentatively decided the Phase 1C floodwall is not necessary pending the results of external review by another Corps of Engineer District office and possible additional updates to the hydraulic modeling (both the LACOE and WEST analyses utilized the results from the most recent HNTB hydraulic model which was developed from 2001 topography and mapped these results on updated topography). Several members of the LACOE staff have concurred that removing the Phase 1C floodwall from the project is likely viable because the El Mirage roadway embankment is just a rise in elevation, not an embankment that requires certification as a levee, and model results show the depth of flow on the western roadside to be only a few inches higher than the lowest ground surface elevation on the eastern side of the road at most.

Richard asked if this update would require a change order or similar process internally for the LACOE. Van indicated that it would not; the only change that will be required for LACOE will be incorporation of the removal of the Phase 1C floodwall into the text of the DDR. Van indicated that Roxanne and her group will be coordinating the external technical review (ETR) to be completed by another District office.

Richard mentioned that due to the availability of better topography data covering an area from approximately 100 feet to the east of El Mirage Road to the downstream end of the hydraulic model (a product of the District's 2008 Gillespie mapping), we should possibly re-cut the cross sections for the hydraulic model in this portion of the study reach. This is due to the fact that FEMA will likely question the methodology of using a hydraulic model cut from 2001 topography and then mapping those results on 2008 topography when the hydraulic model could have been cut initially on 2008 topography. Van mentioned that this would be the correct way to approach the downstream modeling, but that Gwen would have to make the final decision on this issue based on personnel and budgetary considerations. Gwen said that she would discuss this with the team internally before coming to a conclusion on this issue.

Mylene mentioned that she would like to obtain the survey data provided by the Maricopa County Department of Transportation (MCDOT) for El Mirage Road that Richard obtained and forwarded to the LACOE. Paul said that he would forward that survey data to Mylene and Van. There is also a follow-up email that Richard sent to Paul to explain the coordinate projection transformation and scaling that is required to convert that data from a local surveyor projection used for most MCDOT surveys into the standard Arizona State Plane, Central, NAD83, Feet projection.

Don mentioned that he would like to announce at the next meeting with the local community that the Phase 1C floodwall would no longer be required. Van said that if this announcement is made, it should be emphasized that this is still only a preliminary decision pending the results of the ETR and possible hydraulic modeling updates.

Van inquired if the as-builts for El Mirage Road were available for the LACOE seepage analysis of the El Mirage roadway embankment. Richard stated that they were not, and Van indicated that the sampling done by LACOE recently would be sufficient for soil parameter inputs to the seepage analysis. The most recent topography data that the District could provide to aid in this seepage analysis would be the 2008 Gillespie mapping data, which was previously provided to Mylene in both topographic line work format and mass point/break line format for TIN development.

Paul indicated that he had communicated with his staff regarding consistency in call attendance, and he also mentioned that deployments and other interests for the LACOE could still continue to affect staff availability for this project.

With the recent preliminary decision to remove the Phase 1C floodwall from the project, the DDR will have to be updated significantly. This will change the schedule for the DDR. Gwen estimated that the end of this calendar year would be the earliest that the DDR could be completed.

Don asked if Bob and the COP would like to contact Mr. Harper regarding the preliminary decision for the Phase 1C floodwall. Bob indicated that the District should make this call, and Don agreed. Bob concluded that there are no outstanding issues with COP that should delay this information reaching Mr. Harper.

Richard and Don indicated that since the District will be the regulatory agency for the floodplain re-delineation, the District's standards should be achieved for the work map products. Joe was not on the call, so the call attendees agreed that the example work maps provided to the LACOE previously and the work map comments provided via email by WEST would be forwarded to Joe to make updates to the work maps.

Action Items:

1. The LACOE will discuss internally whether to re-cut the hydraulic model cross sections near the downstream end of the hydraulic model based on the updated 2008 Gillespie topography provided recently by the District. This would be ideal for the FEMA submittal and for the improved mapping in the vicinity of the Phase 1C floodwall; however, funding sources and personnel availability need to be identified internally by the LACOE before moving forward with this step. Gwen will follow up on this task.
2. The LACOE will discuss internally what the revised schedule for the DDR and eventually for the LOMR will be based on the preliminary decision regarding the Phase 1C floodwall.
3. Roxanne will begin coordinating the ETR for the LACOE.
4. Paul will forward the MCDOT survey data and instructions to transform that data into the standard coordinate projection to Mylene and Van.
5. WEST will forward the initial comments on the work maps (sent previously to the District and certain LACOE personnel) to all team members.
6. WEST will forward the work map examples that are up to the District's work map standards directly to Joe.

The next call is planned for Monday, May 9th, 10:00 am, MST and PDT. This may change due to availability of technical staff at the LACOE. A formal invitation will follow.

May 9, 2011

Tres Rios Levee Floodplain and Floodway Re-delineation Project Kick-Off Meeting

Those present included:

Chuck Davis and Brian Wahlin of WEST Consultants, Inc.
Don Rerick, Gant Wegner, and Richard Harris of the FCDMC

Basically the meeting entailed going over the previously approved Scope of Work (Scope), beginning with the overall number of days for the major activities and then working through each Scope task. Coordination was of course covered first, with discussion as to when the most appropriate times may be for posting legal advertisements, holding the public Open-House Meeting (OHM), etc.

Brian produced a draft work schedule that included a projected monthly expenditure for the scheduled time-frame, and Don asked if the amount included everything. Brian responded that the amount did include everything, as if WEST will be doing all the work and the LACOE were going to do nothing. This is not intended, of course, but can cover the "worst case" scenario. The LACOE is expected to produce the post-project RAS modeling and revised floodplain/floodway results package, and the Levee Certification documentation.

Richard presented a draft Notice of Intent to study, which Gant asked for in electronic format. It was decided to have the OHM in Mid-March of 2012, and a discussion followed about the format, including the use of Google Earth. Also, the role that WEST will be involved with includes assisting with producing the draft OHM mailer and creating the OHM presentation boards.

Data Collection was covered next and it was very brief because most of the data has already been collected except some GIS files that WEST requested and that Richard will provide.

Hydrology has already been covered.

Hydraulics was discussed in greater length but the general consistence did not vary greatly from most floodplain delineation study Scope sections, with the exception of the number of total RAS models that may be created as part of the final TDN package (this is a result of the Levee-related structural changes to the watercourse geometry). Of particular note the verbiage made allowance for WEST to provide all the models.

Digital data was discussed and the outcome was that WEST requested the District to provide Street and Cadastral information, which Richard will provide.

Deliverables and the FEMA submittal did not include anything unusual, nor did the Final Deliverables.

Action Items:

1. Richard will send Gant an electronic copy of the Notice of Intent to Study.
   Update: Done 5/9/11.
2. Richard will send WEST an electronic copy of the verbiage to be added to the District's website.
   Update: Done 5/9/11.
3. WEST to update the project schedule.
   Update: Done 5/9/11.
4. Gant to provide WEST with an example of a public Open House Meeting notification brochure.
5. Richard to provide WEST with GIS files of Streets and Cadastral Sections for the TRL study area.
   Update: Done 5/10/11.

Date: May 9, 2011

A teleconference was held on May 9, 2011 at 10:00 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE)

1. Joe Goldstein
2. Paul Beaver
3. Mylene Guron
4. Roxanne Vidaurre

U.S. Army Corps of Engineers, Phoenix Branch of the Los Angeles District

1. Gwen Meyer

City of Phoenix (COP)

1. Bob Upham

WEST Consultants

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

The first item discussed, as per the agenda developed by the District prior to the call, was re-cutting the hydraulic model cross-sections near the downstream end of the hydraulic model using the updated 2008 Gillespie topography provided by the District. Mylene indicated that the LACOE had decided to re-cut the model using the updated topography. Mylene also stated that the LACOE will be comparing the new WSEs with the old WSEs. Since they have just received the TIN from WEST last week, there is no schedule for updating the model at this point.

The LACOE met with Ed Curtis from FEMA on April 28th to discuss this project along with other projects. At the meeting, Ed indicated that the Tres Rios project was too large for a LOMR and it must be covered under a Physical Map Revision (PMR), which is a much more lengthy process. Richard stated that this is probably not the case. A LOMR can be applied for if it covers one FIRM panel plus two additional partial panels. Richard will clear this issue up with Ed during a meeting at the AFMA conference on June 8th from 1:00 to 1:45. Personnel from the LACOE are welcome to attend the meeting (and/or the conference) which takes place in Tucson. In addition, the LACOE discussed the modeling scenario around El Mirage Road with Ed Curtis and he seemed to be okay with the approach.

Paul mentioned that he believed that EC 6067 requires an emergency action plan (EAP) to be prepared for the levee. An EAP is required of all USACE levees and if one does not exist, then the levee will get a deficiency during the LACOE inspections (which occur once every 5 years). Paul stated that if the levee fails and the District is not in compliance (i.e., there is a deficiency in the levee inspections), then federal emergency dollars may not be available to repair the failed levee. Brian stated that an EAP was not required by FEMA for a LOMR. It was decided that an EAP would be developed for the Tres Rios levee after the LOMR was completed.

The second agenda item was an update on the status of the DDR. At this point, the LACOE will remove any reference from the DDR to the Phase 1C floodwall (although the modeling that Mylene is working on needs to be completed before the final decision to eliminate the floodwall is made). Because of the external USACE review that is needed (i.e., the Agency Technical Review or ATR), the completion of the DDR has been pushed back to November or December of 2011.

The ATR can take up to 120 days to complete and involves review of technical work by other USACE District office. At this point, the LACOE has made contact with another USACE District office regarding performing a review; however, there has been no response back.

There was a discussion on cleaning up some of the holes and islands in the initial mapping work products. Joe indicated that he would clean these items up when he revised his maps based on Mylene's modeling.

There was some discussion as to the technical details to the modeling such as floodway encroachment methods, critical depth warnings, tie-in considerations, CHECK-RAS, and creating flood profiles and the floodway data table. The LACOE indicated they would contact the District or WEST with any questions.

The next call was set for Tuesday, May 31st at 10:00 AM. Richard asked Mylene if she could have some initial modeling results completed at that time as it would be helpful to review them during the next call and then use them in the meeting with Ed Curtis on June 8th. Mylene indicated that she would try to get some modeling results completed by the next conference call.

Action Items:

1. The LACOE will provide a letter to the District and WEST stating that a meeting with Ed Curtis of FEMA took place on April 28th and provide a short description of the meeting. This information will be used in the TDN documentation for FEMA.

2. WEST will send the LACOE information on the AFMA conference in Tucson. Update: This was done later in the day on May 9th.
3. WEST will send the merged 2001 and 2008 TINs to the LACOE. This will include a brief recommendation to use the merged TIN for re-plotting the LACOE floodplain modeling results.
4. WEST will forward CHECK-RAS instructions to the LACOE.
5. Mylene will attempt to get some modeling results completed by the next conference call on May 31, 2011.

The next call is planned for Tuesday, May 31st, 10:00 am, MST and PDT. A formal invitation will follow.

Date: June 1, 2011

A teleconference was held on May 31, 2011 at 10:00 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE)

1. Van Crisostomo
2. Paul Beaver
3. Mylene Guron
4. Roxanne Vidaurre

WEST Consultants

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

The first item discussed, as per the agenda developed by the District prior to the call, was the merged TIN (combining the 4' C.I. overbank topography east of El Mirage Road, the 2001 2' C.I. in-channel topography east of El Mirage Road, and the 2008 2' C.I. Gillespie topography west of El Mirage Road) developed by WEST. Mylene indicated that the LACOE could not utilize this merged TIN product because a runtime error message was occurring in ArcGIS 9.3.1 indicating that the TIN was too large to generate GeoRAS output properly. WEST said they would check with their GIS personnel to determine if there is a solution to this issue. Additionally, Mylene said the mapping that had been done previously was completed by mapping a portion of the modeling output on the standalone TIN east of El Mirage Road (2001 2' C.I. topography in the channel and 4' C.I. topography in the overbanks) and mapping the remaining output on the standalone TIN west of El Mirage Road (2008 Gillespie topography). Plots of these mapping output products were forwarded to the team by Mylene via email on Thursday, May 26. These plots show good agreement between the upstream and downstream floodplains divided at El Mirage Road. However, the transition between these two mapping products would need to be smoothed to match precisely (assuming that the entire merged TIN product cannot be used).

The second item discussed was the vertical datum to be used for all hydraulic modeling and mapping products. Mylene said that 2.14 feet was used to shift data referencing the NAVD88 datum (e.g., the 2008 Gillespie topography west of El Mirage Road) down to the NGVD29 datum to match the 2001 topography east of El Mirage Road. Therefore, the entire hydraulic model references the NGVD29 datum.

Mylene currently has submitted a draft technical memorandum to Van supporting the removal of the Phase 1C floodwall from the project. The decision to remove this portion of the project will be agreed upon by SPL staff at the completion of the review of this technical memorandum; however, additional review within the Corps via an ATR will still be required to finalize this decision. Roxanne indicated that it is likely that SPK (i.e., Sacramento District) will be the district reviewing this decision. Review of the final review plans for SPK to complete the ATR are currently ongoing, and the ATR can commence at the completion of this review.

The LACOE is still working on tying the hydraulic model in to the effective FEMA model. LACOE will likely wait to complete the floodway analysis until the floodplain modeling and mapping products have been reviewed initially by the District. Also in regards to the hydraulic model, Richard asked about some wording in the description of the RAS model recently provided by the LACOE to the District indicating the low-flow channel clearings were possibly included in this plan. Van and Mylene confirmed that this was a remnant of a previous model developed for the LACOE, and this wording would be removed for the final modeling product. Also, Van confirmed that none of the Phase III project features (i.e., low-flow channel clearings, plantings, etc.) were included in the geometry of the current RAS model deliverable.

LACOE has not downloaded CHECKRAS as of yet. WEST will forward instructions regarding CHECKRAS to Mylene and Van.

The DDR is still expected to be completed between October and December of this year, as stated in the last call on May 9.

Paul forwarded the EC 1110-2-6067 document and pointed out the location of information regarding EAP/ERP information in that document (Pages 49 and 50). Based on the wording of the language in this document, Paul inquired who "developed" this levee. The reason he asked this is based on the following sentence taken from EC 1110-2-6067, Section 9k. Residual Risk and Public Safety, Subsection 4. Emergency Response Plan:

> *The system under evaluation should have an emergency response plan supported by a flood warning system. Such plans are often a component of floodplain management plans developed by USACE and levee system non-federal sponsors as a component of agreements signed when the levee system is transferred to the non-federal sponsor at completion (Reference ER 1105-2-100, Chapter 3, paragraph 3-3). Levee systems developed by others may have such plans developed in support of communities' obligations under the NFIP and associated mitigation grant programs. The emergency response plan should be under the jurisdiction of federal, state, or community officials. The flood warning system must provide warning time sufficient to ensure that the system will be operated as planned during the occurrence of a flood event. The*

emergency response plans must also seek to maximize public safety from the occurrence of flood events that exceed levee system capacity, demonstrating that the possibility of exceedence and failure has been planned for, and that the plan has a high likelihood of being successful should such a flood event occur. Emergency response plans will address the key issues of flood threat recognition, warning dissemination, evacuation, and search and rescue. It shall also be demonstrated that such plans are current and tested (updated and tested at an interval of 5 years or less).

Don reiterated that although the Holly Acres Levee was a pre-existing structure incorporated into the Tres Rios North Levee, the concept was a joint effort between the LACOE and the City of Phoenix. Paul also asked about mapping additional flood-flow return periods for the emergency response plan. Don mentioned that the minimum emergency response plan required for approval by the LACOE and submittal to FEMA would be pursued by the District. The following sentence taken from the introduction Section 9k. Residual Risk and Public Safety, of EC 1110-2-6067:

NFIP levee system evaluation is only concerned with the levee system performance associated with the 1% annual chance exceedance flood. While only one of the elements of residual risk and public safety (Emergency Response Plan, paragraph 9.k.(4)) is a required technical factor in the NFIP levee system evaluation, USACE will examine and report in the NLSER, several other elements of residual risk and public safety as noted in paragraphs 9.k.(1) through 9.k.(4).

Richard mentioned that the LACOE should feel free to submit draft deliverable regarding hydraulic mapping products at any time, as the process of finalizing mapping can be an iterative process to match the District standards.

Richard mentioned that the meeting scheduled with Ed Curtis from FEMA at the AFMA conference on June 8th will not occur now because Ed will be at the District offices on June 7th prior to the AFMA conference. Due to the fact that Richard does not currently know what time he will be meeting with Ed on Tuesday, the District and the LACOE decided that the LACOE would not try to conference in on that call. However, personnel from the LACOE are still welcome to attend the meeting with Ed on June 7th if interested once the details are made known, or to attend the AFMA conference (and possibly still the meeting with Ed on Wednesday, June 8th) which takes place in Tucson. Van, Paul, and Mylene indicated that would likely not be able to attend any of these meetings. Gwen had indicated in a previous call that she might be able to attend pending the final schedule. One primary point of discussion with

Ed will be whether the Tres Rios Floodplain Re-delineation will need to be submitted as a LOMR or as a PMR based on the number of full and partial panels that will be updated for this project.

Action Items:

1. WEST will forward information to Mylene and the LACOE regarding CHECKRAS. *Update: An email was sent by WEST to Mylene on June 1st outlining the installation procedures and typical issues encountered when running CHECKRAS.*
2. WEST will review the EC 1110-2-6067 for additional information regarding the EAP/ERP required for the Corps levee certification process and how those requirements differ from the FEMA requirements.
3. WEST will review any information available in their office regarding travel times between Granite Reef Dam and Tempe Town Lake for additional information regarding a flood warning system.
4. The LACOE will continue to work on identifying tie-in locations between the current hydraulic model and the effective FEMA model. WEST will support in this task if needed.
5. The LACOE will continue to work on mapping products as well as technical documentation relating to all modeling and mapping results.
6. Mylene will follow up with Van on the finalization of the internal SPL technical memorandum declaring that the Phase 1C floodwall will no longer be a required part of the flood protection for the Tres Rios North Levee project.
7. Roxanne will finalize the scheduling of the ATR with SPK at the completion of the review of the final review plans for the ATR.

The next call is planned for Tuesday, June 21st, 10:00 am, MST and PDT. A formal invitation will follow.

Date: June 22, 2011

A teleconference was held on June 21, 2011 at 10:00 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Paul Beaver
3. Mylene Guron

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

Pre-conference call discussion

Prior to the conference call, WEST and the District had a brief discussion regarding the status of the public notification process. The District provided a sworn, signed copy of an affidavit showing the advertisement of the "intent to perform a floodplain and floodway re-delineation study of the Salt and Gila Rivers" that was run in the Arizona Business Gazette on June 9, 2011. This legal advertisement is required by FEMA for the LOMR process. The affidavit will be included in Appendix B of the Technical Data Notebook to be completed by WEST at the end of this project and submitted as supporting documentation for the LOMR package to FEMA. The affidavit will be included in a sub-section of Appendix B specifically for public notification meeting the legal requirements set forth by FEMA.

Additionally, the District requested that WEST finalize the right-of-entry figure for the brochure advertising the floodplain and floodway re-delineation study. This figure is separate from the figure outlining the study area; the right-of-entry figure will include the entire model area just to be sure all possible adjacent landowners are notified of possible access issues across their property due to the re-study. The study area figure will be based on the final tie-in locations as determined by the LACOE.

Conference call discussion

The first items discussed during the call, as per the agenda developed by the District prior to the call, were the action items from the last call on May 31, 2011. These items included the following:

1) The LACOE will continue to work on identifying tie-in locations between the current hydraulic model and the effective FEMA model.
2) The LACOE will continue to work on mapping products as well as technical documentation relating to all modeling and mapping results.
3) Roxanne will finalize the scheduling of the ATR with SPK at the completion of the review of the final review plans for the ATR.

The first two items on this list had been delayed at the time of the call due to a datum conversion issue for the hydraulic model developed by the LACOE. Mylene is working to reference all of the elevation data in the hydraulic model to the NGVD29 datum, at which time the tie-in locations can be identified and the mapping products can be finalized.

The third item on this list regarding the ATR was addressed by David Pham. David said that the South Pacific Division (SPD) had provided review comments on the ATR plan submitted by SPL, SPL had reviewed and incorporated these comments into the draft ATR plan, and this updated ATR plan had been resubmitted to SPD for final review. David was not sure when SPD would finalize their review. Upon completion of the ATR plan review by SPD, the memorandum detailing the analysis supporting the removal of the Phase 1C can be submitted to the Sacramento District (SPK) for the ATR.

The next item discussed on the call was the meeting with Ed Curtis (FEMA Region IX) and Wen Chen (Baker Region IX) held at the District on June 7. Richard summarized this meeting by saying the Ed indicated that the package should be submitted as a LOMR, but it may be rejected by FEMA HQ as a LOMR due to the fact that the updated hydraulic modeling and mapping would affect more than 2 full FIRM panels and 2 partial FIRM panels (i.e., panels that can be updated at the appropriate mapping scale on an 11" x 17" plot instead of the typical 22" x 34" FIRM panel size). If it is rejected, then the mapping changes would have to be made through a Physical Map Revision (PMR) process, which is much longer and more tedious than a LOMR, especially in regards to the funding vehicles for PMR projects. However, Ed did indicate that Region IX has a "floating" PMR grant that is used for projects that are on the small end of the PMR spectrum (as the Tres Rios update would be) that would not be funded as an entirely separate PMR grant. Although the possibility of using a previously established PMR grant is encouraging in that it would reduce the time needed to implement the mapping changes compared to the process of having to add the Tres Rios mapping update project specifically

onto an upcoming new PMR grant, the PMR process suggested by Ed would still likely add 6 months to a year onto the total timeline for updating the Salt/Gila floodplain/floodway mapping to reflect the Tres Rios North Levee with an estimated implementation date of summer 2013. Based on this, the District again stressed the importance of maintaining the current schedule without delay to expedite the PMR process. Based on the discovery that the mapping update would likely have to go through the PMR process, Don mentioned that it might be useful for the City of Phoenix as the project sponsor to encourage the Corps to request that FEMA allow this package to be submitted as a LOMR to forego the schedule delays that a PMR would instigate.

To go along with this discussion, personnel scheduling for the LACOE was addressed at this point in the call. It was mentioned that Mylene would be going on maternity leave in September, and that Joe is currently deployed to Alabama until July. The District reiterated the importance of a consistent team for the LACOE to finalize this project as quickly as possible.

The next item discussed was the status of the LACOE's progress in the technical analysis and supporting documentation to delete the Phase 1C floodwall from the project. Mylene indicated that if the datum conversion currently being completed by her team only changes water surface elevations slightly and does not alter the recommendation of SPL to remove the Phase 1C floodwall, she will likely only update the previously approved technical memorandum signed by Van and approved by SPL using an addendum as opposed to an entirely updated memorandum. Mylene said that the completion of the hydraulic modeling, updated technical analyses for seepage and geotechnical stability, addendum to the memorandum, and revisions to the DDR were all underway currently.

The next several items discussed during the call were based on the proposed summer work items as identified by the District.

First, Mylene indicated that draft hydraulic results and study sheets could possibly be made available in 6 weeks (approximately two conference calls from the present call), but she mentioned that SPL is currently short-staffed due to deployments.

Second, Paul indicated that SPL is currently filling out the MT-2 forms, and a draft might be made available by the next phone call. WEST mentioned that updated MT-2 forms are available on FEMA's website, and Paul indicated that SPL is using the updated MT-2 forms. Also, the issue of the Professional Engineer's stamp that is required for the MT-2 forms was discussed. Don requested that WEST investigate if the Corps could forgo stamping the MT-2 forms as they are able to forgo professional certification for many design documents produced internally. WEST will follow up with FEMA regarding this question.

Third, the District feels confident that the downstream location of the tie-in for the hydraulic model should be able to occur upstream of the confluence with the Lower Gila River and the Agua Fria River. If FEMA's specifications for the tie-in cannot be met upstream of the confluence with the Agua Fria River, the backwater effect of the updated hydraulic model on the Agua Fria River and the corresponding changes to the floodplain/floodway documentation in the Flood Insurance Study will need to be considered as well for the LOMR package.

Post-conference call discussion

After the conference call, WEST and the District had a brief discussion regarding the status of the emergency action plan. Based on the language in EC 1110-2-6067 and the language in FEMA's procedure memorandum #63, WEST will provide the District with a proposed scope of work to develop an emergency action plan based on the simplified case of the entire currently effective floodplain becoming inundated during a levee breach. This level of analysis for an EAP would not require any additional modeling tasks.

Action Items:

1. WEST will post GIS information provided by Richard (including effective FEMA shape files such as floodplain/floodway, base flood elevations, hydraulic baseline, etc.) to the WEST ftp site for retrieval by Mylene and the LACOE. *Update: WEST posted this information to the WEST ftp site and provided access instructions to this data to Mylene on June 21.*
2. WEST will send the right-of-entry figure to Richard and Gant for review.
3. WEST will plot the output of the final hydraulic model from the LACOE on the merged TIN of the entire project area using the HEC-GeoRAS build for ArcGIS 9.2. Additionally, WEST will compare the profiles generated from the updated model against the effective data and discuss the results with the LACOE in context with their identifying downstream tie-in locations.
4. WEST will investigate whether or not a PE seal is necessary when the USACE submits the MT-2 forms to FEMA.
5. Don to discuss the possibility of the City of Phoenix and the Corps requesting that FEMA provide a variance from the typical maximum area of a re-delineation study that would require a change from a LOMR to a PMR with Bob and Gwen at the next steering committee meeting for Tres Rios North Levee. This meeting will be held on Wednesday, June 22, 2011.

6. The LACOE will finalize the tie-in locations between the current hydraulic model and the effective FEMA model. WEST will support in this task if needed.
7. The LACOE will continue to work on mapping products as well as technical documentation relating to all modeling and mapping results.
8. Mylene will review Richard's comments on the HEC-RAS model and provide responses to these comments in writing.
9. Roxanne will finalize the scheduling of the ATR with SPK at the completion of the SPD review of the final review plans for the ATR.
10. WEST to begin developing a proposed Scope of Work for the development of an Emergency Action Plan for the Tres Rios North Levee project.

The next call is planned for Tuesday, July 12th, 10:00 am, MST and PDT. A formal invitation will follow.

Date: July 14, 2011

A teleconference was held on July 12, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Paul Beaver
3. Mylene Guron
4. Roxanne Vidaurre
5. Gwen Meyer
6. Joe Goldstein

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios Levee project.

Pre-conference call discussion

Prior to the conference call, WEST and the District had a brief discussion regarding the status of the project. The discussion centered on tie-in issues. Richard noticed that the there were two sets of BFEs on the FIRMs. One set in the Salt/Gila River and a second set north of Southern Avenue. It appears that Southern Avenue was modeled as an embankment in Baker's original study and the second set of BFEs corresponds to the "without embankment" condition. While most of this floodplain will likely disappear because of the Tres Rios North Levee, care should be taken to determine if tie-ins in this vicinity will be an issue due to the split BFEs.

There was also a discussion of how to handle the changes in the BFEs between the effective conditions and existing conditions. The Baker report has an extensive table describing the BFE changes. Both the District and WEST will look at the Baker report more closely for some ideas on how to handle this issue in the TDN.

Conference call discussion

The first items discussed during the call, as per the agenda developed by the District prior to the call, were the action items from the last call on June 21, 2011. These items included the following:

1) WEST will post GIS information provided by Richard (including effective FEMA shape files such as floodplain/floodway, base flood elevations, hydraulic baseline, etc.) to the WEST ftp site for retrieval by Mylene and the LACOE.
   Update: WEST posted this information to the WEST ftp site and provided access instructions to these data to Mylene on June 21.

2) WEST will plot the output of the final hydraulic model from the LACOE on the merged TIN of the entire project area using the HEC-GeoRAS build for ArcGIS 9.2. Additionally, WEST will compare the profiles generated from the updated model against the effective data and discuss the results with the LACOE in context with their identifying downstream tie-in locations.
   Update: The completion of this item was contingent on the LACOE providing WEST a version of the HEC-RAS model that had the datum conversion issue corrected. The LACOE provided this model and CHECK-RAS results on July 11, thus WEST had not had time to perform this mapping exercise at the time of this call. WEST will work on this mapping exercise now.

3) WEST will investigate whether or not a PE seal is necessary when the USACE submits the MT-2 forms to FEMA.
   Update: FEMA has reported that the LACOE will have to sign/seal the MT-2 forms. David Pham indicated that Mylene would seal the H&H portion while Paul will seal the geotechnical portion. Richard also discussed the overview and concurrence form (MT-2 Form 1) that will have to be signed and sealed by someone from the LACOE.

4) The LACOE will continue to work on mapping products as well as technical documentation relating to all modeling and mapping results.
   Update: Joe Goldstein is back from his TDY and is now available to assist in the development of the work maps. He will try to get a draft version of the work maps complete before the next conference call on August 1. Additionally, Richard provided comments on how to incorporate information from previous studies into the TDN in a format acceptable to FEMA. For example, the progression of updates for Manning's roughness values in this model (Baker effective model, WEST PED model, JE Fuller model,

HNTB model) need to be explained and summarized in the text of the report to justify the use of the current roughness values to FEMA.

5) Mylene will review Richard's comments on the HEC-RAS model and provide responses to these comments in writing.
   Update: This has occurred, and Mylene's responses are being reviewed by WEST. In particular, WEST is reviewing the location of the tie-ins. Note that the LACOE is using ArcGIS 9.3.1, so they will not be able to work with the merged TIN. They will have to develop two separate floodplain polygons (one for the upper portion of the model east of El Mirage Road and one for the lower portion of the model west of El Mirage Road), and then merge these two floodplains together. Hydraulically, there is no issue with doing this; however, there may need to be some smoothing done to the floodplains in the area where they are merged.

6) Roxanne will finalize the scheduling of the ATR with SPK at the completion of the SPD review of the final review plans for the ATR.
   Update: No word from SPD at this point. On July 11, Roxanne's supervisor (Emily) sent a reminder email to SPD but they still have not heard back regarding this issue. David said he would follow up with SPD on this issue also.

<u>*Additional discussion items*</u>

Richard presented the following schedule for the remainder of the project:

1. LACOE to provide responses to review comments and revised modeling by August 1. Response package to include updated model, first draft MT-2 forms, and first draft of study sheets.
   LACOE initial response: The model is already complete; they will attempt to get draft MT-2 forms and work maps completed by August 1.
2. Review by District/WEST of these products for three weeks with comments due to LACOE by August 23.
3. Response by LACOE for the above review comments due by September 13. Response package to include final draft study sheets.
   LACOE initial response: The end of the federal fiscal year is September 30, so this deadline may not be feasible due to end of year commitments.
4. Review of the final draft study sheets, final MT-2 forms, and final post-project RAS model by District/WEST with any comments due to LACOE by September 27. Meeting

this time frame may also be subject to the above item #3; it may be slightly delayed as a result.

5. Finalization of draft materials from LACOE by around October 15.

The LACOE should generate the draft TDN using WEST's Summary Report as a template. The LACOE needs to review the Summary Report and determine the extent of extra work needed to update it into the draft TDN, before committing to the above schedule.

Regarding Phase 1C, now that the model has been updated, a second addendum will be issued to the letter stating that Phase 1C was not necessary (note that the first addendum clarifying a few issues from the original letter was already issued). The second addendum will be issued soon; however, the LACOE needs to map the floodplain using the new model first. David mentioned that the O&M manuals for Phases 1A and 1B need to be reviewed for any mention of Phase 1C. Any reference to Phase 1C in the O&M manuals will need to be removed.

Mylene will be going on maternity leave around September 1. Van will be taking over her duties at that point.

WEST mentioned that a scope of work for the Tres Rios North Levee Emergency Action Plan (EAP) is currently being developed in conjunction with the District.

Post-conference discussion

After the conference call, WEST and the District discussed the draft scope of work for the Tres Rios North Levee EAP. Several comments were obtained from various District personnel. These comments will be incorporated into the scope of work and finalized. Additionally, the draft scope will be sent to members of the LACOE team for review and comment to ensure the scope meets the requirements for EC 1110-2-6067 as understood by LACOE personnel. At that point, the District will approve the scope and issue a Notice to Proceed.

Action Items:

1. WEST will send the LACOE a Word version of the Summary Report that can be used as a template for the final TDN. *Update: WEST emailed the Word version of the Summary Report to the LACOE on July 14.*
2. WEST will send the LACOE completed MT-2 form examples for projects that involve levees that the LACOE can use as guidance when filling out the MT-2 forms. *Update: WEST emailed the example levee MT-2 forms to the LACOE on July 13.*

3. WEST will plot the output of the final hydraulic model from the LACOE on the merged TIN of the entire project area using the HEC-GeoRAS build for ArcGIS 9.2. Additionally, WEST will compare the profiles generated from the updated model against the effective data and discuss the results with the LACOE in context with their identifying downstream tie-in locations.
4. David Pham will follow up with SPD regarding the review plan for the ATR.
5. David Pham will review the Phase 1A and Phase 1B O&M manuals for any references to Phase 1C and remove those references.
6. Paul Beaver will review WEST's Summary Report to determine the level of effort that will be needed to update the Summary Report to the level of the final TDN.
7. Joe Goldstein will research data availability with the LA District office for data supporting work map development (e.g., roads, jurisdictional boundaries, etc.). If these data are not available, the LACOE can acquire this digital data from the District.
8. WEST will talk to Mylene regarding the various models needed for the TDN.
9. WEST will post Baker's Manning's *n*-value report on their FTP site. *Update: WEST posted this report on their ftp site on July 13.*

The next call is planned for Monday, August 1st, 10:30 am, MST and PDT. A formal invitation will follow.

Date: August 5, 2011

A teleconference was held on August 1, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Van Crisostomo
3. Mylene Guron
4. Joe Goldstein

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Conference call discussion

The first item discussed during the call was the recent communication between the District and the City of Avondale. The District has set up a meeting with Charles Andrews at the City of Avondale offices to discuss the status of the Tres Rios Levee LOMR package. This meeting will be held at the city's offices at 1:00 PM on Thursday, August 11. Bob Upham stated that he would like to be at that meeting. Richard stated that he will forward the Outlook invitation to Bob to attend the meeting. Bob has met with Sue McDermott (the city engineer for the City of Avondale and the acting Floodplain Manager for the city) a number of times about this project to make Sue aware of the project-completion issues associated with removing Phase 1C from the project. Additionally, Bob has attended several meetings with the City Council and the Mayor of Avondale to present and discuss the status of the overall project.

The second group of discussion points during the call, as per the agenda developed by the District, was the action items from the last call on July 12, 2011. These items included the following:

1) Mylene recently finished a draft version of the MT-2 forms for the hydrology and hydraulics portions of the forms. Paul was not on the call to discuss the status of the geotechnical portions of the MT-2 forms. WEST will begin reviewing the H&H portions of the MT-2 forms shortly.

2) As a follow up item from the last call, WEST plotted the output of the final hydraulic model from the LACOE on the final topography to be used for the project area using HEC-GeoRAS. This was done to support the LACOE with identifying upstream and downstream tie-in locations. Based on the LACOE's initial mapping results, they were tying into the effective data at the upstream and downstream ends of the hydraulic model. This could possibly lead to some complex mapping issues near the downstream end of the model due to the confluence of the Agua Fria River (another FEMA-mapped floodplain) with the Gila River. To alleviate some of these issues, WEST compared the profiles generated from the updated model against the effective data and located a downstream tie-in location just downstream of El Mirage Road (around XS 198.08). This location ties in to the effective data both vertically and horizontally. WEST summarized this analysis in a technical memorandum dated July 29, 2011. Mylene will review this analysis and determine whether the LACOE will choose to use these suggested tie-in locations. At this time, Don discussed meetings occurring some time ago between the LACOE and the City of Phoenix about the possibility of increasing the extent of Zone AE floodplain removal throughout the project reach, including the Tres Rios North Levee and the flooding downstream of the project that occurs north of Southern Avenue. However, the team decided that we need to keep this LOMR deliverable as simple as possible in order to complete the LOMR specifically for the Tres Rios North Levee, quickly. The idea of tying into the effective floodplain data immediately downstream of El Mirage Road instead of below the confluence of the Agua Fria River would meet the requirements of this project, and this course of action would move the entire package through the FEMA review process more quickly. Finally, there is currently an ongoing mapping update for the Agua Fria River that will be occurring through another LOMR package. Tying in upstream of the confluence with the Agua Fria would avoid confusion for FEMA with multiple LOMR or PMR submittals occurring for the same area simultaneously.

3) David Pham stated that he will contact the SPD shortly to inquire about the status of the review for the ATR plans currently being conducted by SPD.

4) Richard discussed the draft TDN, and he mentioned that Sections 1 through 3 are nearly complete (there remains additional reference to the Gillespie Survey Report, which was

provided to the LACOE by WEST for the LACOE to include in a future Appendix C disk). Richard indicated that Section 4 (Hydrology) still needs a slight update. Mylene noted the slight differences between the effective FIS flows and the flows used by the LACOE. This difference is due to the effective modeling study not using the flows for the Salt River specified in the LACOE study from 1996 for the updated hydrology for the Salt and Gila Rivers based on the modified Roosevelt Dam. Table 2-4 in this report provides the flow values calculated for the Salt River near the confluence with the Gila as being 162,000 cfs, but the effective model uses 164,000 cfs as the 100-year flood discharge in the Salt River. The LACOE will continue working on the Draft TDN. FEMA's own reference for the effective discharge is currently not correctly reported, and therefore the LOMR package for Tres Rios should seek to rectify this. The actual value should be 162,000 cfs.

5) Joe forwarded 6 of the ultimate 12 study work maps to WEST and the LACOE on August 1, 2011, and Joe asked for comments on these draft documents. Richard mentioned to the LACOE that the final Elevation Reference Mark (ERM) dataset has been developed by WEST and approved by the District for use in the work map deliverables. WEST will forward this information to the LACOE shortly. Additional comments from the District and WEST will be forwarded to Joe upon completion.

6) Mylene and WEST recapped their conversation on Thursday regarding the remaining task items for the hydraulic modeling effort supporting this LOMR. These include the following:

    a. Rename the final floodplain model as the "post-project conditions" model for Phases 1 and 2. Currently, the final floodplain model is name the "pre-project conditions" model because the model naming convention is in reference to the Tres Rios Environmental Restoration Effort Phase 3, which has not been constructed yet. Since this LOMR is only to include project features from Phases 1 and 2, the model should be renamed as the "post-project conditions" model.
    b. Complete the floodway analysis on the final floodplain model (i.e., the post-project conditions model).
    c. Create the "pre-project conditions" model, which would involve removing the levee and attendant features from the model geometry to represent the conditions of the study reach prior to the construction of the levee. More information regarding these models can be found in the Draft TDN under Section 5.

The next group of discussion points during the call, as per the agenda developed by the District, was the "other activities underway" points. These items included the following:

1) Richard asked the LACOE staff on the call who they thought would be signing the MT-2 overview and concurrence forms. Van said it might be the engineering division chief, but it would be better to discuss this point with Paul. Rick Leifield is the current engineering division chief who may sign and stamp this form. Paul will follow up on this task for the next call.

2) Richard and Mylene discussed the different modeling products that have been developed up to this point, and they also discussed that the Manning's roughness varied from model to model. Mylene will need to summarize these estimates of Manning's roughness in the Final TDN. Richard suggested that such a summary should be placed in the draft TDN section 5.

3) David mentioned that the DDR would be finalized in January or February of 2012. This is beyond the end of the 2011 schedule the District had previously understood for this item and the LOMR deliverable as of the last call. The District and the City of Phoenix stated that this would be unacceptable for the completion of the project. Don asked if the DDR had to be finalized for the LOMR submittal, or if only the LER needed to be finalized for the LOMR. The reason he asked is that he wants to make sure that the District and the LACOE are not prolonging the LOMR submittal date by finalizing reports that do not need to be finalized for the completion of the LOMR. Basically he was asking if there is anything we can finalize after submitting the LOMR instead of before, to expedite the LOMR submittal process. Based on the initial response from the LACOE, it seems that the DDR in its final form is crucial for the completion of the LER; therefore, the DDR must be finalized before submitting the full package. Don asked if it were possible to identify those items that are required for the MT-2 forms that will also be included in the DDR, and extract those items from the DDR to place this information directly in the MT-2 forms without referencing the DDR. This process would not require that the LACOE wait for the final approval of the DDR following the completion of the ATR process, and could expedite the LOMR preparation and submittal.

4) Mylene mentioned that a risk and uncertainty analysis has to be finalized. Don asked why this is the case when a risk and uncertainty analysis was completed previously as part of the Tres Rios North Levee PED project by WEST and the LACOE for the design of the levee in 2004. Van mentioned that an initial risk and uncertainty analysis was done at that time, but now the LACOE has to update that analysis based on the new model and new water surface elevations which vary from the original analysis.

5) Richard asked the team about possibly extending some of the scheduling deadlines previously set for the LACOE, for example, pushing the Sep 30 deadline back to Oct 6 or 13 to allow the LACOE more time to ask questions regarding WEST's and the District's comments on their analysis. The District and the City of Phoenix were concerned about pushing the schedule out further. Van said that they would try to maintain the original schedule offered by the District in Mylene's absence for maternity leave, if possible.

6) Bob asked what all of the different acronyms and documents were, and why all of these documents were needed for the LOMR. Don said that this would be a good opportunity for the LACOE and WEST to build the list of documents that are needed to finalize the LOMR package. This supports Don's earlier point that we need to make sure that the District and the LACOE are not prolonging the LOMR submittal date by finalizing reports that do not need to be finalized for the completion of the LOMR. Additionally, this will ensure that work is not being duplicated in various LACOE sections or between the LACOE and the District.

7) Van is currently reviewing the second addendum that will finalize the LACOE's analysis supporting the action to remove Phase 1C from the project plans and from the DDR.

8) Richard mentioned that WEST has started work on the EAP task order for the District. David indicated that the LACOE would like to review this document upon completion by WEST. WEST will forward the draft version of this document to Paul and the other LACOE team members after the initial review by the District.

Post-conference discussion

After the conference call, WEST and the District discussed two additional items.

1) The schedule of this project needs to be accelerated, specifically critical path items such as the ATR. As per the District's understanding prior to this call, the ATR is a 90-day process. If this process starts now, it should finish around the end of October. If it starts on September 1, then the ATR should finish near the end of November. This will be important in the scheduling to complete the DDR for the LOMR submittal.

2) The fact that the LACOE is considering delaying the schedule to complete the DDR for the Tres Rios North Levee from December of 2011 to January or February of 2012 is unacceptable to the District and to the City of Phoenix.

Action Items:

1. Richard will send an invitation to Bob Upham for the meeting between the District and Charles Andrews at the City of Avondale. *Update: Richard extended this invitation to Bob on August 1, 2011.*
2. WEST to review the MT-2 forms sent by Mylene regarding the H&H portions of the LOMR submittal. Paul to finalize the draft MT-2 forms for the geotechnical portion of the project.
3. Mylene to review WEST's analysis of tie-in locations and determine whether the LACOE will choose to use these suggested tie-in locations.
4. David to contact the SPD to inquire about the status of the review for the ATR.
5. Mylene and Paul to continue working on the Draft TDN.
6. WEST to forward initial comments regarding the draft panel layout and work maps to Joe. These will include comments from WEST and the District.
7. Mylene to continue working on the remaining task items for the hydraulic modeling effort supporting this LOMR, including (i) floodway analysis, (ii) renaming the current model to the "post-project conditions" model, and (iii) creating a model without the Tres Rios North Levee in place as a "pre-project conditions" model.
8. Paul to follow up with Rick Leifield on who at the LACOE should sign and stamp the final overview and concurrence forms in the MT-2 package.
9. Mylene to continue finalizing the risk and uncertainty analysis.
10. The LACOE and WEST to build the list of documents that are needed to finalize the LOMR package, identifying which documents are currently being completed, which documents are absolutely necessary for the LOMR submittal, and which documents are required for the LACOE's certification process (i.e., EC 1110-2-6067) but may not be required for FEMA. David and Brian will work on this task.
11. Van to review the second addendum to the letter finalizing the LACOE's analysis supporting the action to remove Phase 1C from the project.
12. WEST to forward the draft version of the EAP document to Paul and the other LACOE team members after the initial review by the District.

The next call is planned for Monday, August 22nd, 10:30 am, MST and PDT. A formal invitation will follow.

Date: August 24, 2011

A teleconference was held on August 22, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. David Pham
2. Van Crisostomo
3. Mylene Guron
4. Joe Goldstein
5. Paul Beaver
6. Jody Fischer
7. Gwen Meyer

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Conference call discussion

Richard began the discussion by addressing the modeling tie-in locations, which was the first item listed on the draft agenda developed by the District prior to the call. Mylene indicated that she had just emailed an addendum to the technical memorandum developed by the LACOE which indicated (a) approval of the hydraulic analysis supporting the removal of the Phase 1C floodwall from the project and (b) the final locations of the model tie-ins. *Update: WEST and Richard have since confirmed the receipt of this email. Richard responded to Mylene's email indicating he had no comments on the addendum to the technical memorandum.*

Richard then began discussing the need for model changes based on the current effective FEMA HEC-RAS model as compared to the current LACOE HEC-RAS model. Since there is a junction in the current LACOE model with two reaches upstream of the junction (Salt, Upper Gila) flowing into one reach downstream of the junction (Lower Gila), the BFE's immediately upstream of the confluence of the Salt and Upper Gila Rivers present a problem for mapping the floodplain in this location. Additionally, the effective model only included the Salt River and the Lower Gila River; the Upper Gila River has never been included in any FEMA-approved studies, and no FEMA-approved floodplain has ever been developed for the Upper Gila reach. The

methodology used to map the currently effective floodplain was to extend the cross sections for the Salt River across the flow boundaries of the Upper Gila River, and the flows in the Salt River (164,000 cfs in the effective model and reported in the FIS data) were mapped as if they were not influenced by the Upper Gila River flows (i.e., non-concurrent peaks). Based on this difference in the methodologies, the District suggested that the model be revised to remove the Upper Gila reach from the model along with the junction, and to extend the Salt River cross sections further to the south to allow conveyance area for flow from the Salt River in the area that is currently being modeled as the Upper Gila reach. This methodology is the same as the methodology used for the effective model study.

At this time, the LACOE indicated that a model update of this magnitude would require significant additional effort from the LACOE, and the timing was especially poor with the departure of Mylene on maternity leave (September 2 is Mylene's planned last day in the office, but she might go on leave prior to this date). The District suggested that WEST update the model based on these comments, and the LACOE agreed to this course of action. WEST will begin on these model updates after additional coordination with Van. Van requested that all correspondence from WEST be directed to himself in Mylene's absence, and that Joe be copied on all correspondence. Joe will be filling in for Mylene in Mylene's absence.

The next topic of conversation was the status of the review of the ATR review plan by SPD. David indicated that SPD had provided the first round of review comments to SPL for the ATR review plan. David has addressed those comments, and he provided SPD with an updated ATR review plan and detailed responses to their comments. David is waiting to hear back from SPD for the approval of the SPL updates to the ATR review plan, at which time the ATR review plan will be finalized.

At this time, the District inquired about the status of the investigation into who would be signing the NLSER, and who would sign and stamp the levee certification documentation. Jody Fischer, the recently enacted levee safety program manager for SPL, discussed the role of SPL in this project, and she mentioned the fact that the Corps no longer certifies levees, they only evaluate levees for internal Corps documentation. The Corps also does not provide the final signature and professional stamp on the certification documentation. This is done by the local sponsor for the levee project. As per her discussion, this decision has been made at the Division level in the Corps, and this is based on an agreement with FEMA.

Jody also mentioned that the LACOE has been approved to assist the District in completing the MT-2 forms. However, the LACOE cannot sign and stamp the MT-2 forms. Jody mentioned that the project sponsor should sign and seal the MT-2 forms. At this point in the conversation, Don mentioned that the City of Phoenix is the project sponsor, not the District. Bob mentioned that he felt the City of Phoenix would defer to the District for sponsorship responsibilities, which

was not the understanding of the District as per Don's comments. Jody mentioned that Ed Curtis at FEMA Region IX (RIX) might have some insight as to who should be the acting sponsor for the levee and who should certify the levee. Based on this conversation, all parties agreed that several terms that were being used in the conversation needed further definition and clarification, including "sponsor" (what that means from the LACOE's perspective and who would be handling the sponsorship responsibilities as defined by LACOE on the local side—either the District or the City of Phoenix), "certification" versus "evaluation" (how the LACOE defines these terms and how those definitions differ from FEMA's perspective), and "transmittal letter" (which Jody defined as the document transferred from the LACOE to FEMA for the levee certification package). Based on the need for these further definitions, Jody is working to contact her FEMA counterpart currently to provide some answers to these questions. Also, Gwen and Jody agreed to speak off-line about these issues. Finally, Gwen and Jody both indicated the need for another meeting separate from the regular technical conference calls scheduled every three weeks to discuss the application submittal process moving forward. The District concurred, and it was agreed upon that that Gwen would develop an Outlook meeting using an SPL conference call line for the following parties: Richard, Don, Bob, Gwen, Jody, Brian, Chuck, Ed Curtis (FEMA RIX), and Bob Bezek (FEMA RIX). This call was suggested for Monday, August 29, at 10:30 AM, and all parties agreed to this time. Paul and Van did not feel that their technical expertise relating to the project was needed for this call. Richard also indicated two primary questions that the District would like to have answered during this call: (1) who will complete the MT-2 forms and (2) who will sign and seal the final FEMA certification documents.

The next point of conversation was the TDN. In regards to the TDN, the LACOE's current priority is to complete the DDR. The TDN will be a secondary objective until the DDR is completed. Additionally, Paul brought up the point that funding for the LACOE to complete the TDN might not be clear, because this type of documentation might not be covered under the project funding for SPL since the TDN is not a Corps requirement. The District stressed again that the TDN is a FEMA requirement. Arizona State Standard 1-97 dictates the format of the TDN, but the state regulations apply to the formatting only. The TDN is a national FEMA-required document for LOMR submittals. Also, Don mentioned that the task of securing funding for the project (whether that is for internal technical Corps documentation or FEMA documentation such as the TDN) should fall entirely to the LACOE and the City of Phoenix. Additionally, Jody, Gwen, David, Van, and Paul stressed that the DDR was the priority for their respective portions of the TRL project at this time, and the TDN would be a secondary priority until the completion of at least the final draft of the DDR before the ATR process was complete. The LACOE reiterated that the TDN and MT-2 forms would be able to extract information from the draft DDR before the completion of the ATR process, but the LACOE also indicated that data

to populate the TDN and MT-2 forms could not be extracted until the draft DDR was complete and ready to submit for the ATR process.

The next item of discussion during the call was in regards to the draft study sheets that Joe had finished recently and submitted to the District and to WEST for review. Richard mentioned that Richard, Joe, and Chuck had all been in direct conversation regarding the status of those study sheet products. In light of the modeling changes discussed during this call, Richard mentioned that the study sheets would change significantly with updated cross section alignments and floodplain mapping products, but Richard mentioned that the initial comments from the District and WEST would be sent to Joe by the middle of this week (8/24 or 8/25). Van mentioned that any transfer via ftp would need to occur on WEST's ftp site, as the LACOE's ftp site will be down for some amount of time beginning this week. WEST indicated that the WEST ftp site can handle this traffic.

Several items regarding the status of the hydraulic modeling—including risk and uncertainty analysis, floodway analysis, and creating the pre-project conditions model—were tabled until a recommendation is made by WEST on how best to proceed with the hydraulic modeling package based on the discussion during this call regarding updating the cross section alignment of the model. These discussion points will be revisited during the next call upon completion of WEST's recommendations.

Similarly, the conversation regarding the document flow chart recently completed by Brian and David was tabled until resolution of the responsibilities of the various parties in the certification process for the levees. Additionally, this document will need to be updated further upon agreement that WEST will be finalizing the hydraulic modeling package and the LACOE had recently completed a draft EAP document.

Mylene recently completed the second addendum to the technical memorandum summarizing the analyses completed to support the removal of the Phase IC project features from the project plan and from the DDR. She emailed this addendum document immediately preceding the conference call, and Van has approved this version of the addendum to the technical memorandum. This addendum addressed (1) the inclusion of the new topography downstream of El Mirage Road into the modeling effort, (2) the documentation supporting the datum conversion of the new topography downstream of El Mirage Road from NAVD88 back into NGVD29 to match the remainder of the hydraulic modeling analysis package, and (3) the tie-in locations of the hydraulic model based on the current HEC-RAS model.

David mentioned that the LACOE had developed an EAP document. The District was not previously aware that the LACOE would be completing the EAP internally. Brian and David will finalize this document together. WEST will supply the information regarding the local

coordination for the EAP (i.e., fire and police service contacts in the vicinity of the project, emergency management contacts in the vicinity of the project, etc.), and WEST will review the final EAP document on behalf of the District.

Paul and Mylene mentioned that they had both been working on draft versions of the MT-2 forms. The LACOE indicated that they would track down the most recent version of the respective sections of the MT-2 form that each section had completed and provide these to WEST for comment and review.

The District expressed some concern regarding the status of the third phase of the Tres Rios Environmental Restoration Project, and the affects these phases might have on the LOMR submittal package. Bob provided an update on the status of Phase III—Phase IIIA is now compete, and Phase IIIB is currently fully contracted and near construction. The construction could begin as early as one month from now, depending on the permit process for Kiewit, HNTB, the Corps, and the District (Don mentioned that he would let Angie at the District know that the permit applications would be coming from the Corps contractor soon). Phase IIIB will include significant vegetation clearing and regrading of the main channel of the Gila River, and this portion of the restoration effort is scheduled to be completed by July 2012 at the earliest. Phase IIIC of the project is currently on hold due to funding issues. A portion of the planned Phase IIIB regrading includes the placement of fill upstream of the El Mirage Road low-water crossing across the Gila River. The District mentioned that if this fill is significant, and if the placement of this fill is completed before submittal of the LOMR package, these changes may need to be reflected in the hydraulic model geometry. A LOMR by definition reflects the existing conditions of the watercourse being studied at the time of submittal. The District stressed the importance of maintaining the current schedule of the LOMR submittal (end of calendar year 2011) based on the possible changes in the LOMR package introduced with the construction of Phase IIIB if the LOMR submittal is delayed.

Action Items:

1. Gwen will send an invitation to Don, Richard, Jody, Brian, Chuck, and Bob Upham for a conference call on Monday, August 29, to discuss the roles of the various parties in the remainder of the LOMR submittal process. *Update: Gwen extended this invitation to the above mentioned parties on August 23, 2011.*
2. Richard will forward the invitation that Gwen sends out for the conference call on Monday, August 29, to Ed Curtis and Bob Bezek of FEMA RIX. *Update: Richard extended Gwen's invitation to the above mentioned FEMA parties on August 23, 2011. Ed Curtis*

responded on August 24 that his team with FEMA and some representatives from the Baker review team in Denver will be available for the call on Monday.

3. Don will contact Angie at the District to inform her that permit applications will be submitted from the Corps contractors soon for the Tres Rios Environmental Restoration Project Phase IIIB. *Update: Don contacted Angie on August 22.*
4. WEST to update the hydraulic model to better agree with the effective model methodology by removing the Upper Gila reach from the model and extending the Salt River cross sections to contain the flow.
5. David and Brian to coordinate to begin WEST's review of the EAP document and for WEST to provide additional local coordination information for the EAP document.
6. WEST and the District to forward initial comments regarding the draft panel layout and work maps to Joe.
7. LACOE to continue to work on the DDR and NLSER. LACOE has completed their portions of the MT-2 forms. Upon resolution of the issues regarding the TDN package after the call on Monday, the LACOE and the District will coordinate the best course of action to complete the TDN.

The next call is planned for Tuesday, September 13th, 10:30 am, MST and PDT. A formal invitation will follow.

Date: September 1, 2011

A teleconference was held on August 29, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. Jody Fischer
2. Van Crisostomo
3. Gwen Meyer
4. Emily Kovaleski

City of Phoenix

1. Bob Upham

FEMA, Region 9 (RIX)

1. Ed Curtis
2. Bob Bezek

Michael Baker/AECOM FEMA Contractors

1. Sarah Houghland (Baker Denver office)
2. Joshua Hunn (Baker Alexandria office)

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a USACE review of the LSER and DDR)

CFR – Code of Federal Regulations

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EC/6067 – Engineer Circular 1110-2-6067, USACE process for the NFIP Levee System Evaluation

FEMA – Federal Emergency Management Agency

FEMA RIX – FEMA Region 9

FIS – Flood Insurance Study

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

MAG – Maricopa Association of Governments

NFIP – National Flood Insurance Program

PMR – Physical Map Revision

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

TSDN – Technical Support Data Notebook (herein referring to the FEMA standard document)

USACE – US Army Corps of Engineers (herein referring to the LACOE and other districts and divisions of the US Army Corps of Engineers)

Conference call discussion

As per the agenda developed by the USACE prior to the call, Jody started the discussion by summarizing the purpose of the LACOE's newly formed levee safety division and the scope of their work assignment in regards to how to proceed in acquiring NFIP status for the TRNL and all of the levees under the purview of the LACOE. Jody's main goals are to (1) provide protection for the 100-year flood event for the public behind LACOE levees to the standard of care as outlined in USACE documentation (i.e., EC/6067) and (2) to determine the best way to successfully apply for NFIP accreditation and certification from FEMA. Jody then asked Ed Curtis to explain the various avenues available for the USACE to apply to FEMA for levee accreditation and certification for USACE-constructed and/or USACE-operated levees.

Ed responded to this comment by first explaining the separate processes of a LOMR versus a PMR. When a LOMR application for a hydraulic structure such as a levee is submitted from RIX or any other FEMA region, regardless of the state, it is first sent through the FEMA clearinghouse to Joshua Hunn's group in Alexandria. Joshua is the lead for the Baker/AECOM MT-2 group, and that is why Ed and Bob Bezek asked Joshua to be on the call. If the mapping changes associated with a LOMR affect more than the allowable number of FIRM panels for a LOMR submittal, Joshua's group will review some of the technical data associated with the submittal, but they will eventually send this application back to the respective region from which the application was submitted for review and processing as a PMR. Ed mentioned that this will often lead to large portions of the technical data being reviewed multiple times by various groups within FEMA. This would likely delay the processing of the map changes compared to submitting the package directly to FEMA RIX as a PMR in the first place. Ed also mentioned that FEMA originally recommended that the LACOE submit the Tres Rios North Levee map change request as a LOMR instead of a PMR during conversations between RIX and the District in June, even though the number of panels edited (up to 5 for this project) would disqualify this application from finalizing the mapping portion of the study as a LOMR. If this course of action had been followed, Joshua's group have reviewed the LOMR application and MT-2 forms initially; then his group would have sent the application back to FEMA RIX for further review and to finalize the processing for the map changes as a PMR. Based on the inefficiencies associated with this method of submittal to FEMA, the approach was reconsidered, and Ed now feels that the most expeditious route for the LACOE would be to submit the Tres Rios North Levee map revision as a PMR directly to the RIX office. Ed thinks the PMR application would likely go to the Denver office, and Sarah would likely be the project manager for the Tres Rios North Levee on the Baker/AECOM team. Ed also mentioned that this would eliminate the need for MT-2 forms since only a LOMR requires MT-2 forms, not a PMR.

After the team had concurred that a PMR process would be the best course of action for the submittal from the LACOE to FEMA, the next consideration that Ed mentioned in regards to a PMR is the funding source associated with this course of action. Ed believes that RIX may not have enough funding to process this map change until the fiscal year beginning October 1, 2012, and ending September 30, 2013 (hereafter referred to as FY12-13). Since RIX was under the impression that this project would not be completed until spring of 2012 at the earliest, no line item funding sources were identified in the FEMA contract with Baker/AECOM to process a Tres Rios North Levee PMR during the fiscal year beginning October 1, 2011, and ending September 30, 2012 (hereafter referred to as FY11-12). In order to be processed in FY11-12 by Baker/AECOM, this PMR would have to be funded under a "miscellaneous" or "discretionary" budget task item in the Baker/AECOM contract. Don asked if Ed and Bob Bezek could make it a priority to put Tres Rios on the list for PMR funding from the discretionary funding pool in the FY11-12 budget as well and consider it for a budgeted line item for the FY12-13 budget if it is

not addressed as a discretionary funding item in FY11-12. Jody asked Ed when the deadline is to submit Tres Rios for consideration as a line item for funding on the FY12-13 budget, and Ed said that the process of finalizing the FY12-13 would commence this fall, within the next few months. Richard asked how many PMRs associated with the District are currently included on the FY11-12 as a discretionary funding PMR line item or as a FY12-13 budget as line items. Ed said he could not recall how many were District projects from memory, but he said that he would look into this and get back to Richard. Richard said that the District (primarily Kathryn Gross and Tim Murphy) could realign their requests to ensure that the Tres Rios PMR gets priority on those lists over any other projects that are there currently (however this path could lead to an extended delay in actual map changes compared to using any FY11-12 discretionary funding from FEMA RIX). Ed said he seemed to remember that White Tanks 1 and 2 were currently on the list as FY11-12 discretionary funding items, and there were no PMR budgeted line items listed for the FY12-13 from the District as of yet. However, he was not sure of this, and stated that he would get back to Richard about this. Ed said that Jaclyn Bloor's group with Baker/AECOM in Denver will be handling White Tanks 1 and 2. Richard and Don both said that Tres Rios could take the highest priority PMR project to receive funding for the District in the next few years.

Jody stated that the DDR still needs to be reviewed through the ATR process, and the LSO (currently Rick Leifield) would not sign the LSER until that process is completed, likely around March of 2012. Gwen asked if the FY11-12 discretionary funding would still be available in approximately March of 2012, and if so, could that funding be "earmarked" in a sense for the TRNL PMR. Ed said that the discretionary funding is on a first-come first-served basis for the projects that (a) are previously on the list to possibly receive the PMR discretionary funding and (b) reach completion and are submitted to RIX. Ed mentioned that the amount of funding that will be available in the discretionary spending pool at the completion of the ATR for the DDR and finalization of the LSER cannot be determined until the completion of these products because he cannot know what the status of the other possible PMR projects will be that are to be funded from this funding source.

Regarding the documentation required for the PMR, Jody stated that the levee certification report for this project is the USACE-produced LSER, and Ed was under the impression that the LSER would meet most of the requirements of the FEMA TSDN document. The TSDN document is identical in content to the AZ TDN document we have been discussing in conference calls recently; the only difference in these two documents is that the AZ TDN is more specific regarding formatting the information within the document. The TSDN document is specified in Appendix M of the Mapping Partners Guidelines developed by FEMA. Ed feels that if a LSER is completed, FEMA would not have to review that document independently at all. This is due to the close coordination between FEMA and the USACE during the development of the EC/6067

document specifying the requirements for a LSER package. The District asked if technical information could be pulled from the LSER and DDR package before completion of the entire internal USACE review process for the LSER and DDR to finalize the PMR package. The finalized DDR and LSER could then be submitted to FEMA upon their completion by the LACOE during the concurrent review of the PMR submittal. Ed said that the USACE could submit technical information separately from the LSER deliverable; however, without the finalization of the LSER, FEMA would have to go through their typical stringent independent review process, likely duplicating much of the review that would be ongoing during the ATR performed by the USACE. Joshua concurred with this statement as well. Based on this statement from Ed that the FEMA review process could be significantly expedited by waiting for the completion of the ATR by the USACE, the District and all other team members on the call agreed that the PMR submittal to FEMA RIX should occur after the finalization of the internal review process by the USACE to expedite the map revision process.

Jody also understood that the USACE would have to complete the same technical documentation for the LSER as per EC/6067 compared to the TSDN, but she asked what specifically would be different between EC/6067 requirements and the TSDN. Ed said that the requirements for the TSDN that might be different than the requirements for LSER include (1) FIS data (floodway data table, flood profiles, etc.), (2) an interior drainage analysis, (3) with and without project models to map the shaded Zone X indicating the area protected by the levee, (4) a correspondence section (FEMA, USACE, Baker, District), (5) operations and maintenance manual, (6) as-built drawings, and (7) possibly other categories that he may have missed. Jody indicated that the interior drainage analysis, operations and maintenance manual, and as-built drawings will be included in the DDR. *Update based on post-conference call discussion at the end of this document: The District requested that WEST attempt to create a laundry list of items required for the TSDN and items required for the LSER with a brief comparison of these items to attempt to identify additional gaps in the required data.*

Jody and Gwen then discussed LACOE funding for the completion of the DDR and LSER. Since TRNL is a USACE project, then the LACOE can submit a DDR and a LSER directly to FEMA for a map change since the USACE is a federal agency. Jody then stated that the USACE can work with FEMA to address FEMA's comments on the DDR/LSER while LACOE funds are still available to finalize the map changes. The other option for a request to FEMA for a map change relating to a USACE-sponsored levee is for the local agency acting as the levee sponsor to submit a package to FEMA requesting map revisions. Jody stated that based on the current USACE guidance, the USACE can help fill out the MT-2 forms, but they cannot sign and stamp the MT-2 forms, and they likely cannot help with a state-mandated formatting of the TDN document. Jody then asked Ed if this is how he understood this process.

Ed said he would try to clarify. As a LOMR submittal to FEMA, the agency submitting the request for revisions must submit the applicable MT-2 forms and all supporting technical documentation to meet the 44 CFR 65.10 requirements. For the TRNL submittal, Ed is now suggesting, as an alternative, to submit the same technical documentation/information directly to RIX as a PMR, but without the MT-2 forms (MT-2 forms are not required for a PMR). The PMR package will be sent to Bob Bezek and then to Sarah (or possibly straight to Sarah) so Baker/AECOM can receive everything they need as outlined in the requirements for the TSDN. This would include levee certification documentation, modeling, work maps, draft FIS data, etc. For a private FEMA contractor with an independent contract for a levee certification, all of this information would be required to meet the TSDN-specific format, and likely a state or local agency regulated format as well. Ed thinks that this would be basically everything from the LSER (with possibly a few additions), but that the USACE may not need to reformat the LSER data exactly to match the TSDN format; instead, FEMA would determine if they have everything that they need from the LSER to meet the TSDN requirements. All of the submitted information would go through a slightly modified review process by Sarah's group compared to a typical levee submittal. The process would include the following steps: (1) FEMA would determine if everything from the TSDN checklist was included in the submitted package, (2) what information from our checklist is inside the LSER and what information is outside of the LSER (i.e., did not go through the entire ATR process with the DDR and LSER), and (3) review the information outside of the LSER only (this primarily would be FIS data, mapping products, and modeling products not used directly by the USACE for the design of TRNL such as a pre-project conditions model). If the package submitted to FEMA did not include everything needed for the TSDN, FEMA (Bob Bezek) or Baker/AECOM (Sarah) would communicate what was still needed to the LACOE with copy to the District.

The next question was in regards to ratifying the package delivered to FEMA. Jody has previously stated that the USACE will not use the terminology that they will "certify" a levee; they will only provide levee evaluations. However, Ed stated that the LSER would act as enough supporting documentation to FEMA that the levee would be accredited. Next, Jody stated that the LSO for the LACOE would sign the TRNL LSER, but they would not seal the submittal package with a professional stamp for the final product submitted to FEMA. At this time, Ed brought up the concept of the certification page in Appendix M, called the "Certification of Compliance" form. Sarah said that this form is a general statement certifying the agreements between FEMA and the contractor doing the work, typically meant to be a private contractor. Since FEMA does not and cannot have a contractual agreement with the USACE, the language of this form might have to change slightly for the TRNL submittal and all USACE projects providing a LSER to accredit a USACE levee on a FIRM panel. Jody asked if their page from the EC/6067 (the "Positive NFIP Levee System Evaluation Report Transmittal Letter") would act as a replacement for this form. FEMA said that the transmittal letter would likely not substitute for the

Certification of Compliance form from FEMA's point of view, because the Certification of Compliance form has check boxes on the page for each task covered under the certification submittal (e.g., hydraulic analyses, floodplain mapping, etc.). FEMA wants a signature with (a) each of the boxes checked indicating the full scope of work has been completed for the levee accreditation and (b) the FEMA-specific language in the final certification statement.

Jody then asked what the "Certification of Compliance" form implied in regards to maintenance of the TRNL in the future. Ed said that if the LSER has an expiration date (i.e., if the USACE "positive evaluation" rating for a levee is only applicable for a certain period of time), then FEMA would honor that time period. Jody said the LSER is good for ten (10) years. Ed said, that if the City of Phoenix is the levee owner and local sponsor, then FEMA will ask the city to provide new certification documentation for the levee in 10 years in order to keep the levee accredited on the maps, similar to the recent certification process completed by the District for the Agua Fria Levees in Phoenix and Avondale. Theoretically, the expiration date of the levee certification documentation should trigger the recertification process; practically, however, this process would only be initiated by FEMA at the time of a map update near the project (county-wide update or LOMR for a specific project near the TRNL). Sarah said that there will typically be a FEMA letter corresponding to the FEMA accreditation of a USACE levee that is sent to the local sponsor indicating the time period of applicability of the certification documentation.

Along these same lines, Jody asked if it is a regulation enforced by the City of Phoenix, the District, or FEMA that the agency applying for map revisions for a new or previously-accredited levee also apply for PL 8499. PL 8499 is a USACE program to assist local levee owners or infrastructure owners (for public works constructed by the USACE or by any other agency or private group) for flood-fighting or during other natural disasters by providing engineering-related support work. Jody stated that the local sponsor is automatically enrolled in the program for a levee constructed by the USACE; however, the local owner can later opt out of this program. The reason Jody asked is that one requirement of the PL 8499 program is that the levee be inspected by the USACE every 5 years. If a 5-year inspection results in an unacceptable grade, then FEMA is notified of that grade. Then FEMA would be notifying the city and the District regarding the inspection to inquire what the local sponsors are doing to improve the condition of the levee. She was curious if this would change the length of certification as defined in the LSER. Ed said he was not sure regarding the effect of a failing USACE inspection prior to the expiration of the LSER evaluation period, but that FEMA would likely consider such an occurrence on a case-by-case basis.

Next, Richard stated that he felt that most of the information necessary to complete the TDN was specified in the EC/6067 document. Richard said that the LACOE should be able to complete the TDN quickly and easily based on the TDN outline already completed by WEST and

provided by the District to the LACOE. In fact, organizing the information required by FEMA for a levee accreditation package that is not included in the LSER/DDR package would be easier for the LACOE by using the TDN format as it has already been completed by the District. Jody then stated that whatever documentation is required by FEMA for review and approval of the levee as a NFIP levee providing protection from the base flood is the goal of this project for the LACOE; Richard reiterated that this would be most expeditiously completed by finalizing the TDN.

To help clarify what is required for a PMR submittal to FEMA that is not required in the LSER as specified in EC/6067, FEMA's Procedural Memorandum 63 (PM 63) will be sent to everyone on the call by Sarah. PM 63 outlines the FEMA-required technical data that are needed in the review process to recertify a Provisionally Accredited Levee (PAL). Sarah said that she would also be willing to work with Jody and the remainder of the LACOE team regarding the format of the LSER and any additional technical data to make sure that all of the FEMA requirements are met for the PMR submittal. Ed and Bob Bezek requested that all team members always copy Bob Bezek on any correspondence to Sarah. Ed also mentioned that Appendix M might be an even better source to determine what is needed for the PMR submittal in addition to the LSER and DDR since PM 63 was specifically written for PALs, but PM 63 is a much broader overview of the submittal requirements to identify large differences in technical data needs. Ed mentioned a few things that probably would not be included explicitly in PM 63 that would still be required for the PMR submittal, including items such as work maps in hard copy and digital format, CADD or shapefile data for the flood plain mapping, and others.

Richard briefly reported to the team the current status of work maps, hydraulic mapping deliverables (pending floodway analysis, pending revisions of cross section reach lengths, etc.), and other supporting technical data for the TRNL project. Richard mentioned that the TDN is probably over half done based on the current work by the LACOE and WEST to complete this document. Ed reiterated to Jody and the LACOE that the District has submitted many studies to FEMA for mapping revisions, and the District understands the technical data requirements FEMA has in place. Ed encouraged continued coordination and work between the District and the LACOE to provide the best possible technical data for a PMR submittal.

The conversation at this time turned to a specific technical question presented recently to FEMA RIX by the District and WEST. This question dealt with the best method to map the special flood hazard area south of the Gila River Indian Community (GRIC) border along the Salt River. After the question was posed to FEMA RIX originally, Kathy Schaeffer, Ed, and Bob Bezek talked about GRIC significantly. Bob Bezek said that he does not want to see the special flood hazard area in this location on the tribal lands removed from the FIRM panels, because this gives the impression that the flooding hazard is no longer there, which is not the case. Ed said

that because there is an existing mapped flood hazard on the tribal land and because the water surface elevation would lower in this area, the GRIC would have to be notified at some point in the TRNL PMR process. Ed said that FEMA has a general policy that they never remove flood hazards from a map unless an updated technical study shows that the flooding hazard should not be mapped there for reasons supported by physical process modeling. He does not believe that flooding hazards are typically removed from a map for political reasons if the area has been mapped previously based on defensible engineering analysis, but he said that he thinks that is an unwritten policy. Sarah reiterated that the Baker/AECOM team would have to notify the GRIC of the mapping changes on their land during the PMR process. Sarah said that she would forward a copy of the notification sent to all the Indian communities within Maricopa County that had map changes on their tribal lands for the county-wide PMR update.

Based on this discussion, Don asked if any of the parties developing and submitting the PMR submittal package (the LACOE, the local sponsor, or the District) needed to include any signatures from local affected agencies (i.e., City of Avondale, GRIC, etc.) since there is no longer a LOMR process and therefore there are no MT-2 forms. Ed answered no; there is no equivalent community acknowledgement form in the TSDN documentation for the PMR since the MT-2 forms are not included. Don then asked if there is local responsibility by the LACOE, the local sponsor, or the District outside of the NFIP requirements to contact local affected agencies. Ed felt like there was not, and Sarah agreed. They felt that the only agency required to contact the GRIC was FEMA during the PMR process. For example, Ed said that, similar to the current county-wide update, preliminary maps for the 5 or so panels being revised for the PMR process for TRNL would have to be sent to the GRIC directly for review and comment. Additionally, Sarah mentioned that any change in BFE's and mapping boundaries has to be published in the federal register, and there would be a 90-day public review process from the time of the publication.

Bob Upham provided additional background about the role of the GRIC in the Tres Rios Environmental Restoration Project. He stated that Phases 1 through 3 of the Environmental Restoration Project were being completed jointly between the City of Phoenix and the LACOE (with support from the District). Phase 1 was the construction of the actual physical structure of the TRNL. Phases 4 and 5 of the Tres Rios Environmental Restoration Project are on the south side of the Salt River, and these phases will be a joint project by GRIC and the LACOE, dependent on joint funding currently being pursued by the GRIC and LACOE to begin this project. Originally, the Tres Rios Environmental Restoration Project was entirely a joint project between GRIC, City of Phoenix, and the LACOE. The City of Phoenix would like to involve the GRIC as little as possible for the remainder of Phases 1 through 3, including the PMR submittal. Additionally, Bob Upham said there is a boundary dispute issue regarding the GRIC-Phoenix border along the river. Anything that could be done to avoid rehashing that political issue

would be beneficial to the schedule of the project. Don concurred, emphasizing the fact that this PMR will likely improve the flooding limits on the GRIC lands. All parties agreed that contact with the GRIC should be limited to the contact that FEMA is required to make via the public PMR review process.

Don asked if there was a funding issue for the USACE to complete the TDN. Jody reiterated that the LACOE has not committed to providing the TDN, and that the LACOE would only commit currently to completing the LSER. Jody stated that if it is determined that the TDN is required by FEMA in order to remove the floodplain behind the levee, they would complete the District's TDN outline. Jody said that if that is the case, the USACE would provide all the necessary funding to complete the TDN, as the LACOE has already committed to providing all the required data and documentation to FEMA. However, Jody stated that the LACOE would not complete any local or state forms that FEMA does not require. Don said that, if the final PMR submittal is in the USACE LSER format, the TSDN format, the AZ TDN format, it will not matter as long as FEMA's requirements are met and the mapping changes are implemented by FEMA. All parties agreed that this is an acceptable course of action.

The District requested that the call participants agree on a brief summary of the issues discussed to end the call. The summary points were as follows:

1) The LACOE will continue working towards the finalization of the LSER and DDR. This is the current priority for the LACOE. The change in overall direction of the project discussed today (i.e., the change from a LOMR submittal to a PMR submittal) should not delay the development of technical data towards the finalization of the DDR, LSER, and additional technical data as required by FEMA to complete the map revision request process.
2) The LACOE, with the help of WEST and Sarah, will continue investigating whether completing the TSDN document (either in the AZ TDN format or not) is required and would be the most beneficial course of action for the PMR submittal. The District indicated that they felt completing the TDN would be the most expeditious path towards PMR submittal.
3) The TRNL map change request will be submitted as a PMR submitted directly to FEMA RIX instead of the LOMR process submitted through the national FEMA Clearinghouse in Alexandria.
4) FEMA RIX will provide funding for the TRNL PMR, whether as a discretionary funding item in the FY11-12 budget or as a line item in the FY12-13 budget.

Action items deriving from this call:

1. Ed Curtis and Bob Bezek will place the Tres Rios North Levee PMR on both the list of PMR's to possibly be funded in the FY11-12 budget as discretionary spending PMR projects as well as the list of PMR's included as specific line items for the FY12-13 budget.
2. Jody will send an email to Richard and Don regarding PL 8499.
3. Jody will review Appendix M and get input from Sarah on what else is needed in addition to the LSER for a FEMA submittal.
4. Sarah will send out a copy of PM 63 to all parties. *Update: Sarah sent PM 63 to the TRNL team on August 29 via email.*
5. Sarah will forward a copy of the notification sent to all the Indian communities within Maricopa County that had map changes on their tribal lands for the county-wide PMR update.

Post-call discussion between WEST and the District

The District would like to investigate the differences in TSDN, TDN, and PM 63 for the FEMA requirements to EC/6067, LSER, and DDR requirements for the LACOE. They asked WEST to provide a comparative list. Some initial differences the District has identified between the two include, for example, the fact that the interior drainage report has been completed by LACOE, but there is no statement in that report addressing mapping changes associated with the interior drainage. An additional statement may need to be added to the LSER stating that the interior drainage will not result in any additionally mapped special flood hazard areas behind the levee. WEST will begin compiling this list. Upon completion of the list and review by the District, this list will be sent to the TRNL team. The next regularly scheduled coordination call for the TRNL staff will include this list as an agenda item.

Additionally, the District would like WEST to determine if the GRIC boundary is shown in the Maricopa Association of Governments (MAG) dataset. The District sent this data to WEST prior to the call for another related aspect of the project, and the dataset provided to WEST by the District was updated by MAG in 2008. If that dataset does not include the GRIC lands, WEST will investigate whether or not GRIC has been added to the MAG since that time.

Date: September 21, 2011

A teleconference was held on September 13, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. Gwen Meyer
2. Van Crisostomo
3. Paul Beaver
4. David Pham
5. Joe Goldstein
6. Reuben Sasaki

WEST Consultants (WEST)

1. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a USACE review of the LSER and DDR)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

EC/6067 – Engineer Circular 1110-2-6067, USACE process for the NFIP Levee System Evaluation

ERM – Elevation Reference Mark

FEMA – Federal Emergency Management Agency

FIS – Flood Insurance Study

FIRM – Flood Insurance Rate Map

FW – Floodway

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

MAG – Maricopa Association of Governments

NFIP – National Flood Insurance Program

PMR – Physical Map Revision

SPD – US Army Corps of Engineering, South Pacific Division

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

TSDN – Technical Support Data Notebook (herein referring to the FEMA standard document)

USACE – US Army Corps of Engineers (herein referring to the LACOE and other districts and divisions of the US Army Corps of Engineers)

Conference call discussion

As per the agenda developed by the District prior to the call, Richard started the discussion by inquiring about the status of the ATR. David mentioned that the LACOE needs to get the approval of the review plan from SPD. David sent in the third round of revisions for the review plan to SPD on Thursday of last week. At this time, Gwen requested that the ATR no longer be included in the meeting agendas, action items, or other correspondence relating to FEMA map changes resulting from the TRNL project. The ATR is not pertinent to the completion of the LSER and DDR for the LACOE. The District concurred that this is no longer a necessary item for future teleconference calls regarding TRNL.

The next topic of conversation as per the agenda developed by the District was the Tres Rios Environmental Restoration Project Phase IIIB. Don provided an update regarding the permitting process for this portion of the project, reporting that Angie at the District has not been contacted by Kiewit yet. However, Angie felt that the permitting process went well for Phase 3A, and she expects Phase 3B to move smoothly as well.

Additionally regarding Phase IIIB, Richard asked the LACOE to provide conceptual design drawings or HEC-RAS model results that were used in the design phases (either conceptual or construction design) to help the District understand the level of changes that can be expected

in the field upon completion of in-stream grading (areas of both cut and fill) associated with Phase IIIB. Based on the schedule as it is understood by the District, Phase IIIB is scheduled to finish construction in summer or fall of 2012. If the changes to the physical geometry of the system are significant and if the PMR submittal package for FEMA is not finalized before the completion of these geometry changes to the system, Richard mentioned that the PMR submittal may need to include changes to the model geometry because FEMA requires that a model submitted for map changes represents the current existing conditions of the river system. Gwen asked if we should consider putting everything on hold until construction is finalized for Phase IIIB to avoid redoing the work to finalize the map changes for FEMA. Richard said that we should move forward with the PMR submittal to FEMA as quickly as possible to ensure that we can complete this submittal prior to the finalization of construction for Phase IIIB. Gwen indicated that the contract for construction of Phase IIIB was awarded last week. This also brought up the issue of PMR funding for TRNL. Two methods are currently available to FEMA for funding the TRNL PMR. The first option is to utilize discretionary PMR funding not assigned to any particular PMR in the FY11 budget if the TRNL PMR submittal package is completed before Sep 30, 2012. The other option would be to include the TRNL PMR as a budgeted PMR line item for the FEMA Region 9 FY12 budget, but this funding would not be available until January 2013. Gwen mentioned that if the project is moved to 2013, Tres Rios Environmental Restoration Project Phase IIIC could be moving towards construction, which would then require additional model updates to represent "existing conditions" for the study reach in the HEC-RAS model, and this could further delay the FEMA map changes. Based on this, all parties concurred that the expeditious submittal of the PMR package for TRNL is ideal.

The third topic of conversation as per the agenda developed by the District was the status of the EAP as being completed by WEST. David and Paul mentioned that they were continuing to work on an EAP in-house at the LACOE. Gwen mentioned that WEST was going to be completing the EAP for the project in lieu of the LACOE, the District concurred, and David agreed to act as the point of contact for the LACOE during the review of the EAP.

The fourth item discussed during the conference call dealt with the status of deliverables currently being developed by the LACOE, including the DDR, LSER, TSDN, study sheets for the technical data and mapping deliverables, etc. Ed Curtis from FEMA Region 9 mentioned in his email to the TRNL team that the TSDN would be ideal for FEMA. WEST and Richard have gone through FEMA's TSDN requirements and the EC/6067 document to determine the differences between the TSDN and the LSER, and the conclusion of this research was that the differences between the two are minimal. Gwen said that the LACOE will continue to focus on the LSER and DDR, and it was still unclear who might complete the TDN information using the technical data derived from the LSER and DDR. Van also mentioned that the LACOE will defer to Jody, the current LSO, regarding the documentation issue. Jody has already indicated that the TSDN

might be beyond the level of effort that the LACOE will pursue to finalize FEMA map changes. Therefore, the LACOE will not plan on completing the TSDN or TDN at this point in time, and they will continue to focus on the LSER and DDR. The District requested that Gwen clarify this with Jody, and Gwen agreed.

The next item discussed during the call dealt with data preparation and packaging for the PMR submittal to FEMA. Richard asked about items to include with the submittal such as (1) the worst-case boundary plot using the pre-project conditions model for TRNL and who would provide this mapping, (2) a "without project" model (a.k.a. a pre-project conditions model showing the mapped water surface elevations without the levee in place), (3) a draft levee certification statement for the final levee certification package to be submitted to FEMA with the PMR submittal, and (4) documentation regarding freeboard analysis. Van responded that the finalization of the modeling and mapping for LACOE is being handled by Joe Goldstein and Reuben Sasaki in Mylene's absence, and they are continuing to work on these products. Van also indicated that Mylene had finished a preliminary risk and uncertainty analysis for the most recent model provided to the District and WEST by the LACOE. Richard stated that if the current model updates being completed by WEST did not alter the results of the prior model completed by the LACOE too significantly, this risk and uncertainty analysis could possibly be submitted to FEMA directly. Gwen and Paul indicated that the requirements for the levee certification statement would be fulfilled with the LSER and the transmittal letter accompanying the LSER.

The final topic of conversation during the call was the schedule of the expected deliverable date for the DDR and LSER. Gwen and David indicated that this should be completed by February 2012. Don clarified that this is the expected completion date for the final DDR and LSER after the completion of all internal reviews by the USACE. Gwen and David said that this was correct. Gwen did mention that this is the first time the LACOE has been through this process of levee evaluation and review to meet the requirements of EC/6067, but that she would continue to stress the importance of finalizing these map changes to the internal review team during the review process.

Action items deriving from this call:

1. Richard will contact Ed Curtis about a separate PMR for TRNL. Based on a conversation between Richard, Don, and other parties in the District familiar with the District's planned PMR schedule and requested budget for FEMA Region 9 in FY12, it seems that TRNL being defined as a separate PMR budget line item for FEMA Region 9 would be the best course of action to secure funding if the discretionary PMR funding is not available

in FY11. This conversation between Richard, Don, and other parties in the District preceded the teleconference call discussed herein.

2. LACOE to obtain final draft design modeling and technical documentation for Phase IIIA and Phase IIIB features to distribute to the District/WEST consultants.
3. WEST to continue working on updates to the hydraulic modeling per District request for better integration into the effective FIS data. Further modeling by LACOE for "without project" and "encroachment/FW" models should not commence until review and approval of the WEST updated modeling. WEST consultants to provide updated modeling by 09/16/2011 (Friday) after discussion of the initial modeling results and comments by the District. The distribution of this model will go to the District and the LACOE. Van, Reuben, and Joe will be the contacts for LACOE for this deliverable. Van will be the prime point of contact. *Update: The District has requested a field visit with District and WEST personnel to verify the Manning's roughness values in the current HEC-RAS model and any effects the Phase IIIA construction has had on these values. This field trip is scheduled for Monday, September 26. An updated model will follow shortly thereafter with a field visit report.*
4. Brian to coordinate with David regarding review of the EAP being developed by WEST.
5. LACOE to continue work on LSER/DDR, with a draft expected for distribution and review/comment by the District preceding the finalization of the LSER and DDR in February 2012. This draft will also be utilized to populate any forms that the District will require at the completion of the project for their internal processing.
6. WEST consultants to continue investigating the differences in TSDN, TDN, and PM 63 for the FEMA requirements as compared to the EC/6067, LSER, and DDR requirements for the LACOE. *Update: This document was provided to the TRNL review team on 09/14/2011 via email by WEST.*
7. LACOE to address review comments from the District and WEST regarding the study sheet layout with re-submittal package to include all sheets and written responses to all review comments. In regards to this action item, Joe said that he had not received the hydraulic baseline file, and WEST stated that they would forward that shapefile to Joe. Joe also mentioned that the ERM comments from the District are being incorporated into the study sheets now. Joe has finished the cover sheet, and the other study sheets are being finalized currently. Joe, Reuben, Van, Richard, and Chuck will discuss the mapping deliverables to be sent to the Corps from the model update being completed by WEST currently. *Update: WEST forwarded the hydraulic baseline data to Joe on 09/20/2011.*

The next call is planned for Tuesday, October 4th, 10:30 am, MST and PDT. A formal invitation will follow.

Date: October 6, 2011

A teleconference was held on October 4, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. Paul Beaver
2. David Pham
3. Joe Goldstein
4. Reuben Sasaki

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a US Army Corps of Engineers review of the LSER and DDR)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

TSDN – Technical Support Data Notebook (herein referring to the FEMA standard document)

Conference call discussion

As per the agenda developed by the District prior to the call, Richard started the discussion by providing a status update on the inquiry to FEMA regarding possible opportunities for PMR funding for the TRNL PMR. Richard sent an email to Bob Bezek and Ed Curtis of FEMA Region 9 (RIX) on 9/28/2011 regarding this issue, but Richard had not heard back from Bob Bezek or Ed Curtis at the time of this call. Don mentioned the importance of securing funding in a timely manner for this project to ensure the maps were changed as quickly as possible. Don asked when a homeowner was no longer required to pay flood insurance during a map change process being implemented by FEMA. Brian answered that flood insurance requirements are removed from a property owner only when a FIRM panel update has been completed in its entirety and FEMA has published the new FIRM panels. Don asked if Hasan Mushtaq, the floodplain manager for the City of Phoenix, could provide any additional help in securing funding from FEMA for the TRNL PMR to be funded as a discretionary PMR project on the FY12 budget for FEMA RIX. Bob said that he would work with Hasan to set up a meeting between Don, Richard, Bob, and Hasan. Don said that it would be ideal for this meeting to occur prior to the next meeting of Brogden stakeholders, which occurs on October 17. Bob asked why additional coordination between FEMA and the City of Phoenix would be useful at this time; Don then explained that if we do not get discretionary funding for the FY12 budget from FEMA RIX, then the project will be put on hold until a standalone PMR can be specified for TRNL in FEMA RIX's FY13 budget, which means that the map changes would likely not go into effect until at least calendar year 2015.

During the funding discussion for the TRNL PMR, Richard mentioned that the District has not investigated the possibility of local funding mechanisms to match FEMA funds for the TRNL PMR, or for local funding to pay for the TRNL PMR entirely. Richard did mention that this could be problematic due to the fact that FEMA requires that all PMRs be funded through a region office; therefore, the District (or any participating stakeholder for that matter) willing to pay for a portion of the TRNL PMR might have to provide this funding to FEMA to fund the project instead of funding the PMR directly.

The next topic of conversation as per the agenda developed by the District was the status of technical products currently being developed by the LACOE. Joe and Reuben reported that Mylene had finished the risk and uncertainty analysis before she left for maternity leave. Don asked if the Corps' risk and uncertainty analysis could be forwarded to the District and WEST. Reuben said that he could forward that information, including any reports, other documentation, and the attendant HEC-RAS model(s) for the risk and uncertainty analysis to the District and WEST. ***Update: The LACOE provided the Risk and Uncertainty HEC-RAS model***

files and final Conditional Non-Exceedance Probability results to the District and WEST on Friday, October 6.

Richard then asked if the LACOE had been moving forward with a pre-project conditions model for the "without levee" conditions (which would not include the levee structure or the overbank wetlands features). Reuben and Joe did not know if Mylene had completed this model before she left, but they said that they would forward this model to Richard if they can find it. If they cannot find this model, they will let Richard know that as well.

Richard asked if the LACOE had been working to finalize the floodway analysis. Reuben and Joe said that the LACOE was going to begin the floodway analysis upon receipt of the updated HEC-RAS model from WEST. WEST explained what updates had been implemented in the model to this point, including the updated river stationing and reach lengths to tie-in to the current effective FEMA river stationing, the extension of several cross sections into the left overbank to contain the Salt River flows, and the removal of the Upper Gila River reach and junction from the HEC-RAS model. Richard asked that the LACOE review the model and provide a written statement signing off on the model before beginning the floodway analysis.

Richard discussed whether or not updates were needed for the Manning's *n*-values near the Avondale Boulevard Bridge. This conversation began because the freeboard downstream of the Avondale Blvd Bridge is less than 3 feet based on the original LACOE model, but the FEMA regulations require a freeboard of greater than or equal to 3 feet at all locations along the levees (and additional freeboard is required at the upstream end of the levee and at hydraulic structures such as bridges). The project delivery team can address this in one of two ways: (1) rely on the risk and uncertainty analysis for the model being completed by the LACOE to explain the freeboard discrepancy to FEMA, or (2) update the Manning's *n*-values based on the Phase IIIA grubbing and clearing to refine and hopefully lower the water surface elevation in this area before submitting to FEMA. It is assumed that the water surface elevation will lower in this area because the non-native salt cedars and other dense vegetation will be replaced with cottonwood and other native species that will likely be represented with a lower roughness value. The decision made by the team at the time of this call was to wait until the review of the risk and uncertainty analysis was completed by WEST and the District before changing any roughness values in the model.

Richard asked about the status of the TRNL EAP, primarily the status of the LACOE's review of TRNL EAP being completed by WEST. David had responded to WEST the morning of this call with comments on the levee EAP, and David's primary comment was to ensure coordination took place between the District for the finalization of the contact list and other technical information for the EAP. WEST said that they would ensure coordination with the District moving forward.

David said that February 2012 still seemed like a reasonable date for the completion of the LSER/DDR by the LACOE. Richard said that the District will plan to begin reviewing the document at that time, and the District would like to review any draft versions of those deliverable if available before the finalization of the LSER/DDR in February.

Joe said that he has nearly completed his review and modifications to the work maps based on the review comments provided by the District and WEST, other than comments specifically related to the floodplain boundaries. Joe cannot complete comments directly related to floodplain boundaries until receiving the model update from WEST. ***Update: WEST forwarded an updated hydraulic model to the project delivery team via email on 10/6/2011. This model did not include any adjustments to Manning's roughness values based on Phase IIIA grubbing and clearing based on the discussion during the phone call occurring on October 4, as discussed above.***

Joe said that he could provide the intermediate products without the finalized floodplain boundaries upon finalizing his responses to all of the comments not related to floodplain boundaries. Richard asked if Joe could forward these intermediate map products when available. Joe indicated that he would be able to provide those within a week of this call. ***Update: the LACOE forwarded draft work map products and responses to comments from the District and WEST relating to everything except the final floodplain boundaries (i.e., general work map layout comments, issues with title blocks, ERMs, comments on the index sheet, etc.) on Thursday, October 13. Joe indicated at that time that the updated HEC-RAS model developed by WEST was still under review by the LACOE, and that the final floodplain boundaries would not be incorporated into the work maps until the finalization of that review process.***

Richard asked if the TDN sections 1-4 had been reviewed and completed by the LACOE. Reuben and Joe said they will work with Van to finalize sections 1-4 of the TDN.

Based on an earlier comment from Gwen, it appears that Phases IA, IB, II, and IIIA do not require the ATR review, only DQC. David informed the team that DQC stands for District Quality Control, and that David would be coordinating this for the LACOE. Basically, the DQC varies from the ATR in that the DQC is an internal review process within the LACOE, while the ATR is a review process conducted by another Corps District office for the LACOE. Richard asked if Phase IIIB would require an ATR, and David said that Phase IIIB would require an ATR, but that this should be quick. The reason Richard inquired about this ATR is that the District would like to review the final plans for the Phase IIIB grubbing, clearing, and planting when available, and the District would like to review those in conjunction with the ATR for Phase IIIB, if possible. David said that the plans should be finalized soon for Phase IIIB grubbing, clearing, and planting.

Action items deriving from this call:

1. Bob Upham to contact Hasan Mushtaq to set up a meeting between Hasan, Bob, Richard, and Don, preferably before the next Brogden meeting on October 17.
2. WEST to forward the updated HEC-RAS model to the LACOE, and the LACOE to review this model upon receipt. Additionally, the LACOE will provide comments on this model, if any, and WEST will address those comments. Finally, the LACOE will provide a written statement that they accept the model from WEST upon the satisfactory incorporation of the comments into the model. ***Update: WEST forwarded an updated hydraulic model to the project delivery team via email on 10/6/2011. This model did not include any adjustments to Manning's roughness values based on Phase IIIA grubbing and clearing based on the discussion during the phone call occurring on October 4, as discussed above.***
3. The LACOE to begin the encroachment modeling upon completion and approval of the updated HEC-RAS model provided by WEST.
4. WEST and the District to continue coordinating towards the completion of a draft EAP currently being developed by WEST. The LACOE will be asked to review the draft EAP upon completion.
5. LACOE to continue work on LSER/DDR, with a draft expected for distribution and review/comment by the District preceding the finalization of the LSER and DDR in February 2012. This draft will also be utilized to populate any forms that the District will require at the completion of the project for their internal processing.
6. LACOE to forward information regarding the risk and uncertainty analysis completed by Mylene, including reports, supporting documentation, and attendant RAS model(s). ***Update: The LACOE provided the Risk and Uncertainty HEC-RAS files and the final Conditional Non-Exceedance Probability results to the District and WEST on Friday, October 6.***
7. LACOE to provide a "without project" RAS model using the completed and approved updated HEC-RAS model provided by WEST as a basis.
8. LACOE to forward the updated TDN including Sections 1-4, when available.
9. LACOE to address review comments from the District and WEST regarding the study sheet layout with re-submittal package to include all sheets and written responses to all review comments. LACOE to forward draft work panel products and comment responses to the District and WEST. ***Update: The LACOE provided the draft work panel products to the District and WEST on Thursday, October 13.***

The next call is planned for Tuesday, October 25th, 10:30 am, MST and PDT. A formal invitation will follow.

Date: October 28, 2011

A teleconference was held on October 25, 2011 at 10:30 a.m. Mountain Standard Time and Pacific Daylight Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. Paul Beaver
2. Joe Goldstein
3. Roxanne Vidaurre

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a US Army Corps of Engineers review of the LSER and DDR)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Conference call discussion

As per the agenda developed by the District prior to the call, Richard started the discussion by inquiring about the status of the LACOE's review of (a) WEST's updated hydraulic model and (b) WEST's comments regarding the risk and uncertainty analysis. Joe stated that he has been repeating the risk and uncertainty analysis with the updated hydraulic model provided by WEST. The LACOE's review of the updated hydraulic model is ongoing, and the finalization of the updated risk and uncertainty analysis is contingent on the final review of the updated hydraulic model. Additionally, the LACOE's responses to WEST's comments on the risk and uncertainty analysis will follow the finalization of the updated risk and uncertainty analysis being completed currently by Joe. Joe mentioned that Van is out of the office until next week; he hopes that Van can review and finalize the review of WEST's hydraulic model and the updated risk and uncertainty analysis by the end of next week (Nov 4). Joe stated that the initial results of the risk and uncertainty analysis indicate that the 95% assurance would likely be maintained with greater than 2' of freeboard along the entire length of the levee based on the updated hydraulic model.

Richard then discussed the additional hydraulic modeling deliverables that still need to be developed, including the pre-project conditions model (i.e., with the as-built levee features removed from the geometry) and the encroachment model. Joe said that both of these are currently on hold until WEST's updated post-project conditions model is approved.

The next item discussed was the status of the DDR and LSER deliverables from the LACOE. Roxanne said that David mentioned that the 99% DDR would likely be done by the end of November, and the 100% product would be available by the end of December. The LSER can be populated upon completion of the DDR. Richard requested that those deliverables be forwarded to the District when available. Paul stated that he would be the point person for District comments on the DDR/LSER.

The next item discussed during the call as per the District's agenda was the status of the work maps. Richard mentioned that the newest panels (i.e., Panels 8, 9, and 10) did not have consistent legend symbology compared to the earlier panels (i.e., Panels 1-7). Joe said he would finalize the legend for all of the sheets with consistent symbology after the LACOE has finalized their review of the updated hydraulic model and the floodplain boundaries (it was discussed at this time that WEST can provide the final floodplain boundaries and attendant cross section and BFE shape files meeting FEMA's mapping requirements if the LACOE would like to pursue that option). Richard also mentioned that WEST's comments on the second round of work maps delivered by the LACOE were available for retrieval by the LACOE. WEST will forward a link to Joe for the location on WEST's ftp site where those comments are available in PDF format.

The next item discussed during the call as per the District's agenda was the status of the draft levee certification statement. Richard forwarded the "Positive NFIP Levee System Evaluation Report Transmittal Letter" template taken from EC 1110-2-6067 as an attachment to the meeting agenda for this call. Richard inquired as to the status of the LACOE's finalization of this template for the TRNL PMR submittal. Joe stated that John Drake would likely be the person to talk to regarding this draft document. It was mentioned that the LACOE LSO would be required to sign this letter according to the template developed in EC 1110-2-6067. Richard asked if Jody and/or Paul would be developing this draft statement instead of John; Joe and Roxanne both responded that they were not sure. Richard will follow up directly with John, Paul, and Jody regarding this statement. Don recommended emphasizing that this action item should be addressed prior to the next call on Nov 15.

The next topic of conversation was PMR funding from FEMA. Richard received an email from Bob Bezek at FEMA Region IX on 10/17/11 in which Bob stated that he did not have an answer yet regarding the issue of special PMR process funding for the TRNL PMR. In response to this funding uncertainty from FEMA Region IX, a conference call had previously been held on Oct 24 between Don, Richard, Brian, Bob Upham, and Hasan Mushtaq of the City of Phoenix, at which time these team members discussed possible funding options for the TRNL PMR. This call reemphasized the need for urgency in submitting this PMR package to FEMA because flood insurance requirements for property owners cannot be relinquished until the finalization of mapping updates during a PMR process, and those flood insurance requirements need to be removed as quickly as possible. Richard stressed that the District does not want to include Phases 3A, 3B, or 3C in this submittal because it is expected these Phases will not be completed at the time the study TDN will be completed in Draft Final form, and the Draft Final TDN should be submitted at the time of completion in order to expedite the removal of flood insurance requirements from the effected property owners. The LACOE concurred with this statement. Richard mentioned that one additional outcome of that call is that Hasan Mushtaq and Brian Wahlin will discuss this issue with Bob Bezek and other FEMA Region IX staff at the AFMA conference in Payson from Nov 2-4. LACOE staff and other team members for the TRNL PMR submittal are more than welcome to attend this meeting as well; for additional information regarding meeting times at AFMA, please contact Brian Wahlin or Richard Harris.

Next, Richard inquired about the status of Phase 3B grading plans. Roxanne mentioned that the Phase IIIB 90% working plans should be done by the end of Oct or the first of Nov. Richard requested a copy of those plans when available, and Roxanne said she could post those to WEST's ftp site. Roxanne mentioned that the goal for completion of Phase 3B working plans is Jan or Feb 2012.

Richard then asked about the TDN Sections 1-4. Joe said that he has been directed by Jody and Van to concentrate on modeling updates and on the DDR at this time. However, WEST agreed to send a copy of the TDN to Joe and Reuben given the possibility this may change.

Action items deriving from this call:

1. Emphasize the status of the encroachment modeling on the call on Nov 15, as this could be a sensitive issue if the floodway/floodplain boundaries on the south bank of the river opposite the TRNL need to be expanded further to the south to account for the loss in floodway area taken up by the levee.
2. WEST to email Joe with the URL for WEST's electronic work map comments in PDF format on the WEST ftp site. Richard will forward his work map comments to the LACOE upon completion, hopefully this week. *Update: WEST forwarded their comments to the LACOE via email and ftp site on 10/25/2011, and Richard's comments via email and ftp site on 10/27/11.*
3. LACOE to continue working towards review of updated post-project hydraulic model, updated risk and uncertainty analysis, encroachment model, pre-project model.
4. Roxanne to post the Tres Rios Environmental Restoration Phase 3B 90% working plans to WEST's ftp site.
5. Richard to forward the draft levee certification statement (i.e., the "Positive NFIP Levee System Evaluation Report Transmittal Letter") to John Drake, Paul Beaver, and Jody Fischer. We're assuming one of these people will be the one developing the draft statement? *Update: This was done by Richard on 10/25/11.*
6. WEST to forward their comments on the risk and uncertainty analysis submitted previously by the LACOE to Joe, Reuben, and Van. *Update: WEST forwarded this information to the LACOE via email on 10/26/2011.*
7. Richard to include a more detailed discussion regarding the EAP on the agenda for the next call.
8. WEST to forward the Draft TDN to Joe and Rueben.

The next call is planned for Tuesday, November 15th, at 10:30 am MST, 9:30 am PDT. A formal invitation will follow.

Notes from the 1st call with Bob Bezek at 10AM on October 28, 2011

Brian mentioned that we have been working with Hasan Mushtaq on this project, and Hasan will be talking to Bob Bezek at AFMA next week.

Richard Harris then started talking about the options for possible TRNL PMR funding:

1) Standalone TRNL PMR Grant for FY2013
2) Seeking discretionary PMR funding using FEMA Region IX remaining funds in FY2012
3) Tacking the TRNL PMR on to the Baker PMR in Phoenix that is currently ongoing – Richard asked if the levee certification component of TRNL would preclude this PMR from being added to the Baker PMR at this late stage?

Bob said that adding the TRNL PMR onto the current Phoenix Baker PMR contract might not be possible due to the levee certification component of the TRNL PMR. Bob stated that he was not sure exactly how the new FEMA levee certification procedures (especially those procedures that have been put in place very recently for USACE levee projects) effect the PMR submittal (i.e., how much additional documentation is submitted and how much additional FEMA paperwork is required) and required funding mechanisms for levee PMRs. He asked Richard is the levee certification component of the TRNL PMR submittal would overrun the amount currently budgeted for the Baker PMR contract? Richard said that he did not know, but they would at the very minimum have to update the MAS for a new activity (Table 1.1).

Additional discussion items regarding adding the TRNL PMR to the current Baker PMR contract...

1) How does this fit with Terri's schedule?
2) The CTP is a county project. Bob stated that if they want to add more tasks and the funding was available, nothing should really prevent the county from performing that work.
3) Richard mentioned that the District is willing to add more money to the contract with a contract modification if needed.

The appeal period for Terri to add all of her new data into the PMR is Jan 25. Terri has stated to Richard previously that if this project were to come on to the horizon for her, she would need about 4 months, and she said if she got it by Jan 25, she would be able to finish it up about the first of June.

Richard said that the District is going to request another year extension on the current grant for the CTP. This has been extended once already. Bob indicated that a second one-year extension will likely not be an issue for FEMA Region IX. Richard also stressed that the TRNL PMR on this grant would not further delay the current CTP contract any additional amount of time... i.e., the TRNL PMR is not the reason for the extension.

Richard said he has asked for a cost estimate from Terri to complete the TRNL PMR, but Richard does not know if Terri has any experience with PMR's for levee certification to develop this estimate.

Bob said that FEMA now accepts the Corps certification as an almost "rubber-stamped" certification statement. The levee certification documentation would require some oversight from FEMA, but not as much as a typical levee certification package since the Corps has approved it.

Brian asked that if Baker were to go through the entire review, then FEMA RIX would be able to add more funding for upgrading the data to the MIP (Mapping Information Platform) and finalizing the mapping? Bob verified that RIX does have to add some additional funding to finalize the mapping and implement the data in the MIP. Brian asked how much funding that would require? Bob said that he has to look into how the funding is set up for this CTP. Brian and Richard asked if this additional funding would be prohibitive. Bob said that he will contact the RIX PTS (Production Technical Service provider – Baker/AECOM) contractor before he answers that question.

Richard asked if the local Baker officer acting as the CTP for the TRNL PMR is ok, and Bob said he will call Richard back at 2 PM regarding this issue.

Notes from the 2nd call with Bob Bezek at 2PM on October 28, 2011

Baker serving in the role to review the TRNL PMR deliverable and to develop the final products for the FEMA database is ok with Bob. This same process is already being done with another levee certification PMR study currently ongoing with another PMR grant.

Bob said that this process will be ok moving forward if we can use the funding from the FCDMC PMR grant that is currently in place. Richard asked if the TRNL would need a separate PMR with these funds, and Bob said no, FEMA RIX will just roll it in to the existing current PMR package. This is allowed within FEMA because two separate groups within Baker will be reviewing (1) the technical data for the TRNL and (2) the final overall PMR data to be uploaded to FEMA.

A bigger issue that Bob mentioned is whether or not we have the post-preliminary funding available for this project after it's processed by Baker or using any other funding mechanism.

Richard asked if there was any potential that the TRNL PMR would have to go for an outside review after Baker's process? Bob said no, Baker would do the final review. Brian asked if this was also the case for the levee certification documentation from the LACOE. Again, Bob said no, and that FEMA RIX will accept Corps certification documentation and would not require any additional review for the levee certification documentation from Baker or anyone else.

Terri said that she would need to start this project about 4 months before the LSD, which is end of May (maybe beginning of June), so we need to have everything submitted by February 1 for that schedule. She said that the first of March might be doable for this project.

Chuck mentioned possibly simplifying the review of the hydraulic models because the LACOE has their stamp of approval on it, similarly to "rubber-stamping" a FEMA approval for levee certification based on the LACOE's certification of the levee.

Date: November 11, 2011

A teleconference was held on November 10, 2011 at 10:00 a.m. Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

City of Avondale

1. Charles Andrews
2. Sue McDermott

WEST Consultants (WEST)

1. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District

LOMR – Letter of Map Revision

PIR – Phoenix International Raceway

PMR – Physical Map Revision

TRNL – Tres Rios North Levee

Conference call discussion

Richard opened the call by providing a brief background of the flood map revision project for TRNL. Richard updated the City of Avondale staff regarding the change from a LOMR process to a PMR process for the TRNL mapping updates that FEMA Region 9 mandated some time ago based on the number of FIRM panels affected by the updated hydraulic analysis. In light of this change in procedure from a LOMR to a PMR, the City of Avondale will no longer have to sign off on the MT-2 concurrence forms since these forms are only required for a LOMR, not a PMR. Therefore, Richard wanted to hold this call in order to (1) update the City of Avondale as to the

current status of the TRNL map revision project, (2) determine the level of review that the City of Avondale would like to conduct for the project, and (3) determine if there are any current or proposed projects being managed by the City of Avondale within the study area that the District is unaware of and that might further impact the map revisions for this study.

Richard provided a detailed update on the status of Tres Rios Environmental Restoration Phase 3B project, including the proposed plan to enlarge the culvert crossing under El Mirage Road on the north side of the river (corresponding to the relocation of the thalweg to the northern portion of the river in the Phase 3B proposed project plan) and the proposed removal of a small culvert crossing under El Mirage Road on the south side of the river (corresponding to the filling of the existing low-flow channel in the southern portion of the river in the Phase 3B proposed project plan). Charles said that this grading could significantly affect the water/sewer project along Avondale Boulevard (115th Avenue) that will be going to bid for the City of Avondale shortly. Richard said he was interested in learning more about this project before it goes to bid, and Charles said that he would forward the plans for the water/sewer project to WEST and to the District. In addition, WEST said that they would forward the current draft Phase 3B plans received recently from the LACOE to Charles. Richard explained that the Phase 3B plans are "working plans" due to the nature of the design-build contract that the LACOE has with the contractor. Don estimated that these plans represent a 75% completion level for the design; therefore, the final plans and final construction may vary from these proposed plans.

Richard then explained that the current PMR submittal for the floodplain mapping updates will not include any project features from the Phase 3 Tres Rios Environmental Restoration (Phases A, B, or any subsequent phases) because the construction has not been completed for any of these features at this time. The PMR submittal package should be finalized as quickly as possible to ensure that the construction of Phase 3 features is not completed before submittal. If construction is completed before the submittal of the PMR, those features would be required to be included in the analysis for mapping updates. The urgency of updating the FIRM panels for this project does not allow that amount of delay. Additional mapping updates (either through another PMR or multiple LOMR's) will be implemented upon completion of Phase 3 features in the future, after the changes to the maps are made with the current PMR submittal.

As to the City of Avondale's review of the PMR submittal products, Sue and Charles both said that they would need to review the proposed grading and landscape plans for the Tres Rios Environmental Restoration Phase 3B project features, as this project would likely affect a water/sewer project for the City of Avondale that will be going out to bid shortly as mentioned above. Regarding the floodplain boundaries and other products associated with this request, both Sue and Charles indicated that they felt comfortable with the oversight that the District would be providing for the project and did not feel that additional review of these products by

city staff would be necessary. However, Sue and Charles both said that they would like to be invited to future coordination calls with LACOE staff (held every three weeks) and to the three monthly project update meetings to be held between the District and WEST during the finalization of the FEMA submittal package during December of this year and January/February of next year. Richard said he would be sure to include them on all invitations.

Richard then asked about any possible updates in the project area that the City of Avondale was aware of and that might be occurring in the near future. Charles mentioned the water/sewer project along Avondale Boulevard (115th Avenue) that would be going out to bid shortly, which had been discussed previously.

Richard inquired about a lift station associated with the expansion and development of the PIR that Charles had mentioned to Richard at a meeting held on August 11, 2011. Sue said that that the lift station construction is on hold for the moment, but the city is not aware of the reason for this delay. Sue also mentioned that an assistant city engineer has a meeting scheduled with PIR early next week. Sue will have that staff member inquire about the reasons for delay of the lift station and the proposed project schedule for that feature, and the city staff person will report to the District what they learn. Additionally, the city staff person will report any updates or proposed changes to the overall development plan at PIR to the District.

Sue also mentioned that the PIR just repaved their track and built an ADA acceptable parking lot on their grounds. Neither of these projects altered any conveyance systems of the property that would need to be reflected in the hydraulic analysis for the mapping updates.

Richard asked if the City of Avondale has seen any plans for updates to the commercial features of the PIR property. Sue said that the city has heard about plans for an updated grandstand, but they have not heard about any additional upcoming construction of new structures or other development in the near future. PIR recently obtained approval from the city to change the zoning of their property to include a "sports and entertainment" zoning designation with a possible media center to be built in the future, but no immediate plans have been outlined for that structure. Charles mentioned that the city could send a map of the approved zoning changes in the area, and the District indicated that they would like to see that map.

One landholder in the area protected by the TRNL on the north side of the river sold his land recently to the PIR. Sue said that no zoning updates were approved on the north side of the river. She also said that the City of Avondale city-wide master zoning plan, which was recently updated, still lists all of the area north of the river in the vicinity of the TRNL as rural/residential. Sue will have the city staff member meeting with the PIR next week inquire as to why PIR purchased private land on the north side of the river.

Action items deriving from this call:

1. City of Avondale to forward plans for the water/sewer project along Avondale Boulevard (115th Avenue) that is about to go to bid to the District and WEST. *Update: Charles Andrews provided this information to WEST and the District via email on 11/14/2011.*
2. City of Avondale to forward plans for the zoning updates and proposed projects near PIR to the District and WEST. *Update: Charles Andrews provided this information via to WEST and the District via ftp delivery on 11/11/2011.*
3. WEST to forward Phase 3B grading and landscape plans to the City of Avondale. *Update: WEST provided this information to city staff via ftp delivery on 11/10/2011.*
4. City of Avondale to inform the District of any future development at PIR, especially if there are proposed changes to the plans forwarded by the city in Action Item 2 above.
5. Sue to inform City of Avondale staff attending the meeting with PIR next week to inquire about the purchase of private land on the north side of the river and PIR's plans for the use of that property. City of Avondale staff member to report to the District the result of that inquiry.
6. Sue to inform City of Avondale staff attending the meeting with PIR next week to inquire about the updated schedule for the lift station and the plans for any additional upcoming construction to be commenced on the site. City of Avondale staff member to report to the District the result of that inquiry.
7. Richard to invite Charles and Sue to all of the coordination calls with the LACOE (occurring every three weeks) and to the three monthly coordination meeting with WEST starting in December (monthly coordination meetings to occur in December 2011 and January/February 2012).

Date: November 15, 2011

A teleconference was held on November 15, 2011 at 10:30 a.m. Mountain Standard Time, 9:30 AM Pacific Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. Anabel Ronquillo
2. Joe Goldstein
3. Reuben Sasaki
4. David Pham

WEST Consultants (WEST)

1. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a US Army Corps of Engineers review of the LSER and DDR)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Conference call discussion

The LACOE conference call number did not work for this teleconference call. An alternate call-in number for the teleconference was provided by WEST. David said that he would check on the call-in number before the next call to ensure that it will be working in time for that call. If that call-in number will not work, David and the LACOE will provide an alternate call-in number.

As per the agenda developed by the District prior to the call, Richard started the discussion by inquiring about the status of the LACOE's review of WEST's updated hydraulic model. Joe said that the most recent risk and uncertainty analysis for the downstream levee reach showed an assurance value slightly less than 95%, and the LACOE is still working to review and finalize this risk and uncertainty analysis before proceeding with the final approval of the WEST HEC-RAS model. The model utilized by the LACOE for their original risk and uncertainty analysis (i.e., the accepted HEC-RAS model for the project prior to the WEST updated model from Oct. 6th, 2011) had an assurance value based on the risk and uncertainty analysis of greater than 95%, and the new risk and uncertainty analysis is showing an assurance value of slightly less than 95%.

WEST will perform an additional comparison of the water surface elevations between (1) the original HEC-RAS model prior to adding the Gillespie topography, (2) the HEC-RAS model after adding the Gillespie topography with the original cross section alignments, and (3) the most recent HEC-RAS model after adding the Gillespie topography and after WEST altered the cross section alignments to remove the junction from the model. This analysis will be performed to determine the magnitude and extent of the differences between the water surface elevations in these various analyses. At the completion of this comparison, WEST will set up a call with Joe and other LACOE staff to discuss their findings.

The next topic as per the agenda developed by the District prior to the call was the status of any updated analyses of scour and/or lateral channel migration potential for the Salt/Gila at the TRNL to validate sufficient toe-down has been constructed for the levee. The PED study completed by WEST in 2004 included a 2-D modeling study of the study reach (this study utilized RMA-2, one of the USACE's two-dimensional hydraulic modeling packages) to analyze scour potential and lateral migration potential along the TRNL. The District inquired if there had been any updates to this analysis based on changes to the river system along the TRNL due to the Tres Rios Environmental Restoration Project Phase 3 features, primarily the realignment of the low-flow channel planned for Phase 3B. The current configuration of the low-flow channel directs almost the entirety of the daily low flow to the southern portion of the braided channel system of the Gila River downstream of the 115th Avenue Bridge (although another low-flow channel does currently exist in the northern portion of the river in this area with very low capacity compared to the southern low-flow channel). As per the Phase 3B grading plans, the low-flow channel will be realigned to redirect an approximately equivalent amount of low

flows to the deepened northern low-flow channel closer to the TRNL and the existing southern low-flow channel, and a new set of culverts will be installed underneath El Mirage Road to pass flows from the northern low-flow channel and from the levee interior drainage outlet structures under the roadway at this location. The Phase 3B grading plans also indicate that some amount of the low flows will still flow through the existing southern low-flow channel to a set of culverts beneath El Mirage Road in the southern portion of the braided Gila River alignment. The District wants to ensure that the possibility for any additional vertical scour or horizontal lateral channel migration introduced due to this realignment of a portion of the low-flow channel will be addressed in order to prevent damage to the TRNL levee through scour and undermining of the levee toe. Reuben mentioned that he does not think that any additional scour and/or lateral channel migration analyses have been performed since the PED study. Reuben asked if David knew of any additional scour and/or lateral channel migration analysis that had been performed for the Phase 3B ATR that is currently ongoing for the LACOE. David said that he did not believe any additional analyses had been completed because scour and/or lateral channel migration potential based on the Phase 3B features was likely going to be small. Don mentioned that the District has set up a teleconference call with HNTB for Wednesday, November 16, to discuss this issue and to determine whether or not HNTB has performed any additional scour and/or lateral migration analyses for this portion of the levee. David confirmed that he had received an invitation to this call. Joe and Reuben did not receive an invitation to this call. David said that he would forward the invitation for this call to Joe and Reuben.

The next topic on the District's agenda was in regards to the 99% DDR. Richard asked David what the LACOE's review expectations were for the District for the 99% DDR. David mentioned that there were no expectations, but that he would like to receive the District's review comments by the end of the week (close of business on November 18, 2011) in order to maintain the schedule to complete the DDR by the end of December as the LACOE is currently planning to do. Richard said that he would provide the District comments by the end of this week.

Richard then asked about the status of the Draft Positive NFIP Levee System Evaluation Report Transmittal Letter that will act as the levee certification statement required by FEMA for the PMR submittal. The outline of this letter that is provided in the USACE EC 1110-2-6067 was forward to John Drake, Paul Beaver, and Jody Fischer on 10/25/11. Richard asked if a draft of this letter had been developed for the TRNL. David said he did not know at this time, but that he would follow up with Jody and Paul regarding this issue. David also mentioned that Jody is working on the LSER, and Don emphasized that we need the LSER along with the DDR to make the FEMA PMR submittal on time.

Richard then asked if the LACOE had any questions relating to the comments that WEST forwarded on 10/26/2011 regarding the preliminary risk and uncertainty analysis. Reuben indicated that he had looked over the WEST comments, but that the LACOE will not address those until the final risk and uncertainty analysis has been completed based on the new WEST HEC-RAS model. The LACOE will address the WEST comments that are still applicable to the risk and uncertainty analysis upon approval of the WEST HEC-RAS model and completion of the final risk and uncertainty analysis by the LACOE.

Richard then asked for an update from WEST in regards to the EAP. WEST has completed a review of local, state, and national regulations and standards applicable to EAPs for levees; identified the limits of the TRNL EAP; completed a land use search within the EAP limits and identified critical facilities within this area; identified potential staging and emergency supply storage areas; and identified possible refuge areas. Contacts have been made to corresponding stakeholders regarding the coordination list to be included in the EAP, and WEST is waiting to hear responses from several of the impacted stakeholders to finalize the draft of the EAP. David indicated that this must be completed in order to finalize the LSER as per the EC 1110-2-6067 requirements, and he requested that this draft be forwarded to him as quickly as possible. WEST indicated that this draft will be sent to David before the end of November.

Richard then asked for updates regarding the status of the TDN, and Joe said that the priority for the LACOE at this point was to finalize the hydraulic model and risk and uncertainty analysis before completing reviews of any other items. Joe said he and Reuben would ask Van about finalizing Sections 1 through 4 of the TDN when Van gets back into the office next week. Richard also asked about the status of the study sheets and the remaining hydraulic models that would be required for the FEMA submittal, including the encroachment model and the pre-project conditions model. Again, Joe said that the priority for the LACOE at this point was to finalize the with-project hydraulic model and risk and uncertainty analysis before finalizing any other deliverables at this time.

Don asked about the expected date to finalize both the review of the hydraulic model and the risk and uncertainty analysis in order to proceed with the development of the remaining project deliverables. Joe and Reuben said they hoped to finalize the hydraulic model review and the risk and uncertainty analysis before Thanksgiving pending approval from Van next week. Don mentioned that Don and Richard will give John Drake a call to discuss these scheduling issues.

Action items deriving from this call:

1. David will look into the call-in number and passcode for the next teleconference call. He will provide a new number if needed for these calls.
2. WEST will perform a comparison of the water surface elevations between the original HEC-RAS model prior to adding the Gillespie topography, the HEC-RAS model after adding the Gillespie topography with the original cross section alignments, and the HEC-RAS model after adding the Gillespie topography with the WEST updates to the cross section alignment to remove the junction from the model. This will be done to determine the magnitude of the differences in water surface elevations from these various models. At the completion of this comparison, WEST will contact Joe offline to discuss the changes in hydraulics with the updated HEC-RAS model that was delivered by WEST on October 6 and possible alternative strategies for the risk and uncertainty analysis. *Update: this water surface elevation comparison was made, and the call between WEST and the LACOE was conducted on 11/17/2011. Joe and Reuben will work closely with Van and Mylene to finalize the risk and uncertainty analysis for the LACOE.*
3. WEST to provide the 99% DDR to the District that David forwarded to WEST. *Update: This was done, and review comments were provided by WEST to David via email on 11/17/2011.*
4. David will follow up with Jody and Paul regarding the status of the Positive NFIP Levee System Evaluation Report Transmittal Letter draft.
5. David will follow up with Jody and Paul regarding the status of the LSER and the possible date of the draft LSER deliverable.
6. Joe and Reuben to work with Van to finalize the review of the WEST HEC-RAS model.
7. Joe and Reuben will continue to work towards the finalization of the other hydraulic model deliverables, the study sheets, and the responses to comments from the District and WEST.
8. WEST to forward the draft EAP document to David before the end of November.
9. David will forward the Outlook meeting invitation to Joe and Reuben for the teleconference call on 11/16 between the District, the LACOE, and HNTB. *Update: David forwarded this invitation to Joe and Reuben on 11/15.*
10. Chuck to send a reminder email regarding the HNTB call tomorrow to all attendees, and then outline the times of the call in Missouri, Arizona, and California. *Update: Chuck sent this reminder email to all call attendees on 11/16.*
11. Don and Richard to call John Drake regarding scheduling issues for the DDR/LSER submittals and the final PMR submittal.

The next call is planned for Tuesday, December 6th, at 10:30 am MST, 9:30 am PST. A formal invitation will follow.

Date: November 16, 2011

A teleconference was held on November 16, 2011 at 1:00 PM Pacific Standard Time, 2:00 PM Mountain Standard Time, and 3:00 PM Central Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. David Pham
2. John Drake
3. Reuben Sasaki

HNTB

1. Rob Rastorfer
2. Garrett Cross
3. Jeff Doudrick

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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TRNL – Tres Rios North Levee

Conference call discussion

Richard began the call by asking HNTB about any variations the water surface elevations between the Phase 3B pre- and post-project conditions HEC-RAS models. Rob mentioned the email that he sent to Richard on 11/15/2011 explaining that there were no significant increases in water surface elevations, and that the water surface elevations decreased by up to 0.4 feet in some locations of the Phase 3B project reach for the post-project conditions model compared to the pre-project conditions model. Richard then asked about any analysis that HNTB had done of differences in water velocities between the two models. Jeff said that there were changes in velocities between the two models, but that the water velocities for the post-project conditions model were relatively close to the pre-project conditions model. Richard requested that HNTB send a quantitative analysis of the differences in velocities between the pre- and the post-project models for Phase 3B.

Richard then asked about any additional scour and/or lateral channel migration analyses that had been completed or were planned to be performed for the Phase 3B features. Rob mentioned that there were no plans to update any scour or lateral channel migration analyses for Phase 3B. Rob mentioned that the lateral extents of the braided Gila River system high-flow inundation area and the lateral extents of the low-flow channel in the study reach have both remained relatively stable for the past approximately 20 years; there is no expectation that anything will avulse beyond these limits in the future. Don then discussed the planned changes to the channel alignment as proposed for Phase 3B. The current configuration of the low-flow channel directs 100% of the low flow to the southern portion of the braided channel system of the Gila River downstream of the 115th Avenue Bridge. As per the Phase 3B grading plans, the low-flow channel will be realigned to redirect some amount of low flows to the northern portion of the braided Gila River closer to the TRNL, and a new set of culverts will be installed underneath El Mirage Road to pass low flows from the river and from the levee interior drainage outlet structures under the roadway at this location. The Phase 3B grading plans also indicate that some amount of the low flows will still flow through the existing low-flow channel to a set of culverts beneath El Mirage Road in the southern portion of the braided Gila River alignment. The District wants to ensure that the possibility for any additional vertical scour or horizontal lateral channel migration introduced due to this realignment of a portion of the low-flow channel will be addressed in order to prevent damage to the TRNL levee through scour and undermining of the levee toe. Rob mentioned that the culverts in the northern portion of the

river system have been adequately sized to pass the necessary flows at this location, and the low-flow channel has been constructed to ensure it remains in place. Additionally, there is still a significant distance from this new northern low-flow channel to the levee, providing a reasonable setback to further protect from aggravated scour potential at the levee due to lateral channel migration. Don and Richard mentioned that the engineering staff at the District that will be reviewing the permit application would likely need at least a brief narrative explaining this, along with possible additional hydraulic analysis if warranted.

Richard mentioned that the two-dimensional hydraulic modeling study completed in RMA-2 by WEST for the PED during the initial design of the levee was fairly extensive. He also mentioned that if the final as-built levee features were constructed as studied in this two-dimensional modeling effort for the PED, and if the LACOE and/or HNTB could verify the original scour and lateral channel migration analyses completed for the PED study, then the District staff might be able to accept that report as the scour and lateral channel migration analysis for the as-built condition. Richard also mentioned that the quantitative analysis of the difference in velocity values for the pre- and post-project HEC-RAS models for Phase 3B that he requested earlier from HNTB would further support this analysis by showing that little additional erosive potential would likely be introduced to the system due to the Phase 3B project features because the water velocities did not increase significantly in the study reach. Brian asked Don and Richard to verify with the District engineering staff that these actions would suffice as the acceptable scour and lateral channel migration analysis for the District's permitting standards. Don said he would follow up on that before the meeting on November 23 between HNTB, Kiewit, the LACOE, and the District regarding Phase 3B permitting.

Action items deriving from this call:

1. David and the LACOE to look into the comparison of the as-built levee features (i.e., guide dikes, levee, and scour protection features) to the features as they were represented in the RMA-2 model completed by WEST for the PED. If these features are similar, a statement can be provided verifying that the RMA-2 geometry represents the as-built features and as such can likely suffice as a scour and lateral channel migration analysis for the Phase 3B project features. Richard to forward this statement to the District engineering staff supporting the permitting group.
2. Rob to forward the analysis of water velocity differences between the pre- and post-project HEC-RAS models for Phase 3B to Richard. Richard to forward the results to the District engineering staff supporting the permitting group.
3. Don will contact Angie at the District to have her push the review as quickly as possible for the meeting next Wednesday.

Date: December 5, 2011

A teleconference was held on November 30, 2011 at 3:00 PM Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. John Drake

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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TRNL – Tres Rios North Levee

Conference call discussion

Don started the call by giving John some background on the project since John has been away from the Phoenix office. Don mentioned some concerns for the project regarding the LACOE's personnel, funding, schedule, etc. Don reiterated that the City of Phoenix has the lawsuit, and the District only has an IGA with the City of Phoenix to package the FEMA submittal, not to produce technical documentation. Technical documentation production still falls to the LACOE.

Next, Richard provided some background information on the recent changes in the RAS model, primarily that the model had to be updated to match the FEMA FIS model stationing and the downstream reach lengths (i.e., the FEMA hydraulic baseline). Through that update, we found 2008 topography at the District, called the Gillespie topography, which provided better topographic information downstream of El Mirage Road. The analysis deriving from the inclusion of that topography into the geometry data for the RAS model allowed for the removal of the Phase 1C floodwall which sped up the project deliverable greatly due to problems that had been occurring with land acquisition by the City of Phoenix. However, the RAS model that included the 2008 topography also increased the water surface elevations slightly along the downstream end of the levee, rendering the original risk and uncertainty analysis that had previously met acceptable standards at the 95% assurance level no longer valid if the 2008 topography was to be used for the risk and uncertainty analysis as well. Therefore, the LACOE is currently working both to determine if the risk and uncertainty analysis will meet acceptable standards including the 2008 topography even with the concerns regarding freeboard along the levee for the assurance determinations and to approve the final WEST hydraulic model. John said that he would contact Renee and Van to ensure they are working towards recommending a course of action for the finalization of the risk and uncertainty analysis and the approval of the WEST updated HEC-RAS model. John said that he will work with Renee and Van to determine what the issues are that are being considered for the hydraulic analyses, and John will try to provide additional local input or support to aid them in making a decision to move forward in the process. Don said that this will likely put us a long way down the road with the development of the map revision submittal package for FEMA.

Richard explained that FEMA Region 9 required that the submittal package be changed from a LOMR to a PMR due to the number of FEMA FIRM panels being affected by the study. Richard also explained the requirement of the EAP for the FEMA submittal, which WEST has recently completed and will be forwarding to the LACOE today.

Richard and Don both said that the local project team members (both the District and WEST) should always copy John on all correspondence sent to the LACOE so he can stay informed of what is going on with the project at all times. For example, WEST should copy John when sending the EAP to the LACOE today.

Richard went through the list of the remaining products that need to be delivered from the LACOE, including the DDR (the District has seen a draft called the 99% DDR from the LACOE), the NLSER (the District has not seen a draft of this document yet), and the "Positive NFIP Levee System Evaluation Report Transmittal Letter" (the District has not seen a draft of this letter yet). Jody has already sent John a couple of emails already regarding the NLSER and the letter. John mentioned that the LACOE is under some budget constraints, and they are currently trying to come up with some creative budget solutions, especially to fund the post-construction levee survey that is now required for all levee projects. He said that he would work with her to accomplish these tasks.

Richard then explained the additional RAS models that need to be created and delivered by the LACOE in addition to the post-project conditions model for mapping changes. He talked about the pre-project model, the duplicate effective model, the corrected effective model (which might end up being the same model as the pre-project conditions model), and the encroachment model. John will talk to Van about each of these deliverables.

Richard talked about the floodplain zone change files and the other drawing files that Joe at the LACOE office has already provided for the work map development. These still need to be provided in a final format from the LACOE.

Richard finally talked about the TDN. John said that some of Jody's concern regarding the TDN is the fact that it is literally named "Technical Data Notebook" in the sense that the Corps is no longer supposed to provide "Technical Data" in its entirety due to liability purposes. John thinks that the LACOE might be able to provide some parts and pieces, and then the District can create the draft and eventually finalize the TDN. John will discuss more with Jody about providing these parts.

John emphasized that there is a significant budget constraint right now. John said the USACE needs to get a bill passed to increase the 902 limits (i.e., the "authorized project costs"), and only absolutely necessary projects will go forward until this can happen. For this reason, the Tres Rios project has undergone some recent delays. For example, the USACE will be closing the Tres Rios Demonstration project. A significant funding amount will go towards recreation to finalize the recreation facilities before closing the demonstration project, and the Phase 3B has an emphasis right now as well. John said he will look into reallocating these funds if he can. John also mentioned the 1.2 million dollar settlement fund that the City of Phoenix cannot access until the mapping changes are completed based on the settlement terms implemented originally for the lawsuit. Once those people are removed from the floodplain, the city can access these funds again, and that should be an impetus to complete the mapping change submittal package expeditiously. Don agreed that this should be a significant motivation for the project. Don asked about if John could provide updates from his position on this funding source

as well as any other information he is aware of at the coordination calls every three weeks. John said he would try to provide these status updates when he had them.

Finally, John said that he would try to secure a call-in number before the next call and send that number to Richard.

Action items deriving from this call:

1. John to contact Renee and Van to assist in working towards recommending a course of action for the finalization of the risk and uncertainty analysis and the approval of the WEST updated HEC-RAS post-project conditions model.
2. WEST to forward the levee EAP to the LACOE on Nov 30. *Update: this document has been provided to the LACOE in draft format.*
3. All local project team members (both the District and WEST) to always copy John on all correspondence sent to the LACOE so John can stay informed of what is going on with the project at all times.
4. John to work with Jody towards the finalization of the NLSER and the Positive NFIP Levee System Evaluation Report Transmittal Letter.
5. John to talk to Van about each of the additional RAS model deliverables (duplicate effective model, corrected effective model, pre-project conditions model, encroachment model) required by FEMA for the PMR submittal package.
6. John to discuss with Jody the possibilities of providing TDN components to the District in various parts for the District to then develop the TDN.
7. John to provide any updates regarding the TRNL project that he is aware of at the coordination calls every three weeks when he is available and has updates on items to report.
8. John to secure a call-in number before the next call on December 6 and send that number to Richard.

Date: December 9, 2011

A teleconference was held on December 6, 2011 at 9:30 AM Pacific Standard Time and 10:30 AM Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. David Pham
2. Van Crisostomo
3. Joe Goldstein
4. Reuben Sasaki
5. Mylene Perry

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a US Army Corps of Engineers review of the LSER and DDR)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

PMR – Physical Map Revision

R&U – Risk and uncertainty

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Conference call discussion

Richard began the call by providing a brief summary of another teleconference call held on November 30 between the District and John Drake. Richard mentioned that this call was to inform John as to the status of the FEMA Map Revision Project for the TRNL and to stress the importance of project scheduling for the FEMA deliverable. David mentioned that John was not able to make the current call due to other obligations.

Van then gave a status update regarding the R&U analysis being conducted by the LACOE based on the updated hydraulic model submitted previously by WEST. Currently, the analysis is not showing the required 95% assurance for approximately 500 feet of the levee just upstream of El Mirage Road. The maximum assurance that they could obtain for this reach was 91%. The primary difference in the assurance computations between this analysis and the analysis completed in the PED model was the inclusion of the 2008 Gillespie topography provided by the District that was used to validate removing the Phase 1C floodwall from the project. The inclusion of this topography increased the water surface elevations along the downstream portion of the levee, thereby decreasing the freeboard along this portion of the levee to the point that the assurance requirements seemingly cannot be met currently. Van had a meeting with Renee regarding the R&U analysis issue on December 5. Van, Renee, and other members of the H&H project team discussed several options regarding the next steps of this project based on these recent findings:

1) One option discussed was to utilize the 2001 topography in the channel and the 2008 topography in the overbanks. This would possibly allow for improved results from the R&U analysis while retaining the overbank topography required in the model to verify the removal of the Phase 1C floodwall from the project. Also, this analysis method would be consistent with the original design of the levee, which was designed and constructed based on 2001 topography. However, the LACOE ultimately rejected this option because the levee evaluation process that the USACE has developed is to be based on the most recent, up-to-date information available in the study reach impacted by the levee according to the EC 1110-2-6067 document. Since the 2008 topography is the most recent topography information available in the reach and the hydraulic analysis based on this topography is showing insufficient freeboard to meet the

assurance requirements for the levee evaluation process, the LACOE cannot move forward with a positive NFIP levee evaluation at this time until a sound engineering solution has been obtained to bring the levee back into compliance.

2) One option relating to possible changes to the physical system that could be pursued in order to improve the R&U analysis included modifying the Phase 3B or 3C project features to hopefully increase conveyance and decrease water surface elevations along the downstream end of the levee. Possible modifications could include increased grading to lower the bed elevation or additional changes to roughness values in the reach based on the plantings associated with Phase 3. Bob Upham indicated that funding for these types of modifications could be an issue for the city.
3) Another option that the LACOE discussed relating to possible changes to the physical system that could be implemented in order to improve the R&U analysis included raising the levee. All parties agreed that that was not an ideal solution.

Don then mentioned that the LACOE needs to resolve this issue, and John thinks that he might be able to reallocate some funding from other portions of the Tres Rios Environmental Restoration to the FEMA map revision project to this end based on the District's conversation with John on November 30.

Van agreed that this needs to be dealt with immediately, as this will be the priority issue for the project moving forward until a resolution can be implemented. Van mentioned that he is currently coordinating with Renee, Jody Fischer, and Rick Leifield in the LACOE office to have an internal meeting to determine the best approach to address this issue. Don asked if the District could be updated regarding the outcome of this meeting as soon as possible. Don requested that this debriefing teleconference call be held on Wednesday, December 14, at 1:30 PM PST, 2:30 PM MST. Richard said that the District will set up this call using WEST's call-in number.

At this time, a conversation ensued regarding possible alternate solutions to the R&U analysis issue. Richard asked about the possibility of increasing the size of the box culverts at the El Mirage low flow culvert crossings, and Van does not think that would significantly increase conveyance in the study reach because the increase in water surface elevation in the updated hydraulic analysis occurs due in large part to the increase in bed topography well downstream of El Mirage Road. Next, Don asked if the "transition" for the low flow channel from El Mirage Road to the west—an approximately 600-foot stretch of regarded channel designed to tie the low flow channel in Phase 3A from east of El Mirage Road back into the original channel bed topography 600 feet downstream of El Mirage Road—might be useful to increase the conveyance in this portion of the hydraulic analysis in an attempt to lower the water surface elevations enough to allow the R&U analysis to meet the assurance requirements. The LACOE

said that this channel had not been included into any of the model geometry with the 2008 topography at this point in time.

As per the agenda developed by the District prior to the call, the next item discussed was the status of the Phase 3B project. Bob said that ground has been broken for the construction of the Phase 3B project features, and construction is ongoing for this phase. Richard mentioned a discussion recently between the District, HNTB, LACOE, and WEST regarding the possible impacts of scour and lateral migration on the levee due to the planned realignment of the low flow channel between Avondale Boulevard and El Mirage Road for Phase 3B. HNTB and the LACOE both indicated that no additional scour analysis had been completed since the PED study, but that the two-dimensional scour and lateral migration study completed for the PED was likely still valid based on the final construction of the levee and attendant features. In this previous discussion, the District had requested a statement from the LACOE verifying that the project features included in the original WEST two-dimensional modeling effort were similar enough to the constructed as-built features to consider the two-dimensional scour and migration analysis from the 2-D study valid. David said that he would look into providing this statement for the District's permitting group.

Next, Richard asked about the status of the DDR/NLSER deliverables. LACOE staff indicated that the DDR and NLSER require approval of the R&U analysis before finalization of the model, and therefore cannot be completed prior to the resolution of the issues with the R&U analysis. The District requested that anything that can be completed in parallel to this finalization of the R&U analysis would improve the project scheduling, and offered to review any intermediate products that the LACOE would like to submit.

Richard then asked about the TDN. Van said that they have been directed to focus on the DDR/NLSER and the R&U analysis at this time, and they have not been directed to work on finalizing the TDN. Until funding becomes available and the LACOE staff members working on the TRNL are directed to do so, they will not work towards the finalization of the TDN.

Mylene and Joe both indicated that they have provided comments on the EAP, and David said that he will be reviewing and commenting on the EAP today. WEST will be ready to incorporate those changes into the EAP document upon receipt from the LACOE. David will be the point of contact for the LACOE when WEST provides comment responses to the LACOE.

Richard asked about the status of the Draft Positive NFIP Levee System Evaluation Report Transmittal Letter. David said that he has not seen a copy of the Draft Letter at this time. David will follow up with Jody, Paul, and Rick regarding the Draft Letter; but David also stated that this letter would be dependent on the finalization of the DDR, which itself depends on the R&U analysis.

In regards to the study sheets and other project deliverables, Richard mentioned that Joe and Reuben could send responses to any comments that are able to be finalized at this time prior to the resolution of the R&U analysis issue, such as general sheet layout comments, annotations, etc. This review could be done in parallel with the finalization of the R&U analysis in order to maintain progress towards deliverable dates.

Action items deriving from this call:

1. LACOE to secure a working call-in number before the next call.
2. WEST to work towards including the Phase 3B project features west of El Mirage Road (i.e., the low-flow "transition" channel) into the 2008 Gillespie topography to determine if this will affect the final water surface elevation profile enough to approve the R&U analysis results (i.e., increase the assurance value to 95%). *Update: WEST completed this analysis and forwarded their findings to the LACOE via email on 12/13/2011.*
3. LACOE to provide a statement that the PED scour and lateral migration analysis is still valid for the as-built features because the features as they were represented in the two-dimensional hydraulic analysis were similar enough to the as-built features to validate the original analysis. Richard will be available to answer any questions regarding this action item that Van and David might have.
4. David and Mylene will continue working towards the finalization of the DDR.
5. John to continue investigating funding options for LACOE to work towards completing of the flood study package, and request that he discuss his findings at the next call for which he is available.
6. The LACOE to provide comments to WEST and the District in regards to the EAP. *Update: David provided comments on the draft EAP to WEST and the District via email on 12/8/2011. WEST will respond to these comments upon receipt of all other comments from LACOE staff persons.*
7. Joe and Reuben to work towards the finalization of the comments on the study sheets that can be addressed and completed before the hydraulic modeling and R&U analysis are finalized to continue working towards the original project deliverable dates.
8. Richard to forward an invitation to the appropriate parties for the debriefing on December 14 at 1:30 PM PST, 2:30 PM MST. *Update: Richard forwarded this invitation to the appropriate parties on 12/8/2011.*
9. David to follow up with Jody, Paul, and Rick regarding the Draft Positive NFIP Levee System Evaluation Report Transmittal Letter.

The next regular call is planned for Tuesday, January 3rd, 2012, at 9:30 AM PST, 10:30 AM MST. A formal invitation will follow. Don reiterated the importance of maintaining the original project schedule, and that attendance for the January 3 teleconference call is critical.

Date: December 14, 2011

A teleconference was held on December 14, 2011 at 1:30 PM Pacific Standard Time and 2:30 PM Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. John Drake
2. Van Crisostomo
3. Joe Goldstein
4. Reuben Sasaki
5. Mylene Perry

City of Avondale

1. Charles Andrews

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

CLOMR – Conditional Letter of Map Revision

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

O&M – Operations and Maintenance

PMR – Physical Map Revision

R&U – Risk and uncertainty

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Conference call discussion

As per the agenda developed by the District prior to the call, the conversation started with a discussion about the R&U analysis. Van stated that the hydraulic analysis with the inclusion of the 2008 Gillespie topography does not appear to provide the necessary assurance value (i.e., 95% assurance) to meet FEMA requirements for a levee with freeboard values between two and three feet. The highest assurance values obtained by Van's team throughout the sensitivity analyses performed for the R&U analysis is 91%. Based on this apparent deficiency in the assurance value for the levee, Van met with Jody Fischer to discuss possible options and solutions to this problem. Van said that he and Jody discussed adding additional height to the top of the levee by constructing a small add-on to the current structure of less than 1 foot as an interim solution to the problem until the Phase 3C project features were completed. John Drake called this feature a "curb" to provide additional height to the levee. Van stated that he believes the assurance value will be met without the interim "curb" solution upon completion of the Phase 3C features. Don mentioned that this "curb" could be an option from the District's perspective if (a) the feature is structurally sound and (b) the feature does not affect the District's O&M access on the top of the levee (i.e., does not block the current O&M road on the top of the levee).

Don then asked if FEMA would accept map changes based on an interim "curb" solution, or if this type of feature would require that the map change submittal package be converted to a CLOMR instead of a PMR. Richard felt that any feature constructed by the LACOE that is termed an "interim solution" would require a CLOMR submittal as opposed to a PMR. If a CLOMR is submitted, final map changes cannot be based on this submittal; therefore, final map changes would have to wait for the finalized PMR submittal at the completion of the Phase 3C project features. If this delay pushes the submittal beyond the current funding mechanisms which the District has set up with FEMA Region 9 that require the PMR package be submitted by March of 2012, then the final map changes could be delayed for another 3-5 years depending on the construction schedule for Phase 3C.

John said that he felt confident about the interim solution being enough to satisfy the Corps requirements to finalize the levee to FEMA standards (i.e., between 2 and 3 feet of freeboard throughout the length of the levee coupled with 95% assurance based on the R&U analysis).

Richard talked about possible physical changes to Phase 3B project features that may provide an acceptable assurance value from the R&U analysis, including (1) extending, widening, and/or deepening the low flow channel already in the Phase 3B grading plans downstream (west) of El Mirage Road; (2) adjusting the values of the roughness in the model downstream (west) of El Mirage Road to account for the continued maintenance and clearing that will likely occur for the low flow channel downstream of El Mirage Road; and (3) adjusting roughness values upstream (east) of El Mirage Road by modifying the planting plans upstream of El Mirage Road. Richard pointed out that WEST's effort to add the existing planned low flow channel to the 2008 Gillespie topography downstream of El Mirage Road lowered the water surface elevation by approximately 0.1 feet, and the District feels that additional changes to this low flow channel in the model might result in further lowering the water surface elevation along the levee.

Van mentioned that any slight changes to the model likely would not reduce the water surface the required 0.5 feet to obtain an acceptable assurance value. Reuben explained how the LACOE arrived at this estimated value of 0.5 feet for the required drop in water surface elevation to achieve an acceptable assurance value—in the sensitivity analyses performed by Joe and Reuben, they raised the levee elevation by 0.5 feet at the index location along the levee and were able to obtain an assurance value of 95%. Therefore, they feel that lowering the water surface by approximately 0.5 feet for the 500-foot section of the levee upstream of El Mirage Road would also achieve a satisfactory assurance value, all other things remaining equal.

Richard mentioned another possibility would be to reexamine the roughness values used in the HNTB model compared to the pre-project conditions model, and considering lowering the roughness values in this reach based on the clearing and maintenance that the LACOE is requiring for the Phase 3B low flow channel for 5 years according to the current Phase 3 contract. John said that they should ask HNTB about what vegetation (either native or non-native species that are either included in the planting plans or not included in the plans) are expected to grow back into the Phase 3 project boundaries over time before making these changes. For example, will all vegetation not included in the planting plans be continually cleared from the project area?

The District also suggested accelerating the initiation of construction for the Phase 3C portion of the project. Bob Upham stated that project expenditure limit would need to be raised to accelerate the start date for construction of Phase 3C features. Bob did not feel that an accelerated start for this portion of the project would be likely. Don mentioned possibly having

the LACOE conduct a cost/benefit analysis to determine how much money will be needed to finish the map changes, whether that solution is based on an interim solution such as the "curb" or a more permanent solution such as the accelerated construction of Phase 3C. Richard also suggested turning the Phase 3C portion of the project into a multi-phase project itself (Phase 3C-1 and Phase 3C-2) so the project features necessary to finalize the floodplain map changes could be completed ahead of the other features of the project. Bob mentioned that the amount of money required for all or some of the project features to be built was not the issue; instead, the issue is whether the 902 limit can be raised at all. Raising the 902 limit is not tied to a definitive amount of funding. John and Bob said that they would continue working together to try to obtain the necessary funding to move towards the completion of the FEMA floodplain map changes.

Don asked if David and Van could put together some conceptual plans of the interim "curb" on top of the levee as well as any ideas to the rough project cost of this "curb" construction. The District would need to review these for permitting and feasibility from an O&M standpoint. Van said that he and David would work towards the development of conceptual plans for the "curb" to provide to the District.

Action items deriving from this call:

1. LACOE to secure a call-in number before the next teleconference call.
2. LACOE to inquire with HNTB as to the amount and density of vegetation (both native and nonnative species) expected to grow back into the Phase 3 project area based on the planting plans as well as non-planned growth. This question is designed to provide guidance on any possible further modifications to roughness values that could be implemented in the HEC-RAS model.
3. LACOE to coordinate with WEST to discuss possible physical changes that could be implemented into the Phase 3B project features or other modeling changes that could be completed to provide acceptable assurance values for the R&U analysis. *Update: Joe and Mylene contacted WEST regarding this issue on 12/16/2011, and continued discussions regarding possible physical changes to the system will occur the week of 12/19/2011.*
4. Bob and John to continue discussing possible funding ideas for finalizing the mapping changes.
5. LACOE to provide conceptual design plans and any ideas of project cost for the interim "curb" solution to the District for preliminary permitting and O&M feasibility review.

Date: January 4, 2012

A teleconference was held on January 3, 2012 at 9:30 AM Pacific Standard Time and 10:30 AM Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. Paul Beaver
2. Van Crisostomo
3. Joe Goldstein
4. Reuben Sasaki
5. Mylene Perry
6. Anabel Ronquillo

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

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LSO – Levee Safety Officer

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PMR – Physical Map Revision

R&U – Risk and uncertainty

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Conference call discussion

As per the agenda developed by the District prior to the call, the conversation started with a discussion about the proposed interim "curb" solution to the freeboard issue. Don and Richard stated that this type of structure would likely not suffice for the District's O&M purposes. After discussions with the District's O&M staff, they have significant concerns regarding the durability of this structure under the loadings to which the curb may be subjected, such as vehicle loadings and possible lateral hydrostatic or hydrodynamic forces. The District would recommend that the curb be constructed to approximately 48" depth, with 36" below the top of the levee and 12" above the levee. The District O&M staff recommended that this be the "minimum" structural requirements. This would significantly increase the cost and construction

time of this type of feature. Additionally, the LACOE indicated that this solution had been implemented primarily to increase freeboard along concrete-lined channels in the past and only minimally to increase freeboard along earthen levees, and the LACOE also had some concerns regarding the implementation of this solution for the earthen Tres Rios North Levee.

Based on these concerns, the District would rather see the levee raised by adding more earthen fill to the levee. The District recognizes that adding more fill to the top of the levee would require that the fill be sloped along the sides, thereby reducing the top width of the levee crest and the maintenance access road atop it. Additionally, adding only earthen fill to the top of the levee without armoring that portion of the embankment will likely increase rilling of the earthen fill, which is problematic due to the increased probability of vehicle track runoff, especially when coupled with the fact that the top width will be reduced. However, even with these concerns, this still seems to be the best structural solution to the freeboard option based on cost and constructability.

Van and Paul both agreed that raising the levee is a cleaner solution to the freeboard issue than the concrete curb. The remaining discussion considered different approaches to raise the levee, including re-construction along the levee base along the landside. Don recommended adding fill to only the top of the levee and increasing the side slopes to 2H:1V. If the raise only needs to be 6 to 9 inches, then this reduces the top width to 13'. Don said that a 13' top width would be the minimum that the District could approve for O&M access purposes. The LACOE staff indicated that the height the levee must be raised is more likely 1.0 foot instead of 6 to 9 inches. Therefore, this option may not be feasible while still maintaining the 13' top width required for District O&M purposes. See the figure at the end of this document titled "Option 1: Add fill to only the top of the levee and steepen side slopes" for a conceptual representation of this approach. A variable fill depth by increasing the access road cross slope could result in just one side being 1' higher than at present. For this option, the cross slope for the top of the levee could be increased to ~4%.

Van and Paul proposed overbuilding the landside of the levee in order to raise the levee and thus maintain the current top width of about 16'. Don said that the District would be in favor of this option, but this requires a considerably larger quantity of fill than only adding fill to the top of the levee and steepening the side slopes. Also, Richard pointed out this approach would encroach into the currently existing interior drainage basin on the landward side of the levee near El Mirage Road. If the volume of the drainage basin is reduced significantly based on this construction solution, there may need to be additional excavation in the drainage basin to recoup this lost volume. See the figure at the end of this document titled "Option 2: Overbuild the back side of the levee with existing side slopes" for a conceptual representation of this approach.

A final solution suggested by Don was to overbuild the back side of the levee near the immediate levee crest but not increase the current levee footprint. This could maintain the required top width of the levee (i.e., 13') and possibly increase the top width depending on the final design side slope for the added portion of the embankment along the landward side of the levee. See the figure at the end of this document titled "Option 3: Overbuild the back side of the levee and slightly steepen side slopes" for a conceptual representation of this approach.

Once the LACOE makes the final decision regarding the design approach to raise the levee, Don asked if the LACOE staff (Van or David) could send a conceptual sketch of the proposed plan to the District showing the cross-sectional changes for raising the levee up to 1'. Van said that there would have to be significant discussion with John Drake as well before proceeding with a final design solution. Don reiterated that the minimum final top width in the proposed plan will need to be at least 13' for the District's O&M purposes.

Bob Upham mentioned that the administration and funding to address the freeboard issue would be more problematic than the engineering solution itself. It will be difficult to find the funding to address this issue. Even utilizing discretionary funding by the City or the LACOE is not feasible because the Congressional limits must be raised before any additional funding can be added to the project.

Richard mentioned that there would have to be updated documentation to ensure that there would not be a possibility of third party review later finding a discrepancy between the documentation and the freeboard requirement. He asked the LACOE about the necessary changes to the documentation (i.e., As-built plans, DDR, NLSER, etc.) that would be required to fully document the levee raise. Van said that the As-built plans would be modified accordingly. Don recommended a thorough revision of all related documentation as well. Paul and Van said they would have to work with Jody and David on this issue.

Don mentioned the overall status of the schedule, and what the additional construction to raise the levee might do to the proposed schedule. The District reiterated that they currently have a funding mechanism in place through FEMA to finalize the current PMR submittal if we can complete the submittal by March (as we have currently planned) or May (at the latest). If we cannot meet this timeframe, the floodplain map changes may not be finalized on the FIRM panels until possibly 2015 (two years later than the current planned schedule). We need to expedite the construction of this levee addition if at all possible in order to meet the funding deadline for mapping changes through the current PMR.

Don mentioned that the District's O&M staff had been utilizing plan sheet EIMDB-2 from the Phase 1B plan drawing set to determine that a 9" raise from the current top of the levee at 2H:1V side slopes would decrease the top width to the minimum 13'. Richard mentioned that it

might not take much more work to update the drawing files themselves as opposed to developing conceptual plans or sketches, if that would be easier for David. Van and Paul indicated that someone would communicate to David that the District will be willing to review whatever plan format would be easiest for David to expedite the review of a concept plan.

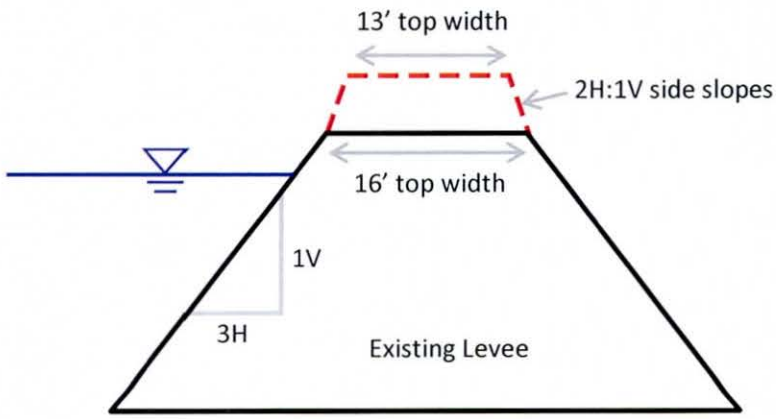
WEST asked about one of the comments that the LACOE had regarding the key contacts to be identified in the EAP. Van said that he and his staff would identify the appropriate staff persons in the LACOE office to act at the key contacts for the EAP.

Action items deriving from this call:

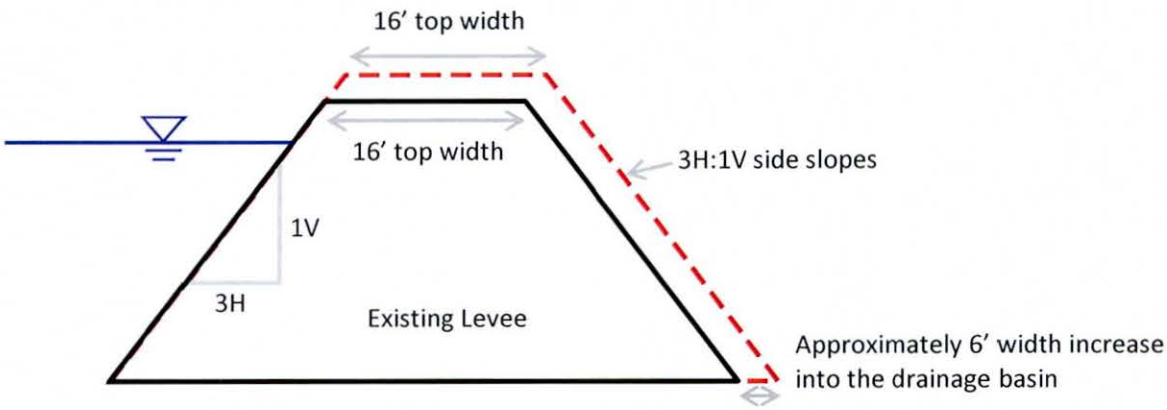
1. LACOE to secure a call-in number before the next teleconference call. Van mentioned that John Drake's office should have a call-in number, and that H&H does not have one.
2. LACOE staff to talk to John Drake about the option of raising the levee to address the freeboard issue for the risk and uncertainty analysis as opposed to building the interim curb, and for John and the project team to come to an agreement as to the best course of action for the construction of the levee addition. The District would like to request an intermediate call prior to the next regularly scheduled call-in time to be able to discuss this and move forward with this process.
3. Van and the H&H staff to determine the needed height addition to the levee to obtain adequate freeboard for the purposes of obtaining the necessary assurance values in the risk and uncertainty analysis. The District requests that consideration be given to providing an additional factor of safety to the amount of height increase in order to account for future variance in water surface elevations.
4. Upon finalizing the decision of how to proceed with the construction to complete the levee raise, LACOE staff to communicate with David Pham to provide cost estimates and conceptual design sketches or updated drawing files to John Drake and to the District for review in the near future.
5. Van and LACOE staff to provide the 2 key contacts for the LACOE District office to be listed in the levee EAP to WEST.
6. Richard to include a graphic of the Sunland Ave Tributary and Buckeye Feeder Canal flooding extents in the next meeting agenda, and to communicate to City of Phoenix and City of Avondale staff that these floodplain extents will still remain on the FIRM panels after the removal of the Salt/Gila floodplain from the landward side of the levee.

The next regular call is planned for Tuesday, January 24th, 2012, at 9:30 AM PST, 10:30 AM MST. A formal invitation will follow.

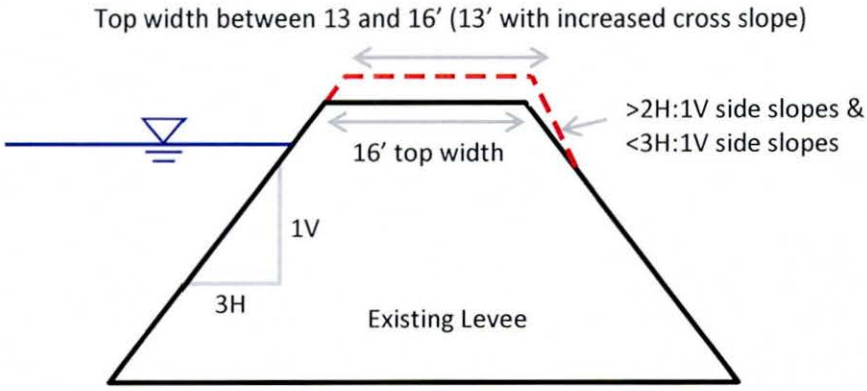
Option 1: Add fill to only the top of the levee and steepen side slopes



Option 2: Overbuild the back side of the levee with existing side slopes



Option 3: Overbuild the back side of the levee and slightly steepen side slopes



Date: February 1, 2012

A teleconference was held on January 24, 2012 at 9:30 AM Pacific Standard Time and 10:30 AM Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. John Drake
2. David Pham
3. Mylene Perry
4. Joe Goldstein

City of Phoenix

1. Bob Upham

City of Avondale

1. Charles Andrews

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

This call was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

BFC – Buckeye Feeder Canal

CLOMR – Conditional Letter of Map Revision

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

O&M – Operations and Maintenance

PMR – Physical Map Revision

RFP – Request for Proposal

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TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Conference call discussion

As per the agenda developed by the District prior to the call, the conversation started with a discussion about the proposed construction of a levee raise for the TRNL to address freeboard issues. David said that the conceptual design for the levee raise has been firmed up and is close to finalization. The only change to the conceptual plan added by the LACOE since the last submittal to the District is the addition of a geo-grid (or geo-textile). The original conceptual plans did not show the geo-grid under the gravel mulch on the land side of the levee for the levee raise, but the LACOE has decided that this is needed on the land side under the gravel mulch to finalize the conceptual plans.

Richard asked John about the funding sources and contractor. John indicated that the LACOE is going to use Kiewit, the current contractor for Phases 3A and 3B, and the contracting mechanism will be a modification to Kiewit's existing contract. LACOE has provided Kiewit with an RFP for this construction effort, and John is ready to move forward with construction immediately once Kiewit approves the RFP. The funding has been secured for this contract modification, and John feels that construction should move quickly once Kiewit approves the RFP. John wants to have a meeting to discuss the Phase 3B permit and the levee raise with Kiewit separately. Richard asked that the results of that meeting (i.e., meeting minutes, notes, etc.) be forward to the District when available. John said he would do this.

Joe and Mylene indicated that the R&U has been rerun based on the conceptual plans that David has provided, and the R&U analysis shows that the required assurance value is

maintained along the entire length of the levee based on the additional freeboard provided by the levee raise.

Richard asked if we could now finalize the HEC-RAS model that WEST submitted to the LACOE. Mylene stated that the LACOE has a few final comments on the most recent WEST HEC-RAS model before the LACOE can approve the model, and WEST will work with LACOE offline to address these comments if needed.

David said that we will have to update the Phase 1A & 1B DDR and O&M manuals. John said that if the LACOE provides new as-builts, then the LACOE may not need to update the O&M manuals. Richard and Don concurred, stating that the District's O&M group likely would not need an updated O&M manual for Phases 1A and 1B based on a levee raise for a short portion of the levee, as long as updated as-built plans are provided. David stated that he will be updating the as-built plans for the DDR.

Richard discussed the Buckeye Feeder Canal and Sunland Avenue Tributary flooding sources just north of the Southern Avenue alignment that were previously not included on the FIRM panels because the Salt/Gila floodplain was the dominant floodplain in the area (i.e., the Salt/Gila floodplain has higher water surface elevations than the BFC or Sunland Ave flooding sources). WEST will forward the study information regarding the BFC and Sunland Avenue flooding sources to Mylene and discuss this information with her offline.

Richard then asked about the status of the LSER/DDR. David said that Jody and Paul would be the best persons to answer questions about the LSER. David said that the DDR is near final, and he is working to finalize that now. John said that he will contact Jody and Paul to discuss the status of the LSER. John mentioned that Jody needs to have the initial periodic inspection done before finalizing the LSER. John noted that this inspection is not the levee survey that had been discussed in previous meetings.

WEST asked David about some remaining questions regarding the outstanding LACOE comments on the EAP. First, WEST asked David to clarify the LACOE's comment regarding "bridge blockage" at the 115th Avenue Bridge. David stated that this blockage in reference to traffic blockage, not hydraulic blockage due to debris on the bridge piers. Second, WEST asked David to clarify the LACOE's comment regarding the MCDEM RED book. David stated that the LACOE wants a brief explanation of what this book is. WEST will provide that explanation in the updated EAP. Third, WEST explained that the reason the currently effective FEMA floodplain is still shown in the figure of the EAP is that the assumed worst-case floodplain in the event of a levee breach is the currently effective floodplain with no levee in place. This conservative assumption was made in lieu of hydraulic modeling to determine a smaller area of inundation based on physical levee breach modeling. Finally, WEST discussed the stockpiling comment

that the LACOE made. David stated that we need to provide locations of stockpiled materials. Don said that he thought the District's O&M group or the Maricopa County Department of Emergency Management may have a separate emergency document to use in case of an emergency outlining this information. This external document may need to be referenced in the TNRL EAP. WEST will research this topic further before finalizing this comment.

Action items deriving from this call:

1. John to forward notes regarding the meeting between the LACOE and Kiewit to discuss the Phase 3B permit and the levee raise to the District, especially if delays are expected after that meeting.
2. WEST to finalize the existing conditions HEC-RAS model based on the final LACOE comments. *Update: Joe forwarded those comments to WEST on January 25. WEST provided written responses to these comments along with an updated RAS model on February 1.*
3. David and the LACOE to work towards the finalization of the updated as-built plans and the DDR.
4. WEST to forward the information for the BFC study to Mylene and discuss this information with her offline.
5. John to contact Jody and Paul to discuss the status of the LSER.
6. WEST to finalize responses to the LACOE regarding the LACOE comments on the EAP. *Update: WEST provided written responses to the LACOE comments as well as an updated EAP to the LACOE via email on February 1.*

The next regular call is planned for Tuesday, February 14th, 2012, at 9:30 AM PST, 10:30 AM MST. A formal invitation will follow.

Date: February 13, 2012

A meeting was held on February 8, 2012 at 2:00 PM Mountain Standard Time with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

Michael Baker Corporation (Baker)

1. Teri George
2. Geoff Brownell

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis
3. Jeff Bradley

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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PMR Review Schedule

Teri pointed out that Baker could do some work, at risk, towards the PMR completion for the TRNL project before the levee certification package (i.e., LSER, DDR) was completed. She went on to say that the final levee accreditation letter and removal of the floodplain based on levee protection will not be able to be finalized by FEMA HQ until all the documents (i.e., LSER, DDR) are approved and delivered by the LACOE, but it should not delay the local Baker review. Don asked what "at risk" means. Teri said that it means any changes that occur late in the PMR finalization process based on any changes in the levee certification documentation provided by the LACOE could create additional fees from Baker. Don said we need to make sure that we still push for a deliverable of all the final documentation from the LACOE as quickly as possible including the LSER and DDR, but that Baker being able to begin their review without the final documentation may help us to meet the FEMA deadline for the PMR funding.

Because the TRNL project is a LACOE project, Geoff mentioned that they will not have to go to the detailed level of review on the levee certification documentation that they have to for other levee projects that are not built and certified by the LACOE or other districts.

To finalize the hydraulic model, there needs to be a final statement/memo from LACOE signed by Van stating that the model developed by WEST has been approved and is the final model.

Buckeye Feeder Canal (BFC)

Teri mentioned that it might be better for WEST to finalize the BFC tie-in study than for Baker to do that because of the timing of the PMR grant. Baker might not have the capacity in the PMR grant to complete that portion of the study along with the PMR finalization.

Richard asked if Baker feels that a water surface elevation profile will be required for the BFC all the way down to the confluence with the Gila. Teri said that they would not, they would only need to see the profile from El Mirage Road (or wherever the final tie-in is) upstream along the BFC.

Freeboard

Geoff said that we would not have to notify FEMA HQ because the LACOE would be writing up the R&U analysis, he does not think that the question Richard had regarding page 4 of the PM 63 letter from FEMA would be a problem for this project because of the LACOE R&U. The phrase Richard was referring to from PM 63 is reproduced below:

> *In certain circumstances, exceptions to the minimum riverine freeboard requirement may be approved by FEMA when a minimum of 2-foot freeboard exits throughout the levee as described under 44 CFR Section 65.10(b)(1)(ii). Requests for exceptions, however, shall be coordinated with FEMA HQ prior to submittal of the accreditation request.*

Coordination with Phoenix and LACOE

Richard will copy Hasan on the meeting notice for the next regularly scheduled TRNL conference call with the LACOE on February 14 as well as the next regularly scheduled coordination meeting on March 14. He needs to know that his signature will be required, and we need to inform Hasan of the newly discovered issues associated with the BFC study.

Richard and Don would like WEST to take over preparation of the TDN and work maps from the LACOE. Care needs to be taken to make sure this is done tactfully. It was decided that if we ask the LACOE to take over the preparation that it should be couched as "because of the time crunch, could we take over for you now?" as opposed to "we're taking it and go."

Chuck asked how much approval documentation we need from LACOE for the FEMA stuff, Richard doesn't think much.... i.e., the Corps provides the LSER/DDR, and WEST stamps the TDN and provides all of the FEMA documentation.

Richard and Don discussed some of the issues associated with permitting for the levee raise. Don said that as soon as Kiewit can see the updated plans and provide the LACOE with a cost estimate, and the LACOE approves this cost and provides the notice to proceed, Angie can modify the existing permit very quickly to move forward with construction.

Action items deriving from this call:

1. WEST to ask LACOE for a memo officially approving the updated TRNL hydraulic model. UPDATE: E-mail sent to Mylene on 2/13/2012 requesting memo.
2. WEST to request effective BFC model. UPDATE: WEST requested model from FEMA library on 2/9/2012.
3. WEST to forward the water surface elevation profile plot to Charles Andrews. UPDATE: Profile plots were sent on 2/8/2012.
4. WEST to provide an estimate towards the additional expenses associated with the BFC study. Richard asked if we could get this done before 2/14/2012.
5. Richard to ask the LACOE if the floodway is done.
6. Richard to invite Hasan to next meeting. UPDATE: Hasan was invited but declined due to a conflict.
7. WEST to follow up with the LACOE regarding the back check comments for the EAP. UPDATE: E-mail sent to Mylene on 2/13/2012.
8. Brian will provide the available monies left on the current WEST on-call contract to Richard. UPDATE: Completed.
9. WEST to prepare a max and min floodway width table.
10. WEST to prepare a max and min rise and decrease of the BFE's in the reach table.

The next regular coordination meeting is planned for Wednesday, March 14th, 2012, at 2:00 PM MST. A formal invitation has been sent by Richard for this meeting.

Date: February 14, 2012

A meeting was held on February 14, 2012 at 10:30 AM MST (9:30 AM PST) with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. John Drake
2. David Pham
3. Van Crisostomo
4. Mylene Perry
3. Reuben Sasaki
4. Paul Beaver

City of Phoenix

1. Bob Upham

City of Avondale

1. Charles Andrews

WEST Consultants (WEST)

1. Brian Wahlin

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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LSO – Levee Safety Officer

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TRNL – Tres Rios North Levee

Buckeye Feeder Canal (BFC) and Sunland Avenue Tributary (SAT) Models

Richard described the impact of the BFC and the SAT on the floodplain behind the TRNL. This "hidden" floodplain will need a multi-jurisdictional coordination, which the District will handle. Don mentioned that the BFC will keep the mapped floodplain north of Southern Avenue while the area south of Southern Avenue (i.e., the Holly Acres people) will be removed. Don wanted to make sure Bob was aware of that in case there were people north of Southern were expecting to be removed. Bob indicated that there were not people north of Southern who were expecting to be removed from the floodplain.

Mylene asked about the boundary condition used in the BFC model. Brian explained that the recently approved Salt/Gila model was used to determine the downstream boundary condition in the BFC model, which was then used to determine the backwater along the BFC. Because of some confusion over which version is the correct model, WEST has requested it from the FEMA library to make sure everybody is using the "correct" effective model. WEST will send the model/shapefile to District and LACOE when they get it.

EAP and R&U

The TRNL EAP was back-checked. However, the Levee Safety Program Manager, Jody Fischer, would like to review it one more time before approving it. This review should be completed by Tuesday.

The LACOE has approved the WEST model for the Salt/Gila River. The R&U was updated using the new model The LACOE will provide an email stating R&U analysis is complete and that the freeboard on the levee is adequate (once the levee is raised).

Floodplain Study

Because of the complexity of the work maps due to the BFC, Richard asked if the LACOE would like WEST to complete the work maps for them. The LACOE has agreed to have WEST finish up the work maps. The LACOE will provide WEST and District the latest version of the TRNL work maps and related files.

Floodway

WEST has completed the floodway modeling. They are working on some tables to display the results. When this is completed, WEST will send the floodway model and the results to the District and LACOE for review.

Permitting and Construction

The LACOE expects to get a proposal from Kiewit for the new construction needed to raise the TRNL in the next day or two.

Don mentioned that the LACOE needs to have Kiewit get an amended permit (amended from the existing permit for the construction of the levee) from the District. Kiewit will need to coordinate with Angie of permitting at the District. To facilitate this process, Don asked that the David send the plans sheets to him and Richard and they will make sure that the District personnel get them.

John indicated that the construction time should be about a month or shorter. There is hope that the construction could be completed by the end of February.

LSER/DDR Update

John indicated that there was an internal LACOE meeting last week where they discussed the LSER/DDR for the TRNL. The goal for completing the DDR is the first week or two of March. The only things remaining to complete the DDR are the R&U write up, addition of text for responding to previous comments, and possibly the embankment report. Of these, only the embankment report will take some effort to complete. The LSER requires that the TRNL be inspected and this inspection will hopefully be completed before May. The pre-inspection report is part of the LSER but an effort will be made to complete this report during the wrap up on the DDR. After the inspection is complete, the LSER can be completed but this will take some time. The LACOE will try to complete the LSER by May or early summer. Baker, FEMA's contractor to review the PMR, has already agreed that they will begin reviewing the TDN prior to the completion of the LSER. However, their review will be at risk in case anything in the LSER

causes changes to things in the TDN, and they cannot approve the floodplain changes until LSER is complete which makes it critical that the inspection and LSER are submitted as soon as possible.

Action items deriving from this call:

1. WEST to send LACOE and District the BFC and SAT effective models once they are provided by the FEMA library.
2. The LACOE to provide an email stating R&U analysis is complete and that the freeboard on the levee is adequate.
3. The LACOE to send WEST and the District an email verifying that they have approved the WEST RAS model.
4. The LACOE to provide WEST and District the latest version of the TRNL work maps and related files. Update: Complete as of February 16.
5. WEST to send the floodway model and the results to the District and LACOE, when completed.
6. David to send the Levee-Raising plans sheets to Don and Richard. Update: Complete as of February 14.
7. WEST to send Reuben the Durango ADMP study. Update: Complete as of February 16.
8. Don and/or Richard to make sure the Levee-Raising plans are given to Angie of permitting at the District. Update: Complete as of February 14.

The next regular conference call is planned for Tuesday, March 6th, 2012, at 10:30 AM MST, 9:30 AM PST. A formal invitation will be sent by Richard for this meeting.

Date: March 6, 2012

A meeting was held on March 6, 2012 at 10:30 AM MST (9:30 AM PST) with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

U.S. Army Corps of Engineers, Los Angeles District (LACOE or SPL)

1. John Drake
2. David Pham
3. Van Crisostomo
4. Joe Goldstein
5. Jody Fischer

City of Phoenix

1. Bob Upham

WEST Consultants (WEST)

1. Chuck Davis

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LSO – Levee Safety Officer

NLD – National Levee Database

O&M – Operations and Maintenance

PMR – Physical Map Revision

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TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Buckeye Feeder Canal (BFC) and Sunland Avenue Tributary (SAT) Models

These HEC-RAS models were obtained from the FEMA library. During the call, it was stated that WEST had sent these models to the District and LACOE. These models have not been sent yet. FEMA provided several models that were originally submitted for the BFC/SAT study, and the various models were used to map differing portions of the floodplains throughout the BFC/SAT study area. Once WEST has fully understood the models pertinent to the portions of the BFC/SAT floodplains that will be reintroduced to the effective FIRM panel on the landward side of the TRNL after the Salt/Gila floodplain is removed from the FIRM panel, WEST will prepare a memo detailing the various BFC/SAT models and send the LACOE only the models necessary for the TRNL study documentation.

WEST will also provide an email or technical memo explaining the BFC 2' topographic interchange with the 4' topographic sources. Joe said that he understood the hydraulics of the Salt/Gila model will not change with the addition of the 2' topography in the overbank. If WEST can provide that memo in writing, the LACOE will have no need to review the updated RAS model which will include the 2' topography in the overbanks on the landward side of the TRNL.

EAP and R&U

The LACOE sent an email to the District and WEST stating that the R&U analysis was complete for the TRNL. Van stated that the R&U would not need to be updated upon completion of any levee construction, as long as the levee raise reaches to, or is greater than, the height shown in the conceptual levee raise plans and the remainder of the levee matches or exceeds the as-built heights.

The LACOE has not completed their review of the EAP. They provided it to their Emergency Management Office and will have comments by March 24, 2012. These comments, when addressed, will bring the EAP into California state requirements and USACE requirements. The EAP document will be finalized by WEST to include all comments from the LACOE, and WEST will be including recent District comments as well to bring the EAP up to all applicable Arizona state and District requirements.

Floodplain Study

Floodplain maps are being developed by WEST. A draft version has been turned in to the District.

Richard proposed a plan to the LACOE to allow them time to provide review comments on all floodplain mapping products without being required to do so. Basically, any deliverables that the LACOE would like to have the opportunity to review before submittal to FEMA would be posted to an ftp site for a set period of time, but the District would proceed with the product development at the completion of the set period of time without LACOE comments if none were provided. The LACOE agreed to this proposed plan. Jody asked if this plan would only be applicable to the work done to re-delineate the floodplain/floodway. Richard said that this was correct. Jody then asked if the TDN or other floodplain/floodway re-delineation documentation would need to be in the LSER/DDR, and LACOE and District staff on the call stated that this documentation was not required for the LSER.

Richard asked if the LACOE wanted to see every level of production for the floodplain mapping. Joe said that a final draft would be sufficient for the LACOE review by the H&H branch, not every level of production (e.g. 50% submittals, 75% submittals, etc.). It was decided that a draft final version of the work maps would be submitted to the LACOE.

Richard would like WEST to provide a draft of sections 1-4 of the TDN by next Wednesday, March 14.

Floodway

The floodway model was completed and sent to both the District and LACOE.

Construction

John Drake said that he is working with Kiewit to do a modification to their contract for the levee raise because it was determined that the levee is higher than anticipated in the area of concern along the downstream portion of the levee. John stated that the contract will be changed for Kiewit to state that they should raise the levee at any location where it does not meet the required minimum elevation in the area of concern.

Kiewit surveyed the top of the levee to determine how much fill would be needed to bring the levee to the 940.34' elevation shown in the conceptual plans for the levee raise. During this survey, Kiewit found that the centerline of the levee would only require a maximum of 6" raise to bring it up the 940.34' level as opposed to the originally anticipated 9" of levee raise required based on the elevations in the as-built plans. Due to this reduced amount of required fill, the Geogrid will not be needed for construction of the 6" raise. The Geogrid would be required for the 9" raise, but not for a 6" raise. However, the suggestion was made to use the present plan details for the raise including the Geogrid in order to avoid recreating the plan details and to avoid delaying the permitting process. David mentioned that the shift between NGVD29 and NAVD88 might be the reason for the discrepancy in elevations. If the levee was constructed using the wrong coordinate system, then it is possible that the contractor overbuilt the levee because of this shift.

Don asked if the levee inspection would include a levee survey as well. Jody said that no survey will be completed for the inspection. The LSER is supposed to include survey information along with an explanation that the elevations are sufficient and match the elevations used in the RAS modeling.

John said he would talk to Troy and Joel to get Kiewit to complete a full survey of the levee. David said that the survey should pick up three points at each levee cross section surveyed: one at the levee centerline, one at the river hinge point, and one at the landward hinge point.

Don asked what the repetition interval is for the monuments along the top of the levee. David said he thought that it was either 500' or 1,000'. Don said that the future District O&M practices will include resurveying those monuments to determine possible settlement of the levee. Don mentioned that the baseline, annotated elevations on these monuments must be correct and on the as-builts for the District's O&M surveys for possible settlement to be correct. David will request for Kiewit to survey in these monuments as well.

Richard asked if the LACOE or if District installed the monuments. Don said that he thought that these monuments were installed during construction, as they are shown on the as-builts for the levee.

Joe looked at the as-builts to determine the monument spacing. There appear to be a number of monuments in the vicinity of the area of concern, spaced at approximately 1,000'. Joe did not see elevations associated with the monuments on the as-builts, only coordinate locations. David thinks that the elevations should have been shot in during construction, but he was not sure. STA 2+50 and either STA 10 or STA 11 are the two monuments that Joe saw in the vicinity of the levee raise. Don mentioned again that from a long-term maintenance inspection perspective, the monuments definitely need to be surveyed in with elevations, and these elevations should likely be shown on the as-builts if possible. Joe indicated that there are 7 along the top of the levee in Phase 1B, which corresponds to approximately 1,000' spacing. Richard reiterated that all the monuments should be surveyed in Phases 1A and 1B.

Jody said that the NLD performed a survey of the levee last summer. The LACOE is currently reviewing this survey data. Jody just sent an email to John to discuss this, because she is not sure as to the status of approval of this data. Jody said that if the as-built plans elevations for the top of the levee match closely with the NLD survey, then we might be able to corroborate our as-built elevations without completing an additional survey. Richard mentioned that the most recent levee as-built construction plans would have used the most current and recently available survey control. The NLD survey control could then be checked to be sure it agreed with the most recent survey control used for the as-builts. Don mentioned that this whole conversation highlights the need to check the NGVD29 and NAVD88 data sources for the as-builts, Kiewit construction plans, NLD survey, etc., to verify that everything matches before the documentation is finalized.

John said that the Phase 3B construction should be completed in May.

Permitting

John said that he sent Don a letter this morning regarding the permitting process. Don said that he has tentatively convinced the permitting group at the District to accept John's letter as sufficient to move forward with construction without a bond.

Further discussion about the permitting led to the item of construction specifications being required for the amended construction permit for the levee raise. Richard mentioned adding notation to the design drawing to address this (such as "Compaction to 95% density" for the fill, etc.). The outcome of the discussion was that John and Don agreed to move forward now with the existing permit amendment, and begin construction ASAP.

Richard asked if the completion of the levee raise construction would require a final update to the R&U analysis with the surveyed final levee elevations. Van said that it would not, because if the minimum elevations used in the R&U analysis are met, which they should be based on the most recent plans, then a slightly higher elevation based on a final levee survey would not affect the outcome of the R&U analysis. Therefore, the LACOE will not need to run an additional "as-built" R&U analysis.

LSER/DDR Update

Jody said that the levee inspection is planned for the first or third week in April. Don asked that Jody contact the District so that District O&M staff can join the LACOE inspection team for the inspection to provide access to the levee if needed and to learn how the LACOE inspects levees so the District can follow their best practices. Jody asked who she should contact regarding this coordination effort. Don indicated that Jody should contact Don directly, and Don would get in touch with Charlie Klenner. Jody said that this would likely be a 3-day trip for LACOE staff for the inspection.

With regards to the DDR, David said that he is waiting on the H&H appendix and geotechnical appendix to finalize the DDR. Joe said that the H&H should be ready on Thursday. Jody asked if we had any status update for the geotechnical appendix, and David said that he thinks Paul has nearly completed the geotechnical appendix.

Richard asked if the "drawing files" for the one sheet of the as-builts affected by the levee raise will be inserted into the as-built plan set instead of issuing a whole new set of as-built plans. David said that that was correct. Richard emphasized that the revised sheet must be labeled as an as-built and not labeled as a design drawing. Don clarified that the entire as-built set will not be re-dated and that only the one sheet will be re-dated. David said that that was correct as well. David also said that that drawing inserted into the as-built plan sets will be stamped as-built.

With regards to the LSER, Jody said that the LACOE will be doing a concurrent review with the District and with LACOE staff simultaneously. Jody wants to use DRCHECKS for the District's review comments on the LSER. WEST said that they have used DRCHECKS, and they could facilitate the District comments through DRCHECKS since WEST is already in the DRCHECKS system for the LACOE.

As to the schedule, Jody said that they would have to wait until the levee inspection was complete before finalizing the LSER. She said with everything else going on, and if an inspection is done in April, the LACOE might be able to get the LSER done in a draft form by June.

Action items deriving from this call:

1. *LACOE (David) to ask Kiewit to survey the top of the levee as well as all the monuments along the levee.*
2. *LACOE to check into the NGVD29 vs. NAVD88 data sources for the as-builts, Kiewit construction plans/survey, NLD survey, and other pertinent data related to the levee raise.*
3. *Jody to contact Don regarding levee inspection schedule.*
4. *WEST to check access to DRCHECKS.*
5. *WEST to provide a memo describing the 2' topography from the BFC/SAT models that will be added to the Salt/Gila model in the right overbanks.*
6. *WEST to provide the LACOE with the BFC/SAT models and attendant memo once WEST has gained an understanding of the models that will apply to the areas being affected by the TRNL study model.*
7. *WEST to complete a draft of sections 1-4 of the TDN by Wednesday, March 14.*

The next regular conference call is planned for Tuesday, March 27th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: March 15, 2012

A meeting was held on March 14, 2012 at 3:00 PM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. John Stock
4. Frank Brown

WEST Consultants (WEST)

1. Brian Wahlin
2. Jeff Bradley
3. Chuck Davis

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

BFC – Buckeye Feeder Canal

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FEMA – Federal Emergency Management Agency

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PMR – Physical Map Revision

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District EAP comments and update to the EAP document

Steve Waters was not able to attend this meeting. Further discussion regarding District comments on the EAP will be postponed until he is available.

Don discussed one of the District's review comments briefly in regards to the methods utilized by District observers deployed to the levee in case of high flow situations for independent visual observations of river stage in relation to levee crest and the likelihood of possible overtopping/failure. Steve commented that the EAP should deal more explicitly with how the observers are to note this stage. WEST pointed out that this could be difficult to specify exactly because of (1) the width of the river at this location as well as the distance from the levee to the river thalweg and (2) the variation in levee height due to the fact that the levee is built on a natural high terrace near the eastern (upstream) end of the levee but rests on a lower terrace nearer the river bed elevation near the western (downstream) end of the levee making the levee much taller and closer to the river thalweg in this area. Don recommended using some of the gaging stations in the area, possibly the gage at the 115th Avenue Bridge, to allow the observers to make the independent visual observations from the top of the levee. These observations could be made in reference to painted river stage markers on the bridge piers, if available. However, Don would still have concerns regarding the accuracy of this measurement since the majority of flow is in the southern portion of the river near the 115th Avenue Bridge, and the distance from the levee to the closest pier that would represent an accurate water surface elevation near the thalweg may be too far to feasibly allow for visual observation. More discussion regarding this issue will be required with Steve when he is available.

Additionally, the LACOE has stated that they are still working to provide comments on the EAP. After WEST addresses the District's comments regarding the EAP, Richard and Don requested that WEST provide the updated version to the LACOE with a clear statement of what changes were made based on the District comments, and then state that we will accept comments back within a two-week period before we move forward with finalization of that document.

Once completed, WEST will be sure to provide a copy of the finalized EAP to the entire TRNL floodplain/floodway re-delineation team, as well as Steve and Frank.

Overall Project Status

Richard began this portion of the conversation with a discussion of the certification of the Maryvale 2' C.I. topography for the area north of the levee and east of El Mirage Road for the Buckeye Feeder Canal study data. John Stock joined the conversation for this discussion. He is concerned that the combination of the 1994 Maryvale 2' C.I. topography, the 2008 Gillespie 2' C.I. topography, the 2001 1' C.I. topography from the LACOE in the channel, and the 1991-1992 4' C.I. topography used in the effective study for this project will very likely raise red flags with FEMA due to the variability of flight dates and mapping scales. Richard suggested that we simplify the language in the report describing the mapping product, and then provide greater detail in one of the appendices to the TDN. Don, John, and WEST agreed to this course of action. Additionally, Richard mentioned that the 2' C.I. topography from 2001 contained all of the flow in the Salt/Gila upstream of El Mirage Road anyway. Based on this, Frank suggested only noting the flight date for the area of the Salt/Gila floodplain mapping on the work maps, and not including the dates of the other topography data sources on the work maps. These can be discussed in an appendix as well. Everyone agreed that this is a reasonable course of action.

As to the certification of the 2' C.I. topography from the 1994 Maryvale study, Don suggested that we provide John with scopes of work for the data collection and RMSE analysis quickly so he can begin collecting the points. Richard said that he could provide those scopes by next Tuesday.

John thinks that based on Richard's request there will not be more than about a day's worth of field work. What John requested to begin these tasks was a perimeter (coordinates, major cross streets, polygon shapefile, etc.) within which we need to get the verification shots for the RMSE analysis. This area/perimeter will include the 2,000'-3,000' of backwater area north of Southern Ave and east of El Mirage Road that will include the area of the BFC study updated by the Salt/Gila backwater. John also requested the DTM information (in point format, or possibly TIN format) to extract data for the RMSE comparison. WEST said that they could provide all of these data to John by tomorrow. If WEST will be sending the DTM data in a GIS TIN format, John requested that WEST forward that information to Joseph Wagner as well. It was suggested that WEST contact Mr. Wagner ahead of any transmittals to get his recommendation on the best format.

Construction of levee raise

The LACOE inspection of the levee raise is to occur next Wednesday (Mar 21) at 10AM MST. The 3-day LSER inspection is now scheduled for the end of April (instead of the beginning of April as was originally planned). District O&M staff will be attending that inspection with LSER inspection team made up of LACOE staff. John Drake has gotten in-house people from the LACOE office to complete the inspection as opposed to LACOE contractors. John Drake

originally thought that the LACOE was going to have an outside contractor complete the LSER inspections, but the decision to keep that task with in-house employees was made recently.

Don mentioned a few things that we still need to ask David regarding the levee raise on the next teleconference call 3/27/12, including the following:

(1) What is the status of the as-built plans? What he sent was only the survey shots. The DDR will eventually need the stamped as-built plan and profile sheet.

(2) How did their inspection of the levee raise go on Mar 21?

(3) What is left to finalize the DDR? John Drake indicated this in the final stages of production at this point.

Memo to LACOE regarding the BFC modeling

WEST will finalize this early next week and send it to the LACOE by Tuesday.

Project Schedule – any changes needed/foreseen?

WEST does not currently foresee any issues with the schedule moving forward. All milestones are currently being met as per the most recently revised schedule provided to the District.

Project Budget – any foreseen need to add new or amended WA at this time or in near future?

Everything done recently that was not a part of the original scope and could be classified as a "miscellaneous task" (such as increased time required for coordination) has been billed to Task 5, Floodplain delineation, by Brian. Richard said that we should start billing some miscellaneous tasks into the "FEMA deliverables" because that budget task item still has not been billed almost at all. However, Richard wants to keep most of the money available in the "FEMA deliverables" task (we need to keep $15K out of the $20K in this task) in case Baker comes back with tasks to update the final FIS information that we submit. Richard has seen this happen recently for other floodplain studies reviewed by Baker.

Richard also asked that WEST provide an update regarding the number of hours required to finish everything taking into account the additional tasks that have been performed recently. Brian said that he will work on our estimate of additional hours required.

In regards to a contracting vehicle to continue WEST's work on this project, Don thinks it will be better to go straight to Tom Loomis' recently initiated on-call contract with WEST instead of using the currently existing on-call contract. Brian mentioned that the only two tasks still open

on the currently existing on-call contract are Katherine Gross's Guadalupe floodplain study and Bing Zhao's HEC-6T Monte Carlo simulation tool.

Review comments/redlines for the draft study sheets submitted 3/6/12 – general discussion.

The complete review comments and redlines will be provided by Richard by the end of this week. However, two intermediate comments that could be addressed now both have to do with the panel layout. First, we need to renumber the panels starting with #1 at the downstream end of the model. Second, we need to provide Richard with some options regarding a "zoomed out" panel layout to be developed in parallel with the 1" = 200' mapping scale work maps so we can include the cross section endpoints in the panel for the FEMA reviewers to be able to scale from the ends of the cross sections. The scale for these "zoomed out" work maps could be 1" = 1000' or 1" = 500', but WEST should try to use a 1" = 500' scale if possible. Additionally, Richard requested that we provide these panel layout shapefiles to him soon for his review.

Action items deriving from this call:

1. *Richard, Don, and WEST to discuss the District's EAP comments with Steve Waters when he is available.*
2. *Richard to provide the surveying scopes of work to John by next Tuesday.*
3. *WEST to provide (1) the surveying area outline for John to complete his RMSE survey task and (2) the final DTM used for the floodplain mapping clipped to the boundary given to John for the RMSE calculations. John requested that this be sent to Joseph Wagner as well.*
4. *District and WEST to ask the following questions to David regarding the levee raise on the next regularly scheduled teleconference call on 3/27/12:*
    a. *What is the status of the as-built plans? What David sent previously was only the survey shots. The DDR will need the stamped as-built plan and profile sheet.*
    b. *How did the LACOE inspection of the levee raise go on Mar 21?*
    c. *What is left to finalize the DDR? John Drake indicated this in the final stages of production at this point.*
5. *WEST to finalize the memo to the LACOE outlining the BFC models by Tuesday.*
6. *WEST to provide an updated estimate regarding the number of hours required to finish everything taking into account the additional tasks that have been performed recently.*
7. *WEST to provide Richard updated panel layouts including (a) the new numbering scheme and (b) the "zoomed out" panel layout to be developed in parallel to the regular work maps.*

Date: March 30, 2012

A meeting was held on March 27, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Mike Jones

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Van Crisostomo
2. Mylene Perry
3. Reuben Sasaki
4. Paul Beaver
5. Anabel Ronquillo
6. Chris Spitzer

Kiewit

1. Adam Kolwicz
2. Rick Lusk

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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Pre-Conference Call Discussion

There was a quick discussion on the status of the work product for the TRNL TDN. The first four sections of the TDN have been updated per Richard's comments. The work maps, except for the work maps with specific changes in the vicinity of the BFC/SAT study area, have also been updated per Richard's comments. WEST will provide the electronic shapefile of the panel layout soon.

Mike Jones with the District said that they will need surveyed as-builts indicating the final levee elevations of the levee raise to fulfill the requirements of the permitting process. The surveyed information has to be included on a signed and sealed sheet of the as-built drawings to meet the permit requirements. Don said that we need to separate the FCDMC permit issues from the FEMA submittal and deliverables for this project so we are not holding up the FEMA submittal for the FCDMC permit.

Discussion of the Levee Raise Inspection

Richard began talking about the discrepancies between the "as-built" cross section of the raised levee section versus the planned cross section. Riprap was shown on the original plan that was not installed in the field. This discussion was in reference to the riprap that was not placed along the raised portion of the levee near the downstream end of Phase 1B immediately east of El Mirage Road.

Adam with Kiewit stated he received a verbal ok from Joel Rodriguez (LACOE) to not include the riprap because the raise was between 1" and 6", and the riprap called for in the plans was 9" (d_{30}), and that size of rock was actually larger than the levee raise itself. Thus, Joel said that the riprap would not be necessary.

Van was not certain that the riprap on the plan could be neglected, as the levee raise will still be subject to wave-type erosion. Van will talk to David in LA and Joel, Troy Olsson, and John Drake in Phoenix about the proposed course of action for the riprap issue. Van will also report back to the TRNL team what the final decision is.

Don discussed the permit issue with Kiewit and stated that Kiewit would be hearing from the District regarding an addendum to the permit once there has been a final decision on the riprap issue.

Additionally, there was some question as to the material along the face of the levee near the 115th Avenue Bridge resulting from an initial inspection of the levee by District staff. However, upon further field inspection it was found that soil cement was in place in this area as per the as-built plans.

Riprap Variability along TRNL

Richard mentioned the riprap variability along the face of the levee, from angular to rounded river rock. Although the LACOE design team was aware of this issue, Richard wanted to bring it to the LSER inspection team's attention prior to the LSER inspection in case this would lead to questions or concerns on behalf of the inspection team. Chris Spitzer, the lead for the inspection team for the LSER inspection team from the LACOE, stated that he was aware of the riprap variability along the levee.

Levee Inspection Schedule

Chris said that the team is shooting for Thursday and Friday, April 26-27, for the LSER inspection. Don asked if the original 3-day plan had been cut down to 2-days. Chris said that that is the current discussion from the LACOE, but they are still trying to finalize that. Don mentioned that the District would like to attend. Chris said that he would like to have the District staff on board. Chris and Don will coordinate regarding the scheduling for this inspection.

WEST DRCHECKS Account

WEST's DRCHECKS account has expired. Van will email David to get the WEST DRCHECKS account reinstated.

BFC/SAT Update

WEST sent the effective BFC model to the District and the LACOE. A description of the topography used for this model will appear in the TDN. The LACOE does not want a separate memo regarding this; they will just rely on the TDN. WEST is currently modifying the effective BFC model for mapping the Buckeye Feeder Canal floodplain behind the TRNL. When the modifications are complete, WEST will send the model to the LACOE and the District along with a memo.

DDR Update

Paul (geotechnical) and David (construction/civil design) are still responding to comments on the DDR. Van will check to see when they might be done responding to comments.

EAP

David's comments on the EAP have been received. WEST will incorporate David's comments quickly and finalize this. Of David's comments, WEST needs additional clarification on only one of the comments. *Update: David clarified this comment and stated that the particular comment in question could be ignored.*

Joe is setting up another call with the emergency management office to try to push this through as quickly as possible. The LACOE will include WEST on this call. *Update: Joe has invited WEST and several LACOE staff to a conference call on Monday, April 2.*

Action items deriving from this call:

1. *WEST to provide the electronic shapefile of the panel layout to the District.* ***Update: This was provided to Richard via email on March 30.***
2. *Van to investigate the riprap on the levee raise and report back to the team on the LACOE's decision.*
3. *Van to remind David to ask Kiewit to survey the entire top of the levee as well as all the monuments along the levee.*
4. *Van to remind David to check into the NGVD29 vs. NAVD88 data sources for the as-builts, Kiewit construction plans/survey, NLD survey, and other pertinent data related to the levee raise.*
5. *Van to email David to get the WEST DRCHECKS account reinstated.*
6. *WEST to send the modified BFC model to the LACOE and the District along with a memo, once complete.*
7. *Van to check on expected completion date for the DDR.*
8. *Joe to coordinate with WEST on conference call to discuss EAP.* ***Update: This call is scheduled for Monday, April 2.***

Date: April 5, 2012

A teleconference was held on April 5, 2012 at 9:00 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Stephanie Gerlach
4. Frank Brown
5. Steve Waters

WEST Consultants (WEST)

1. Brent Travis

Maricopa County Department of Emergency Management (MCDEM)

1. Glen Floe

This meeting was in regards to the actions that may be required to a revision of the Tres Rios North Levee (TRNL) Emergency Action Plan (EAP) in response to the April 2nd teleconference with the Army Corps of Engineers.

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EAP

The USACE raised a number of concerns following another review of the TRNL EAP, and these comments were delivered to WEST on a teleconference call held on April 2. This teleconference was organized by the District to develop responses to the LACOE comments.

In general, all attendees agreed that the requests from the USACE to move levee descriptive data to an Appendix were reasonable. However, since these items were originally included per USACE instructions it was agreed that the USACE, and particularly John Drake, will need to verify that this is the final USACE stance.

Some of the USACE comments were specifically discussed:

USACE Comment	**Discussion**
Make inundation map larger. Remove arrows. Add jurisdictional limits. Make two versions: One 8.5 x 11 and one 24 by 36 to be included in a back pocket. Add depths.	Glen Floe agreed that this is a useful item to include. Richard Harris requested the WEST estimate the number of hours that would be required to produce these maps.
Change 'it is assumed that Maricopa County will lead the emergency response' to put the Sheriff's office in charge with support from FCDMC, MCDEM, and the other ones listed.	Glen Floe and Stephanie Gerlach will work together to generate a clear list of contacts and a hierarchy of command and then provide this to WEST to update the EAP accordingly.
Make 'wetland pools' section part of the action items.	The attendees were generally opposed to the idea that environmental services should be first tier contacts because of possible water quality issues from the wetland pools in the event of a levee

USACE Comment	Discussion
	breach, since water quality issues would likely be very minimal. This item will be discussed by Richard Harris and Don Rerick when they meet with John Drake.
The 'Inundation Response Resources' section should include specific resource requirements, such as sand, rock, etc. This should be specific and include volumes.	Stephanie Gerlach recommended that we address this concern by providing the Flood Response Manual to the Corps. WEST noted that the USACE may not feel that this is sufficient. It was therefore decided that this topic be designated as a bullet item to be discussed between Richard Harris, Don Rerick, and John Drake.
The 'Potential Emergency Conditions' section should include explanations on how the noted conditions would create emergency conditions. For example, the 'channel blockage' would raise the potential for flows to overtop the levee.	Attendees raised a concern that this level of detail may detract from the practical use of the EAP, since not all emergency conditions and their potential consequences can be anticipated. This will be an item discussed at the meeting between Richard Harris, Don Rerick, and John Drake.
USACE and MCDEM disagree on evacuation / staging area designations. USACE believes it to be important to specify; MCDEM believes it to be up to the Red Cross to identify these locations.	Glen Floe maintained the position that this is not typical to emergency operations and specifically other similar EAP's developed Maricopa County. All attendees agreed that the TRNL EAP should be as consistent as possible with other EAP's in the County, and in particular the dam EAP's. That said, Glen Floe will contact key personnel within the County and the Red Cross to determine if they feel comfortable identifying potential refuge / staging area locations. He will report the results of this effort to Richard Harris and Don Rerick so that they may further discuss this item with John Drake.
FCDMC will determine who the levee engineer should be (not Jody Fischer, the acting Levee Safety Officer for the LACOE)	It was decided that the ALERT Operations Center Manager be designated as the one taking the role of levee engineer for purposes of the EAP. WEST will update the EAP accordingly.
The contact list should be revised	As noted earlier, Glen Floe and Stephanie Gerlach will work together to generate a clear list of contacts and a hierarchy of command and then provide this to WEST to update the EAP accordingly.

USACE Comment	Discussion
	Further, Richard Harris and Don Rerick will address the USACE contacts during their meeting with John Drake.

Action items deriving from this call:

1. *WEST will provide an estimate of the number of hours that will be required in order to generate the updated maps (both 8.5" x 11" and 24" x 36") as requested by the USACE and MCDEM.*
2. *Glen Floe and Stephanie Gerlach will work together to generate a clear list of contacts and a hierarchy of command. In particular, It was decided that the ALERT Operations Center Manager be designated as the one taking the role of levee engineer for purposes of the EAP. Once complete, the updated contact list will be provided to WEST.*
3. *WEST will update the EAP contact list as revised in Action Item 2 upon receipt from the District.*
4. *Glen Floe will contact key personnel within the County and the Red Cross to determine if they feel comfortable identifying potential refuge / staging area locations to include in the EAP. He will report the results of this effort to Richard Harris and Don Rerick.*
5. *Richard Harris and Don Rerick will schedule a meeting with John Drake to discuss the items noted above and summarized here as bullet items:*
    - *The role that environmental services should play as contacts because of possible water quality issues from the wetland pools in the event of a levee breach reach. The call attendees herein feel that water quality issues will be of minimal importance in the event of a levee breach.*
    - *The extent to which flood fighting resources (e.g. material types (rock, sand, etc.), material volumes, and construction requirements) should be identified in the EAP.*
    - *The extent to which the EAP should identify potential emergency conditions and corresponding consequences. The call attendees herein feel that this may not be productive, as not every possible potential emergency condition can be addressed and included in the EAP.*
    - *The importance of keeping the TRNL EAP consistent with the County Dam EAP template in order to facilitate emergency response.*
    - *The extent to which potential refuge / staging area locations should be specified within the EAP. This item will take into account the results of Glen Floe's investigation into the matter (see action item 4).*
    - *The revised contact list (see action item 2), the designated levee engineer (ALERT Operations Center Manager), and the contact list that USACE would like included in the EAP.*

Date: April 18, 2012

A meeting was held on April 17, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Van Crisostomo
2. Mylene Perry
3. Reuben Sasaki
4. Joe Goldstein
5. David Pham
6. John Drake

Kiewit

1. Adam Kolwicz

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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TRNL – Tres Rios North Levee

Discussion of the Levee Raise As-Builts

The as-built provided by David Pham on 4/9/12 showed all items satisfactory to the TRNL team. Don indicated that these plans had been approved by the District's permitting and O&M groups separately. To finalize this issue, the District will make copies of the final as-builts for the levee raise along Phase 1B of the project and insert this copy into the O&M manual that the District has on file.

Status of the DRCHECKS account for WEST to facilitate review of the LSER

David indicated that he did not want to utilize DRCHECKS for the review of the DDR or any other deliverables he is involved with currently for the TRNL. David asked WEST as to the status of their use of DRCHECKS for this project. Chuck responded that WEST had not utilized DRCHECKS for the TRNL project, but that WEST had utilized DRCHECKS recently with the LACOE for other projects. As per the final meeting minutes for the TRNL coordination call on March 6 of this year, Jody requested that DRCHECKS be used for review of the LSER. David indicated that he would talk to Jody about reinstating WEST's DRCHECKS account with the LACOE, because Jody initially indicated that WEST would need this account reinstated to facilitate the review of the LSER document by WEST and the District. David will work towards the reinstatement of WEST's DRCHECKS account if Jody wants to pursue this review mechanism for the LSER.

Updates on the DDR and LSER

David indicated that the DDR is moving towards finalization currently. David said that he thought they would be able to meet their original schedule of DDR finalization by the end of this month, April 30. John stated that he had recently sent an email to LACOE Chief to ensure that this schedule is met.

Richard then asked if anyone could speak to the status of the LSER since Jody was not on the line. John said this was Jody's deliverable, and her input would be required to answer this inquiry. John indicated that Chris Spitzer, the team lead for the LSER levee inspection coming up next week, is providing input for the LSER as well. John mentioned that there will need to be an embankment report completed in addition to the LSER. Richard and Don mentioned that the June 1 date discussed initially for the finalization of the LSER would be critical for Baker's review of the FEMA deliverable package. John indicated that he was not sure if Jody would be able to meet that date due to the input required from various LACOE departments, but he stated that he would talk to Jody about it.

EAP

John mentioned some additional comments would be coming from Jody soon regarding the EAP, from both her levee safety group and from the LACOE EOC group (Anne Hutton, group lead). Don inquired if John could provide the final contact numbers from the LACOE and finalize the current version of the EAP with these updated contact numbers from the LACOE, as per the last conference call regarding the EAP with staff from the District, the LACOE, and MCDEM. John said that he would forward the necessary contact information today. Upon incorporation of this final contact number, John will consider the EAP complete in regards to the FEMA deliverable package and the supporting documentation form the LACOE to finalize the floodplain mapping for FEMA. John said that he will look for the final EAP to be posted to an ftp site by WEST including this contact number. John indicated that any subsequent comments on the EAP from Jody's group (levee safety) and Anne Hutton's group (EOC) in the LACOE will be suggestions to improve the document, not requirements to finalize the LSER. Additionally, John indicated that Jody will be incorporating all comments from the levee safety group and from the EOC group into a single deliverable package for the District and WEST.

Levee Inspection Schedule

Don indicated that he had been working with Chris Spitzer to coordinate that District and WEST personnel would be attending portions of the TRNL inspection for the LSER with the LACOE inspection team on April 26-27. Mylene also indicated that she will be attending the entirety of the levee inspection next week.

Progress with the FDS package

Richard provided an update as to the status of the overall deliverables for the floodplain delineation study and the final FEMA deliverable. Richard indicated that the District and WEST should be able to meet the previously estimated delivery date of May 3 for these products.

Action items deriving from this call:

1. *Don to make copies of the final as-builts for the levee raise along Phase 1B of the project and insert these copies into the Phase 1B O&M manual that the District has on file.*
2. *David to work with Jody towards the reinstatement of WEST's DRCHECKS account if Jody wants to pursue this review mechanism for the LSER.*
3. *LACOE to work towards DDR finalization by April 30.*
4. *John to follow up with Jody regarding the finalization of the LSER by the previously discussed date of June 1.*
5. *WEST to finalize the EAP deliverable upon receipt of the final contact number from John Drake, and WEST to post the final EAP to be posted to an ftp site upon incorporation of this final contact number.* ***Update: John Drake provided this contact information via email on April 17, and WEST posted the final EAP to the WEST ftp site for retrieval by the LACOE and the District on April 18.***
6. *Don and WEST to continue to coordinate with Chris Spitzer regarding attendance by District and WEST personnel for portions of the TRNL inspection for the LSER with the LACOE inspection team on April 26-27.*
7. *The District and WEST to continue to work towards the estimated delivery date of May 3 for the final floodplain delineation products for FEMA to be delivered to the LACOE.*

The next regular conference call is planned for Monday, May 7th, 2012, at 10:30 AM MST, 10:30 AM PDT. Please note the change in schedule from our regularly scheduled calls on Tuesday to Monday for the next call. A formal invitation will be sent by Richard for this meeting.

Date: May 7, 2012

A meeting was held on Monday, May 7, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Frank Brown

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Paul Beaver
2. Chris Spitzer
3. John Drake
4. Joe Goldstein
5. David Pham

City of Phoenix

1. Bob Upham

City of Avondale

1. Charles Andrews

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

MCDOT – Maricopa County Department of Transportation

NLD – National Levee Database

O&M – Operations and Maintenance

PMR – Physical Map Revision

RFP – Request for Proposal

R&U – Risk and Uncertainty

SAT – Sunland Avenue Tributary

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the DRCHECKS account for WEST to facilitate review of the LSER

David stated that Jody still wanted to use the DRCHECKS system for the District and WEST to provide review comments to the LACOE for the LSER. Therefore, she would like to reinstate WEST's DRCHECKS account for the LSER review, and WEST would enter comments from both the District staff and WEST personnel using this account. Chris Spitzer will contact Jody regarding this item to remind Jody to reinstate this account.

Updates on the DDR and LSER

The DDR has been finalized.

In regards to the LSER, John Drake stated that the LACOE would finalize the LSER this summer. Chris said he thought it might be August/September before finalization was complete. Chris said that the schedule for the LSER at this point is dependent on the LACOE construction team finalizing and making available the necessary documentation for the embankment report. John stated that the embankment report (i.e., documentation of the delivery of the construction materials to the site, QA/QC reports during construction, etc.) is what was still needed from the construction team for the finalization of the LSER. Richard asked if this embankment report was the same document as the "construction report" that Brian, Richard, and Chris had discussed at the recent TRNL inspection. Chris said that it is the same report. Don asked who the point person would be for the LSER for the LACOE moving forward. John responded that

Chris and John are the primary point people, and other staff would be working on various portions of the LSER and supporting documentation such as the embankment report (including Joel Rodriguez, Troy, Jody Fischer, and Paul Beaver).

Richard stated that, in order to maintain the PMR schedule to be able to implement the TRNL floodplain delineation updates with the next FEMA mapping update for the District and to retain the currently identified FEMA funding vehicle available for the TRNL mapping updates, the entire TRNL PMR-review submittal package—including the LSER—must be completed by the end of September. Otherwise, as Richard and Don stated, it could be another 2 or more years before these updates can be published on FEMA's maps. In order to meet this end of September deliverable date and to allow for District/WEST review of the document, Richard suggested a target date of August 1 for the LSER. John and Chris both restated that they understood the importance of the schedule deliverable for FEMA purposes, and that they will continue to work towards finalization of the LSER document, but that no final date could be provided at this time.

In regards to the progress of the LSER outside of the embankment report, Chris stated that his group has made good progress in documenting the recent levee inspection. Most of the data, photographs, etc., from that exercise have been included in the inspection report, and Chris is working with the District to obtain as-built drawings of 115th Avenue bridge and other pertinent information for project features that the District will provide. (Specifically, WEST will provide the LACOE with instructions to retrieve as-built drawings for the 115th Ave Bridge that the District obtained from MCDOT; these will be posted on the WEST ftp site).

Final Floodplain Delivery Products/FDS Package

The District and WEST are continuing to work towards the finalization of the floodplain delineation products for FEMA to be delivered to the LACOE. Richard stated that the draft final TDN for FEMA will be posted for the LACOE and the Cities of Avondale and Phoenix by the next call on the May 21st. Joe asked that the H&H staff that has been involved with this project (i.e., Joe, Van, Mylene, Reuben) be copied on the correspondence when the final floodplain delineation deliverables are provided to the LACOE.

Levee Inspection

The TRNL Inspection was held on April 26 and 27, 2012. The inspection team noted that some items were in need of repair. Richard inquired as to the time frame for these repairs and how they might affect finalization of the inspection/LSER process. Chris said that responses to the inspection concerns should not delay finalization of the LSER, and he will confirm this with Jody.

Action items deriving from this call:

1. *Chris Spitzer to contact Jody Fischer regarding reinstating WEST's DRCHECKS account to facilitate review comments on the LSER from the District and WEST.*
2. *John Drake and Chris Spitzer to continue coordination towards the finalization of the LSER. The requested finalization date from the District of August 1 was noted, but no estimated finalization date was provided by the LACOE.*
3. *The District and WEST to continue working to provide the requested documents to Chris Spitzer to finalize the levee inspection. Specifically, Don will provide more of Chris's requested documentation, and WEST will provide the LACOE with instructions to retrieve as-built drawings for the 115th Ave Bridge that the District obtained from MCDOT. These as-builts will be posted on the WEST ftp site.* ***Update: WEST posted these as-builts to the WEST ftp site for retrieval by the LACOE on May 7. Chris Spitzer retrieved this PDF file from the WEST ftp site, and realized he would need additional plans called for in the as-builts, specifically CSA plans referenced in the as-builts for the proposed dike along the northern abutment of the 115th Ave Bridge.***
4. *The District and WEST to provide the draft final TDN and supporting documentation for FEMA (i.e., HEC-RAS models, Shapefiles, Study Sheets, etc.) to the LACOE (specifically to the H&H staff that have been involved with the TRNL project) before the next call on the May 21st.*

The next regular conference call is planned for Monday, May 21st, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: May 11, 2012

A teleconference call was held on Friday, May 11, 2012 at 10:00 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

Michael Baker, Jr., Inc. (Baker)

1. Teri George

This meeting was in regards to converting hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project from NGVD29 (the current vertical datum of all mapping products) to NAVD88.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

NAVD88 – North American Vertical Datum of 1988

NGVD29 – National Geodetic Vertical Datum of 1929

PMR – Physical Map Revision

SAT – Sunland Avenue Tributary

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Current Vertical Datum of LACOE products

Teri began the call by inquiring what the LACOE would be expecting in terms of deliverables and the datum those deliverables reference. Brian and Chuck stated that, while all of the models and as-built plans provided by the LACOE to this point had been delivered in NGVD29, the LACOE would likely be fine with final FEMA mapping deliverables referencing either NGVD29 or NAVD88. The LACOE likely would not use the end FEMA deliverables for any additional analysis internally; they would only archive these delivered products for their records. Richard brought up the point that not only has everything that has been delivered electronically from the LACOE up to this point referenced NGVD29, but all of the additional supporting documentation that will be provided eventually from the LACOE in regards to levee certification (including the LSER and DDR, the two major documents that will be delivered by the LACOE that provide the levee certification documentation needed by FEMA) will also reference NGVD29. Richard stated that maintaining the floodplain delineation study in the NGVD29 datum would provide a consistent vertical datum for all deliverables, including the levee certification documents and other supporting documents provided by the LACOE. All members of the call agreed.

Datum of the BFC/SAT study information

Additionally, WEST mentioned that the BFC/SAT study data references the NGVD29 datum as well. All of the BFC/SAT work maps, modeling products, and shapefiles delivered by the District were referencing NGVD29. Based on this, Richard stated that maintaining the current floodplain delineation study in NGVD29 would once again provide consistency across the documentation for various studies used to finalize the TRNL TDN.

Conversion of Study Data to NAVD88

Although the floodplain delineation study should reference NGVD29 for consistency, as discussed above, Teri explained that any data eventually uploaded to FEMA's database must reference NAVD88 for the PMR that Baker is working to complete. Therefore, the digital hydraulic data and FIS data (flood profiles, XSEC WSEL's, and floodway data tables) for the TRNL submitted to FEMA must reference NAVD88. Richard mentioned that one of the two firms, WEST or Baker, would have to provide the converted floodplain delineation study data at some point, and that it is in the best interest of the District to determine which consultant can provide these services at the best cost to the District. Teri pointed out that WEST is more familiar with the study data based on their involvement with the project up to this point, and this familiarity would likely make WEST well-suited to provide the best cost to the District. WEST agreed that this was the case, and then asked for clarification regarding the specific data that would need to be converted into NAVD88 for FEMA. The following list summarizes the remainder of the discussion regarding what data would and would not need to be converted into NAVD88 before final submittal to Baker for review.

1) Items that **will** need to be converted to NAVD88 (based on Teri's direction)
    a. The final post-project HEC-RAS models for the Salt/Gila and the BFC/SAT: WEST will update (i) ground elevations for all cross sections in the model, (ii) elevations for other pertinent geometric features (e.g., the levee elevations), and (iii) hydrologic data in the model (e.g., boundary conditions that are set to be a known water surface elevation). This will generate updated HEC-RAS model calculations referencing NAVD88. WEST will complete this task for all of the Salt/Gila model, and for all of the BFC/SAT models (including the portion of the BFC model that WEST edited, and the upstream portion of the BFC model and the entire SAT model that WEST did not edit for this study). WEST will generate the DXFs for the HEC-RAS models referencing NGVD29. However, WEST will not generate DXFs for the updated HEC-RAS models referencing NAVD88, as Baker stated it would be easier for them to generate these profiles in their development of final water surface elevation profiles.
    b. Digital data for the Salt/Gila and the BFC/SAT: Shapefiles that will need to be updated include (i) the cross section shapefile (which will simply include changing the water surface elevations included in the attribute table as the horizontal alignment will not change) and (ii) the BFE shapefiles (these will be completely regenerated for both the Salt/Gila and the BFC/SAT using NAVD88).
    c. Floodway data table for the Salt/Gila: A copy of the floodway data table that is included in Section 7 of the TDN will be provided using modeling results from the HEC-RAS model that references NAVD88. This copy of the table will be provided to Baker separately (i.e., outside of the TDN), as the floodway data table that is included in the TDN will still reference NGVD29. The BFC/SAT study did not delineate a floodway; therefore, no floodway data tables will be provided for the BFC/SAT.

2) Items that **will not** need to be converted to NAVD88 (based on Teri's direction)
    a. HEC-RAS models other than the post-project conditions models: The effective models, the duplicate effective models, and the pre-project conditions models will not be updated to NAVD88, as none of these deliverables will be utilized for FIS data generation or final digital data development.
    b. Topography product: WEST will not update the final, merged topography dataset to NAVD88.
    c. TDN: All text in the TDN will remain the same, and all data reported in the TDN will reference the NGVD29. A sentence will be added to Section 7 stating that the final FIS and digital deliverables to FEMA were converted to NAVD88 prior to the PMR submittal and eventual upload to the FEMA database, but nothing in the TDN references NAVD88.
    d. Study sheets: The current study sheets that have been developed in NGVD29 will not be changed.
    e. Any other products associated with the TRNL floodplain delineation study not explicitly listed above as an item to be converted to NAVD88.

Implications of this agreement for the District

Richard indicated that it may be best to talk to Cathy Regester as well for guidance regarding final deliverables for the District's database, and what, if any, additional data conversion tasks above the conversion of study data for FEMA's database might be required for compliance with the District's database. Conversions necessary for the District's pending layer will not be performed by Baker. Instead, District's GIS staff will perform any conversions necessary for inclusion into Data Delivery System.

Implications of this agreement for WEST

WEST to investigate if any funds may be needed above what has already been allocated through existing work assignments to determine if there is any need to increase funds to perform the related additional work. If additional funds are required, they will notify the District prior to commencing.

Action items deriving from this call:

1. *WEST to determine if additional funds are necessary to produce converted file copies and inform the District before they begin converting copies of the post-project HEC-RAS models and digital data (cross section and BFE shapefiles) to reference NAVD88.* ***Update: After reviewing the current status of the budget, WEST feels that these additional tasks will not require additional funds from the District. WEST will proceed with the datum conversion for the HEC-RAS models.***
2. *WEST to generate a floodway data table for the Salt/Gila model referencing NAVD88 and provide this to Baker and the District separate from the TDN.*
3. *WEST to add a very brief explanation in the text of the TDN stating that copies of the final FIS and digital deliverables to FEMA were converted to NAVD88 prior to the PMR submittal and eventual upload to the FEMA database, but nothing in the TDN references NAVD88.*
4. *Richard to discuss with Cathy Regester any additional tasks possibly required for compliance with the District's database.*

Baker

MEETING NOTES

FEMA PMR Activities & Floodplain Management Map Maintenance Services
Contract FCD 2009C022 & 2010C003

Subject: **Project Status**

Location: 2801 W. Durango St., Phoenix

Date/Time: Thursday May 17, 2012 at 9:00 PM

Attendees: Richard Harris (FCDMC), Don Rerick (FCDMC), Chuck Davis (WEST), Teri George (Baker), Geoff Brownell (Baker)

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1. Schedule/Budget:

A. There was a brief discussion on the remaining tasks for the PMR which are to finalize Rainbow FIS and address any more FEMA comments on Rodger & WS.

- Action item: None

2. Flood Studies & Draft DFIRMS

A. TRNL – attendees received an update from WEST on the status of the deliverables.

B. TRNL - Overview of WEST draft final Section 4, FIS, Work Maps, and Annotated FIRMSs. Discussion of reference to freeboard/Risk & Uncertainty in DDR – any comments from WEST towards finalization of draft items? WEST confirmed that the TRNL profile ties into BFC & SAT profiles within 0.5'.

- Action items – WEST will revise FDT to follow FEMA FIS format, and the FDT for the TDN will reference the NGVD29 vertical datum. Another copy of the FDT will be provided to Baker separately referencing the NAVD 88 vertical datum per Baker's request.
- Action items – WEST will revise annotated maps to distinguish between proposed floodplain and Effective Floodplain.
- Action item – WEST to include specific text in the TDN referencing Bob Bezek's correspondence approving the proposed hydrology in both Section 4 and Section 7.1. These sections should also reference the copy of the correspondence from Bob in Appendix B.
- Action item – WEST to include specific text in Section 4 of the TDN referencing the location of the electronic version of the USACE Section 7 Report for the updated hydrology on disc in a TDN appendix.
- Action item – WEST to include the preliminary inspection report of the TRNL completed by the District in the TDN. WEST to request this from Richard if it is not available in WEST's records.
- Action item – On the index sheet of the study maps, WEST to show the areas on the BFC/SAT upstream of the current FEMA gutter lines as dashed linework with no

shading indicating these areas are currently effective, similar to the effective area upstream and downstream of the proposed Salt/Gila River mapping updates.

- Action item – WEST to add a cross section label to the middle cross section for all of the 3 cross-section roadway crossings included in the BFC/SAT models.
- Action item – Richard to continue moving forward with the GIS review towards final GIS products before mid-July.
- Action item – Richard to provide the Dibble linework from the District database to Baker.
- Action item – WEST to provide Baker with the final merged topo product, following a conversation with Joe Wagner, Richard, and WEST in regards to possibly converting the merged topo product that WEST is currently using to the District's database format.

C. TRNL - What is the PMR review work schedule – draft TDN to be posted for local review and then updates during next 2 weeks, plan to transmit to Baker by July 1st. When does Baker consider as a last-date to receive the final Levee Certification documentation? July 1st would be the latest submittal date to provide required items to Baker. To what extent will the document review by Baker follow PM 63? It was discussed the documents that must be submitted in addition to "regular" flood study documentation (copy of PM 63 attached), and when they must be submitted relative to the PMR review schedule.

- Geoff stated that PM 63 has been superseded by LAMP, and that the PM 63 checklist does not have to be followed precisely when the LACOE NLSER documentation is provided for levee certification documentation, as the LACOE is a federal agency with a technical agreement with FEMA regarding levee certification packages.

D. Willow Springs Wash FDC LOMR status – 2 sets of the revised items were submitted to FCD 5/11/12 which Richard forwarded onto FEMA 5/16/12; copy of FCD transmittal to FEMA provided to Baker. *Update: Inserts placed in District library TDN copy by Richard 5/17/12*

E. Rodger Creek status – Baker resubmitted revised items due to survey error on April 4th, Cathy submitted it April 12th and FEMA acknowledged receipt on April 27th. FEMA reviewer requested shape files of FP linework on May 2nd. FEMA continuing with review.

F. District requested an approximate date when the Preliminary Map Products will begin to be submitted to District for review and/or comment. Baker estimates that if LFD occurs in early September, District can begin to expect maps in November. District requested DFIRM to be in electronic format, not paper copies.

3. Source of funds to cover the TRNL review & mapping.

- Action item - Richard would verify that RBF's Planning On-Call scope is written general enough that TRNL tasks could be covered under it. *Update: Richard sent Teri the contract information from an RBF contract to use towards updating the TRNL proposal.*
- Action item – Teri would revise hour estimate using approved On-Call contract *Update: proposal revised and sent to Richard 5/18/12*

If there are additional comments or corrections, please send them to Teri at tsgeorge@mbakercorp.com by COB Wednesday May 23, 2012; otherwise these will be considered final.

Date: May 23, 2012

A meeting was held on Monday, May 21, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Chris Spitzer
3. John Drake
4. Mylene Perry

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

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LSO – Levee Safety Officer

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SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the support materials to be provided by the District to the LACOE to finalize the LACOE levee inspection

Richard began the call by asking Chris if everything had been provided by the District that the LACOE requested/needed to finalize the levee inspection, and Chris said that almost all of the necessary data transfer from the District to the LACOE has been completed. Chris and Don have been working towards the finalization of these deliverables from the District to the LACOE. The only remaining items on the list of data to be transferred from the District to the LACOE are (i) video inspections of two levee penetrations that are return irrigation water pipes from the St. John's Irrigation District into the river and (ii) the letter from the District to the St. John's Irrigation District that will initiate the operations and maintenance agreement between these two entities. Don is working to get the two levee penetrations video inspections from the St. John's Irrigation District and the final signature on the letter from the District to the St. John's Irrigation District, with an estimated delivery date to the LACOE for these items during the week of June 4.

Updates on the TDN

The Draft Final TDN has been completed by WEST and the District, and the cities and the LACOE can begin their review of the product once the Draft Final TDN package (including electronic deliverables) is posted to the WEST ftp site. The District has requested all review comments be returned two weeks after posting of the final TDN package to the ftp site. Upon incorporation of comments from the LACOE and the cities, the Draft Final TDN will become the Final TDN and will be delivered to FEMA for PMR review.

Richard stated that the Draft Final TDN package to be uploaded to the WEST ftp would include the TDN document itself; electronic data associated with Appendices A, B, D, E, and F; and final study sheets and annotated FIRM panels in PDF format. The Draft Final TDN package on the

WEST ftp site will not contain the draft final shapefile deliverables or electronic data for Appendix C (survey reports and backup survey data) or Appendix G (supporting documentation from the LACOE such as the DDR and the O&M Manuals) at this time due to electronic file size limitations. If any reviewers would like to have any of these other data provided to them separately, WEST and the District will facilitate this additional data delivery. Mylene requested the shapefiles to facilitate her review of the materials.

Update on the LSER

Richard and Don asked if the LSER was still scheduled to meet the previously discussed submittal date of Aug 1 to be able to maintain the current schedule for the FEMA PMR submittal and review process. Chris indicated that LACOE staff is working towards completion, and, although he cannot confirm the Aug 1 deliverable date, that is still the target his team is striving to meet. The District asked if the LSER still had to have Jody's approval, or if Chris would be handling the LSER finalization entirely within his team. Chris said that the LSER has to obtain Jody's approval as the levee safety program manager, and eventually the LSER will have to be approved by Rick Leifield, the LACOE levee safety officer. John said that from a funding perspective, all work for the finalization of the LSER is funded from this point moving forward, and he is also still working with the Aug 1 deadline in mind.

Reinstatement of WEST's DRCHECKS account

Richard asked if the LACOE had been able to reinstate WEST's DRCHECKS account to facilitate the LSER review by the District and WEST as per Jody Fischer's request. Chris said that he spoke with Jody about this, and asked if WEST had received the reinstatement notification. Chuck indicated that WEST had not received this notification. Chris said he would follow up with Jody on this issue.

District Public Meeting

Richard mentioned that the public meeting is currently being scheduled by the District for the second or third week in August to inform the public in the vicinity of the TRNL of the proposed updates to the floodplain/floodway boundaries and flooding elevations. This type of public meeting is standard for all District floodplain delineation studies and is standard FEMA practice as well. The District will organize and host this event, and Richard wanted to invite the LACOE and city staff members associated with the TRNL to attend if interested and available. If any of the TRNL team members from the LACOE or the cities would like to attend, they can coordinate with Richard regarding the final scheduling and location of the public meeting.

Action items deriving from this call:

1. *Don and the District to continue working to get the two levee penetrations video inspections from the St. John's Irrigation District and the final signature on the letter from the District to the St. John's Irrigation District in regards to the operations and maintenance agreement between these two entities, with an estimated delivery date to the LACOE for these items during the week of June 4.* ***UPDATE: The District completed the letter task with a copy sent to Chris Spitzer on May 23.***
2. *Richard and WEST to provide the Draft Final TDN package for review by the LACOE and the cities, delivered via the WEST ftp site.* ***UPDATE: WEST and the District finished uploading the Draft Final TDN deliverable package to the WEST ftp site on Tuesday, May 22. An email was sent out at that time instructing LACOE, City of Avondale, and City of Phoenix staff on how to retrieve this data for review.***
3. *LACOE and city staff members reviewing the Draft Final TDN requested to complete and return all comments at the end of the two week review period on Monday, June 4.*
4. *If needed to facilitate review, any Draft Final TDN reviewers to request electronic data for Appendix C, Appendix G, and GIS shapefiles, none of which were included in the current Draft Final TDN deliverable via ftp site due to file size limitations.* ***UPDATE: GIS shapefiles accompanying the Draft Final TDN package were delivered to Mylene separately via email on May 22.***
5. *John Drake and Chris Spitzer to continue coordination towards the finalization of the LSER by August 1.*
6. *Chris Spitzer to contact Jody Fischer regarding reinstating WEST's DRCHECKS account to facilitate review comments on the LSER from the District and WEST as per Jody's request.*
7. *Any TRNL team members from the LACOE or cities interested and available to attend the public meeting announcing floodplain/floodway updates resulting from the TRNL FDS (to be held the second or third week of August) to coordinate with Richard regarding the final date and location.*

The next regular conference call is planned for Tuesday, June 12th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Baker

CONFERENCE CALL NOTES

FEMA PMR Activities & Floodplain Management Map Maintenance Services
Contract FCD 2010C003

Subject: **Project Status**

Location: 2801 W. Durango St., Phoenix

Date/Time: Thursday May 24, 2012 at 12:30 PM

Attendees: Richard Harris (FCDMC), Don Rerick (FCDMC), Chuck Davis (WEST), Brian Wahlin (WEST), Tom Smith (Baker), Teri George (Baker), Geoff Brownell (Baker)

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1. Discussion regarding FEMA requirements for Tres Rios North Levee FDS project:

A. The purpose of the call was to confirm the levee certification package review process & requirements of the Tres Rios North Levee project/PMR. Geoff had previously stated that the level of review would be different, less detailed, for a Corps project when submitted to FEMA. FCD was concerned that the PM63 requirements might not be met and requested confirmation from a levee expert within Baker. Richard explained to Tom Smith of Baker/AECOM about Phoenix's role in the PMR project and wanted to know if the levee certification package would be reviewed again or would it be reviewed in a stricter sense after Baker/Phoenix has completed their review work and incorporated it into the PMR.

B. Tom's response explained that FEMA reviews levee submittals differently when they are submitted by a sister-agency versus a non-federal agency. If a submittal package has been prepared by another federal agency, for example the Corps, SCS, Bureau of Reclamation, etc., the review process is scaled back. The reason for the different approach is because, for example in this case, the Corps has their own strict internal review process that includes a focus on the structural integrity of the levee system. If there were tie back levees or smaller, private levees that were involved, then FEMA would review the package in more detail. FEMA doesn't add further scrutiny beyond the Corps' process. Don confirmed that the Corps is taking responsibility for the modifications to the levee constructed several years ago as well as the new levee components that extend the levee system upstream. Furthermore, Tom stated that if the Corps is signing off on the integrity of the structure, FEMA wouldn't dispute their acceptance.

If there are additional comments or corrections, please send them to Teri at tsgeorge@mbakercorp.com by COB Friday May 25, 2012; otherwise these will be considered final.

WEST Consultants, Inc. **MEMORANDUM**

TO: **Teri George and Richard Harris**

FROM: **Brian Wahlin**

DATE: **June 12, 2012**

SUBJECT: **Meeting minutes for meeting on June 12, 2012**

On June 12, 2012, Richard Harris (Flood Control District of Maricopa County), Teri George (Michael Baker, Jr.), and Brian Wahlin (WEST Consultants) met to discuss changes or modifications to the annotated FIRM panels, work maps, technical data notebook, and GIS deliverables for the Tres Rios North Levee Physical Map Revision.

Annotated FIRMs

The following is a summary of changes that should be made to the annotated FIRM panels.

1. The effective floodplain for the Buckeye Feeder Canal (BFC) is shown on annotated FIRM panel 04013C2095F-2 as a dashed line. This is correct and should remain.
2. The effective floodplain for the Sunland Avenue Tributary (SAT) should be shown as a dashed line on annotated FIRM panels 04013C2095F-1 and 01013C2095F-3 just as it was done for the BFC.
3. When the annotated FIRM panels are turned over to Baker for review, they should be printed at full size.
4. Gutter lines should be added between all proposed and existing floodplains, even if the proposed zones are the same type (i.e., both Zone AE or both Zone A). An example of this is shown in Figure 1.
5. The effective Zone A area on the annotated FIRM panels should not be highlighted in red. These areas are effective and should be dashed outlines like the effective floodplains for the BFC and SAT.
6. The dark red portion shown in Figure 1 on annotated FIRM panel 04013C2095F-2 is not actually a Zone A. According to Dibble's original study of the area, the dark red portion should be Zone AE. FEMA changed the designation to Zone A for mapping purposes. The annotated FIRM panel should show this area as a Proposed Zone AE as was done for the original Dibble study.
7. The index sheet should be updated to reflect the Zone A to AE change as described in Item 6 above.
8. The areas that are to be removed from the floodplain due to the Tres Rios North Levee should be labeled as Proposed Zone X (no shading).

9. The existing floodplains at the upstream areas for BFC and SAT will reflect approved LOMRs and not the effective floodplains.

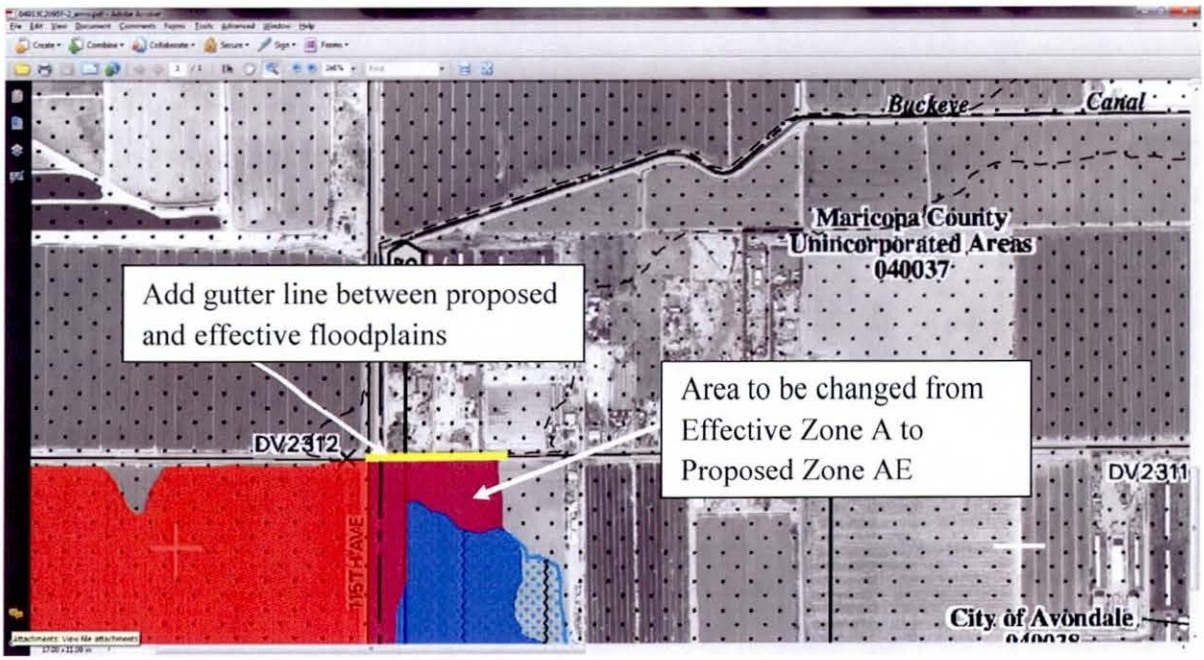

Figure 1. Gutter line (yellow line) between effective BFC floodplain (dashed area north of yellow line) and proposed BFC floodplain (dark red area south of yellow line)

Work Maps

The following is a summary of changes that should be made to the work maps.

1. On work maps 7 and 8, update the Effective Zone A defined by FEMA to reflect the Proposed Zone AE in the Dibble study (same as Item 6 in the annotated FIRM section).
2. The areas that are to be removed from the floodplain due to the Tres Rios North Levee should be labeled as Proposed Zone X (no shading).
3. WEST will create geo-rectified work maps. However, this task will wait until the work maps are finalized.

Technical Data Notebook

1. The as-built plans for the 115th Avenue Bridge have been added to the TDN.
2. WEST will create only digital copies of the flood profiles in both NGVD29 and NAVD88. No paper copies will be necessary. The flood profiles should have markers indicated cultural features such as bridges, the Salt/Gila confluence, the start of the levee, the end of the levee, etc.
3. A hard copy of the TDN will be submitted to Baker for final review.

GIS Deliverables

1. WEST will update the GIS deliverables to show the Proposed Zone X areas (i.e., areas to be removed from the Salt/Gila floodplain). Note that the FCDMC standard code for Zone X is actually X1.

Date: June 12, 2012

A meeting was held on Tuesday, June 12, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Frank Brown

WEST Consultants (WEST)

1. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Van Crisostomo
2. Chris Spitzer
3. John Drake
4. Mylene Perry
5. David Pham

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

MCDOT – Maricopa County Department of Transportation

NLD – National Levee Database

O&M – Operations and Maintenance

PMR – Physical Map Revision

RFP – Request for Proposal

R&U – Risk and Uncertainty

SAT – Sunland Avenue Tributary

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the TDN review

The draft final of the TDN was posted on WEST's website for review by team members. WEST received comments on the TDN from both the District (Richard Harris) and the LACOE (Mylene Perry). Brian indicated that WEST has responded to all of Mylene's comments and some of Richard's. Brian will send Mylene a formal response to her comments. The updated TDN will be available around June 27 for Mylene to back check the response to comments.

Status of the LSER

Chris indicated that the LACOE has awarded a contract to Genterra to complete the embankment report, which is an accompanying document to the LSER. Note that the embankment report is sometimes referred to as a construction report. The embankment report will be incorporated into the LSER as a review of construction data. Genterra has been given a notice to proceed and instructions to complete the project in a timely fashion. Chris is expecting a draft report sometime between June 22nd and June 29th. The LACOE review of Genterra's draft report will also be quick.

Cynthia has been working on the inspection report for the levee. Chris is now expecting to also work exclusively on the inspection report. Chris believes that they have all the data to complete the inspection report except for the video inspections. Don was supposed to organize the video inspection. Unfortunately, Don was unable to attend this meeting. Richard will

follow up with Charlie Klenner to see if Don has organized the video inspections. Chris indicated that the LACOE received the letter from the District to the St. John's Irrigation District in regards to the operations and maintenance agreement between those two entities.

David indicated that he needs to incorporate the as-built dimensions of the interior drainage basins near 115th Avenue into the as-built plans.

Chris indicated the August 1st deadline for LSER still appears to be a reasonable deadline. The review of LSER requires an ATR (third-party review) since this is standard before any project is released to the public. The ATR review will take place on July 9th. John indicated that Jody is working through whether or not there also needs to be a review plan along with the ATR. Since there is standard criteria for this project (i.e., the levee either meets scour criteria or not), there may not need to be a review plan. Jody is also working on getting DRCHECKS accounts set up for all team members (WEST, District, etc.).

District Public Meeting

Richard mentioned that the public meeting is tentatively scheduled for August 21st in the evening. An update to this date is August 29th. Richard stated he would like a member of the LACOE to attend this meeting and John indicated he would attend. Brian has prepared a draft board for the public meeting. In addition, a board may be prepared to illustrate the Tres Rios Environmental Restoration Project. Although the floodplain study is not part of the restoration project, many people who attend the public meeting may have questions about the restoration project.

Issues Not Related to Tres Rios

Richard would like to speak to somebody at the LACOE who is familiar with the 1996 hydrologic study done for the Salt/Gila River. Van suggested that Richard contact the Chief of Hydrology, Cuong Ly at (213) 452-3566.

Richard was also interested in obtaining as-built plans for the Painted Rock Dam Emergency Spillway. This spillway was re-built after the 1993 flood. Van thought that the LACOE should have the as-built plans and indicated that Richard should contact Joe Ryan at (213) 452-3679.

Action items deriving from this call:

1. *Brian to send Mylene formal a formal response to her comments on the TDN.* ***UPDATE: Brian sent Mylene the formal response to her comments on June 12.***
2. *Richard to call Charlie Klenner about video inspections.* ***UPDATE: Richard spoke with Charlie on 6/14/12. Charlie said the video had been completed and a report was being prepared for the District. He said he thought Bill Leal is the POC for further updates.***
3. *David to obtain as-built dimensions of the interior drainage basin near 115th Avenue and incorporate into the as-built plans.*
4. *Brian to email Richard a PDF of the draft public meeting board.* ***UPDATE: Brian sent the Study Sheet Index to Richard, Hasan, and Charles on June 12 as a draft public meeting board, asking for input from them.***
5. *Brian to email and mail Hasan Mustaq (City of Phoenix) and Charles Andrews (City of Avondale) the draft public meeting board.* ***UPDATE: See update to item 4, above.***

The next regular conference call is planned for Tuesday, June 26th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: June 28, 2012

A meeting was held on Tuesday, June 26, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Brian Wahlin
2. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Mylene Perry
2. Chris Spitzer
3. John Drake
4. David Pham

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

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FIRM – Flood Insurance Rate Map

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LSO – Levee Safety Officer

O&M – Operations and Maintenance

PMR – Physical Map Revision

R&U – Risk and Uncertainty

SAT – Sunland Avenue Tributary

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the flood study technical documentation

WEST has now responded to all comments on the TDN received from both the District (Richard Harris) and the LACOE (Mylene Perry). Brian sent Mylene a formal response to the LACOE comments, and Brian sent Richard a formal response to the District comments. WEST is reposting the technical documentation to the WEST ftp site for retrieval shortly, and hard copies of the report will be provided to the District and to Baker on July 3. Hard copies will be provided to the City of Avondale, City of Phoenix, and the LACOE upon completion and incorporation of all FEMA comments into the final version of the TDN. The LACOE and City of Phoenix staff in attendance indicated that there were no remaining comments from either party on the TDN document or any other technical data for the study.

Mylene is still working to develop a technical memorandum stating that the LACOE has approved the final HEC-RAS model used for the study. Mylene stated that this type of a memorandum will likely have to be signed by the division chief or the branch chief. This signature process could significantly delay the finalization of this memorandum.

Status of the Public Meeting to be held at the conclusion of the study

The Public Open-House type Meeting to inform the local land-owners and other stakeholders of the study results has been scheduled to occur on 8/29/12, and the meeting will be held in Avondale. Invitation brochures will be sent out in late July or early August, and an advertisement for the meeting will be run in local newspapers. Richard will send invitations for the meeting to John Drake, Hasan Mushtaq, Charles Andrews, and Bob Upham.

Bob requested that all public invitations and information to be viewed by the public during the meeting be forwarded to him before the District mails out the invitations. Richard will forward the display panel for the Public Meeting and the invitation to Bob before it anything is mailed so Bob can review this information and send it in advance to the persons in the Holly Acres area.

The District has developed a mailing list of all landowners in the vicinity of the study area. Richard asked if anyone on the call would like to view the final mailing list before mailing out

the invitations. No one indicated that they felt it would be necessary to review that list prior to the mailings.

Status of the LSER

Chris stated that the LSER process has been delayed slightly based on contracting issues for the construction report (i.e., the embankment report). John indicated that the delay was due primarily to a funding issue, but the funding is now available for the construction report and the contracting for that should be finalized shortly. This should not be a long delay. The firm that will be completing this report is Genterra.

Chris is currently working on the final LSER package for ATR review to begin on Jul 5 and to close on Jul 26. Chris stated that this schedule is based on the assumption that there are no major issues in the embankment report or in the culvert video inspection report. At this point, Don stated that the video inspection report of the culverts being completed by the District should be ready for delivery to the LACOE this Friday (Jun 29) along with the video documentation of the inspections as well.

Additionally, Jody and Chris assumed that the ATR team would be specified for the TRNL, but that was not the case. Jody is still working to finalize the ATR team for Jul 5.

Status of the DRCHECKS account for WEST

Brian got an email on Jun 26 from LACOE staff with instructions to set up WEST's DRCHECKS account. WEST will facilitate the District's review of the LSER package by entering the District's comment in DRCHECKS. Chris requested that WEST indicate who each comments is from and who each comments is directed to (if possible) when WEST enters comments into DRCHECKS to improve communication with LACOE staff and expedite the review process. ***Update: Brian has completed the activation of the WEST DRCHECKS account.***

Status of the TRNL as-builts

David has finalized the as-builts for Phases 1A and 1B, including the as-built dimensions of the interior drainage basin near 115th Avenue. He is doing the final review of the total as-built package now, and he will email the final product to the District later this week. The requested changes will be provided as replacement sheets for the final as-built plans as opposed to regenerating the entire plan set. Originally, an underground water line was included in the Phase 1A, but that was not in the final construction. This created another change in the as-built

plan set; about 4 or 5 additional sheets of the final as-built plan set will be updated for this reason. ***Update: David provided the updated as-builts to the District and WEST via email on Jun 26.***

Status of the draft Public Meeting display board

Brian sent the draft meeting display board to Richard, Hasan, and Charles on June 12, and WEST has received comment from Richard and Charles as of the call. Richard will contact Hasan again to inquire if he approves of these displays before the Public Meeting. WEST has updated the Public Meeting display board based on comments received to date, and WEST will forward the draft version to Richard again shortly. Bob requested that he be sent the display board for review as well before finalizing.

Action items deriving from this call:

1. *WEST to repost the technical documentation to the WEST ftp site for retrieval and backcheck of all comments. Also, WEST to print and provide hard copies of the report to the District and to Baker on July 3. Hard copies to be provided to the City of Avondale, City of Phoenix, and the LACOE upon completion and incorporation of all FEMA comments into the final version of the TDN.*
2. *Mylene to develop a technical memorandum stating that the LACOE has approved the final HEC-RAS model used for the study.*
3. *WEST will forward the updated draft version of the Public Meeting display board to Richard again shortly.*
4. *Richard to forward the updated display panel and the invitation/flyer for the Public Meeting to Bob Upham before the District mails the invitations for Bob's review and comment.*
5. *Richard to send invitations for the Public Meeting to John Drake, Hasan Mushtaq, Charles Andrews, and Bob Upham.*
6. *LACOE to continue working towards finalization for the LSER package for review in the ATR process to begin on Jul 5. The District and WEST will provide review comments on the final LSER package via DRCHECKS.*

The next regular conference call is planned for Tuesday, July 10th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: July 11, 2012

A meeting was held on Tuesday, July 10, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris

WEST Consultants (WEST)

1. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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TRNL – Tres Rios North Levee

Status of the TRNL as-built plan sets

Richard asked what the differences were in the updated as-built plan sets delivered in June and those delivered more recently (in July) by David and Chris. David indicated that the as-built plan set updates delivered in June only reflected changes to Phase 1B due to the levee raise along the downstream 500' of the levee, while the as-built plan set updates delivered in July reflect the final updates to the as-built plan set for both Phase 1A and 1B including several additional changes to the as-builts in addition to the levee raise such as interior drainage features and other updates. Richard asked David if changes to the as-built plan sets would change the DDR, and David said he would provide the "amended" DDR by the end of next week. Richard asked if this is the last of the updated as-builts for TRNL, and David said that it is the last update because the as-builts are now finalized.

Status of the TDN review

Richard mentioned that the TDN has been submitted to FEMA, and an electronic copy of the FEMA submittal has been made available via ftp to the TRNL project team. Hard copies will be provided to the LACOE, City of Phoenix, and City of Avondale at the finalization of the FEMA review process and approval of the study.

Status of the LSER and embankment report

Jody provided the NLSER to WEST and the District via DRCHECKS, and WEST was able to access the NLSER through their now active DRCHECKS account. The NLSER was delivered by WEST to the District on July 10. Jody has asked that all comments from the District be submitted by July 25. WEST will facilitate this process by entering the District's review comments into DRCHECKS.

David indicated that the LACOE's ATR (external review by another USACE District office outside of LA but still within the South Pacific Division) and DQC (internal review by the LACOE) began on July 9, the same date as the delivery of the NLSER by Jody to WEST and the District. The review being conducted by the District is not a part of the DQC or ATR; David termed this review a "sponsor review."

Richard asked David if he had any additional information regarding the status of the embankment report. David said he did not. Richard said that he would resend an email to John Drake regarding the status of Genterra finalizing the embankment report.

Technical memorandum stating that the LACOE has approved the final HEC-RAS model

This was not completed at the time of the call, and David did not know the status of this technical memorandum. ***Update: Mylene delivered the final technical memorandum signed by Rene Vermeeren (Chief, Hydrology and Hydraulics Branch) via email on July 11, 2012.***

Public Meeting

The Public Meeting to present study results to local land owners is scheduled for Wednesday, August 29. Invitation brochures will be sent out in late July or early August, and an advertisement will be posted in local newspapers. Richard will send an invitation for the meeting to certain TRNL project team members, including John Drake, Hasan Mushtaq, Charles Andrews, and Sue McDermott. Richard asked David if anyone else from the LACOE should be invited. David said that the following persons should receive invitations:

- David Pham
- Mylene Perry
- Van Crisostomo
- Paul Beaver
- Jody Fischer
- Chris Spitzer
- Michael J. Fink (ecologist/biologist in the Phoenix Support office with John Drake, michael.j.fink@usace.army.mil)

Richard also stated that there would likely be a preliminary meeting held the week before the public open house meeting to discuss study results and include the expertise of some attendees with regards to the flood insurance requirement changes. Jody and Chris requested invitations to this preliminary meeting via email prior to this call.

In regards to the public display board, Richard asked WEST to utilize more recent aerials for the development of the public meeting display. WEST will make this update and resend the display board to Richard for review and approval.

Action items deriving from this call:

1. *David to provide the "amended" DDR by the end of next week (7/20/2012).*
2. *LACOE and Cities to continue working to backcheck WEST's responses to their comment on the TDN.*
3. *WEST to provide hard copies of the TDN to the LACOE and the Cities upon finalization and approval by FEMA.*
4. *The District and WEST to finalize all comments on the NLSER and upload these comments to the DRCHECKS system by July 25.*
5. *Richard to resend an email to John Drake regarding the status of Genterra finalizing the embankment report.*
6. *Mylene to finalize the technical memorandum stating the LACOE approves the final HEC-RAS model.* ***Update: Mylene delivered the final technical memorandum signed by Rene Vermeeren (Chief, Hydrology and Hydraulics Branch) via email on July 11, 2012.***
7. *WEST to update the aerial photos for the public meeting display board and resend the display board to Richard for review and approval.*
8. *Richard to forward the updated display board and the invitation/flyer for the Public Meeting to Bob Upham for review/comment before the District mails the invitations.*
9. *Richard to forward the invitation for the public meeting to TRNL project team members, including John Drake, Hasan Mushtaq, Charles Andrews, Sue McDermott, David Pham, Mylene Perry, Van Crisostomo, Paul Beaver, Jody Fischer, Chris Spitzer, and Michael J. Fink.*
10. *Richard to forward the invitation for the preliminary meeting prior to the public meeting to discuss insurance requirements to Jody Fischer and Chris Spitzer.*

The next regular conference call is planned for Tuesday, July 24th, 2012, at 10:00 AM MST, 10:00 AM PDT. Please note the time change from the usually scheduled time of 10:30 AM to 10:00 AM for this meeting. A formal invitation will be sent by Richard for this meeting.

Date: July 27, 2012

A meeting was held on Tuesday, July 24, 2012 at 10:00 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Frank Brown

WEST Consultants (WEST)

1. Chuck Davis
2. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Tim Fairbank
3. Chris Spitzer
4. Mylene Perry

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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O&M – Operations and Maintenance

PMR – Physical Map Revision

R&U – Risk and Uncertainty

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

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TRNL – Tres Rios North Levee

Status of the Sponsor Review of the NLSER by the District

Brian uploaded all comments from both WEST and the District to DRCHECKS on July 23 and July 24. Chris asked for verification that this included all comments from the District and WEST, and Brian verified that that was all of the comments from both the District and WEST.

Richard and Brian mentioned that there were erroneous statements in the NLSER regarding what was implemented in the hydraulic modeling for HEC-RAS. The District has concerns that FEMA might take issue with inconsistencies between the NLSER and the technical documentation for the floodplain study portion of the project (i.e., the TDN) that has already been submitted to Baker for FEMA's technical review. Richard indicated that utilizing the text from the TDN document might be useful in resolving some of these inconsistencies pointed out by the District and WEST; the LACOE should have the most recent electronic version of the TDN (DOC format) from a previous delivery to facilitate this process.

Richard asked if the District would be receiving a finalized version of the NLSER. Tim indicated that the resolution process in DRCHECKS would require that the District and WEST would have to back check the comment resolutions from the LACOE to close out all of their comments in the DRCHECKS system, and the finalized NLSER would be provided in DRCHECKS for this resolution process.

Richard inquired about the status of the embankment report. Chris indicated that he is not aware of Genterra's schedule for the embankment report. Tim mentioned that the contract should be awarded to Genterra today (July 24). Regarding the ATR, Tim and Chris both indicated that ATR would continue to be ongoing for the geotechnical and H&H sections of the report; the embankment report not being finalized will not delay the bulk of the work completed towards ATR finalization.

Status of the Public Meeting for the Floodplain Study Results

Richard indicated that the public meeting has been planned for August 29 from 6:00 to 7:30 PM at La Joya Community High School in Avondale (near Avondale Boulevard and Lower Buckeye

Road). Richard requested that everyone from the TRNL team planning to attend arrive by 5:00 PM to allow time to coordinate before the public arrives. Chris Spitzer said he would likely not be available for the public meeting on August 29.

A preliminary meeting prior to the public meeting will be held on August 23 at the District's offices to discuss impacts to flood insurance rates for residents affected by the proposed floodplain mapping. Richard mentioned Jody had stated in an email that she would like to attend this preliminary meeting. Don and Richard both mentioned that this would likely be a very brief meeting at the District office, and that they would provide a call-in number for Jody or any other TRNL team members to call in if interested instead of attending in person. Tim said that he would follow up with Jody to see if she intended to state that she would be personally attending the preliminary meeting (Aug 23), the public meeting (Aug 29), or both. Richard will secure a conference room at the District with a conference call-in number to give to any TRNL members interested in calling in to the preliminary meeting.

Don asked Bob when the next scheduled Brogden meeting will be for residents in the Holly Acres area, and Bob stated that the next Brogden meeting will be held after the next regularly scheduled TRNL conference call (which will be occurring on August 7). Don requested an update on the NLSER at the time of the next regularly scheduled TRNL conference call to relay to the attendees at the Brogden meeting. Tim mentioned that if Genterra is awarded the contract today, the LACOE feels confident that they should have a good idea by the TRNL conference call on August 7 as to the status of the embankment report and the overall NLSER. Tim said that he would provide this update to the TRNL team during the call on August 7.

Richard asked if there were any additional comments regarding the final public meeting display board sent to the TRNL team by the District on 7/19/2012; there were none. Richard stated that he would send the preliminary brochure that is to be mailed to the public in the vicinity of the levee inviting them to the public meeting to the TRNL team for review by August 3.

Status of the revised DDR

David hopes that the revised DDR will be finalized this week or early next week. The final DDR will include some minor updates to text (removal of references to portions of the levee that were not built and removal of references to the underground water pipe for Phase IV which was not built) and the final as-builts in their entirety.

David stated that the updated as-built separate sheets were sent on July 9, and he asked if WEST and the District were able to receive those files successfully. Richard and Brian both said that they were able to access those files. David said that the final DDR will include be a memo signed by Richard Leifield (the LACOE LSO) confirming that the as-builts in their entirety are now final.

Action items deriving from this call:

1. *David to provide the amended DDR by the end of the month (8/1/2012).* ***Update: David posted this document to the LACOE ftp site on 7/27/12. An email summarizing the final changes to the amended DDR was sent on 7/27/12 as well.***
2. *WEST to provide hard copies of the TDN to the LACOE and the Cities upon finalization and approval following the FEMA review. This will likely occur near the first of September.*
3. *Tim to provide an update during the August 7 conference call regarding the status of the embankment report and the overall NLSER.*
4. *LACOE to provide the updated NLSER. This will be done via the comment back check and resolution process within DRCHECKS. WEST and the District to complete the comment back check and resolution process within DRCHECKS when the LACOE makes this available.*
5. *Richard to forward the preliminary brochure (that is to be mailed to the public inviting them to the public meeting) to the TRNL team for review by August 3.*
6. *Richard to forward the invitation for the public meeting on August 29 to TRNL project team members, including John Drake, Hasan Mushtaq, Charles Andrews, Sue McDermott, David Pham, Mylene Perry, Van Crisostomo, Paul Beaver, Jody Fischer, Chris Spitzer, and Michael J. Fink.*
7. *Richard to secure a conference room at the District with a call-in number for the preliminary meeting (prior to the public meeting) on August 23. Richard to forward the invitation for the preliminary meeting (prior to the public meeting) with the call-in information to TRNL project team members.*

The next regular conference call is planned for Tuesday, August 7th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: August 8, 2012

A meeting was held on Wednesday, August 1, 2012 at 12:30 PM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Steve Bruffy
3. Cathy Regester
4. Gant Wegner

WEST Consultants (WEST)

1. Chuck Davis
2. Brian Wahlin

City of Avondale

1. Charles Andrews

City of Phoenix

1. Bob Upham

Michael Baker, Jr., Inc.

1. Teri George

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

FEMA – Federal Emergency Management Agency

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

OHM – Open House Meeting

PIO – Public Information Officer

PMR – Physical Map Revision

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the PIO activities regarding TRNL

This discussion included PIO activities for the following items: (i) the draft mailer brochure, (ii) the status of the draft display board, (iii) the project information on the District website, (iv) the mailing list for the final brochure, and (v) the draft OHM meeting newspaper announcement. Each of these items is discussed in greater detail below.

(i) Draft mailer brochure – Comments on the draft mailer provided by the District at the meeting included the following:

a. Bob and Charles both felt that the labels of the proposed floodplain zones were too vague and confusing. They suggested the following revisions to those labels:
    1. Change the label of the "Area of Proposed Flood Depth Changes" to "Area of Proposed Lowered Flood Depths".
    2. Change the label of the "Area of Proposed Low-Risk Flood Zone" to "Area of Proposed Removal of the 100-Year Floodplain".
b. Chuck requested that the phrase "Salt and Gila Rivers" be changed to "Salt and Gila Rivers and tributaries."
c. Gant said he would get these changes made as soon as possible. Richard will send this to the team when it is available.

(ii) Status of the draft display board – Cathy Regester mentioned some issues she corrected in the FPZN floodplain zone shapefile provided by WEST to the District for the pending floodplain layer. Richard requested that WEST incorporate these changes along with two other minor changes (including a proposed modification of the BFC floodplain based on Baker's review comments and providing the two separate Zone A floodplain polygons for the Zone A area immediately southwest of the intersection of Broadway Road and 115th Avenue). WEST will provide the updated shapefile for inclusion in the draft display board by Wednesday, August 8.

(iii) Project information on the District website – Comments on the District's website text for the project included the following:

a. Brian pointed out that we should remove Gwen Meyer as the project manager for the LACOE. Bob indicated that John Drake will likely not be available to attend the public meeting, and Bob also indicated that Brian Kenney will be acting as the interim project manager for the LACOE for an undetermined length of time beginning at the end of August. Richard will follow up with John Drake to determine who should be listed as the project manager on the District website. ***Update: Richard followed up with John Drake and forwarded the information to Gant on 8/7/12.***
b. Richard pointed out that we should change the verb tense to from present to past tense for the last half of the first paragraph of the project description on the website.
c. Bob mentioned that the project extents should be from "105th Avenue to El Mirage Road" instead of "105th avenue to the Agua Fria River."

d. Chuck pointed out that "Letter of Map Revision" and "LOMR" should now read "Physical Map Revision" and "PMR" throughout the text.
e. Richard and Teri decided that the next to last sentence of the status section of the website text should be changed to from 'mid-2012' to 'mid-2013'. The last sentence should read "The floodplain maps will be revised by FEMA at a later date."

(iv) Mailing list for the final brochure – Richard is working with the GIS department at FCDMC to finalize this now.

(iv) Draft OHM meeting newspaper announcement – Comments on the draft OHM meeting newspaper announcement published by the District included the following:

a. Gant recommended using the first paragraph of the public mailer and the last paragraph of the public mailer as the first two paragraphs of the OHM announcement in the newspaper.
b. Bob asked that we include the phrase "in cooperation with City of Phoenix, City of Avondale, and the Corps of Engineers" to the first paragraph of the public mailer text for the newspaper announcement, and that we add the City of Phoenix, City of Avondale, and the Corps of Engineers logos to the bottom of the advertisement.
c. Bob requested a final version of the OHM newspaper announcement prior to publishing to provide to the stakeholders he is working with. Charles requested the same thing. Gant indicated that he would send out the final versions of the two advertisements for both papers before publishing.
d. Gant will be running this advertisement in two newspapers for a total cost of $800.

Status of the pre-meeting preparation on August 23 prior to the August 29th OHM

Richard announced that there would be a pre-meeting preparation on August 23rd from 9:30-11:00 AM at the District prior to the August 29th OHM, with the following items available for discussion: all boards, FMS assistant staff's approach towards the public, computer applications, etc. Richard announced that the City officials will be invited to this meeting.

Status of the PMR study review comments

Teri discussed the Baker review comments with WEST and Richard in detail. The primary comment of technical significance is the treatment of the BFC and SAT flooding sources. It was decided that WEST would not modify the BFC model in any way, and the only changes to the flooding extents east of El Mirage Road in the vicinity of the BFC compared to the Dibble study would be attributed to a mapping exercise to show the backwater effects of the Gila flooding source on the floodplain in this area. WEST, Teri, and Richard discussed all of the other Baker

review comments in detail, but all of the other comments were minor, and neither WEST nor Richard had serious issue with any of them.

Status of the pending floodplain information for District data base and model library files

Cathy Regester joined the meeting briefly to inform WEST that for their next submittal of a floodplain shapefile to the District, WEST could remove "sliver" Zone X1's that occur based on slight reductions in floodplain width. While these were technically correct in the submittal because a previously mapped Zone AE was becoming a Zone X ("X1" per District Data Standards) in that area, some of these "sliver" polygons were less than one foot in width. For "sliver" Zone X1 polygons, the District will just remove these for the pending floodplain layer and assume everything outside the flood zones provided in the line work would be mapped as Zone X1 anyway. WEST responded that they would complete that task for Cathy before the next submittal.

Action items deriving from this call:

1. *Gant to update the draft mailer brochure based on the recommended changes as soon as possible. Richard to send the draft mailer to the team when it is available.* ***Update: Gant completed the mailer, and Richard provided the final draft to the team via email on August 7.***
2. *WEST to provide the updated floodplain zone shapefile for inclusion in the draft display board by Wednesday, August 8.*
3. *Gant to update the project information on the District website based on the recommended changes from the meeting.* ***Update: These changes were incorporated into the text on the District's website as of August 8.***
4. *Richard will continue to work with the GIS department at FCDMC to finalize the mailing list for the final brochure. WEST will include this list in Appendix B of the TDN.*
5. *Gant to update the draft OHM meeting newspaper announcement based on the recommended changes from the meeting. Gant to send out the final versions of the two advertisements for both papers before publishing.*
6. *Richard to invite the City officials to the pre-meeting preparation on August 23 prior to the August 29th OHM.*
7. *WEST to begin addressing Baker's technical review comments on the PMR submittal in detail. Updates are expected to be submitted to Baker the week of August 26.*
8. *WEST to remove "sliver" Zone X1's that occur based on slight reductions in floodplain width compared to effective data before our next submittal per the direction of Cathy Regester.*

Date: August 8, 2012

A meeting was held on Tuesday, August 7, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Frank Brown

WEST Consultants (WEST)

1. Chuck Davis
2. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Tim Fairbank
3. Chris Spitzer
4. Mylene Perry
5. John Drake

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a term used by the USACE)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

DQC – District Quality Control (a term used by the USACE)

FEMA – Federal Emergency Management Agency

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

NLSER – National Levee System Evaluation Report (a Corps document, also known as a LSER)

O&M – Operations and Maintenance

PMR – Physical Map Revision

R&U – Risk and Uncertainty

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of FEMA's technical PMR reviewer being performed by Baker Engineering

Richard mentioned that Baker has submitted their comments to the District and to WEST. Only one of their comments was significant, and this comment had to do with the floodplain mapping approach for the BFC. However, the final floodplain boundaries will change very little from the most recent floodplain boundary shapefile submitted to the cities and the LACOE; WEST will just have to update the documentation to reflect a slightly different approach to explain the mapping for the portion of the BFC floodplain immediately upstream of El Mirage Road. There were approximately 50 other comments from Baker, but these were primarily small, editorial comments. Overall, the requested changes should take about 4 weeks to finalize. Richard mentioned that Baker has already indicated that the next submittal will be considered final by Baker due to the thorough technical content of the TDN. Congratulations, TRNL team! WEST will provide the final package back to Baker with their comments addressed the week of August 26.

Status of the ATR review comments provided by the LACOE on the EAP

Richard has reviewed the LACOE's additional comments on the EAP through the ATR process, and the District appreciates comments to improve the technical content. But the District wanted to verify that the LACOE's ATR comments in regards to the EAP were not going to require action items from the District based on several previous rounds of comment from the LACOE and the state and local emergency management agencies responsible for implementing the EAP. Additionally, the District had assumed that the EAP was finalized at this time and would not require update before submitting the technical floodplain delineation data to FEMA. Chris indicated that the LACOE ATR team responded to the ATR reviewer who made the EAP comments, and Chris and the LACOE ATR team told this reviewer that the EAP was not developed by the LACOE and therefore was not to be included in the ATR review. The reviewer has not back-checked their comments at this time, so Chris indicated that this back-check process might be a bit of an unknown in the review schedule, but Chris does not anticipate that the LACOE ATR team will issue any action items to address these comments.

John Drake pointed out that these comments on the EAP likely should be considered and possibly addressed before the first federal levee inspection completed by the Corps (likely in 5 years). Don said that the LACOE comments from the ATR process would be passed along to the appropriate parties, and the updates to the EAP would incorporate these comments if deemed applicable. However, some of the ATR comments on the EAP were in opposition to the state

and local emergency management policies and procedures; therefore, these comments would be considered and discussed at a later date after the submittal of the floodplain mapping changes package to FEMA.

Status of the LSER review comments from WEST and the District, and the progress of the ATR in general

Chris and Tim both indicated that the NLSER with all comments addressed should be provided to the District this week and written responses to all but one of the ATR comments submitted via DRCHECKS have been posted by Chris and his team in the DRCHECKS system. As soon as the LACOE sends the "back-checked" version of the NLSER report today, WEST and the District can close out their comments on DRCHECKS.

The team went over the proposed schedule Tim had forwarded previously. Tim indicated that 207 comments have been submitted via DRCHECKS on the NLSER, and 206 of those comments have been addressed in their entirety. The last comment should be addressed within the next few days. Tim mentioned that the draft embankment report will be ready by August 14. He also hopes that the review schedule (i.e., ATR schedule) for the embankment report will be condensed as much as possible, hopefully faster than the 7 day review indicated in the schedule. Richard asked if the 3 days of finalization between August 28 and August 31 included back-checking all comments, and Tim assured Richard that it did. The final proposed delivery date of the NLSER to the District will be August 31. The LACOE has requested that the District and WEST backcheck their comments in DRCHECKS by August 10 based on the proposed schedule forwarded by Tim.

Tim requested the Baker reviewers' contact information for direct coordination between the LACOE and FEMA's reviewer during NLSER review (Baker has indicated the NLSER review will be minimal based on the agreement between FEMA and the USACE). Richard and Don requested that coordination with Baker be sent through the District, specifically through Richard, since the District has been tasked with finalizing the floodplain re-delineation submittal to FEMA.

Status of the public open house meeting

John Drake will be unavailable for the public meeting and for an indeterminate length of time beyond that meeting. Brian Kenny will be the interim project manager while John is away. However, Brian will not be available for the public meeting either.

Mike Ternak of the LACOE will be attending the public meeting for the LACOE. He will not be acting in any capacity as a project manager or interim project manager, but he will be attending the public meeting due to his background knowledge of the project. John will bring both Brian and Mike up to speed before John steps away as project manager (this will be prior to public meeting as well). Richard requested Brian and Mike's contact information from John. John said that he would forward those contacts to Richard shortly.

Richard asked who else might need to be included on the invitation for the open house public meeting. John mentioned Brian Kenny, Mike Ternak, and Tim Fairbank should be added to this list in addition to those already being invited from the LACOE.

Chris mentioned that both he and Jody would still like to be invited to the call for the preliminary meeting (prior to the public meeting) on August 23 to discuss the final products before the public meeting. This meeting will be from 9:30-11 AM. Richard will post all information for review before the pre-meeting by all attendees by August 21.

Action items deriving from this call:

1. *WEST to provide the final TDN package back to Baker after addressing Baker's comments during the week of August 26.*
2. *WEST to provide hard copies of the TDN to the LACOE and the Cities upon finalization and approval following the FEMA review.*
3. *The District to consider the LACOE comments from the ATR process on the EAP before the first federal inspection of the TRNL by the USACE and address them in concert with the state and local emergency management agencies' comments.*
4. *LACOE to provide the updated NLSER. This will be done via the comment back check and resolution process within DRCHECKS. The LACOE has proposed that the document with comments addressed would be provided as early as this week. WEST and the District to complete the comment back check and resolution process within DRCHECKS when the LACOE makes this document available. The LACOE has requested that this be completed by WEST and the District by August 10. The LACOE to provide the final version of the NLSER with all ATR completed by August 31.* ***Update: The LACOE provided the updated NLSER on DRCHECKS. The District and WEST have back checked all of their comments on the updated NLSER closed out the LACOE response to comments out on DRCHECKS. In addition, the embankment report was provided by the LACOE via ftp on August 15.***
5. *Richard to forward the preliminary brochure (to be mailed to the public inviting them to the public meeting) to the TRNL team for review.* ***Update: This was emailed on Aug 7.***
6. *Richard to forward the invitation for the public meeting on August 29 to TRNL project team members, including John Drake, Hasan Mushtaq, Charles Andrews, Sue McDermott, David Pham, Mylene Perry, Van Crisostomo, Paul Beaver, Jody Fischer, Chris Spitzer, Michael J. Fink, Bob Upham, Brian Kenny, and Mike Ternak.*
7. *John Drake to forward Richard contact information for Brian Kenny and Mike Ternak.*
8. *Richard to secure a conference room at the District with a call-in number for the preliminary meeting (prior to the public meeting) on August 23. Richard to forward the invitation for the preliminary meeting (prior to the public meeting) with the call-in information to Chris Spitzer and Jody Fischer.*

The next regular conference call is planned for Tuesday, August 21st, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: August 22, 2012

A meeting was held on Wednesday, August 21, 2012 at 9:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Steve Bruffy
3. Gant Wegner
4. Don Rerick

WEST Consultants (WEST)

1. Chuck Davis
2. Brian Wahlin

Michael Baker, Jr., Inc.

1. Teri George

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

<u>Acronyms and Terminology used herein</u>

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

FEMA – Federal Emergency Management Agency

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

OHM – Open House Meeting

PIO – Public Information Officer

PMR – Physical Map Revision

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the PIO activities regarding TRNL

Richard began this meeting by showing some pictures provided by Bob Upham that might be used for the public meeting displays. After viewing these images, Gant and Steve were concerned about the use of these pictures on printed media due to the low resolution of the digital picture files. After discussing this further, Richard and Gant decided that Gant would have these pictures available on a laptop during the public meeting to show if the need arises. Richard will provide Gant with those pictures prior to the public meeting.

Gant and Steve presented the public display boards that will be available at the meeting. There will be two overview displays of the entire study area with indices for the other display panels and for the study maps; three display boards showing zoomed in views of the western, central, and eastern portions of the study area; and one even further zoomed in display board focused specifically on the Holly Acres area. Richard, Brian, and Steve made some comments on these public display boards. Steve and Richard will work to finalize these displays. Gant will likely be printing two sets of public display boards for the meeting.

Gant sent the public mailers to all property owners on the list provided by Richard. Only a very small number of them were returned due to bad addresses. Gant said he would try to track down alternative addresses for those mailers and re-send them.

Gant has submitted the newspaper advertisements announcing the public meetings to both the Southwest Valley Republic (ad set to run on Wednesday, August 22nd) and to the West Valley View (ad set to run on Friday, August 24th).

Chuck will convert the floodplain shapefile used in the public mailer and the parcel outline shapefile into Google Earth KMZ files for use during the public meeting. Chuck will email those Google Earth KMZ files to Gant today. Gant mentioned that he will bring his laptop with Google Earth installed, and Brian and Chuck both said they would bring their laptops with Google Earth installed as well. Gant indicated that wi-fi internet access would available in the library during the public meeting, which is necessary for Google Earth to function properly. Gant said he would also look into using additional computers available in the school library for the Google Earth application as well.

This Wednesday (Aug 22) or Thursday (Aug 23), Gant will be sending a public meeting checklist to Richard. Items on this checklist will include (1) the names and affiliations of those who plan to attend for the development of nametags, (2) the required equipment and who will bring which pieces of equipment, etc.

Don had a question from the public at the Brogden meeting. There was a couple at that meeting who live just south of Southern Ave and between 99th Avenue and 91st Avenue that have been paying flood insurance for many years. The mailer shows that they are not in the floodplain currently, but they have been paying flood insurance all that time. Brian and Richard checked this during the meeting, and they are in fact not in the effective floodplain. Don

requested that the TRNL team be ready to respond to this comment if it comes up during the public meeting.

WEST will print one set of FEMA FIRM panels for the meeting. WEST will also print one full-size set of work maps for the meeting, and another set for the District flat files.

Status of the PMR study review comments

Richard began this discussion by asking if Baker had given any new comments to WEST regarding the technical data for the TDN since the last meeting. Teri said that Baker had not provided any new comments.

Chuck provided a status regarding the responses to Baker's comments at this point in time. Chuck asked for clarification regarding a few comments, and Teri provided clarification when requested. Primarily, Chuck and Teri discussed the differences in the topography provided to Baker in the final TIN format, and the final geometry that the LACOE developed for the final RAS model. Chuck mentioned that the LACOE utilized as-built information for the overbank wetlands facilities (Phase 2 of the Tres Rios Environmental Restoration Project) upstream of the as-built features of the levee itself (Phase 1 of the Tres Rios Environmental Restoration Project), and that is why the geometry in RAS varies from the topography in the right overbank for those cross sections upstream of the levee. This will be explained in the response to comments document as well, and Teri requested that WEST provide that as-built information if it were not already provided as part of the original TDN deliverable package.

Teri requested that WEST provide another hard copy of the TDN at the time of the submittal and response to Baker's comments, including all replaced study sheets, electronic files on disc, maps, etc., for Baker to replace in their current copy of the TDN. Richard only needed an electronic copy delivered at this time; when Baker finalizes the response to comments document, then Richard will need another hard copy of this report.

Action items deriving from this meeting:

1. *Richard to provide Gant with the Tres Rios Environmental Restoration pictures prior to the public open house meeting to have available on Gant's laptop during the meeting.* ***Update: Richard provided these to Gant on 8/22/12.***
2. *Steve and Richard to finalize the display boards for the public meeting based on the red lines provided by Brian, Richard, Steve, and Gant. Gant to print up to two sets of public display boards for the meeting.* ***Update: All display boards have been prepared as of 8/23/12.***
3. *Gant to continue to track down addresses for the mailers that were returned and re-mail to those individual property owners if feasible before the public meeting.*
4. *Chuck to convert the floodplain shapefile used in the public mailer and the parcel outline shapefile into Google Earth KMZ files for use during the public meeting, and Chuck to email those Google Earth KMZ files to Gant and Richard.* ***Update: Chuck sent these files to Gant and Richard via ftp on August 22.***
5. *Gant, Brian, and Chuck all to bring their laptops with Google Earth installed to the public meeting. Gant to investigate the possibility of using additional computers in the school library for the Google Earth application as well.*
6. *Gant to sending a public meeting checklist to Richard this week. Richard to begin responding to those action items upon receipt of that list.* ***Update: Gant sent Richard the checklist on 8/23/12.***
7. *WEST and Richard to prepare a response for the couple who live just south of Southern Ave between 99th Avenue and 91st Avenue that have been paying flood insurance for many years but appear to not be in the currently effective floodplain in case they were to show up at the public meeting.* ***Update: The property was identified on 8/23/12 and the owners will be notified at the OHM.***
8. *WEST to print one set of FEMA FIRM panels for the meeting and one full-size set of work maps. WEST to also print an additional full-size set of work maps for the District.*
9. *WEST to continue addressing Baker's technical review comments on the PMR submittal in detail. Updates are expected to be submitted to Baker the week of August 26. WEST to provide Baker with another hard copy of the TDN at the time of the submittal and response to Baker's comments, including all printed study sheets, electronic files on disc, maps, etc, for Baker to replace in their current copy of the TDN. WEST to provide Richard with only an electronic copy at this time.*
10. *WEST to provide the as-built information for the overbank wetland facilities upstream of the TRNL if those plans were not already provided as part of the original TDN deliverable package.*

Date: August 22, 2012

A meeting was held on Tuesday, August 21, 2012 at 10:30 AM MST (10:30 AM PDT) with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Frank Brown
4. Gant Wegner

WEST Consultants (WEST)

1. Chuck Davis
2. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Mike Ternak
2. Jody Fischer
3. Chris Spitzer
4. John Drake

City of Phoenix

1. Bob Upham

Michael Baker, Jr., Inc.

1. Teri George

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

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LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSO – Levee Safety Officer

NFIP – National Flood Insurance Program

NLSER – NFIP Levee System Evaluation Report (a Corps document, also known as a LSER)

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the NLSER and embankment report

The call began with a discussion of the embankment report. The embankment report has been provided to the District and to WEST, and that report is now in the ATR process. LACOE staff asked if WEST or the District would have any comments on this document. Both WEST and the District indicated that a geotechnical study would be beyond the field of their expertise, so neither of them would be providing comments on that document. Jody and Chris indicated that they have been working to address some early issues that they noticed with the embankment report while the ATR process is ongoing. They stated that this is in anticipation of the ATR reviewers commenting on these items anyway; therefore, they are hoping that this head start will allow them to resolve ATR comments on the embankment report very quickly once the comment period is closed.

Chris previously provided the "final amended DDR". Based on this submittal and the nearly final status of the ATR for the NLSER, Jody estimated that the final NLSER will be available during the second week of September. One of the last tasks required to finalize the NLSER is the signature of the LACOE LSO, Rick Leifield. Everything seems to be in place to move through this process quickly.

The only remaining concern that Jody has regarding the NLSER ATR is the regional ATR coordinator from SPD. Jody has been in touch with the regional coordinator to ensure that the ATR for the final NLSER can conclude without resolving some additional comments posed during the NLSER ATR process on documents referenced by the NLSER (DDR, EAP, etc.). John and Jody both indicated that the regional coordinator thinks that a swift resolution should occur, but the regional coordinator is back-checking the comments that Jody and John are proposing to forego at this time to ensure that those can be addressed at a later date while still allowing the NLSER ATR to conclude as planned (which would provide FEMA with the necessary documentation to issue an accreditation for the levee for floodplain mapping purposes). In the end, John and Jody both feel confident that the NLSER ATR will resolve quickly, allowing the NLSER finalization to maintain the currently proposed schedule of the second week in September.

Status of the public open house meeting

Richard stated that the main draft display had been posted on the WEST FTP site for review. No one on the call had comments on this draft product. Richard stated that all of the final display

boards would be posted on the WEST FTP site in PDF format for discussion during the pre-meeting on Thursday, August 23. This pre-meeting is intended to provide the TRNL team planning to attend the public open house meeting with additional information regarding the study (especially in relation to the impact that the proposed floodplain changes will have on insurance rates for affected land owners) ahead of the public open house meeting. John said he would be calling in to this meeting.

Mike said that he would be attending the public open house meeting for the LACOE. In regards to the environmental components of the Tres Rios Environmental Restoration Project, Mike and Bob both can answer questions about these features, but everyone on the call agreed that no display boards for the environmental components of the project should be set up at the public open house meeting, as the primary focus of this meeting will be the hydraulic impacts that the levee has on reduced flooding inundation in the study area.

Don asked if Brian Kenny would be on the next call, and John Drake said that he would. Brian's in training this week.

Discussion of the ATR comments on the EAP

Richard indicated that the District will be considering the LACOE comments on the TRNL EAP that resulted from the NLSER ATR process prior to the first federal inspection of the levee in approximately 5 years. Frank Brown, who is working on the District's levee emergency action plan program, was on the call to discuss this with those in attendance. WEST will be providing the NLSER ATR comments on the EAP to Frank for his information so the District can address the comments deemed applicable by the local emergency management agencies prior to the first federal inspection of the TRNL.

Action items deriving from this call:

1. *WEST to provide the final TDN package back to Baker after addressing Baker's comments during the week of August 26.*
2. *WEST to provide hard copies of the TDN to the LACOE and the Cities upon finalization and approval following the FEMA review.*
3. *LACOE to provide the final version of the NLSER with all ATR completed and all necessary signatures by the second week of September.*
4. *Richard and WEST to post all of the final display boards to the WEST FTP site in PDF format for discussion during the pre-meeting on Thursday, August 23.* ***Update: These displays were uploaded to the WEST FTP site with access instructions provided to the TRNL team members on August 22.***
5. *WEST to provide the NLSER ATR comments on the EAP to Frank Brown for his information so the District can address the comments deemed applicable by the local*

emergency management agencies prior to the first federal inspection of the TRNL. ***Update: Brian forwarded these comments to Frank via email on August 21.***

6. *Richard to forward the invitation for the public meeting on August 29 to TRNL project team members, including John Drake, Hasan Mushtaq, Charles Andrews, Sue McDermott, David Pham, Mylene Perry, Van Crisostomo, Paul Beaver, Jody Fischer, Chris Spitzer, Michael J. Fink, Bob Upham, Brian Kenny, and Mike Ternak.*

The next regular conference call is planned for Tuesday, September 4th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: September 7, 2012

A meeting was held on Tuesday, September 4, 2012 at 10:30 AM MST (10:30 AM PDT) with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick
3. Frank Brown

WEST Consultants (WEST)

1. Chuck Davis

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Chris Spitzer
2. David Pham

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a term used by the USACE)

CRS – Community Rating System (a program maintained by FEMA to rate communities on their compliance with the NFIP policies above and beyond the required amount)

CEI – Continuing Eligibility Inspection (the name of the continuing federal inspections as part of the Rehabilitation and Inspection Program, or RIP)

IEI – Initial Eligibility Inspection (the name of the first federal inspection before handoff to the local sponsor for the RIP)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

FEMA – Federal Emergency Management Agency

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSO – Levee Safety Officer

NFIP – National Flood Insurance Program

NLSER – NFIP Levee System Evaluation Report (a Corps document, also known as a LSER)

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Status of the LACOE Project Manager

Don asked if Brian Kenny would be able to be on the call, and Chris stated that he was not sure. Don stated that his understanding was that the only significant issues that the project manager (John Drake and/or Brian Kenny) generally dealt with were in regards to resource management, and Chris said that is correct. Chris went on to say that from a day-to-day operations perspective of the required tasks remaining to finalize the NLSER and the FEMA documentation, the LACOE office can finish most everything without much additional input from Brian (other than the final project management tasks that must be performed); the tasks remaining should not need significant input in regards to resource allocation.

Discussion of the Public Open House Meeting

Richard stated that this meeting went very well! Richard has had a small number of data requests from the public since the meeting, but generally the response from all the public participants was very positive. Several public participants commented regarding the professionalism of the entire team at the public open house meeting in performing the study and responding to comments. Great job team!

If anyone would like to see the final display boards used at the public meeting, they can all be found online at the following link (near the bottom of the page):

http://fcd.maricopa.gov/Projects/PPM/projStructDetails.aspx?ProjectID=71

Status of the LSER/Embankment ATR finalization

Chris stated that there have been some minor delays for the embankment report ATR due to the delivery of ATR reviewer responses. However, Chris feels that this ATR should finalize

hopefully this week (i.e., by 9/7/2012). Chris hopes to have the final ATR comments on the embankment report to Genterra by Friday, September 7; at that time, Genterra can finalize the embankment report with a target finalization date for the entire NLSER package of 9/20/12. Chris also stated that he feels the resolution of the final ATR reviewer's comments should not cause a delay beyond the estimated ATR finalization date of 9/7/2012. Rick Leifield is the LACOE LSO who will need to sign the NLSER, and Chris hopes that the conclusion of the ATR including all required signatures can occur in its entirety by 9/20/2012.

Discussion of the Baker comments on the TDN

WEST has addressed all of Baker's initial comments, and WEST submitted the response package to Baker on 9/4/2012. Assuming Baker's comment back check process takes two weeks (ending on 9/18/2012) with no additional technical comments deriving from that process, WEST will reproduce the final TDN in its entirety and mail the final document to the cities, the District, and the LACOE by October 1.

Discussion of the LACOE ATR comments on the TRNL EAP

WEST provided the NLSER ATR comments on the TRNL EAP to Frank Brown for his information so the District can address the comments deemed applicable by the local emergency management agencies prior to the first federal inspection of the TRNL. Frank provided an update on the status of this task during the call.

The District (in association with the local emergency management agencies) will be updating the EAP to attempt to improve the FEMA CRS score for the portions of Maricopa County that fall under the regulatory jurisdiction of the District. This update to the TRNL EAP and subsequent submittal to FEMA for CRS scoring will occur soon. During this update for the CRS requirements, the District will consider including the updates provided by the LACOE during the DDR ATR process if feasible. However, the goal of this update will be to meet the necessary CRS requirements for an improved CRS rating from FEMA for the District's regulatory jurisdiction; as such, some or all of the DDR ATR comments on the EAP may not be addressed during this EAP update.

Frank also pointed out that the DDR ATR comments on the EAP will remain on file with the District, and these comments will be revisited prior to the next CEI of the TRNL in approximately 5 years. While Chris is fairly confident the first CEI will occur within 5 years, he suggested contacting Baron Arakawa of LACOE Emergency Operations for more information regarding the exact timing of the first CEI of the TRNL. Frank indicated that he had been in contact with Baron previously in regard to the Agua Fria River Levees, and that he would get in touch with him regarding the timing of the first CEI for the TRNL.

Action items deriving from this call:

1. *WEST to provide hard copies of the TDN to the LACOE and the Cities by October 1 upon finalization and approval following the Baker comment back check process (the October 1 delivery date mentioned herein assumes the Baker review can conclude by September 18).*
2. *LACOE to provide the final version of the NLSER with all ATR completed and all necessary signatures by September 20.*
3. *Frank to contact Baron Arakawa of LACOE Emergency Operations for more information regarding the exact timing of the first CEI of the TRNL.* ***Update: The first CEI should occur within 2 years of the date of the published IEI Report. Due to practical considerations of scheduling and funding, it could be about 5 years before the first CEI. New action item: Ask Chris Spitzer for an approximate time as to when the IEI Report may be published.***

The next regular conference call is planned for Tuesday, September 18th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: September 19, 2012

A meeting was held on Tuesday, September 18, 2012 at 10:30 AM MST (10:30 AM PDT) with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Chris Spitzer
2. David Pham
3. Jody Fischer
4. Mylene Perry

City of Phoenix

1. Bob Upham

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a term used by the USACE)

CRS – Community Rating System (a program maintained by FEMA to rate communities on their compliance with the NFIP policies above and beyond the required amount)

CEI – Continuing Eligibility Inspection (this is the name of the federal inspection that will occur for the TRNL in approximately 5 years as part of the Rehabilitation and Inspection Program, or RIP)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

FEMA – Federal Emergency Management Agency

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSO – Levee Safety Officer

NFIP – National Flood Insurance Program

NLSER – NFIP Levee System Evaluation Report (a Corps document, also known as a LSER)

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Possibility of Early Removal of Residents from Floodplain

Brian had met with FEMA employees at the recent FMA conference and they discussed the possibility of getting people in the effective floodway who were behind the levee removed from the floodway and related insurance requirements earlier than anticipated. The process would involve preparing a separate LOMR package that would be processed and effective before the PMR. While the thought of getting people out of the floodplain/floodway early is a good one, the District does not want to pay for it and neither does the City of Phoenix. Bob mentioned that the Brogdon committee may want to do that. Bob needs more details; Brian to provide those details when he hears back from FEMA. At that point, the City of Phoenix and the Brogdon committee will evaluate and determine if it is worth pursuing.

Status of LSER/Embankment ATR

LACOE has received all internal review comments (except one as explained later). They plan to incorporate the internal review comments by 9/20/12. However, one internal reviewer has not provided comments because of technical details. The LACOE has the Genterra draft embankment report and has generated comments on the report for Genterra, the majority of which are minor. It should take Genterra 5 days to respond to the comments. It appears that the LSER will now be completed by 9/28/12, including all the necessary signatures. The LACOE will post the final LSER on WEST's FTP site or the USACE FTP site. WEST and the District will distribute the LSER to the appropriate parties. The LACOE may have a draft final version of the LSER completed before 9/28/2012. The District does not need to see the draft final copy.

Chris mentioned one issue that has not been resolved with regards to the LSER. There is an 18-inch CMP at the downstream end of the levee and the exact owner of this culvert is unknown. During the ATR, it was noted that this culvert is corroded and does not have a flap gate. The LACOE is going to recommend that the culvert be removed, plugged and filled, or replaced with a culvert/flap gate. Fortunately, this does not have to be done before the LSER is finalized so it should not hold up anything with the LSER. David feels removal of this culvert will lead to drainage issues. The culvert is corroded already so just installing a flap gate is not a solution. Don will have FCDMC personnel investigate the ownership of the CMP culvert.

New Conference Call Plan

Since the TRNL project is wrapping up, the plan is to have calls every 2-3 weeks up until the LSER is approved by Baker. After that, calls will be as needed in relation to upcoming FEMA processing of FIRM panel changes.

Request from Frank

Frank Brown had the following request: "Ask Chris Spitzer for an approximate time as to when the Initial Eligibility Inspection (IEI) Report may be published." Chris and Jody indicated that the LSER might be considered as the IEI report. However, Jody and Chris wanted to check to make sure. They said they would speak with Baron of Emergency Operations about this.

Status of the TDN and Floodplain Maps

Baker has tentatively approved the TDN and floodplain mapping revisions. WEST turned in their responses to Baker's comments on 9/18/2012. It is anticipated that Baker will formally approve the TDN and floodplain maps soon. Once approval is obtained, WEST will provide the updated final hard copies to the FCDMC, LACOE, Avondale, Phoenix, and Baker.

Mylene mentioned that they have updated the DDR (minor updates) since the last version they provided to the District and WEST. Changes in the DDR have been italicized. The as-built plans have also been updated (David sent them out earlier this week). Changes (clarifications and deletions) are indicated in title block. When the LSER is finalized, the new DDR will also be provided by the LACOE.

Action items deriving from this call:

1. *Don to have District personnel investigate the ownership of the 18-inch CMP culvert at the downstream end of the TRNL near El Mirage Road.*
2. *LACOE to post the final LSER and DDR using the LACOE or WEST FTP site.*
3. *Jody and Chris to check if the LSER can be used as the IEI Report for the TRNL.*
4. *David to provide WEST with as-built drawings for Phase 2A and 2B.*

The next regular conference call is planned for Tuesday, October 2nd, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

If the LSER is finalized by 9/28/2012, then the conference call on October 2 will be postponed.

Date: October 10, 2012

A meeting was held on Tuesday, October 2, 2012 at 10:30 AM MST (10:30 AM PDT) with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Chris Spitzer
2. David Pham
3. Mike Ternak
4. Brian Kenny

This meeting was in regards to the status of producing supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project, and other levee inspection related issues.

Acronyms and Terminology used herein

ATR – Agency Technical Review (a term used by the USACE)

CRS – Community Rating System (a program maintained by FEMA to rate communities on their compliance with the NFIP policies above and beyond the required amount)

CEI – Continuing Eligibility Inspection (this is the name of the federal inspection that will occur for the TRNL in approximately 5 years as part of the Rehabilitation and Inspection Program, or RIP)

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

FEMA – Federal Emergency Management Agency

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LSO – Levee Safety Officer

NFIP – National Flood Insurance Program

NLSER – NFIP Levee System Evaluation Report (a Corps document, also known as a LSER)

PMR – Physical Map Revision

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

Discussion of Activities Since Last Call

David Pham said he was been trying but is still not able to upload the Phase 2 as-built plans to the WEST ftp site that Brian of WEST provided to him by email. He asked that Brian be contacted for directions on how to do this.

The issue of the 18" CMP located near the west end of the levee was brought up, and discussion began with Don saying he will be onsite for investigation on 10/4/12. Don said he would like the LACOE to clarify what will have to be done on their end given the previous inspection recommendation that the culvert be plugged or removed/replaced. David voiced concern that if the culvert were plugged it could affect positive local drainage and therefore lead to drainage issues in the vicinity of the west basin and end-of-levee. Discussion ensued regarding the supposed function of the culvert, which could not be brought to light by those on the call, so Don asked Chris to discuss the culvert as a known (or not) feature in the levee and interior drainage design data, with Van and Mylene, and then inform the team of what implications may be brought about by following the inspection recommendations. This includes all coordination with the District and other affected entities. The culvert may have been constructed by the MCDOT or nearby residents, and so its' origin will be looked into by District staff per Don's direction. Due to its' size, proximity to the river, and alignment it is likely for cross-drainage of agricultural tail water or another otherwise minor function, but any activities the LACOE will have to perform in regards to this feature being plugged or removed/replaced should be known beforehand. Thus the origin and function need to be identified and agreed upon. These culvert-related activities should not have any impact on the finalization of the LSER.

Status of LSER/Embankment ATR

Chris said that everything has been approved in their office but they are waiting on ATR certification (signature) from Division Headquarters (HQ). This delay is in relation to the removal of the phase 1C feature. David asked Chris what he thought HQ needed – the DDR or a memo? This is being looked into further and is complicated by the fact that this may be the first LSER not only done in the Region, but even west of the Mississippi River. Therefore, the team is seeing processes as they unfold, apparently some in unexpected ways. Don asked what the drop-dead date is for Baker to receive the LSER for their review, and Richard said it should be no later than November 1st, 2012. There remains confidence among the team that the LSER will be completed well before then. This schedule does not change the anticipation that the entire

TDN package to be completed by December 15th, 2012 as previously planned. Chris said he and staff will be on the phone with HQ every day until the LSER is finalized, and Don asked Brian Kenny to consider doing whatever is necessary to ensure this is done as fast as possible. This should include determining what the ATR staff may need to complete their activities.

Regarding Previous Request from Frank

Chris was asked about the result of the action item from last call wherein it was stated that *"Jody and Chris to check if the LSER can be used as the IEI Report for the TRNL."* Chris said that the management of Federal Levees is being moved to the Dam Safety side, and that the inspection report in the LSER will likely serve as the IEI.

Action items deriving from this call:

1. *Richard to ask Brian at WEST to get David what he needs to understand process to upload the phase 2 as-built plans to the WEST ftp site.* ***Update: Richard sent Brian an email asking him to help on 10/3/12.***
2. *Chris to investigate any Corps implications of decision to remove/replace or plug the 18" CMP. If plugging alone will be acceptable, then what processes might the team have to follow? Chris to discuss this issue with the LACOE design team in context with the project design for interior drainage.*
3. *Don to inspect the 18" culvert onsite and investigate its' origins and function.* ***Update: Don inspected the culvert on 10/4/12 and learned that the 18" CMP was installed when the Holly Acres Levee was constructed in order to address road side nuisance flows. The same day he made recommendation to LACOE that the District should plug the culvert completely and re-grade the project interior drainage basin maintenance access road to intercept flows into the basin, instead. Additional recommendation to replace the basin north-slope cover with grouted riprap protection against sheet flow erosion. Don said that all work will be done by the District, and asked Chris Spitzer to discuss this with LACOE H & H staff and reply so that the work can get underway. This was previously anticipated as described in Action Item #2, above, sans understanding of the origin of the culvert.***
4. *Brian Kenny to coordinate with the LA office to ensure that all activities proceed as fast as is possible. This includes ensuring that all documents needed for finalization of the ATR are provided to the relevant staff.*
5. *Chris and staff to be on the phone with HQ as often as possible until signatures needed from them to complete the LSER are obtained.*

The next regular conference call is planned for Tuesday, October 16th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

If the LSER is finalized by 10/12/2012, then the conference call on October 16th will be cancelled.

Date: October 16, 2012

A meeting was held on Tuesday, October 16, 2012 at 10:30 AM MST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. David Pham
2. Chris Spitzer
3. Mike Ternak
4. Brian Kenny

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

MCDOT – Maricopa County Department of Transportation

NLD – National Levee Database

O&M – Operations and Maintenance

PMR – Physical Map Revision

RFP – Request for Proposal

R&U – Risk and Uncertainty

SAT – Sunland Avenue Tributary

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

USACE – US Army Corps of Engineers

Status of LSER/Embankment ATR

The USACE Albuquerque District office is performing the ATR on the deletion on Phase 1C for TRNL. The Albuquerque District office is supposed to have the ATR completed by the end of this week. Chris Spitzer does not expect any surprises from this review. Because it looks like the ATR will be completed in a relatively short time frame, there does not appear to be the need to make changes to the overall schedule.

If the ATR is completed by the end of the week, then the ATR lead will prepare an ATR report and sign it. Then Jody Fischer will sign the LSER. The LSER and ATR will then be sent to the Division for signatures. Once that is complete, the LSER will be delivered to the LSO (Rick Leifield) for his signature, thus concluding the signature process. Chris is hopeful this will all happen quickly because most of the signatures are electronic.

Action items deriving from call 10/02/12

1. Richard to ask Brian at WEST to get David what he needs to understand process to upload the phase 2 as-built plans to the WEST ftp site.

Update: David uploaded the as-built drawings on WEST FTP's site on 10/15/2012.

2. Chris to investigate any Corps implications of decision to remove/replace or plug the 18" CMP. If plugging alone will be acceptable, then what processes might the team have to follow? Chris to discuss this issue with the LACOE design team in context with the project design for interior drainage.

Update during the call 10/16/12: Don investigated this issue and believes this culvert can simply be plugged. Don asked if the LACOE was okay with the culvert being plugged. Chris responded that the LACOE was ok with the culvert being plugged. Don asked if the LACOE preferred to have the District do the work. Chris responded that the LACOE would prefer to have the District do the work as they feel it is covered by O&M. Chris also indicated that the text of the LSER would have to change slightly. The LACOE would also need letter from the District stating that the work was done.

Some grading work will also need to be done in conjunction with plugging the culvert. The District will make a one sheet detail outlining the grading working that was done.

The District can commit to having this work done (plugging culvert and grading), but cannot commit on when the work will be done. Don asked if the LSER status would be affected if the work was not done immediately. Chris stated that not having the work done will not affect the LSER completion.

3. Don to inspect the 18" culvert onsite and investigate its origins and function. Update: Don inspected the culvert on 10/4/12 and learned that the 18" CMP was installed when the Holly Acres Levee was constructed in order to address road side nuisance flows. The same day he made recommendation to LACOE that the District should plug the culvert completely and re-grade the project interior drainage basin maintenance access road to intercept flows into the basin, instead. Additional recommendation to replace the basin north-slope cover with grouted riprap protection against sheet flow erosion. Don said that all work will be done by the District, and asked Chris Spitzer to discuss this with LACOE H & H staff and reply so that the work can get underway. This was previously anticipated as described in Action Item #2, above, sans understanding of the origin of the culvert.

Update: Covered above under Item 2.

<u>Action items deriving from this call:</u>

1. *Chris to provide Don with details on how to write the letter outlining the abandonment of the 18 inch culvert.*
2. *David to give Don a DNG of the as-built drawings so the District can modify the drawing to reflect the grading around the abandoned culvert. Update: David provided requested files to Don the same day as this call.*
3. *Brian Kenny and Chris Spitzer to coordinate with LACOE staff to ensure all activities proceed as fast as possible.*

The next regular conference call is planned for Tuesday, October 30th, 2012, at 10:30 AM MST, 10:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

Date: October 30, 2012

A meeting was held on Tuesday, October 30, 2012 at 10:30 AM PST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Brian Wahlin

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Jody Fischer
2. Chris Spitzer

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

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SAT – Sunland Avenue Tributary

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

USACE – US Army Corps of Engineers

Status of LSER/Embankment ATR

The USACE Albuquerque District office is performing the ATR for the LSER. The ATR review has raised some questions regarding the removal of the Phase 1C floodwall. Mylene Perry contacted WEST (Brian Wahlin and Chuck Davis) to request information on the analysis that was done to show that no overtopping occurs at El Mirage Road. WEST provided Mylene with the final RAS model, an email stating that the reviewers at Baker accepted the floodplain study, and a LACOE memo summarizing that the FEMA regional engineer (Ed Curtis) was okay with the removal of the Phase 1C floodwall.

The LACOE prepared a memorandum to address the ATR reviewer's comments. A summary of the arguments in LACOE's response to the ATR reviewer is listed below:

1. "Freeboard" at El Mirage Road not appropriate since there is no flowing water against the roadway
2. Overall project not complete – once Phase 3C is constructed overtopping of El Mirage Road may be reevaluated
3. Increase in water surface above a 100-yr flood event would negate the ability of the upstream levee to maintain freeboard (probabilistic risk-based levee)
4. FEMA and District reviewers have approved the floodplain study

If the ATR review comments are satisfied, then the ATR lead will prepare an ATR report and sign it (ATR lead works part time, so she may not be able to sign immediately). Then Jody Fischer will sign the LSER. The LSER and ATR will then be sent to the Division for signatures. Once that is complete, the LSER will be delivered to the LSO (Rick Leifield) for his signature, thus concluding the signature process. Chris is hopeful this will all happen quickly because most of the signatures are electronic.

If the ATR reviewer in ABQ does not agree, Jody is ready to initiate a resolution of comments in an effort to keep the project moving forward. Rick Leifield could make a statement that he does not concur with the ATR reviewer's comment.

The ATR review questioned if the TRNL was tied into high ground or would it be flanked. Don and Richard indicated that it was tied into high ground. Jody indicated that if the low spot of El Mirage Road overtopped and flooded houses on the east side of El Mirage Road but did not touch the back side of the levee, then the levee would not be considered flanked. Richard and Don indicated that if it was overtopped, water would not reach the backside of the levee, especially considering the interior drainage features for the levee. Richard said such runoff would be intercepted by interior drainage features before reaching the levee. Richard also said that El Mirage road will not be overtopped during the 1%-annual chance runoff event. This is the event used to update floodplain and floodway boundaries for the study.

Proposed course of action is to wait to see if the ATR reviewer concurs with the LACOE response to comments. Jody will be following up with him later today.

Action items deriving from call 10/16/12:

1. Chris to provide Don with details on how to write the letter outlining the abandonment of the 18 inch culvert.

Don's staff will develop some plans and Don will write a letter outlining the abandonment. Don hopes the actual construction will happen soon, probably not until after the end of the year.

2. David to give Don a DNG of the as-built drawings so the District can modify the drawing to reflect the grading around the abandoned culvert. Update: David provided requested files to Don the same day as this call.

David provided this to Don.

3. Brian Kenny and Chris Spitzer to coordinate with LACOE staff to ensure all activities proceed as fast as possible.

Coordination has been ongoing.

The next regular conference call is planned for Tuesday, November 13th, 2012, at 10:30 AM MST, 9:30 AM PDT. A formal invitation will be sent by Richard for this meeting.

If the LSER is finalized by 11/08/2012, then the next conference call will be cancelled.

Action items deriving from call 10/30/12

1. Jody to let the District and WEST know if the ATR reviewer has approved the LSER as soon as this occurs.

Meeting adjourned at 11:00 am PST

Date: November 15, 2012

A meeting was held on Tuesday, November 13, 2012 at 10:30 AM MST, 9:30 AM PST with the following attendees:

Flood Control District of Maricopa County (District)

1. Richard Harris
2. Don Rerick

WEST Consultants (WEST)

1. Chuck Davis

City of Phoenix (COP)

1. Bob Upham

US Army Corps of Engineers, Los Angeles District (LACOE)

1. Chris Spitzer

This meeting was in regards to the status of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River @ the Tres Rios North Levee project.

Acronyms and Terminology used herein

DDR – Design Documentation Report (technical data developed in support of the TRNL design)

EAP – Emergency Action Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

LACOE – US Army Corps of Engineers, Los Angeles District (also referred to as SPL)

LOMR – Letter of Map Revision

LSER – Levee System Evaluation Report (a Corps document, also known as a NLSER)

LSO – Levee Safety Officer

MCDOT – Maricopa County Department of Transportation

NLD – National Levee Database

NWP – US Army Corps of Engineers, Portland District

O&M – Operations and Maintenance

PMR – Physical Map Revision

RFP – Request for Proposal

R&U – Risk and Uncertainty

SAT – Sunland Avenue Tributary

SPL – US Army Corps of Engineers, Los Angeles District (also referred to as LACOE)

SPD – US Army Corps of Engineers, South Pacific Division

TDN – Technical Data Notebook (herein referring to the AZ state standard document)

TRNL – Tres Rios North Levee

USACE – US Army Corps of Engineers

Status of LSER/Embankment ATR

The USACE Portland District office (NWP) is the lead for the ATR for the LSER. As per the previous meeting minutes for the call on October 30, one of the ATR reviewers in Albuquerque raised some questions regarding the removal of the Phase 1C floodwall. Based partially on the previous information provided by WEST and the District to the LACOE, the LACOE prepared a memorandum to address the ATR team's comments. A summary of the arguments in LACOE's response to the ATR reviewer is listed below:

1. "Freeboard" at El Mirage Road not appropriate since there is no flowing water against the roadway
2. Overall project not complete – once Phase 3C is constructed overtopping of El Mirage Road may be reevaluated
3. Increase in water surface above a 100-yr flood event would negate the ability of the upstream levee to maintain freeboard (probabilistic risk-based levee)
4. FEMA and District reviewers have approved the floodplain study

The ATR reviewer in Albuquerque was satisfied with these arguments; however, the ATR team lead in Portland continues to have concerns regarding this portion of the project. Chris Spitzer stated that he had been discussing the ongoing issues with this review with Jody Fischer, and

both he and Jody had encouraged SPL to elevate the ongoing issues to SPD shortly to possibly override the ATR team from Portland if needed. Jody and Chris will be elevating the ATR review directly to the SPD technical coordinator (Ken Herrington) for this possible override. Jody had a call with Ken later in the day on November 13, and she stated that she would be discussing this item with him at that time.

Don asked once again the order of signatures needed to finalize the process once the ATR is finalized. If the ATR review comments are satisfied, then the ATR lead at NWP will prepare an ATR report and sign it. Then Jody Fischer will sign the LSER. The LSER and ATR will then be sent to the Division for signatures (Ken Herrington and others). Once that is complete, the LSER will be delivered to the LSO (Rick Leifield) for his signature, thus concluding the signature process for the USACE. Once the USACE delivers the LSER to WEST Consultants and the District, Tim Phillips can sign the document for the District and send the PMR package to the FEMA reviewer for floodplain mapping changes. Chris stated that the LACOE will not need a receipt of the final LSER document signed by Tim Phillips before submitting the LSER to FEMA for review.

Bob Upham stated that the City of Phoenix is becoming concerned with the schedule impacts on floodplain mapping updates that the ATR process is having. Bob Upham requested that he be contacted by Chris and/or Jody via call/email as soon as possible. District staff asked to be copied on correspondence if possible, but asked the LACOE to follow up with Bob directly if needed as the City sponsor requested to take the lead on this follow-up process. Chris Spitzer said that he would be sure to contact Bob directly or have Jody contact Bob as soon as they had more information. Chris also stated he would be talking to Rick Leifield about this issue immediately.

Proposed course of action is to wait to see if the ATR review team concurs with the LACOE response to comments, and then for Jody and Chris to possibly elevate the ATR override proceedings to SPD if needed. Jody and/or Chris will be following up with Bob Upham as soon as possible, copying the District staff if feasible.

<u>Action items deriving from call 11/13/12</u>

1. Jody to let Bob Upham with the COP know if the ATR lead in NWP approves the LSER as soon as this occurs, and Jody to copy the District and WEST on this correspondence as well if feasible.

Meeting adjourned at 11:30 am MST, 10:30 am PST

The next regular conference call is planned for Tuesday, November 27th, 2012, at 10:30 AM MST, 9:30 AM PST. A formal invitation will be sent by Richard for this meeting.

If the LSER is finalized before the next call, then the next conference call will be cancelled.

Appendix B: General Documentation and Correspondence

B.4 General Correspondence

TRES RIOS TOPOGRAPHY DATASETS
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: September 22, 2010

To: Richard Harris – FCDMC

Cc: Amir Motamedi – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to describe the topography that WEST currently has for the Tres Rios LOMR project. WEST developed a Triangulated Irregular Network (TIN) of the topography in the Tres Rios reach for the previous Tres Rios Preconstruction Engineering and Design (PED) modeling study performed for the USACE by WEST. The figures below explain the following issues regarding this TIN topography:

- The first figure shows the differentiation between the USACE topography data WEST received for the Tres Rios PED study and the topography that WEST appended to the USACE topography data in order to contain the 100-year flow in the model cross sections. The pastel polygons are the boundaries of the individual USACE topography datasets WEST received for PED, and the extents of all of these polygons are the total extent of this dataset. The remaining area of the TIN shown (with green and tan elevation contour colors and blue breaklines) would have been developed using supplementary data provided from a modeling study completed previously by WEST. In addition, the thick red line shown in this figure is the proposed levee alignment that WEST received from USACE during the PED modeling study. As can be seen in this figure, the levee alignment is contained entirely within the extents of the USACE topography, and does not cross into the topography appended by WEST.

- The second figure shows the same topography differentiation as the first figure, but the cross sections from the PED modeling study are shown on top of the polygons and TIN in order to show how much of those cross sections were taken from USACE topography data and how much were taken from the topography data that WEST appended. As can be seen from this figure, the area to the north of the levee in the right overbank was the largest area included in the PED model from the appended data.

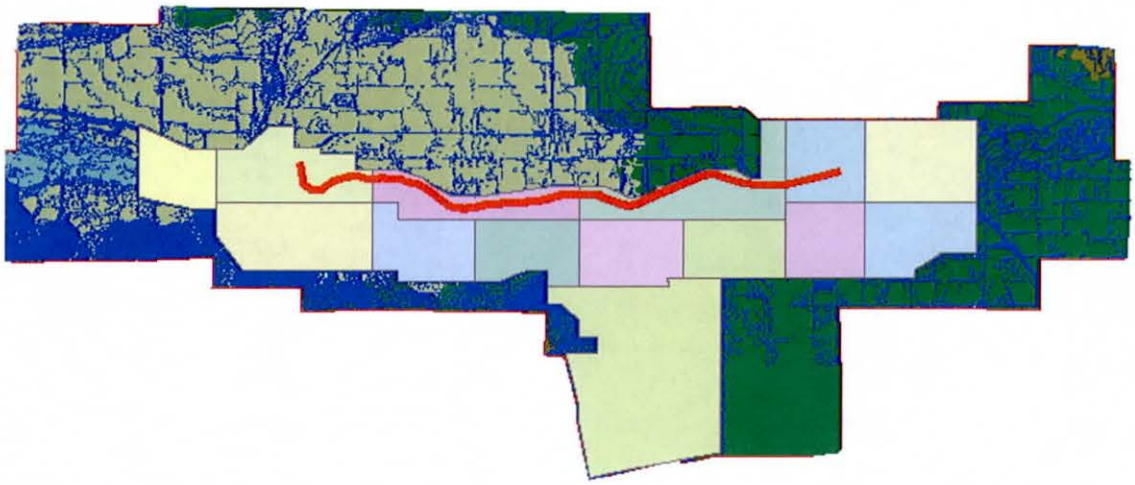

Figure 1. Pastel polygons indicate USACE topography data from the PED modeling study, and the underlying TIN represents the entire topography dataset. Therefore, any area of the TIN not covered by the polygons was based on data that WEST appended to the dataset from a previous modeling study. The red line shows the proposed levee alignment that WEST received from USACE for the PED model.

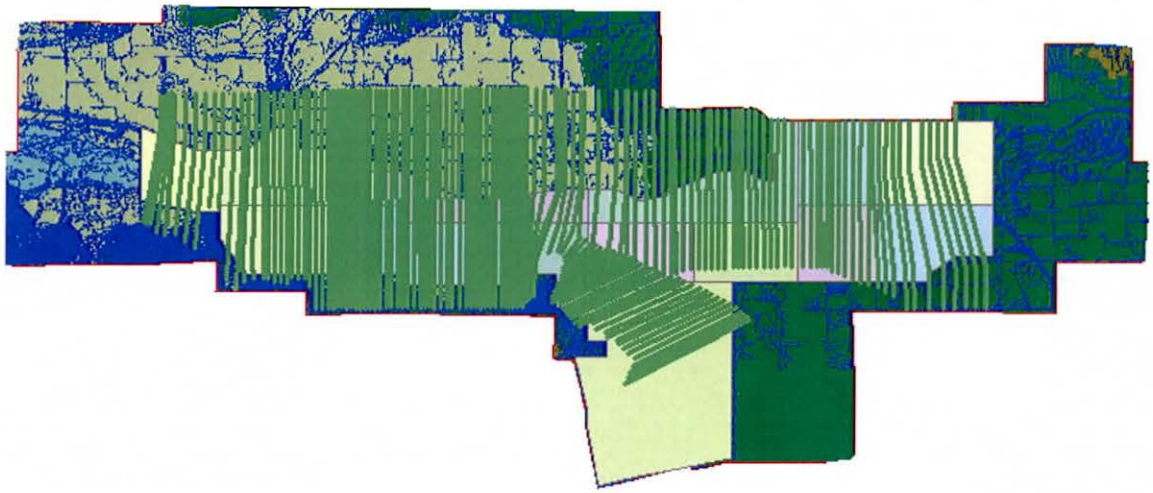

Figure 2. This figure is the same as Figure 1 with the cross sections from the PED model (shown in neon green) overlaying the topography data. This figure highlights the portions of the model cross sections developed from the two different data sources.

City of Phoenix
WATER SERVICES DEPARTMENT
TREATMENT PLANT ENGINEERING DIVISION

November 1, 2010

Gwen Meyer
Project Manager
U.S. Army Corp of Engineers, Los Angels District
3636 N. Central Ave., Suite 900
Phoenix, Arizona 85012-1939

RE: Tres Rios Environmental Restoration Project
Phase I – LOMR

Dear Gwen,

The City, as the local sponsor, formally requests that the Corps provide all supporting technical information and documentation, including FEMA forms sealed by a registered engineer, needed for the Flood Control District of Maricopa County (FCDMC) to apply for the LOMR.

If you have any questions, please contact me at 602.534.9205.

Sincerely,

Robert F. Upham, PE
Civil Engineer III
Wastewater Engineering

200 West Washington Street, 8th Floor, Phoenix, Arizona 85003-1611 602-534-5812 FAX: 602-495-5843
Recycled Paper

TRES RIOS TOPOGRAPHY DATASETS
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: November 1, 2010

To: Richard Harris – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to describe the results of an investigation performed by WEST comparing the suggested levee elevations from the PED Hydraulic Design of Tres Rios North Levee study completed by WEST in 2002 to the actual constructed levee elevations based on the AS-BUILT plans provided by the Los Angeles District of the U.S. Army Corps of Engineers (LACOE).

Table 1 below is a reproduction of a portion of "Table 6-1: Levee Heights for Tres Rios North Levee" from the final report for the PED study. Only a portion of the table was reproduced because the final design and construction of the Tres Rios North Levee did not cover as much longitudinal distance of the river as the original anticipated design analyzed in the PED study. In this table, the X-Section numbering refers to the original HEC-RAS cross section numbers developed for the PED study. It should be noted that the PED study designed for 3.0 feet or more of Freeboard throughout the portion of levee that was eventually constructed (see the heading title of the last column of Table 1).

Table 2 below compares the design levee height values from the PED study to the levee heights from the AS-BUILT plans provided by LACOE (Environmental Restoration Flood Control North Levee Phase 1A Plan and Profile AS-BUILT construction drawings, Dec 17, 2007; Environmental Restoration Flood Control North Levee Phase 1B Plan and Profile AS-BUILT construction drawings, Aug 9, 2007). As can be seen from this table, the greatest difference between the design levee heights and the constructed levee heights with the constructed levee height being lower than the design height is 0.2 feet. Since the original levee design utilized 3.0 feet of Freeboard, the minimum freeboard in the levee based on the original hydraulic analysis is estimated to be 2.8 feet.

Table 1. A portion of "Table 6-1: Levee Heights for Tres Rios North Levee" reproduced from the final report for the PED Hydraulic Design of Tres Rios North Levee study

X-Section	Thalweg Elevation (ft)	Existing Ground (ft)	Computed WSE (ft)		WSE Increase w/ Levee (ft)	Height With 3-feet Freeboard
			Existing	Future-Levee		
⋮	⋮	⋮	⋮	⋮	⋮	⋮
198.4	922.23	939.47	935.34	935.85	0.51	938.85
198.45	922.19	939.9	936.39	936.69	0.3	939.69
198.49	922.46	939.75	936.82	937.1	0.28	940.1
198.54	922.67	940.51	937.13	937.35	0.22	940.35
198.6	923.3	940.47	937.34	937.57	0.23	940.57
198.65	923.88	940.66	937.74	937.94	0.2	940.94
198.7	923.9	940.81	938.07	938.25	0.18	941.25
198.76	923.9	940.98	938.27	938.45	0.18	941.45
198.8	923.9	940.92	938.58	938.71	0.13	941.71
198.83	923.9	941.5	938.8	939.01	0.21	942.01
198.88	923.9	942.19	939.03	939.23	0.2	942.23
198.93	923.9	942.1	939.41	939.63	0.22	942.63
198.97	925.1	942.5	939.53	939.75	0.22	942.75
198.99	925.1	942.5	940.05	940.22	0.17	943.22
199.02	925.4	942.52	940.15	940.31	0.16	943.31
199.06	925.4	943.67	940.76	940.87	0.11	943.87
199.11	925.4	943.54	941.64	941.78	0.14	944.78
199.18	925.4	940.08	942.02	942.18	0.16	945.18
199.21	927.64	940.1	942.74	942.96	0.22	945.96
199.31	928.11	946.63	943.29	943.48	0.19	946.48
199.38	926.6	947.85	943.84	943.98	0.14	946.98
199.47	926.6	948.13	944.92	945.06	0.14	948.06
199.55	931.65	946.74	946.25	946.35	0.1	949.35
199.69	931.79	943.07	947.65	947.84	0.19	950.84
199.86	931.12	944.68	948.65	948.99	0.34	951.99
199.98	932.56	945.59	948.88	949.24	0.36	952.24
200.02	931.98	945.44	949.25	949.6	0.35	952.6
200.11	931.98	945.83	949.53	949.88	0.35	952.88
200.22	931.78	945.58	950.04	950.39	0.35	953.64*
200.31	931.67	948.57	950.4	950.77	0.37	954.02*
200.4	931.55	949.27	950.87	951.21	0.34	954.46*
200.47	931.67	949.8	951.15	951.46	0.31	954.71*
200.52	932.45	949.94	951.31	951.61	0.3	954.81**
⋮	⋮	⋮	⋮	⋮	⋮	⋮

**3.25 feet of Freeboard*
***Raised 0.2 feet to transition upstream*

Table 2. A comparison of the design levee heights from Table 1 to the AS-BUILT plan levee heights

X-Section	Computed WSE (ft)		WSE Increase w/ Levee (ft)	Height With 3-feet Freeboard	**AS-BUILT Plans Levee Height**	**Difference btwn design and construction†**
	Existing	Future-Levee				
198.4	935.34	935.85	0.51	938.85	939.4	0.55
198.45	936.39	936.69	0.3	939.69	939.7	0.01
198.49	936.82	937.1	0.28	940.1	940.1	0
198.54	937.13	937.35	0.22	940.35	940.46	0.11
198.6	937.34	937.57	0.23	940.57	940.86	0.29
198.65	937.74	937.94	0.2	940.94	940.93	-0.01
198.7	938.07	938.25	0.18	941.25	941.24	-0.01
198.76	938.27	938.45	0.18	941.45	941.44	-0.01
198.8	938.58	938.71	0.13	941.71	941.7	-0.01
198.83	938.8	939.01	0.21	942.01	942.0	-0.01
198.88	939.03	939.23	0.2	942.23	942.23	0
198.93	939.41	939.63	0.22	942.63	942.63	0
198.97	939.53	939.75	0.22	942.75	942.74	-0.01
198.99	940.05	940.22	0.17	943.22	943.21	-0.01
199.02	940.15	940.31	0.16	943.31	943.3	-0.01
199.06	940.76	940.87	0.11	943.87	943.87	0
199.11	941.64	941.78	0.14	944.78	944.78	0
199.18	942.02	942.18	0.16	945.18	946.5	1.32
199.21	942.74	942.96	0.22	945.96	946.84	0.88
199.31	943.29	943.48	0.19	946.48	947.41	0.93
199.38	943.84	943.98	0.14	946.98	947.81	0.83
199.47	944.92	945.06	0.14	948.06	948.44	0.38
199.55	946.25	946.35	0.1	949.35	949.35	0
199.69	947.65	947.84	0.19	950.84	950.84	0
199.86	948.65	948.99	0.34	951.99	951.8	-0.19
199.98	948.88	949.24	0.36	952.24	952.24	0
200.02	949.25	949.6	0.35	952.6	952.6	0
200.11	949.53	949.88	0.35	952.88	952.88	0
200.22	950.04	950.39	0.35	953.64*	953.64	0
200.31	950.4	950.77	0.37	954.02*	954.0	-0.02
200.4	950.87	951.21	0.34	954.46*	954.46	0
200.47	951.15	951.46	0.31	954.71*	954.71	0
200.52	951.31	951.61	0.3	954.81**	954.61	-0.2

**3.25 feet of Freeboard*

***Raised 0.2 feet to transition upstream*

†Positive values indicate additional Freeboard over the design values, negative values indicate less Freeboard

90% DDR INTERIOR DRAINAGE DESIGN NOTES
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: November 8, 2010

To: Richard Harris – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

The following notes were taken directly from the 90% Draft Design Documentation Report (DDR) for the Tres Rios Flood Control North Levee provided by the Los Angeles District of the U.S. Army Corps of Engineers (LACOE). The page number of the DDR and the corresponding page number in the report itself of each section are provided for each note for reference. This information will aid in the discussion of remaining information required to allow WEST to complete the detailed technical review of the Interior Drainage Analysis.

Main text of the DDR Report

From Section 1.11, Subsection a. (i)., "Interior Drainage" (page 19 of 568 in the DDR, page 12 in the report)

"Interior drainage. In cooperation with the Maricopa County Flood Control District, the City of Phoenix Wastewater Treatment Plant and Holly Acres Community's representative, The U.S Army Corps of Engineers has conducted a detailed study of the interior drainage. A refinement of the interior drainage plan was developed for incorporation into the project including collector channels; catch basins and storm drain channels."

From Section 2.4, "Interior Drainage" (page 21 of 568 in the DDR, page 14 in the report)

"A detailed interior drainage study was not completed. However, results from a previous study done by Dibble and Associates for the FCDMC and information generated to determine the quantity of urban runoff for the Rio Salado Study were used to formulate a preliminary interior drainage analysis. The estimated interior area peak discharge and associated 24-hour runoff volume were based upon drainage area versus discharge relationships."

WEST Note: In Section 1.11, Subsection a. (i)., the DDR states that a detailed study of interior drainage was completed. In Section 2.4, the DDR states that a detailed interior drainage study was not completed. This discrepancy should be corrected.

Notes from the Hydraulic and Hydrologic Analysis Appendix (Appendix B)

From Section 6, "Hydrology and Design Discharges" (pages 285-286 of 568 in the DDR, pages 1-2 of the appendix)

"The following table summarizes the discharges that were analyzed for the project. The methodologies and assumptions used to determine these discharges are documented in the Hydrology Appendix of the Tres Rios Feasibility Report (2000). Appendix A2 gives a detailed description of the hydrology used in the Sedimentation Analysis."

Table 1. Discharge-Frequency Values

Location	Return Period (Years)						
	5	10	20	50	100	200	500
Salt R. above Gila R.	19,500 cfs	49,000 cfs	82,000 cfs	130,000 cfs	162,000 cfs	198,000 cfs	235,000 cfs
Gila R. below Salt R.	23,500 cfs	57,000 cfs	92,000 cfs	185,000 cfs	227,000 cfs	243,000 cfs	285,000 cfs

U.S. Army Corps of Engineers, Los Angeles District. 2000. "Tres Rios, Arizona, Feasibility Study," Los Angeles, CA.

WEST Note: The hydrology reported herein does not match the FIS hydrology, which is 164,000 cfs in the Salt River above the Gila River confluence.

Notes from the Hydrologic Analysis for Design of Interior Drainage Feature Appendix (Appendix A1 of Appendix B, was this mislabeled?)

From Paragraph 1 of the "Introduction" section (page 331 of 568 in the DDR, page 1-2 of the appendix)

"There appear to be three sources of surface water runoff from the interior areas to the rivers along the line-of-protection

a. Excess Rainfall (i.e. incident precipitation in excess of the infiltration rate of the soil/land surfaces);

b. Irrigation Return Flow (water delivered to the farms for irrigation in excess of demand due to antecedent/coincident precipitation, and cycled applied-irrigation water);

c. Stormwater Runoff Conveyed Within Irrigation Canals And Or Wasteways (off-site water which may have been conveyed to line-of-protection via delivery/wasteway systems).

At a minimum the project must ensure that interior flooding is not aggravated by the levee construction."

From Paragraph 6 of the "Introduction" section (page 332 of 568 in the DDR, page 1-3 of the appendix)

"The draft report for the Durango area [the Master Drainage Plan for the Durango Area prepared by Dibble and Associates Consulting Engineers] (flow paths and contributing drainage areas) provided by FCDMC was then used to estimate peak discharges from the interior area along the line-of-protection as well as volumetric data. The procedure followed was one developed by the LAD for the Rio Salado Interior Drainage study, and was considered applicable to this area as well because of similar meteorology and topography. **Note: peak discharge and volume relationships for the Rio Salado Interior Drainage study were developed from an 8-drain sample of urbanized drainage areas in the Phoenix vicinity. As a consequence, the peak flow rates and volumes estimated using the relationships developed from this data overstate runoff from the existing, mostly agricultural areas.** As a consequence, the rainfall-runoff modeling procedure for the 8-drain study was modified to represent rural/agricultural drainage rather than urban drainage by adjusting the loss rates. Regression curves for estimation of peak flow rates and 24-hour flood volumes, developed for the Rio Salado Study, were likewise modified to reflect the rural/agricultural makeup of the contributing areas. These modified regression curves were then utilized to make interior runoff estimates for the Tres Rios Project levee design."

WEST Note: The table below provides all of the reports associated with the Durango ADMP that were provided from the FCDMC site. The report referenced after the table is the Rio Salado Draft Drainage Master Plan completed by Wood, Patel, but from the DDR, it appears that the interior drainage study completed for the Rio Salado area was completed in house by LACOE.

#	Call Number	Title	Author	ID	Date
1	CDA565.2	Durango Area Drainage Master Plan, Data Collection Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult. for Flood Control District of Maricopa County-FCD	FCD 99-41	2000
2	A565.901S	Durango Area Drainage Master Plan, Data Collection Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for Flood Control District of Maricopa County-FCD	FCD 99-41	2000
3	CDA565.1	Durango Area Drainage Master Plan, Alternatives Analysis Report (PDF on CD) (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult. for Flood Control District of Maricopa County-FCD	FCD 99-41	2001
4	A565.902S	Durango Area Drainage Master Plan, Alternatives Analysis Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for Flood Control District of Maricopa County-FCD	FCD 99-41	2001

#	Call Number	Title	Author	ID	Date
5	CDA565.4	Durango Area Drainage Master Plan, Recommended Design Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for Flood Control District of Maricopa County-FCD	FCD 99-41	2002
6	A565.601S	Durango Area Drainage Master Plan, Recommended Design Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for Flood Control District of Maricopa County-FCD	FCD 99-41	2002
7	CDA565.3	Durango Area Drainage Master Plan, Hydrology Report, Revised April, 2003 (ADMP)	Dibble and Assoc. for Flood Control District of Maricopa County-FCD	FCD 99-41	2001
8	A565.701S	Durango Area Drainage Master Plan, Hydrology Report, Revised April, 2003 (ADMP)	Dibble and Assoc. for Flood Control District of Maricopa County-FCD	FCD 99-41	2003

Call Number: A124.301S

Title: Rio Salado Drainage Master Plan, Draft (DMP)

Author: Wood, Patel and Assoc., Inc. for Rio Salado Project and City of Tempe

ID: WP# 97644

Date: 1997

From Paragraph 7 of the "Precipitation" section (pages 333-334 of 568 in the DDR, pages 1-4 and 1-5 of the appendix)

"This is in agreement with NOAA Atlas 2 precipitation duration isopluvials for the Phoenix area that indicate the 5-year, 24-hour precipitation depth is 2.0 inches." **Question: Is the entire interior drainage design based on the 5-year event? Does this conform to a City of Phoenix standard (it isn't the FCD standard)?Please check and if not clear, will become a comment for the LACOE to address in the DDR.**

WEST Note: How would this compare to NOAA Atlas 14 information? WEST compared these numbers quickly, and found that the NOAA Atlas 14 5-yr, 24-hr precipitation depth is 1.91 inches.

From the DDR, only the sizing of the catch basins is based on the 5-year event. The outlet culvert sizing is based on the 100-yr event.

The ADWR state standard for stormwater detention/retention is based on the 100-yr, 1-hr storm. The FCDMC design manual specifies the 100-yr, 2-hr storm (City of Phoenix has adopted the FCDMC standard as well). For comparison, the NOAA Atlas 14 data for the area is 2.44 inches for the 100-yr, 1-hour storm, and 2.73 inches for the 100-yr, 2-hour storm.

As a note, another engineer at WEST who has completed many LOMR packets does not think this will be an issue for the FEMA review because these are defined as "catch basins" and not "retention basins." Since their only design feature is to attenuate flow in the specialized case when the stage in the Salt/Gila is high enough to cause the flap gates in the outlet culverts to close and not allow outflow, and not to retain the entirety of that flow until complete infiltration can be obtained as would be the case with a retention basin, that the sizing of these catch basins will not be an issue for FEMA.

From Paragraph 16 of the "Interior Runoff: Excess Precipitation" section (page 350 of 568 in the DDR, page 1-21 of the appendix)

"The highest peak discharge from the interior area should occur during the warm-weather months, when the threat of high discharge/stage in the mainstream Salt River and Gila River is at a minimum. Hence interior drainage facilities such as collection channels, catch basins, and culverts, designed to pass the 100-year peak from the interior areas, should be sufficient to prevent flooding along the land-side of the levee project during the warm-weather months. As mentioned previously in this report (Paragraph 6), the interior drainage estimates for the Tres Rios Project were based upon an 8-drain sampling procedure developed for the Rio Salado Project; however the N-year, rainfall-runoff models developed for the 8-drain sample were modified to reflect rural/agricultural land use rather than urban land use."

WEST Note: The DDR makes no reference of how this method was modified. If we obtain the Rio Salado Interior Drainage study to review the "8-drain method," we still do not know how this method was modified for the Tres Rios DDR. Good point. Please make a comment in the form of a question for the LACOE.

Question for the LACOE: Which study includes the Rio Salado Interior Drainage Study? Was this a standalone report, or was this part of another study? Could we obtain a copy of this report for the technical review of the interior drainage analysis for Tres Rios?

Question for the LACOE: How was the "8-drain sampling procedure" developed for the Rio Salado Interior Drainage Study modified to reflect greater agricultural land use in the interior drainage area of the Tres Rios levee?

From Paragraph 17 of the "Interior Runoff: Excess Precipitation" section (page 352 of 568 in the DDR, page 1-23 of the appendix)

"Although interior runoff during the cold weather months should have lower peak discharges, the duration of runoff may increase. If interior runoff reaches the line-of-protection during period when spills have occurred from SRP reservoirs and/or there are significant flows from the upstream Gila River watershed, high river stages may create adverse hydraulic conditions. During such period interior runoff might pond alongside the levee for extended periods. To eliminate or reduce this undesirable condition, drainage/collector channels will be designed to direct interior runoff near the levee to catch basins designed to accommodate a substantial portion of the interior runoff. Figure A1-11 depicts the regression curve of the 5-year, 24-hour interior-runoff volume on drainage area… Even during the 100-year flood event in the Salt-Gila Rivers, the river stage is not high [sic] even to preclude side drainage from the catch basins for a time period extending beyond 24 hours. Hence, storage of 24-hours of interior runoff should be adequate to prevent exceeding the catch basin design storage during the design flood, even if interior runoff is contemporaneous with the 100-year design river stage. Tailwater restrictions are discussed more thoroughly in the Hydraulic Appendix (Appendix A)."

WEST Note: From the Figure below (Fig A1-11 in the DDR), the depth of precipitation used is 2.0 inches. Chuck: a point of clarity would be nice if the LACOE explained that the interior drainage did not have an existing 100-year floodplain as a result of local drainage – this to stop any possible future questions about the return interval used for the interior drainage design. Is this stated anywhere in the DDR? Also, they should point out any design standards they used relative to location (I don't think they used a locally approved method), if this is what they did – how should we have them address this?

The DDR references the floodplain maps completed by WEST in the PED study for the 100-year flood event for without-project, with-levee only, and with-project conditions. From these maps, it is apparent that the only flooding source in the reach is the Salt and Gila Rivers, and no flooding sources or effective floodplains are present to the north of the study reach on the landward side of the levee that eventually drain into the Salt/Gila system (the only flooding sources to the north drain into the Agua Fria River). However, this is not explicitly stated anywhere in the DDR.

They also do not discuss any design standards they used relative to the location of the levee (ADWR, FCDMC, City of Phoenix, etc.).

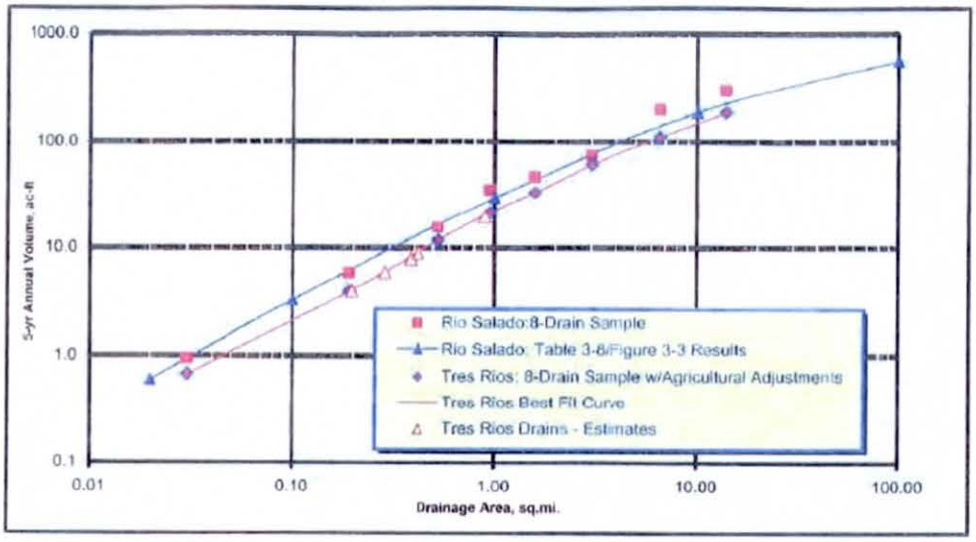

Figure A1-11. Tres Rios Interior Drainage: Runoff Volume: 2-In, 24-Hour Storm (5-year Annual Event, 1% Annual Chance, Jan - Mar Event).

From Paragraph 17 of the "Interior Runoff: Excess Precipitation" section (pages 353 and 354 of 568 in the DDR, pages 1-24 and 1-25 of the appendix)

"The catch basin geometry was established to enable storage of the entire 5-year, 24-hour interior-runoff volume, and result in free drainage after 24-hours. The river elevation associated with the 100-year, 1-day duration discharge (Table A1-6, 100,000 cfs) was used to design the catch basin near 99th Avenue (above the Gila River); for catch basins at 115th Avenue and Dysart Road, the 100-year, 1-day duration discharge was increased approximately 40% to allow for additional flow from the Gila River."

From Paragraphs 18 and 19 of the "Interior Runoff: Irrigation Return Flow" section (page 356 of 568 in the DDR, page 1-27 of the appendix)

"The result may be interior flooding from overflow of delivery canals and/or downstream tail water ditches."

"To offset any flooding induced by the Tres Rios Levee and Dysart Road, catch basins and collector channels will be located along land-side of the levee where tail water ditches formerly wasted water directly to the rivers. The collector channels include an allowance for the full capacity of each ditch (30 cfs per mile of field parallel to the levee), and the catch basins are sized to detain an additional volume of runoff from each tail water ditch resulting from a 1-hour duration flow at full capacity (2.5 ac-ft)."

From Paragraph 21 of the "Interior Runoff: Hydrologic Design" section (page 358 of 568 in the DDR, page 1-29 of the appendix)

"**All interior drainage collection features designed to prevent interior flooding during the levee design event will be sized to convey the 100-year peak local inflow.** In addition catch basins are included along the land-side of the levee to provide impoundment areas for interior runoff and to limit the number of levee penetrations. **Each catch basin will include a box culvert with hydraulic capacity to convey the peak 100-year inflow from the interior area to the Salt and Gila Rivers at approximately 3-feet of head. Each catch basin will be excavated to provide sufficient volume to store the entire 24-hour runoff volume anticipated to reach the levee during the 5-year, 24-hour storm.** The 5-year, 24-hour storm (2 inches of precipitation) has not been exceeded in approximately 100 station-years of record during the cold-weather months of January through March."

From Paragraph 22 of the "Interior Runoff: Hydrologic Design" section (page 359 of 568 in the DDR, page 1-30 of the appendix)

Table A1-7. Interior Drainage: Hydrologic estimates for Tres Rios collector channels

	East side of 91st Ave to the Salt River[1]	West side of 91st Ave to CB-1 to 99th Ave[2]	Inflow to CB-2 (115th Ave)[2]	Inflow to CB-3 (El Mirage Road)[2]	Inflow to CB-4 (Dysart Road)[2]
Drainage Area, sq mi	1.378	0.444	0.549	0.528	0.162
100-yr Peak Discharge, cfs	620	320	380	365	175

Notes: data (peak estimates) based upon Figure A1-10. In addition, inflow to each catch basin has been increased to reflect agricultural waste water or offsite water delivered from drains: 30 $ft^3/s/mi.$ of field length measure parallel to levee

[1] Contributing drainage area and peak inflow based upon diversion of all interior runoff east of 91st Ave directly to the Salt River u/s of the project levee

[2] Contributing drainage areas for catch basins based upon flow paths presented in the Master Drainage Plan for the Durango area (prepared by Dibble & Associates Consulting Engineers) and verified by on-site visits.

Chuck: Does the above mentioned Figure A1-10 show the sub-basin boundaries? If not it would be best for the LACOE to provide one. Please make a comment.

Figure A1-10 (page 353 of 568 in the DDR) has been included below. This figure is a regression plot of drainage area versus peak flow, not a map showing the sub-basin boundaries. The only map provided in the interior drainage report appendix was Plate A1-1 (page 365 of 568 in the DDR), which is copied below. This is a schematic of urban drainage pathways draining to the landward side of the levee, but the detailed, delineated sub-basins are not provided in this figure either. WEST assumes this figure can be found in the Durango ADMP study report.

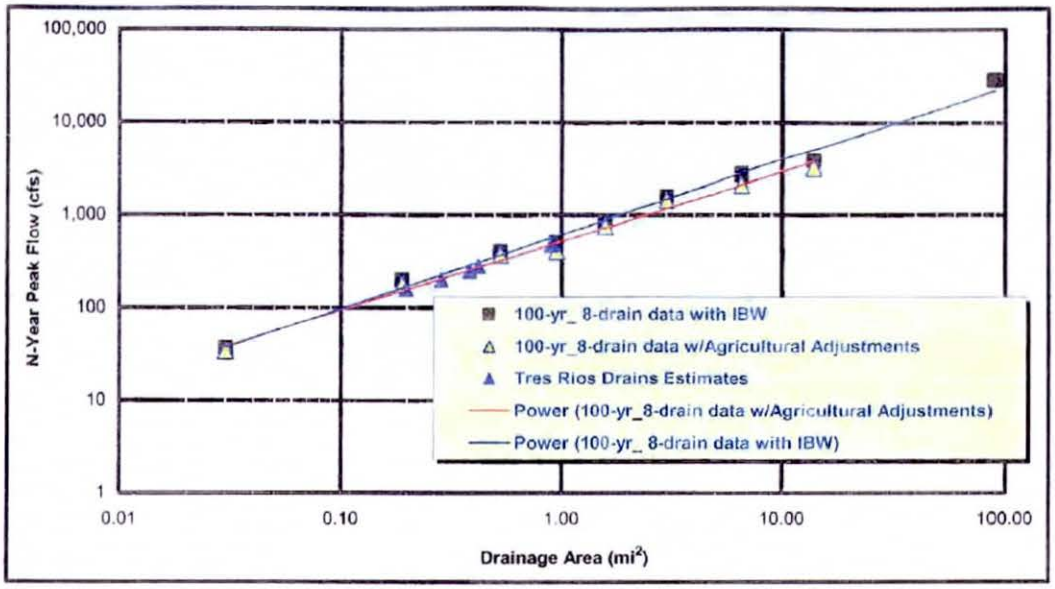

Figure A1-10. Tres Rios Interior Drainage: 100-Year Peak Discharge versus Drainage Area, 8-Drain Urban Sample, Adjusted to Reflect Agricultural Drainage Areas.

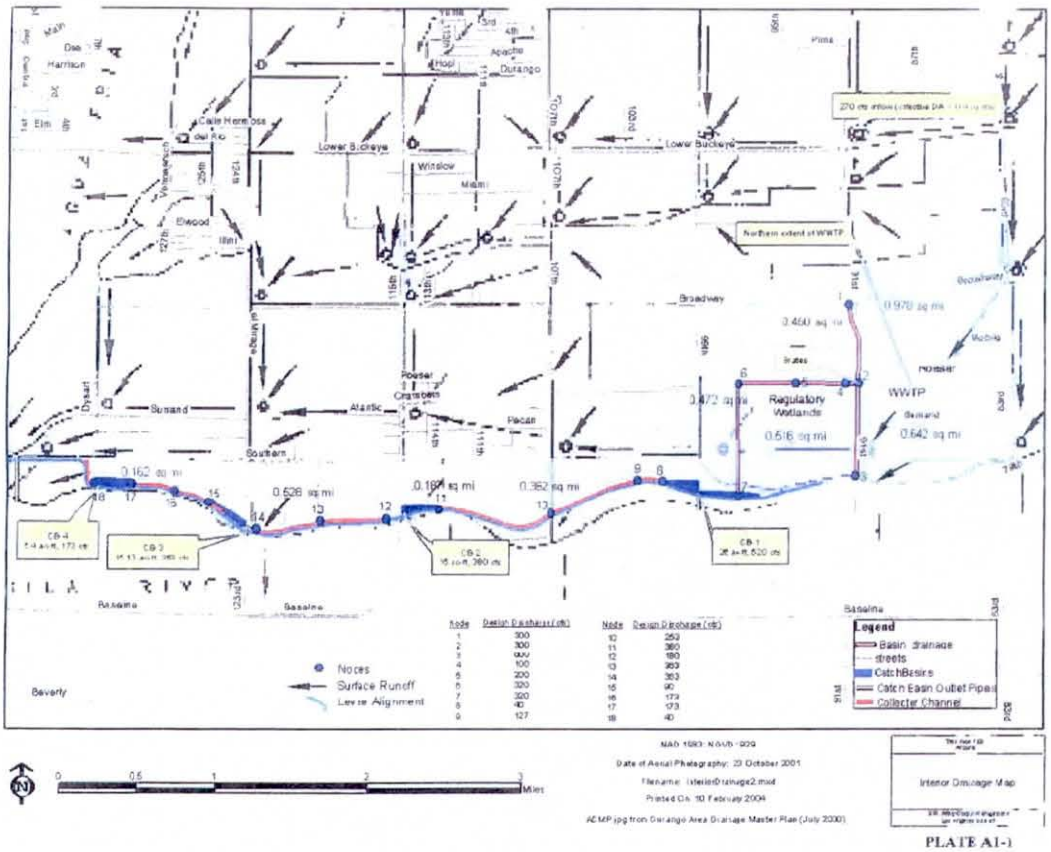
Lower Buckeye
Winslow
Miami
Elwood
Broadway
Northern extent of WWTP
0.970 sq mi
0.460 sq mi
Regulatory Wetlands
WWTP
0.642 sq mi
0.516 sq mi
Bussard
Atlantic
Pecan
Southern
0.162 sq mi
0.628 sq mi
0.362 sq mi
CB-4
CB-3
CB-2
CB-1
Baseline
Beverly
Nodes
Surface Runoff
Levee Alignment
Legend
Basin drainage
streets
CatchBasins
Catch Basin Outlet Pipes
Collector Channel
Miles
Interior Drainage Map

PLATE A1-1

COMMENTS ON THE 90% DDR INTERIOR DRAINAGE DESIGN TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY TRES RIOS LOMR PROJECT

Date: November 11, 2010

To: Richard Harris – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

The following comments were made based on the 90% Draft Design Documentation Report (DDR) for the Tres Rios Flood Control North Levee provided by the Los Angeles District of the U.S. Army Corps of Engineers (LACOE). The page number of the DDR and the corresponding page number printed at the bottom of the page are provided for each comment for reference.

Comment #1: On the first title page of the document, "County" is misspelled.

Comment #2: In Section 1.11, Subsection a. (i). [page 19 of 568 in the DDR, page number 12 of the report], the DDR states that "…The U.S Army Corps of Engineers has conducted a detailed study of the interior drainage."

In Section 2.4 [page 21 of 568 in the DDR, page number 14 of the report], the DDR states that "A detailed interior drainage study was not completed."

This discrepancy should be corrected.

Comment #3: The numbering of some of the appendices is confusing. For example, Appendix B [page 280 of 568 in the DDR] references five appendices which are listed in the List of Appendices on page iii of Appendix B [page 282 of 568 in the DDR]. However, each of these appendices is labeled A1, A2, etc. These should be relabeled B1, B2, etc.

Similarly, Appendix C contains two sub-appendices, currently labeled A and B. These should be labeled C1 and C2 for clarity.

Comment #4: The following statement was taken from Paragraph 6 of sub-appendix A1 (interior drainage design) of Appendix B [page 332 of 568 in the DDR, page 1-3 of the appendix]. Emphasis in the text has been added.

"The draft report for the Durango area [the Master Drainage Plan for the Durango Area prepared by Dibble and Associates Consulting Engineers] (flow paths and contributing drainage areas) provided by FCDMC was then used to estimate peak discharges from the interior area along the line-of-protection as well as volumetric data. The procedure followed was one developed by the LAD for the Rio Salado Interior Drainage study, and was considered applicable to this area as well because of similar meteorology and topography. **Note: peak discharge and volume relationships for the Rio Salado Interior Drainage study were developed from an 8-drain sample of urbanized drainage areas in the Phoenix vicinity.** As a consequence, the peak flow rates and volumes estimated using the relationships developed from this data overstate runoff from the existing, mostly agricultural areas. **As a consequence, the rainfall-runoff modeling procedure for the 8-drain study was modified to represent rural/agricultural drainage rather than urban drainage by adjusting the loss rates. Regression curves for estimation of peak flow rates and 24-hour flood volumes, developed for the Rio Salado Study, were likewise modified to reflect the rural/agricultural makeup of the contributing areas.** These modified regression curves were then utilized to make interior runoff estimates for the Tres Rios Project levee design."

Comment 4-1: The DDR should present a reference for the Rio Salado Interior Drainage study that is referenced in this section of the text. This reference was not found in the DDR. Was this a standalone report, or was this a part of another report?

Comment 4-2: Brief discussions should be presented of (i) the fundamentals of the "8-drain sample" method for determining peak flows and volumes for the Rio Salado interior drainage area and (ii) the modification of this method for greater agricultural land use in the Tres Rios interior drainage area compared to the Rio Salado interior drainage area.

Comment 4-3: A brief discussion of the modification of the regression curves should be included as well. Were these regression curves generated from the output of the "8-drain sample" method?

Comment #5: The catch basin interior drainage features were sized based on the 5-year, 24-hour precipitation depth of 2.0 inches. Paragraph 17 of the "Interior Runoff: Excess Precipitation" section of the interior drainage sub-appendix A1 of Appendix B [pages 353 and 354 of 568 in the DDR, pages 1-24 and 1-25 of the appendix] states that "The catch basin geometry was established to enable storage of the entire 5-year, 24-hour interior-runoff volume, and result in free drainage after 24-hours."

The local standard (Flood Control District of Maricopa County and City of Phoenix) for detention/retention basins is storage of the 100-yr, 2-hr storm. For comparison, the NOAA Atlas 14 data for the site estimates a depth of 2.73 inches for the 100-yr, 2-hour storm. The DDR should address why a local standard was not considered in the design of these basins.

Comment #6: The reviewers could not identify any discussion in the interior drainage study appendix regarding existing 100-year floodplains as the result of local drainage, probably because no local flooding sources that are mapped by FEMA or regulated by FCDMC are present on the landward side of the levee. However, this should be stated explicitly in the DDR.

Comment #7: Plate A1-1 [pages 365 and 366 of 568 in the DDR] does not show the actual basin boundaries and drainage areas of the hydrologic analysis for the Master Drainage Plan for the Durango Area prepared by Dibble and Associates Consulting Engineers. The figure from the report for the Master Drainage Plan for the Durango Area showing the entire interior drainage area should be included in the DDR.

Comment #8: Paragraph 14 of Appendix B [page 287 of 568 in the DDR, page 3 of the appendix] states that "Least Damage Levee Overtopping Location: The most feasible location would be downstream of the existing mining pit located along the north bank downstream from the 116th Avenue Bridge (River Mile 197.87 through 198.08). At these locations, the levee height was reduced to a level so flows in excess of the 100-year flow could inundate the floodplain on the north bank. This location is preliminary but will be finalized in the next project phase."

The river miles that are mentioned in the DDR are actually just downstream of the 123rd Avenue Bridge, not the 116th Avenue Bridge. The least damage levee overtopping location as it was designed in the PED report was downstream of the 123rd Ave Bridge (between the river miles that are mentioned in the DDR) in a portion of the original planned levee alignment that was never constructed.

The AS-BUILT drawings show less freeboard (approximately 2.5' instead of the 3.0' of freeboard everywhere else) for a section of the levee downstream of the 116th Avenue Bridge. However, the top of levee elevations in this section of the levee match the top of levee elevations from the PED report which were designed with 3.0' of freeboard in this reach. Therefore, the water surface elevations in this portion of the AS-BUILT drawings are shown on the plans approximately 0.5' higher than the water surface elevations calculated in the PED report. There had to have been additional hydraulic analysis done in house by the LACOE or by another AE firm to determine the changes of the new levee alignment on the water surface profile, and that may have bumped up the water surface elevations in this reach by half a foot. However, the design of the levee apparently did not change after this additional hydraulic analysis, since this still matches the PED report very closely.

The following issues should be addressed in the DDR: (1) the location of the correct river miles for the final constructed least damage levee overtopping location and (2) the reason for lower freeboard (i.e., 2.5 feet instead of 3.0 feet) between approximately levee stations 150+40 and 115+40 downstream of 116th Avenue.

WEST ACTION ITEMS FROM THE 11/09 CONFERENCE CALL
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: November 15, 2010

To: Richard Harris – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

From Richard's meeting minutes on the conference call held on November 9, 2010, between LACOE, the District, and WEST, one action item was developed for WEST to complete. This action item has been copied from the meeting minutes below.

> *Which study includes the Rio Salado Interior Drainage Study?*
>
> *An aside conversation with Chuck led to him being assigned to investigate the above study for documentation in our library, and Don later said that there may be documentation in the local LACOE office.*

WEST investigated the reports on the following page from the District's library. Findings of this search are summarized below.

- The Durango ADMP (Dibble and Associates) assessed hydrology in the drainage area on the landward side of the levee using HEC-1 only. No mention of outlet drains in the development of urban runoff regression equations was made in this study.
- The draft report for the Rio Salado Drainage Master Plan (Wood, Patel and Associates) does not develop these regressions either.

#	Call Number	Title	Author	ID	Date
1	A565.901S	Durango Area Drainage Master Plan, Data Collection Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for FCD	FCD 99-41	2000
2	A565.902S	Durango Area Drainage Master Plan, Alternatives Analysis Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for FCD	FCD 99-41	2001
3	A565.601S	Durango Area Drainage Master Plan, Recommended Design Report (ADMP)	Dibble and Assoc. in Cooperation with McCloskey Peltz, Inc. and SWCA Environmental Consult., Inc. for FCD	FCD 99-41	2002
4	CDA565.3	Durango Area Drainage Master Plan, Hydrology Report, Revised April, 2003 (ADMP)	Dibble and Assoc. for FCD	FCD 99-41	2001
5	A124.301S	Rio Salado Drainage Master Plan, Draft (DMP)	Wood, Patel and Assoc., Inc. for Rio Salado Project and City of Tempe	WP# 97644	1997

USACE TOPOGRAPHY CERTIFICATION
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: December 9, 2010

To: Richard Harris – FCDMC

Cc: Amir Motamedi – FCDMC
Don Rerick – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to evaluate whether the 1-foot topography collected by Towill Survey, Mapping and GIS Services (Towill) on behalf of the US Army Corps of Engineers (USACE) is certifiable. WEST reviewed the Towill's *Field Survey Record Data, Notes, and Calculations* report for the Tres Rios Project to determine if the survey is certifiable to FEMA standards. Towill's report consists of the following sections:

- Project location map
- Survey report
- Coordinate spreadsheets
- Record control
- Level GPS control
- Description of horizontal control station
- Bridge notes and photos

Because the topography collected by Towill in the Tres Rios area was for a USACE project, Towill followed USACE standards for topographic mapping (i.e., EM 1110-1-1000, *Photogrammetric Mapping*). It appears that Towill did follow appropriate standards based on the following statement taken from their Survey Report section:

> *"The results of the final least squares adjustment of the horizontal and vertical control networks were analyzed and approved by the Project Manager (Jim Kor of Towill) prior to commencement of photogrammetric work. The results were suitable for digital topographic mapping and digital terrain modeling (DTM) using photogrammetric techniques, for the map scale and contour interval requested."*

Based on the information given in Towill's report, the topography appears to meet FEMA standards; however, there is no backup information to support this claim:

- The report is not sealed by a licensed RLS, which is common for USACE projects.
- The RMSE values are not reported.
- The metadata for the survey information has not been located.

From WEST's experience in these matters, it appears that the Towill topography will pass as certified; however, there is no guarantee. At this point, there appears to be two ways to rectify the survey certification situation:

- USACE requests that Towill provide RMSE values for the survey.
- Discuss the survey certification with FEMA Regional IX Engineer (Ed Curtis) to get his approval of the topography before the LOMR is submitted.

From:	Chuck Davis
To:	Richard Harris - FCDX; Crisostomo, Van G SPL
Cc:	Brian Wahlin
Subject:	Comments on HNTB model
Date:	Thursday, January 20, 2011 6:41:00 PM

Richard and Van,

Please find our initial review comments regarding the HNTB model deliverable below.

(1) HNTB suggests lowering the Manning's roughness coefficients for the cottonwood areas along the edge of the channel from 0.07 to 0.04 for 100-year flows. They indicate that this is based on engineering judgment and that JE Fuller's roughness coefficients for cottonwood stands are conservative. We would add that it should be noted that at no cross section of the revised HEC-RAS model does the cottonwood land-use designation make up a large majority of the active flow width. When calculating water surface elevations, HEC-RAS utilizes a conveyance-weighted Manning's n value for the cross section. Changing portions of a cross sections' Manning's roughness coefficients will have a minimal impact on the overall average roughness coefficients, especially when most of the cottonwood stand land-use designations are along the channel edges which will be weighted less heavily in the overall average roughness calculations than the coefficients in the deep portion of the channel near the thalweg using a conveyance-weighted approach. WEST suggests that lowering the Manning's n for small areas of particular cross sections is defensible based on engineering judgment. However, they make this change for only a small number of cross sections in the revised model. FEMA will review roughness values for the entire RAS model submitted for the LOMR, and this change in roughness coefficients should be applied consistently throughout the model.

(2) JE Fuller included two (2) of the dikes along the toe of the levee in their model (XS 199.06 and XS 198.8) by changing the ground points in the geometry to reflect these dikes. HNTB added 5 additional dikes into the revised model using the "blocked obstruction" feature of HEC-RAS. FEMA will question the inconsistency of these approaches for similar structures. Additionally, the two dikes added by Fuller appear to be of approximately similar size to the five dikes added by HNTB from the aerial photos, but the two dikes added by Fuller are significantly larger (wider and taller) than the other five in the HEC-RAS

geometry. Is this difference in sizes for the dikes correct?

(3) HNTB suggests moving the levee alignment in the JE Fuller HEC-RAS model further away from the river alignment based on as-built drawings and ground points, which were reflected in the LACOE HEC-RAS geometry file titled TresRiosCLOMR.g04. WEST agrees with this change to reflect the as-built conditions of the levee, and WEST agrees with the current alignment of the levee in the HEC-RAS model. However, based on a comparison of the original WEST PED "with levee" model and the revised HNTB model, attachment 2 of the HNTB technical memorandum appears to be incorrect. For example, at cross section 198.88, the levee alignment in the HNTB revised model is located at station 5,449.11. In the original WEST PED "with levee" model, the levee alignment is located at station 5,456.00, a difference of 6.89 feet (in the direction further away from the channel thalweg). However, the figure shows approximately 75 feet between the two levee alignments at this cross section. Attachment 2 should be updated.

(4) The HNTB technical memorandum along with the JE Fuller report identify this model as the pre-project conditions for the Tres Rios Phase 3 project, implying that all components of Phases 1 and 2 were included in this model based on topography provided by LACOE. After speaking with Van on 1/6/11, Brian determined that the grading for the OBW features were included in the topography provided by LACOE. No in-channel vegetation clearing, plantings, or low-flow channel alignments were included in this model. Were all of those clearing, planting, and in-channel grading components a part of Phase 3? There has been some confusion regarding this with the City of Phoenix and the District. WEST recommends clarifying that only those components associated with OBW were included in this model.

(5) The embankment for the OBW upstream of the levee alignment (XS 200.52 and upstream) have been modeled with a "levee" feature in the HEC-RAS geometry. Is the LACOE planning to certify the embankment containing the OBW upstream of the Phase 1A levee as a levee? If not, this may need to be modeled as an ineffective flow area only and then mapped appropriately. Certifying a levee in a RAS model using the "levee" feature in the geometry editor and using the "levee" feature for other flow containment uses may raise questions in the FEMA review.

If you have any questions about any of this information before the phone call on Tuesday, please let us know.

Best,

Chuck Davis, CFM

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USACE PRE-PROJECT CONDITIONS HEC-RAS MODEL
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: February 8, 2011

To: Richard Harris – FCDMC

Cc: Amir Motamedi – FCDMC
Don Rerick – FCDMC
Van Crisostomo – LACOE

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to provide review comments on the HEC-RAS model delivered by HNTB to the US Army Corps of Engineers, Los Angeles District (LACOE). A summary technical memorandum, titled "Revised Draft Tres Rios Phase 3 Pre-Project Hydraulic Analysis Review," was also delivered to LACOE by HNTB accompanying the revised HEC-RAS model, and the HNTB technical memorandum is reviewed herein as well. The objective of this review is to improve the HEC-RAS model with particular emphasis on issues that would enhance the likelihood of a successful LOMR application submittal based on the modeling product and WEST's familiarity with FEMA's review process.

The following sections of this technical memorandum provide comments on the HNTB technical memorandum, comments on the HNTB HEC-RAS model, and a summary of items to address resulting from these review comments.

COMMENTS ON THE HNTB TECHNICAL MEMORANDUM

HNTB summarized their task order for the HEC-RAS modeling revisions in the first paragraph of the technical memorandum as follows:

> *This memorandum summarizes a review of the HEC-RAS hydraulic modeling documented in the "Tres Rios Phase 3 Environmental Restoration Project Design Documentation Report - Hydraulic Analysis Appendix" completed by JE Fuller May 2010. The 100-year water surface profiles generated by the Fuller models were determined to differ from those generated by the 2004 USACE analysis used to design the*

Phase 1 and Phase 2 Tres Rios project features. The intent of this review is to evaluate the source of discrepancies between the two models and to determine whether model assumptions might reasonably be adjusted to develop a design model for the Tres Rios Phase 3 project that is consistent with the previous USACE modeling.

The Tres Rios project has been divided into several phases of implementation. Phase 1 includes the levee and associated features (i.e., dikes for erosion protection); Phase 2 includes the flow regulating and overbank wetlands features (OBW), pump station, and piping system; and Phase 3 includes construction of conveyance channels, open water marsh, and riparian corridors with planting of native plant species.

To assess the effects of the Phase 3 restoration efforts on the Salt and Gila River System from the approximate 107th Avenue alignment to approximately one-half mile upstream of the Agua Fria River confluence, JE Fuller performed a hydraulic analysis of the system for the existing conditions prior to implementation of the Phase 3 environmental restoration and for the proposed conditions after the construction of the Phase 3 features. This hydraulic analysis was completed by modifying an existing HEC-RAS model of the system provided by the LACOE. The existing HEC-RAS model was developed by WEST Consultants as part of the PED study completed for the LACOE in 2003 (WEST, 2003). This information was alluded to in the HNTB technical memorandum.

However, the HNTB technical memorandum indicates that the model includes all of the features from Phases 1 and 2 in the modeling effort. As stated on page 2 of the HNTB technical memorandum, "The model of interest represents the condition that includes the features from both Phase 1 and Phase 2; this is referred to as the Pre-Project condition for the Tres Rios Phase 3 project." Currently, the OBW area has been graded to the final design specifications, but the plantings and wetlands have not been fully completed. For the LOMR application, the model should reflect only the current conditions in the field. To clarify this, WEST personnel contacted Van Crisostomo of the LACOE on 1/6/2011. Van provided a PDF copy of the JE Fuller (JEF) report from May 2010, which states the following: "Wetland ponds reflected in the pre-project hydraulic model cross-sections are based on the topography provided to JEF by the USACE." Van confirmed that this topography is based on the current conditions of the grading for the OBW. This text should be clarified in the HNTB report in order to assure FEMA reviewers that the model reflects the current conditions at the time of LOMR submittal. Also, HNTB should confirm that this geometry reflects the final as-built conditions of the wetland ponds and not an intermediate as-built condition or design drawing topography.

The remainder of the technical memorandum submitted by HNTB addresses HNTB's revisions to the HEC-RAS model delivered by JE Fuller. Although most of the length of the reach modeled by JE Fuller showed lower water surface elevations than the WEST PED "with levee" model, small portions of the model displayed higher water surface elevations than the PED "with levee" model, including a portion of the Lower Gila River from station 198.49 to 199.31, and a portion of the Salt River from station 199.55 to 202.94. As stated in the HNTB technical memorandum, the changes that contributed to higher modeled water surface profiles in these segments include the following:

1. The modeled north bank levee location was shifted riverward from Station 198.4 to 198.49 and to lesser degree from Station 198.54 to 199.11.

2. Roughness values were increased and reassigned to have vertical variation as a function to discharge.

3. Horizontal roughness variation was revised based on updated land cover information.

Since the levee design and freeboard calculations were based on the "with levee" water surface profile from the PED HEC-RAS model, higher water surface elevations in some areas along the levee alignment would create design discrepancies in the amount of freeboard available. Therefore, HNTB discusses the three major revisions made by JE Fuller to the WEST PED model and whether or not these model assumptions could be reasonably adjusted to agree with previous water surface profiles (i.e., the WEST PED model). Review comments for these adjustments are provided below.

First, HNTB suggests moving the levee alignment in the JE Fuller HEC-RAS model further away from the river alignment based on as-built drawings and ground points, which were reflected in the LACOE HEC-RAS geometry file titled *TresRiosCLOMR.g04*. WEST agrees with this change to reflect the as-built conditions of the levee. However, based on a comparison of the original WEST PED "with levee" model and the revised HNTB model, Attachment 2 (i.e., Figure 2) of the HNTB technical memorandum appears to be incorrect. For example, at cross section 198.88, the levee alignment in the HNTB revised model is located at station 5,449.11. In the original WEST PED "with levee" model, the levee alignment is located at station 5,456.00, a difference of 6.89 feet (the WEST PED levee was further away from the channel thalweg). However, the figure shows approximately 75 feet between the two levee alignments at this cross section. Attachment 2 should be updated.

Second, HNTB suggests lowering the Manning's roughness coefficients for the cottonwood areas along the edge of the channel from 0.07 to 0.04 for 100-year flows. They indicate that this is based on engineering judgment and that JE Fuller's roughness coefficients for cottonwood stands are conservative. In addition, it should be noted that at no cross section of the HEC-RAS model that was revised to reflect this roughness change does the cottonwood land-use designation make up a large majority of the active flow width. When calculating water surface elevations, HEC-RAS utilizes a conveyance-weighted Manning's n value for the channel, right overbank, and left overbank areas. Changing relatively small portions (e.g., < 10% of the total flow width) of a cross sections' Manning's roughness coefficients will have a minimal impact on the overall average roughness coefficients, especially when most of the cottonwood stand land-use designations are along the channel edges which will be weighted less heavily in the overall average roughness calculations than the coefficients in the deep portion of the channel near the thalweg using a conveyance-weighted approach. WEST suggests that lowering the Manning's n value for small areas of particular cross sections is defensible based on engineering judgment; however, this should be applied consistently throughout the model, which is not currently the case. HNTB has currently only changed the Manning's roughness values for cottonwood stands in the vicinity of the cross sections that had higher water surface elevations compared to the PED model.

The last change that HNTB makes to the HEC-RAS model was not completed to alleviate discrepancies in the water surface elevations between the JE Fuller model and the WEST PED model (only the roughness coefficients and levee locations were changed for this purpose), but to reflect the current conditions of the topography of the system in the HEC-RAS model as

requested by LACOE. HNTB added five (5) guide dikes constructed at the toe of the levee to the HEC-RAS geometry that were not represented in the JE Fuller model. WEST agrees that these guide dikes should be reflected in the final HEC-RAS model. However, JE Fuller had previously incorporated two guide dikes that were built at the toe of the levee into the geometry by changing the ground points of the geometry file of the HEC-RAS model. On the other hand, HNTB added the additional five guide dike structures into the model using the "blocked obstruction" feature of the HEC-RAS geometry data editor. FEMA will want to see consistency in the modeling method utilized to represent these guide dikes.

COMMENTS ON THE HNTB HEC-RAS MODEL

Based on review of the HEC-RAS model itself, four additional comments are provided below that were not mentioned in the technical memorandum provided by HNTB.

1) The levee alignment was modified by HNTB to reflect the current levee alignment in the HEC-RAS model. However, the "levee" feature of the HEC-RAS geometric data editor was used upstream and downstream of the actual Tres Rios North Levee alignment along the north bank of the river and in various locations along the south bank of the river to block areas of these cross sections that would not convey flow. However, FEMA will not allow the use of the "levee" feature of the HEC-RAS geometric data editor to represent anything other than the levee itself, especially in a LOMR to approve a certified levee. Also, the fact that the embankment for the OBW upstream of the levee alignment (XS 200.6 and upstream) has been modeled with a "levee" feature in the HEC-RAS geometry and removes a portion of the effective floodplain from the final mapping product will be scrutinized by FEMA since this embankment will not be certified as a levee by LACOE.

To remedy this issue, the levees placed in cross sections upstream and downstream of the actual Tres Rios North Levee alignment on the north bank and anywhere along the south bank should be replaced with ineffective flow areas. Note: WEST realizes that this will not make a difference in the hydraulic modeling results. The LACOE has utilized an acceptable modeling technique to remove areas of non-conveyance. However, FEMA is very specific in their review process that ineffective flow areas must be used instead of levee features.

2) All seven of these guide dike structures appear to be approximately the same size based on recent aerial photography; however, the two included in the geometry by JE Fuller using ground points appear to be much larger than the five included in the geometry by HNTB using blocked obstructions. The sizes of these dikes should be verified in the geometry data.

3) There is still some confusion as to whether or not the levee and overbank wetlands features of the Tres Rios project have been represented in the HEC-RAS geometry data based on design drawings or as-built information. The following statement was taken directly from the JE Fuller report:

> *The levee horizontal alignment is reflected in the pre-project HEC-RAS cross-sections, but the levee geometry within the model is assumed. As-built top-of-levee information*

was not readily available and is not truly reflected in the pre-project HEC-RAS model; levee containment was assumed.

This statement seems to indicate that the geometry data for the levee alignment and elevation is assumed based on design drawings, and this would lead one to conclude that the overbank wetlands features were probably included in the JE Fuller model using design drawings as well. However, the following statement was taken from the HNTB Technical Memorandum dated December 23, 2010:

USACE-SPL provided HNTB with a HEC-RAS geometry file (TresRiosCLOMR.g04) which updates the representation of the north levee using as-built information and actual ground points.

This statement implies that there was an additional intermediate geometry file created by LACOE in between the JE Fuller model and the HNTB model that possibly included the as-built information for the levee alignment, levee elevations, and overbank wetlands features.

The topography source for the final post-project conditions model should be verified to ensure that final as-built information was used to build the HEC-RAS geometry file.

4) Based on the current post-project conditions HEC-RAS modeling results, a large portion of the floodplain on the south bank between the 115th Avenue Bridge and El Mirage Road near the Phoenix International Raceway (PIR) would be removed from the floodplain by a roadway embankment when compared to the effective floodplain. This may be pointed out by FEMA during the review process due to the fact that such a large portion of the floodplain and a small section of the floodway (approximately 50' wide by 3,000' long) would be removed compared to the effective floodplain and floodway mapping. However, removing this area from the floodplain would be defensible because of (a) the lowered water surface elevations in this portion of the channel compared to the effective model and (b) the updated accuracy of the 1' topography compared to the 4' topography.

Once again, it should be noted that the Tres Rios North Levee was modeled correctly for the required design considerations of a levee. In a model used for levee design, the maximum encroachment should be utilized on the opposite bank of the levee to ensure that the maximum water surface elevation is calculated correctly to complete freeboard computations. Therefore, the LACOE utilized the correct modeling technique for levee design. However, the goal of the FEMA review process is to determine the maximum horizontal flooding extents, the antithesis of the LACOE's modeling purpose. This requires that embankments such as the 115th Avenue roadway embankment be removed from the model. This example highlights the variations of hydraulic modeling techniques required for different applications, such as levee design, river restoration, and floodplain mapping.

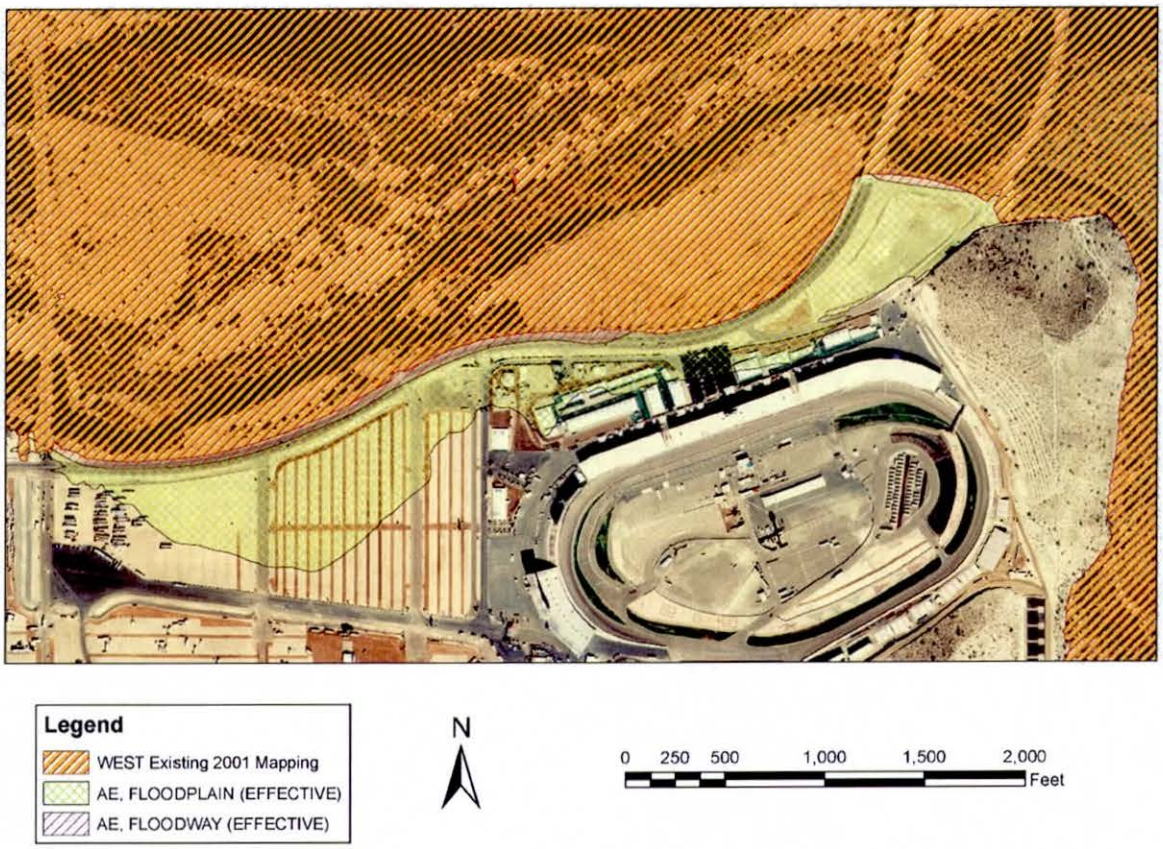


Figure 1. Floodplain mapping near PIR

REFERENCES

WEST Consultants, Inc., 2003, Preconstruction Engineering and Design (PED) Hydraulic Design of Tres Rios North Levee, Prepared for U.S. Army Corps of Engineers, Los Angeles District.

REMAINING TASKS FOR THE TRES RIOS HYDRAULIC MODELING EFFORT IN SUPPORT OF A LOMR APPLICATION
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: February 11, 2011

To: Richard Harris – FCDMC

Cc: Amir Motamedi – FCDMC
Don Rerick – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to provide a summary list of remaining task items to be completed for the hydraulic modeling package to be submitted to FEMA in support of a LOMR application for the Tres Rios North Levee project. The explanation of the hydraulic modeling products yet to be completed provided herein is based on the District's current understanding of the hydraulic modeling materials either currently available or being developed by the US Army Corps of Engineers, Los Angeles District (LACOE).

HEC-RAS HYDRAULIC MODELING PRODUCTS

Currently, there are four HEC-RAS models that have not been fully completed by the LACOE. FEMA will require these models for the LOMR application, and these models are identified and discussed in the list below.

Model 1 – Duplicate Effective Model

The MT-2 instruction form defines a duplicate effective model as "a copy of the hydraulic analysis used in the effective FIS, referred to as the effective model." The MT-2 instruction form further states the following:

> *"The effective model should be obtained and then reproduced on the requester's equipment to produce the duplicate effective model. This is required to ensure that the effective model's input data has been transferred correctly to the requester's equipment*

and to ensure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach."

The effective model for this portion of the Salt-Lower Gila river system was developed by Michael Baker for the original FIS study generated through District contract FCD 92-01. This model was completed using HEC-RAS version 2.1.

FEMA will require that the geometry and flow files used in the effective model be copied into a hydraulic model using the version of HEC-RAS being used for the project conditions analysis (i.e., HEC-RAS version 4.1). After copying the geometry and flow files into the updated version of HEC-RAS, modifications to the geometry may be required to duplicate the hydraulics and water surface elevations of the original model HEC-RAS version 2.1. These changes are based on differences in the algorithms that HEC-RAS employs to calculate certain parameters (e.g., composite hydraulic roughness within a channel) from older versions of HEC-RAS to newer versions. If there are significant differences in the effective model water surface profile and the duplicate effective model water surface profile, these changes in the algorithms of HEC-RAS could possibly cause some of the differences. Also, bridges typically have to be closely checked to make sure the bridge deck, piers, and abutment information is entered correctly. For example, in HEC-RAS version 2.1, the downstream reach length from the upstream bounding bridge cross section to the face of the bridge was allowed to be 0 feet (i.e., the cross section coincided with the face of the bridge). In HEC-RAS version 4.1, this value has to be greater than 0. These changes would require updates to the duplicate effective model in order for HEC-RAS to run properly. Any changes required to the geometry file to duplicate the hydraulics of the effective model will have to be discussed in the text of the TDN for LOMR submittal.

Finally, the study reach was split between 4 HEC-RAS models for the effective study completed for FCDMC (Reach2.prj, R2wlevee.prj, Reach3.prj, and R3wlevee.prj); duplicate effective models will have to be created for all 4 of these models.

Additionally, the encroachment analysis of the effective model will have to be repeated exactly using HEC-RAS version 4.1. If the surcharge at any location is greater than 1.0 foot using the new version of HEC-RAS, the encroachment analysis will have to be modified to prevent this, and any changes required to the encroachment analysis of the effective model will have to be discussed in the LOMR submittal.

Task items remaining:

- Recreate the effective model in HEC-RAS version 4.1.
- Recreate the effective floodway encroachment analysis in HEC-RAS version 4.1.
- Review the effective model for any obvious data entry errors in structures or erroneous hydraulic parameters.

Model 2 – Corrected Effective Model

The MT-2 instruction form defines a corrected effective model as "the model that corrects any errors that occur in the Duplicate Effective Model, adds any additional cross sections to the Duplicate Effective Model, or incorporates more detailed topographic information than that used in the current effective model." Based on the MT-2 instruction form, the corrected effective model cannot reflect any man-made physical changes since the effective model topography was developed (e.g., Tres Rios North Levee construction, Tres Rios overbank wetlands (OBW), sand and gravel mining pit changes, roadway embankment construction, etc.). The cross section alignments for the corrected effective model should be similar to the effective and duplicate effective models.

It should be noted that the corrected effective model is only necessary if (a) obvious errors are noted in the effective model and/or (b) there are significant differences between the duplicate effective model and the pre-project conditions model not attributable to changes in topography (e.g., tie-ins for matching water surface elevations between the duplicate effective model and the pre-project conditions model cannot be successfully developed with a reasonable distance upstream or downstream of the project location where the topography is similar to the original 2001 topography). If no errors are noted or if significant differences do not occur between the pre-project conditions and the duplicate effective model water surface elevations, the corrected effective model may not be required.

The primary variations in the hydraulic conditions other than man-made changes in the reach that can cause these types differences are typically the changes to roughness parameters that occur between the development of the effective model and the pre-project conditions model. Some of the additional errors that are commonly addressed in the corrected effective model include structure data, ineffective flow areas, and other parameters which appeared to be outdated or otherwise incorrect in the effective model based on natural changes to the channel.

Additionally, an encroachment analysis similar to the duplicate effective model will have to be performed and compared to the effective model for differences. If the surcharge at any location is greater than 1.0 foot using the corrected effective geometry, the encroachment analysis will have to be modified to prevent this, and any changes required to the encroachment analysis of the duplicate effective model will have to be discussed in the LOMR submittal.

Task items remaining:

- Determine if a corrected effective model is required based on (a) obvious errors noted in the effective model and/or (b) significant differences between the duplicate effective model and the pre-project conditions model not attributable to changes in topography. If these errors in the effective model or significant differences in water surface elevations between the duplicate effective model and the pre-project conditions model are not found, the corrected effective model may not be necessary.

- If the corrected effective model is deemed necessary, identify the geo-referenced alignments of the effective model cross sections for comparison with the alignments of the pre- and post-project conditions models (the latter two have the same cross section alignment).

- If the corrected effective model is deemed necessary, update the duplicate effective model cross sections based on their original alignment with the 1-foot 2001 topography in the channel merged with the 4-foot topography used for the effective model development in the overbank areas and any major natural changes to the channel. The roughness values of this model should match the roughness values used in the pre-project conditions model.

Model 3 – Pre-project Conditions Model

The MT-2 instruction form states the following regarding a pre-project conditions model:

> *"The Duplicate Effective Model or Corrected Effective Model is modified to produce the Existing or Pre-Project Conditions Model to reflect any modifications that have occurred within the floodplain since the date of the Effective Model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective Model or Duplicate Effective Model. The existing or pre-project model may be required to support conclusions about the actual impacts of the project associated with the revised or post-project model or to establish more up-to-date models on which to base the revised or post-project conditions model."*

WEST created a new cross section alignment for the pre-project conditions model in the PED model development. Therefore, the pre-project conditions model will vary from the corrected effective and duplicate effective model alignments. However, the cross sectional alignments for the pre-project conditions model appear to cross the thalweg of the channel near the intersection of the original effective model cross sections and the thalweg of the channel; if these locations are close, then the final post-project conditions model may be able to maintain the same lettering scheme as the original FIS study in the effective model.

Issues such as the roadway embankment (i.e., Phoenix International Raceway embankment) on the left (south) bank of the river opposite the Tres Rios North Levee between the 115th Avenue Bridge and El Mirage Road will need to be addressed in this model and discussed in the LOMR submittal. There is a large portion of the floodplain on the south bank in this area that could be removed from the floodplain by the Phoenix International Raceway (PIR) embankment. This may be pointed out by FEMA during the review process due to the fact that such a large portion of the floodplain and a small section of the floodway (approximately 50' wide by 3,000' long) could be removed compared to the effective floodplain and floodway mapping. Seeking to remove this area from the floodplain would be defensible because of (a) the lowered water surface elevations in this portion of the channel compared to the effective model and (b) the updated accuracy of the 1' topography compared to the 4' topography. It should be noted that the 1' topography includes the current bridge and roadway embankment because the 1' topography was collected in 2001 and the bridge was constructed in 1997 (the as-built plans were completed in 1999 according to City of Avondale Engineering Department staff).

Additionally, all of the roughness changes that HNTB incorporated into the post-project conditions model should be included in the pre-project conditions model for consistency between

roughness values in these two models so the differences in the water surface elevations can be attributed directly to the impact of the construction of the Tres Rios North Levee. Other hydraulic parameters (e.g., ineffective flow areas, channel lengths, expansion/contraction coefficients, etc.) should also be checked for consistency between the HNTB post-project conditions model and the pre-project conditions model for the same reason.

Task items remaining:

- Address the roadway embankment on the left (south) bank of the river opposite the Tres Rios North Levee between the 115th Avenue Bridge and El Mirage Road.

- Verify that the roughness coefficients and other hydraulic parameters are consistent between the pre-project and post-project conditions models to be able to attribute differences in the water surface elevations to the levee features.

Model 4 – Post-project Conditions Model

The MT-2 instruction form states the following regarding a post-project conditions model:

> *"The Existing or Pre-Project Conditions Model (or Duplicate Effective Model or Corrected Effective Model, as appropriate) is modified to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project."*

This model should be developed to reflect the as-built conditions of the Tres Rios North Levee and the overbank wetlands operating facilities.

The LACOE has provided a post-project conditions HEC-RAS model (delivered by HNTB). Several things should be clarified regarding this model before proceeding with a FEMA submittal:

1) Was the topography reflecting the levee and overbank wetlands facility used to develop this model based on design drawings of the features or on the as-built drawings of the features? If this model was based on design drawings, the model will need to be updated to reflect the as-built plans of the final constructed facilities. Additionally, the as-built topography for the Phase 1C floodwall parallel to El Mirage Road should be incorporated into the model upon completion of the construction of this feature.

2) FEMA may require that the embankment for the overbank wetlands be removed from the model. This may be required because this embankment removes a portion of the floodplain from the mapped inundation area, but the OBW embankment is not being certified as a levee. In Figure 1 below, a portion of the area that is removed from the floodplain due to the OBW embankment is shown. Typically, any embankments not certified as a levee will be required to be removed from the topography for hydraulic analysis to determine the extent of inundation effects by removal of the non-certified embankment.

Based on this requirement from FEMA, it is likely that two (2) post-project condition models will have to be created, a "with OBW embankment" model and a "without OBW embankment" model. The current HNTB model may be considered the "with OBW embankment" model if the as-built geometry was used to develop this geometry, but Ineffective Flow Areas (IFAs) should be used at the crest of the embankment instead of the "levee" feature in HEC-RAS. To create the "without OBW embankment" model, the cross sections upstream of the Tres Rios North Levee alignment (i.e., XS 200.6 and higher) should be taken from the pre-project conditions model (reflecting the original 2001 topography without the OBW embankment). Also, this will show that the backwater effects from the levee features would not cause flow to go around the east end of the levee's Phase 1A alignment on the landward side if the OBW embankment were to fail.

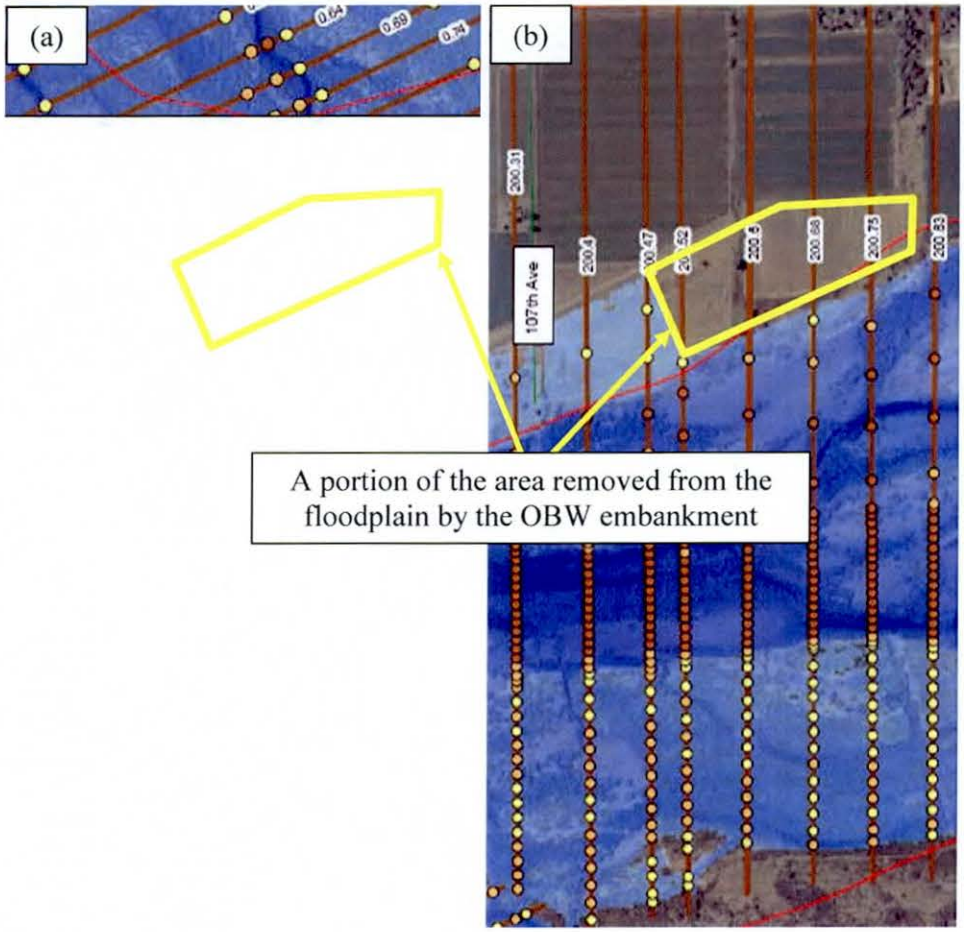


Figure 1. (a) Inundation extents of the pre-project conditions HEC-RAS model and (b) inundation extents of the post-project conditions HEC-RAS model near the upstream end of the Tres Rios North Levee alignment

3) The levee alignment was modified by HNTB to reflect the current levee alignment in the HEC-RAS model. However, the "levee" feature of the HEC-RAS geometric data editor was used upstream and downstream of the actual Tres Rios North Levee alignment along the north bank of the river and in various locations along the south bank of the river to block areas of these cross sections that would not convey flow. However, FEMA will not allow the use of the "levee" feature of the HEC-RAS geometric data editor to represent anything other than the levee itself, especially in a LOMR to approve a certified levee. The levees placed in cross sections upstream and downstream of the Tres Rios North Levee alignment on the north bank and anywhere along the south bank should be replaced with ineffective flow areas. *Note: WEST realizes that this will not make a significant difference in the hydraulic modeling results. The LACOE contractors have utilized an acceptable modeling technique to remove areas of non-conveyance. However, FEMA is very specific in their review process that ineffective flow areas must be used instead of levee features for high ground not certified as a levee that separates a non-conveyance area from the channel. Final revised floodplain boundaries will have to include the flow extents in the non-conveyance areas.*

4) The Manning's roughness coefficients in the post-project conditions model were updated by HNTB compared to the JE Fuller model. HNTB suggested lowering the roughness coefficients for the cottonwood areas along the edge of the channel from 0.07 to 0.04 for 100-year flows. However, the model only applies this change to a short portion of the modeled reach; this change should be applied consistently throughout the model because FEMA will comment on the variability of roughness parameters.

5) HNTB added five guide dikes that were not represented in the JE Fuller model. This was completed to reflect the current conditions of the topography of the system in the HEC-RAS model as requested by LACOE. There is some discrepancy between these five guide dikes and the two guide dikes that JE Fuller had already entered into the model. JE Fuller reflected two of these guide dikes by changing the ground points of the geometry file of the HEC-RAS model, whereas HNTB added the additional five guide dike structures into the model using the "blocked obstruction" feature of the HEC-RAS geometry data editor. FEMA will want to see consistency in the modeling method utilized to represent these guide dikes.

6) There is an additional guide dike that was constructed as part of the Tres Rios project near the 97th Avenue alignment that is not currently in the HEC-RAS model. This should be added to the topography for the hydraulic analysis. Based on recent discussion with the LACOE, LACOE is currently working on including this additional guide dike into the HEC-RAS analysis.

7) A final floodway analysis must be performed for the post-project conditions model. In order to verify that the placement of the proposed levee embankment will not cause excessive surcharge, a comparison of the encroached post-project conditions water surface elevations with those for the non-encroached post-project conditions will be conducted. The increase in the encroached water surface elevations compared to the non-encroached water surface elevations should be less than or equal to one foot everywhere in the project reach.

Task items remaining:

- Address the seven issues listed above.

SUPPORTING INFORMATION AND DOCUMENTATION

There are five additional items that are not completed that FEMA will require for the LOMR application. These items are identified and discussed in the list below.

Item 1 – FEMA MT-2 Forms

FEMA requires that the application forms for letters of map revision be completed and submitted with each LOMR application. These application forms are known as the FEMA MT-2 forms. The MT-2 forms comprise seven individual forms, labeled MT-2 form 1, MT-2 form 2, etc. For a levee on a river system, MT-2 forms 1, 2, 3, and 7 will be required by FEMA.

FEMA requires hydraulic and geotechnical design information for a levee to be entered directly on the MT-2 Forms. All of the design information required for these forms will be available from the final DDR and the final hydraulic modeling items listed herein upon their completion. However, some time will still be required to transcribe the information from the final DDR and hydraulic modeling output to the MT-2 forms.

Task items remaining:

- Complete the MT-2 forms based on the final DDR and final hydraulic modeling deliverables described herein.

Item 2 – Work Study Maps

FEMA requires that the updated hydraulic analysis identify the extent of the floodplain and floodway boundaries on certified topographic maps. These mapping products are typically provided at a mapping scale of 1" = 200'. Based on the extent of the floodplain boundaries that will change due to the updated hydraulic analysis provided herein and a typical map panel of 24" x 36" with a 2" margin, the District estimates that approximately 30 work study maps will be required to be submitted with the LOMR application packet. These maps must show the certified topography that the modeling and mapping was based on, the boundaries of the floodplain and floodway, base flood elevations, limits of the hydraulic modeling study and the location of tie-ins with the effective floodplain and floodway, and other salient features as required by FEMA and the District.

Task items remaining:

- Complete approximately 30 work study maps for the floodplain and floodway of the Salt-Lower Gila river system based on the post-project conditions model.

Item 3 – Parameter Estimation (Roughness Coefficients)

FEMA requires documentation of the roughness and expansion/contraction coefficients utilized in the final post-project conditions model. The roughness values utilized in the HNTB "Phase 3 pre-project conditions model" (which is the Phase 2 post-project conditions model that will be submitted to FEMA) does not match the roughness values as described in the JE Fuller "Tres Rios Phase 3 Environmental Restoration Project Design Documentation Report: Hydraulic Analyses Appendix." Therefore, either the JE Fuller modeling report for the roughness parameters was not correct or HNTB changed more values than just the cottonwood stands for the 100-year flow from 0.07 to 0.04. This discrepancy will be noticed by FEMA. All changes to the roughness values made by HNTB should be described in writing.

Task items remaining:

- Write a new description of the reasoning for choosing the roughness values in the final HNTB model and include this information in the text of the TDN.

Item 4 – FIS Report Data (Floodway Data, Annotated Flood Insurance Rate Maps, Flood Profiles)

FEMA requires that the final output from the modeling products be provided in the final format for the FIS report to complete the LOMR submittal. These data include the floodway data table, annotated Flood Insurance Rate Maps (FIRMs), and flood profiles.

The floodway data table summarizes the following variables for the post-project conditions HEC-RAS model by cross-section: width, section area, mean velocity, the regulatory water surface elevation, the base flood water surface elevations for floodway and floodplain, and the corresponding water surface elevation increase due to encroachment to the floodway boundaries.

The MT-2 instruction form states the following regarding annotated FIRMs:

> *"Attach an annotated FIRM panel showing the revised 1% and 0.2% annual chance floodplains and floodway boundaries. The revised boundaries must tie into the effective boundaries. The annotated FIRM ensures that FEMA is aware of how the requester anticipates the FIRM will be revised."*

Portions of at least 5 FIRM panels will be altered by the hydraulic analysis provided in the LOMR submittal (more may be required depending on the distance to the upstream and downstream hydraulic model tie-in locations), and therefore 5 or more full or partial annotated FIRM panels will be required for the LOMR application process. It should be noted that in

Maricopa County, only the 1% annual chance floodplain and floodway boundaries are shown on the FIRMs; the 0.2% annual chance floodplain will not be required for this analysis.

The flood profiles show the longitudinal variation in flood elevations along the reach. These should be generated in RASPLOT, a program created by FEMA to develop flood profiles. Approximately 4 to 6 profile panels will require updating based on the hydraulic analysis submitted with the LOMR packet.

Finally, the modeling output will have to be checked using the software CHECK-RAS, another program created by FEMA to aid FEMA in the review process for Flood Insurance Studies. Any issues identified by CHECK-RAS will need to be addressed in the hydraulic model if necessary; if a comment produced by CHECK-RAS is not addressed in the hydraulic model to resolve the comment, the issue has to be identified in writing to FEMA, and the reasoning for not addressing the comment has to be defended as well.

Task items remaining:

- Develop the floodway data table based on the final post-project conditions HEC-RAS model.
- Develop approximately 5 full or partial annotated FIRMs.
- Develop approximately 4-6 flood profile panels.
- Develop the CHECK-RAS output files, and address all remaining comments in the CHECK-RAS output files in writing.

Item 5 – Hydrologic Information System (HIS) Data Delivery Specifications

For floodplain studies, the District requires that all GIS product deliverables meet their standards so they can be incorporated into the District's HIS database. While developing the GIS data deliverables to meet the District's HIS standards is not a requirement for the FEMA LOMR submittal, this task needs to be completed for the District to properly utilize the final results of the hydraulic study. Typical GIS information that needs to be modified to meet the HIS standards include: floodplain water surface elevations, cross-sections, floodplains and floodways, stream centerlines, etc.

Task items remaining:

- Modify GIS deliverables from the study to meet the District's HIS standards.

USACE PRE-PROJECT CONDITIONS HEC-RAS MODEL
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: March 14, 2011

To: Richard Harris – District

Cc: Amir Motamedi – District
Don Rerick – District
Van Crisostomo – LACOE

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to provide review comments on the HEC-RAS model delivered by HNTB to the US Army Corps of Engineers, Los Angeles District (LACOE). This is the most recent model (as received by WEST Consultants from Richard Harris via email on Tuesday, February 15, 2011) which was updated by HNTB in response to initial review comments from WEST provided by the Flood Control District of Maricopa County (District) to LACOE via email on January 25, 2011. The objective of this review is to improve the updated HEC-RAS model with particular emphasis on issues that would enhance the likelihood of a successful LOMR application submittal based on the modeling product and WEST's familiarity with FEMA's review process.

The following sections of this technical memorandum provide comments on the updated HNTB HEC-RAS model and a summary of items to address resulting from these review comments.

COMMENTS ON THE HNTB HEC-RAS MODEL

Based on a technical review of the updated HEC-RAS model, five (5) comments are provided below for the LACOE and/or HNTB to address.

1) Twelve of the cross-sections utilized the algorithm built in to HEC-RAS to composite Manning's *n* roughness values for cross-sections having multiple Manning's *n* values within the channel banks. These cross sections are shown in Table 1 below. In our previous experience with composited Manning's *n* values, we have found that the composited Manning's *n* value does not always produce a realistic value for the channel. Thus, any time

HEC-RAS automatically composites the Manning's *n* value, these composited values should be examined closely.

Table 1. Cross-sections in the updated HNTB model that composited Manning's *n* values in the channel

River	Reach	River Station	Composited Manning's *n*
Gila	Lower Gila	198.54	0.035
Gila	Lower Gila	198.49	0.037
Gila	Lower Gila	198.45	0.033
Gila	Lower Gila	198.2	0.034
Gila	Lower Gila	198.15	0.034
Gila	Lower Gila	197.92	0.031
Gila	Lower Gila	197.87	0.032
Gila	Lower Gila	196.94	0.036
Gila	Lower Gila	196.69	0.041
Gila	Upper Gila	1.09	0.062
Gila	Upper Gila	0.64	0.06
Gila	Upper Gila	0	0.06

In older versions of HEC-RAS, there was no option to turn of the Manning's *n* value compositing. However, in HEC-RAS version 4.1, the algorithm to composite Manning's *n* values in the channel can be turned off using the "Main Channel Manning's *n* Value Compositing" editor window under the Options tab of the geometric data editor, as shown in Figure 1 below.

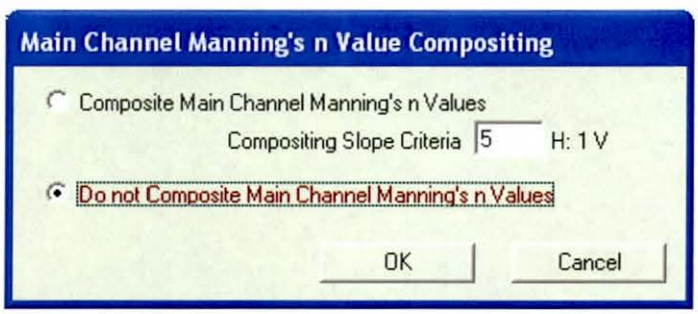


Figure 1. The editor window for the Main Channel Manning's *n* Value Compositing feature

WEST turned off this feature and re-ran the model for an initial comparison. This step lowered the water surface up to 0.075 further feet. FEMA may question the consistency of the compositing algorithm for Manning's n values in the channel.

2) Any features defined as "levees" in the HEC-RAS geometric data editor that are not representing the actual Tres Rios North Levee should be changed from "levees" in the HEC-RAS geometric data editor to ineffective flow areas. These include the levees specified anywhere on the south bank of the Salt/Lower Gila River system, and the levees specified on the north bank of the Lower Gila River from cross-section 198.33 moving downstream to the

end of the model. FEMA will question the use of levees anywhere other than along the alignment of the Tres Rios North Levee.

3) Twenty-nine (29) cross-sections in the model extend the ends of the cross-section geometry vertically to contain flow that spills out of the provided geometry. These vertical geometry extensions can be categorized in one of three ways.

Category 1 – vertical extension of cross-section behind high ground

For cross-section 0.91 along the Upper Gila, the vertical extension of the cross section geometry occurs behind existing high ground. In most scenarios, this flow would be considered ineffective (and in the case of cross-section 0.91, has been correctly identified as an ineffective flow area in the geometry). An example of this category of vertical cross section extension has been shown in Figure 2.

Category 2 – vertical extension of cross-section behind an ineffective flow area

For cross-section 0.40 along the Upper Gila, the vertical extension of the cross-section geometry occurs behind a marked ineffective flow area, but no high ground exists between the main channel and the side of the cross-section that is extended vertically. This flow could be considered ineffective for a number of reasons (e.g., dense overbank vegetation, the cross-section upstream had ineffective flow in the corresponding overbank due to high ground, etc.). An example of this category of vertical cross-section extension has been shown in Figure 3.

Category 3 – vertical extension of cross-section with no ineffective flow or high ground

For cross-section 0.22 along the Upper Gila, the vertical extension of the cross section geometry occurs in an area that does not fall behind high ground and has not been identified as an ineffective flow area. This category of vertical channel extension is often strictly examined and questioned by FEMA during the review process. An example of this category of vertical cross-section extension has been shown in Figure 4.

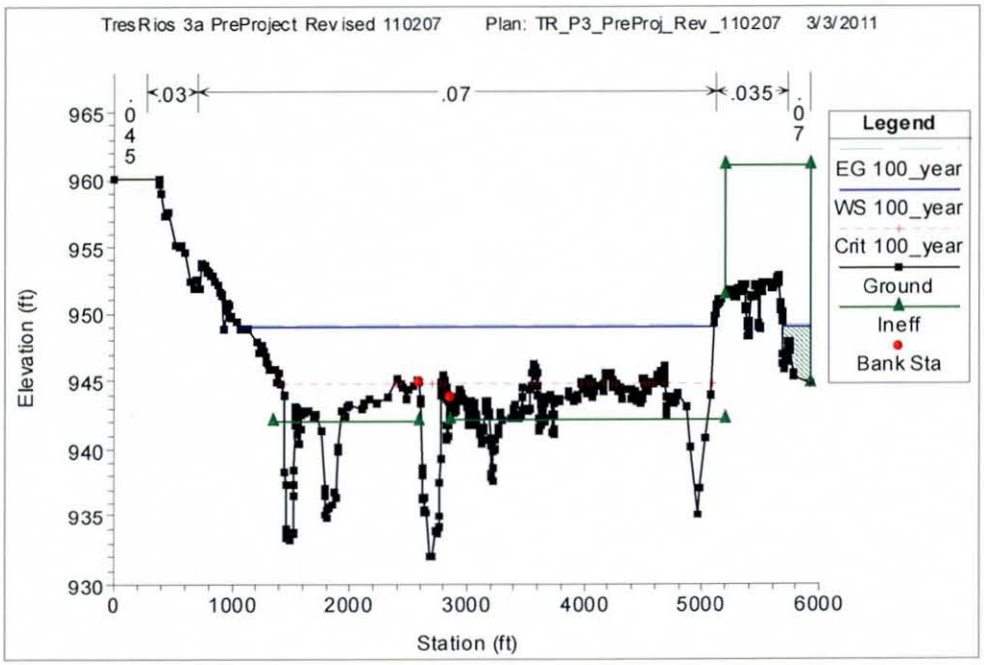


Figure 2. Vertical extension of the cross-section geometry for Category 1 when the vertical extension of the cross-section geometry occurs behind adjacent high ground. The cross-section shown is cross-section 0.91 of the Upper Gila River, and the vertical extension would occur on the right side of the cross-section.

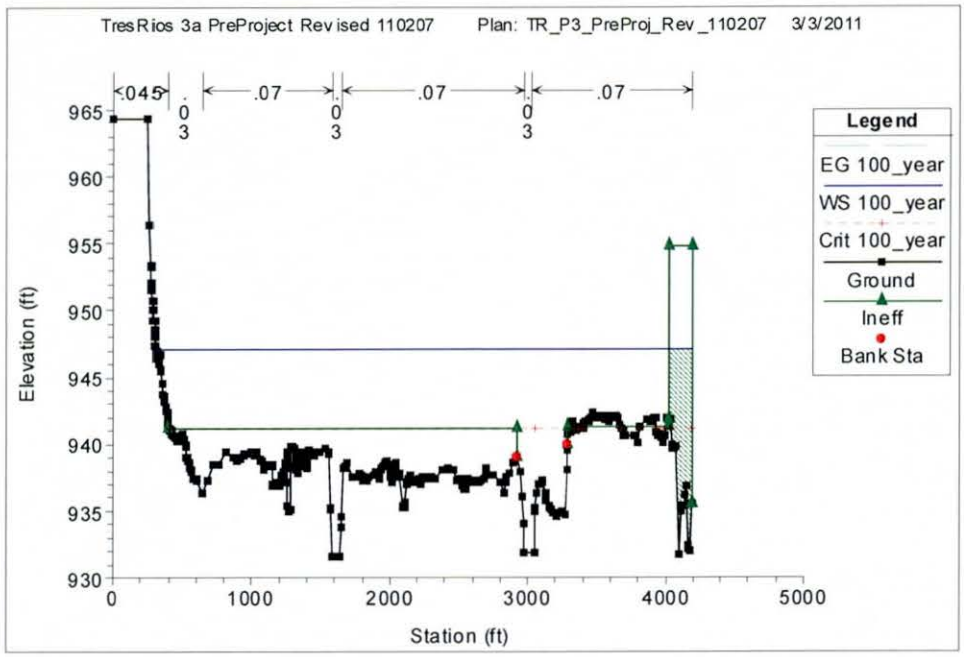


Figure 3. Vertical extension of the cross-section geometry for Category 2 when the vertical extension of the cross-section geometry occurs behind an identified ineffective flow area only. The cross-section shown is cross-section 0.40 of the Upper Gila River, and the vertical extension would occur on the right side of the cross-section.

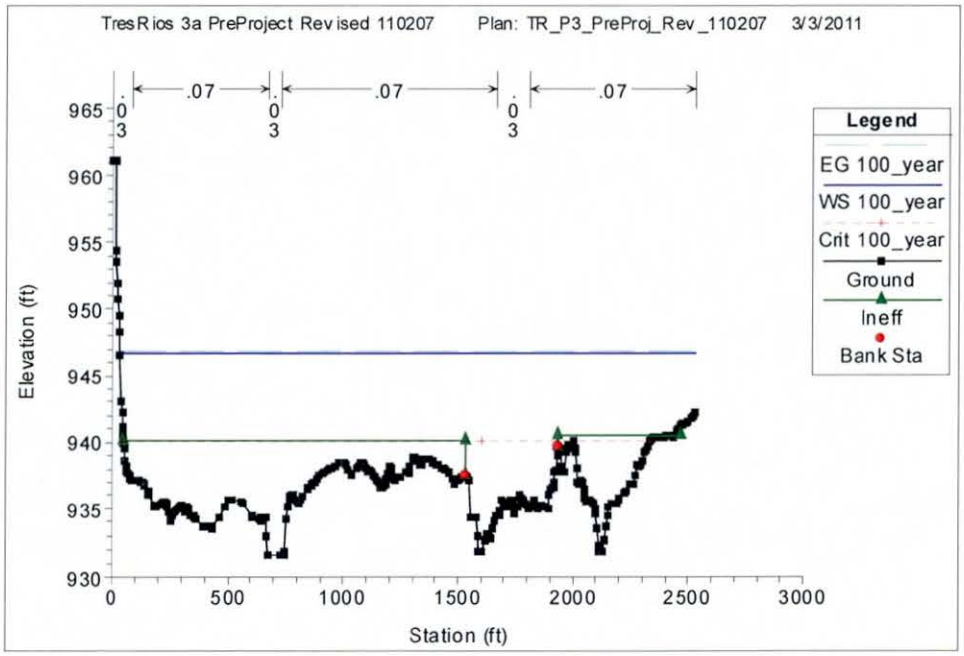


Figure 4. Vertical extension of the cross-section geometry for Category 3 when the vertical extension of the cross-section geometry occurs behind neither high ground nor an identified ineffective flow area. The cross-section shown is cross-section 0.22 of the Upper Gila River, and the vertical extension would occur on the right side of the cross-section.

Table 2 below provides a list of all of the cross-sections for which vertical extensions have been identified in the current model, the category of the vertical extension from the list above, and the location of the vertical extension for the particular cross-section (left overbank or right overbank). As can be seen from this table, 25 of the cross-section vertical extensions correspond to either the Upper Gila River (16 vertical extensions) or the Salt River (9 vertical extensions) where the flows converge and the flow areas for the right overbank of the Upper Gila and the left overbank of the Salt River overlap. The cross-sections in these areas are required to be cut short in order to avoid considering the same flow area for two different flow paths in the same hydraulic model. This is a correct modeling technique and can be explained to FEMA as such if they have any issues with the vertical extension of cross-sections in these locations. However, when this situation is modeled as it has been in the HNTB hydraulic model, the vertical extension of the cross-section on the end of the cross-section that converges with another flow path should be identified as an ineffective flow area in the geometric data editor of HEC-RAS (i.e., Category 2 as described above). This is due to the fact that a water-to-water boundary would not introduce additional wetted perimeter to the hydraulic calculations. If no ineffective flow area is assigned to the end of the cross-section that is extended vertically, then the height of the vertical wall below the water surface elevation adds additional wetted perimeter length to the hydraulic calculations, which is not correct for the case of a water-to-water boundary. FEMA will allow a vertical extension of these 25 cross-sections, but they may request that ineffective flow areas be assigned to the cross-sections in the area of the flow convergence for this reason.

FEMA may request that the four cross-sections along the Lower Gila River identified in Table 2 below either be clipped behind the adjacent high ground (XS 198.03) or lengthened in order to contain the flow (XS 197.98, 197.95, and 197.75).

Table 2. Cross-sections in the updated HNTB model vertical extensions

River	Reach	River Station	Category of Vertical Extension (1, 2, or 3)	Location of Vertical Extension (L or R)
Gila	Lower Gila	198.03	1	R
Gila	Lower Gila	197.98	2	R
Gila	Lower Gila	197.95	2	R
Gila	Lower Gila	197.75	2	R
Gila	Upper Gila	0.91	1	R
Gila	Upper Gila	0.86	1*	R
Gila	Upper Gila	0.74	1	R
Gila	Upper Gila	0.69	2	R
Gila	Upper Gila	0.59	3	R
Gila	Upper Gila	0.53	2	R
Gila	Upper Gila	0.49	3	R
Gila	Upper Gila	0.44	2	R
Gila	Upper Gila	0.40	2	R
Gila	Upper Gila	0.35	2	R
Gila	Upper Gila	0.27	2	R
Gila	Upper Gila	0.22	3	R
Gila	Upper Gila	0.17	3	R
Gila	Upper Gila	0.12	3	R
Gila	Upper Gila	0.06	3	R
Gila	Upper Gila	0	3	R
Salt	Salt	200.4	1*	L
Salt	Salt	200.31	3	L
Salt	Salt	200.22	3	L
Salt	Salt	200.11	3	L
Salt	Salt	200.02	2	L
Salt	Salt	199.98	2	L
Salt	Salt	199.86	3	L
Salt	Salt	199.69	3	L
Salt	Salt	199.55	3	L

** Indicates that the area behind the high ground for Category 1 has not been identified as an ineffective flow area in the current HNTB model. This area should be trimmed from the cross-section or identified as an ineffective flow area.*

4) The following text (in red) has been reproduced directly from the "Description" editor window on the main window of the HEC-RAS software. First, this HEC-RAS model has only one plan titled TR_P3_PreProj_Rev_110207. Second, the highlighted sections below seems to indicate that the levee information was not the as-built information and that sections of the Phase 3 plantings and in-channel grading work has already been included in this model. The description of the final Phase 2 post-project conditions model should be updated to avoid confusion with FEMA.

"TRESRIOS Phase 3 Hydraulic Model

Plan 01:

The Existing conditions model from the USACE TRES RIOS PED report.

Plan 02:

The pre-project hydraulic modeling reflects the known changes that have occurred on the Salt and Gila Rivers since implementation of Tres Rios Phases 1 and 2. These known changes include the following:

· Construction of the Tres Rios North Levee, in the north overbank area, between the 105th Avenue alignment and El Mirage Road. The North Levee is reflected in the pre-project hydraulic model by using the HEC-RAS "Levees" option (a vertical line). The as-built levee alignment provided by the USACE was verified against recent aerial photography. The levee alignment is reflected in the pre-project HEC-RAS cross-sections. As-built top-of-levee information was not readily available and is not reflected in the pre-project HEC-RAS model. However, the top-of-levee elevations reflected in the pre-project model are no lower than the as-built elevations.

· Construction of wetland ponds in the north overbank area between 91st Avenue and 111th Avenue. Wetland ponds reflected in the pre-project hydraulic model cross-sections are based on the topography provided to JEF by the USACE.

· Changes in land use and/or vegetation type and density (within the limits of inundation), which are reflected in the pre-project hydraulic model through roughness coefficient updates.

Plan 03:

The with-project HEC-RAS model reflects the known changes that have occurred on the Salt and Gila Rivers since implementation of Tres Rios Phases 1 and 2, but also includes proposed grading and vegetation improvements within the Phase 3 Reach. Refer to the DDR for complete discussion regarding grading and vegetation improvements.

New Plans

Pre-Project_100907

Included new topographic information and with project changes to the 90% Pre-Project geometry file. Included Block Obstruction to cross section 199.31 to represent roadway.

With Project_100907

Included new topographic information and with project changes to the 90% With Project geometry file. Included Block Obstruction to cross section 199.31 to represent roadway.

Revised Pre-Project_110207

Added obstructions to represent dikes that were not included in original geometry file. Levees locations and roughness elevations were updated based on communications with USACE. 120810"

5) The post-project conditions HEC-RAS model delivered by the LACOE uses the hydrology originally delivered to the LACOE as part of the PED model deliverable (USACE, 1996). The FEMA effective study is also supposed to be using this same hydrology. However, the flows in the HNTB model are slightly different than the effective flows reported by FEMA. WEST's opinion is that the flows in the HNTB model are correct; however, they do not agree with the values that FEMA is using. There are two ways of correcting this issue. First, change the flows in the HNTB model so that they agree with what FEMA considers the effective flow rates. Second, keep the current flow rates and ask FEMA to update the hydrology based on the 1996 USACE report.

SUMMARY OF ITEMS TO ADDRESS RESULTING FROM THE REVIEW COMMENTS

Of the five (5) technical review comments above, 3 of those comments definitely need to be addressed in the modeling package before submitting the LOMR application and 2 of the comments need only to be addressed in the text of the TDN. The 3 that need to be addressed in the modeling deliverable are (a) the use of "levees" to represent ineffective flow in areas other than the actual alignment of the Tres Rios North Levee, (b) the vertical extension of the cross-sections in the right overbank for 4 of the cross-sections along the Lower Gila River in the model, and (c) the notes provided in the Description editor window on the main window of the HEC-RAS software to avoid confusion for FEMA reviewers. The other two comments provided above, including the composite roughness Manning's *n* value issue and the difference in the hydrology between the post-project conditions and the effective FIS model, can be discussed in the text of the TDN report to be delivered to FEMA with the LOMR application. Although neither of the last two comments should cause rejection of the LOMR application from FEMA, either one of them might raise concerns from the reviewer(s) involved in the LOMR review, and modeling changes may or may not be required based on these issues.

REFERENCES

U.S. Army Corps of Engineers, Los Angeles District. 1996. Section 7 Study for Modified Roosevelt Dam, Arizona (Theodore Roosevelt Dam): Hydrologic Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam.

CESPL-ED-HH 2 June 2011

MEMORANDUM FOR RECORD

SUBJECT: Tres Rios Environmental Restoration Project May 2011 Hydraulic Analysis

1. The Tres Rios Environmental Restoration Project is located southwest of the Phoenix metropolitan area in Maricopa County, Arizona and includes an eight-mile reach of the Salt and Gila Rivers beginning at 91st Avenue and extends west to the confluence of both Gila and Agua Fria Rivers. The Feasibility Report completed in April 2000 describes and outlines project alternatives that were considered for basis of design of the Tres Rios Environmental Restoration Project. The project recommended plan included the North Levee (Phase I), Pump Station (Phase II), Regulating and Overbank Wetlands (Phase II), Riparian Corridors (Phase III), and the Open Water March (Phase IV).

2. In February 2011, Hydraulics Section received the most current HEC-RAS hydraulic model supplied by HNTB, which included all of Hydraulics' Section comments. The model used 1996 and 2001 topography. The 2001 elevation dataset used to construct the main channel model geometry was composed primarily of 1-foot vertical resolution. Additional overbank geometry were cut from 4-foot vertical resolution 1996 topography supplied by the Flood Control District of Maricopa County (FCD). The model was then updated incorporating comments received from FCD's contractor WEST Consultants Inc., dated 14 March 2011. Additional July 2007 topography along a portion of El Mirage Road and Southern Avenue, flown by Morrison-Mairele as contracted by the City of Phoenix, was used to supplement and determine the extent of the 100-year floodplain boundary. All topography was developed using State Plane coordinates, Arizona – Central, NAD 83 and NGVD 29. A draft overflow map showing the extent of the 100-yr floodplain boundary was prepared in March 2011.

3. The elevations of the 2007 topography along El Mirage Road and Southern Avenue are higher than the older topography. As such, the rise in road elevation acts as a barrier to flows. As a result, overflows do not inundate the area east of El Mirage Road nor the area north of Southern Avenue. However, a potential for concern was seepage. A summary of hydraulic parameter key points that would preclude seepage include: both roads should not be impacted until around a 40-yr flood frequency event; flow velocities in this area would be less than 1 foot per second (i.e. backwater area); both roads can expect to be flood stressed for approximately 5 hours; and 2 to 3 feet of freeboard exists along Southern Avenue and 2 to 4 inches along a small portion of El Mirage Road.

4. On 28 April 2011, representatives from the Hydrology and Hydraulics Branch and Geotechnical Branch met with Ed Curtis of the Federal Emergency Management Agency. All parties agreed that no additional improvements, modeling, or calculations along El Mirage Road (previously noted as Phase 1c floodwall) are necessary for the reasons state above.

5. In an April 2011 project teleconference meeting, new 2008 topography, contracted out by

FCD, was discussed and provided to the COE in May. Since project funding was available, the Project Delivery Team decided to update the hydraulic model. The 2008 topography begins approximately 100 feet east of El Mirage Road and extends west to the end of the project limit. The topography was developed using State Plane coordinates, Arizona – Central, NAD 83 and NAVD 88 with 2-foot contour intervals. The same cross sections used in the hydraulic model was processed for the new terrain data using the GeoRAS extension within ArcGIS version 9.3.1. Thirty-two cross sections were trimmed along the southern end of each section due to lack of coverage of the topography. Post-processed data was exported into the HEC-RAS hydraulic model.

6. The cross sections within the hydraulic model were then modified accordingly: conversion from NAVD88 to NGVD29, i.e. a factor of minus 2.14 feet; and bank stations, vertical n-values, and ineffective flow areas were adjusted to match the March 2011 cross sections. Additionally, the 32 cross sections were moved accordingly to match the pre-trimmed cross section starting points.

7. Note that the 2001 topography is used for the project area upstream of El Mirage Road and the 2008 topography is used downstream of El Mirage Road. In comparison to the old topography, the 2008 topography results show a decrease decrease in invert bed elevation of approximately one foot downstream at El Mirage Road. Bed elevations continue to scour moving downstream, up to 5.2 feet at the downstream end of the project. Accordingly, the water surface profile has also dropped, up to 3 feet with the 2008 topography. The water surface profile drop progresses upstream of El Mirage Road to the confluence of the Gila and Salt Rivers. However, the bed elevation in the model may not reflect additional scour east of El Mirage Road since it uses the older 2001 topography. The FCD has noted that there has been both scour and deposition in several locations since the older topography. An additional drop in the water surface profile upstream of El Mirage Road is likely.

8. Additionally, use of the 2008 topography shows that overflows do not inundate east of El Mirage Road nor to the north of Southern Avenue, which confirms the analysis using the 2007 topography. Refer to Plates 1 and 2 depicting the 100-year overflow boundaries east and west of El Mirage Road.

9. For questions or comments regarding this memorandum, please contact Mylene Guron, Hydraulics Section, (213) 452-3551 or mylene.m.guron@usace.army.mil.

Encl

VAN CRISOSTOMO, PE
Chief, Hydraulics Section

CESPL-ED

SUBJECT: Tres Rios Environmental Restoration Study May 2011 Hydraulic Analysis

CF:

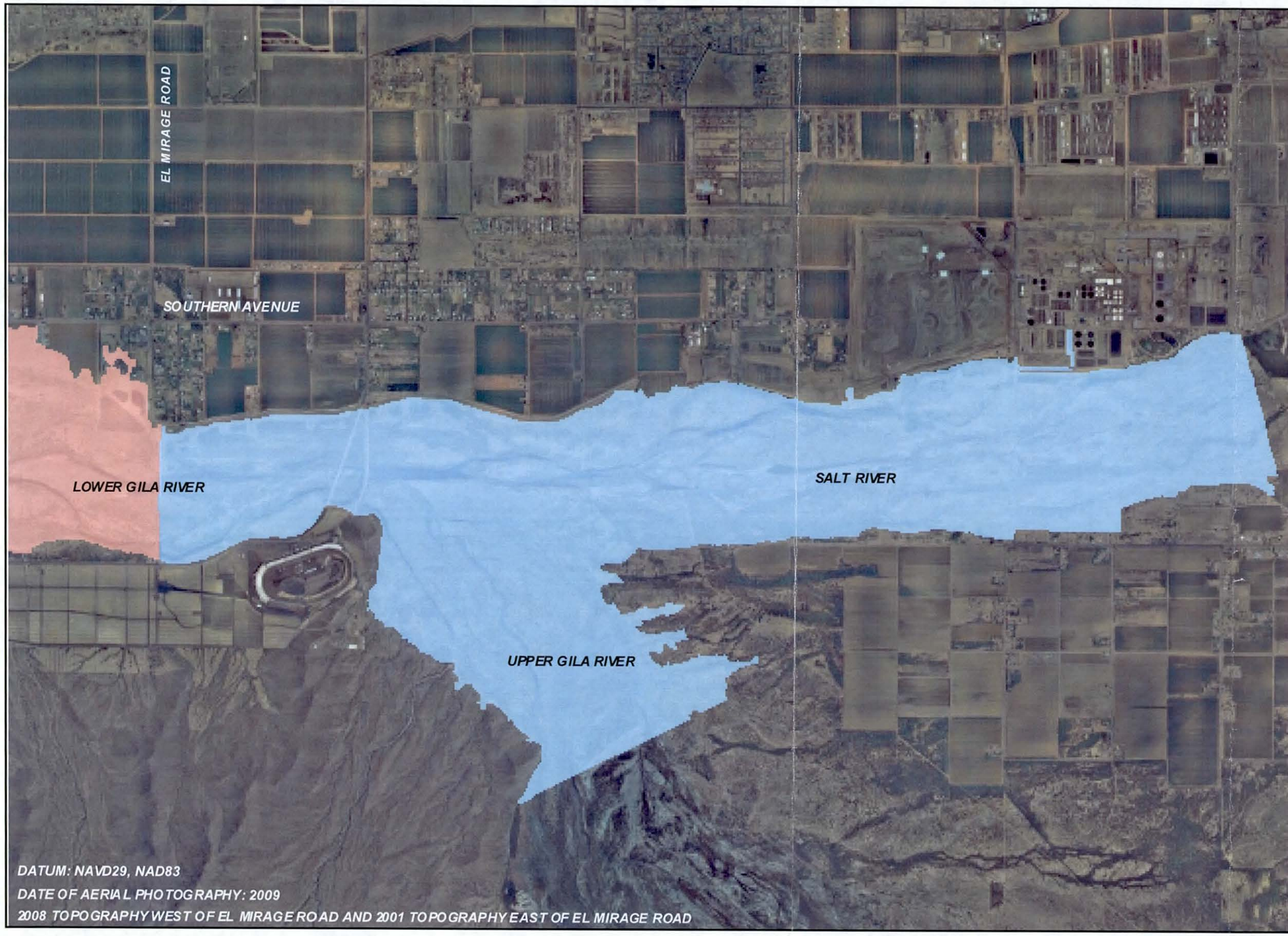
CESPL-PM-C
CESPL-ED-DA
CESPL-ED-GD
CESPL-ED-H
CESPL-ED-HH (2)

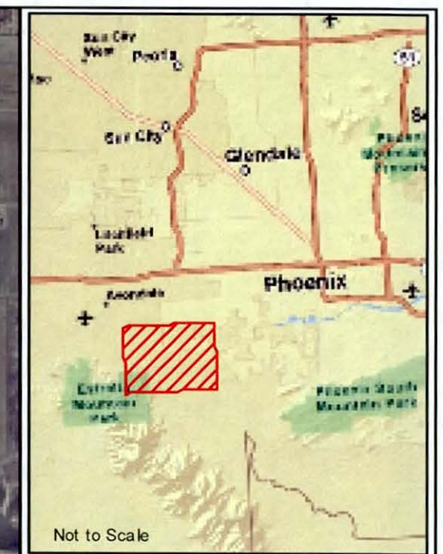
JC 6/2/11

CRISOSTOMO
CESPL-ED-HH

MG 6/2/11

GURON
CESPL-ED-HH





Vicinity Map

PRELIMINARY

Legend

100-yr FP 2001 Topo E of El Mirage

100-yr 2008 Topo W of El Mirage

3

Miles

0 0.1 0.2 0.4 0.6 0.8

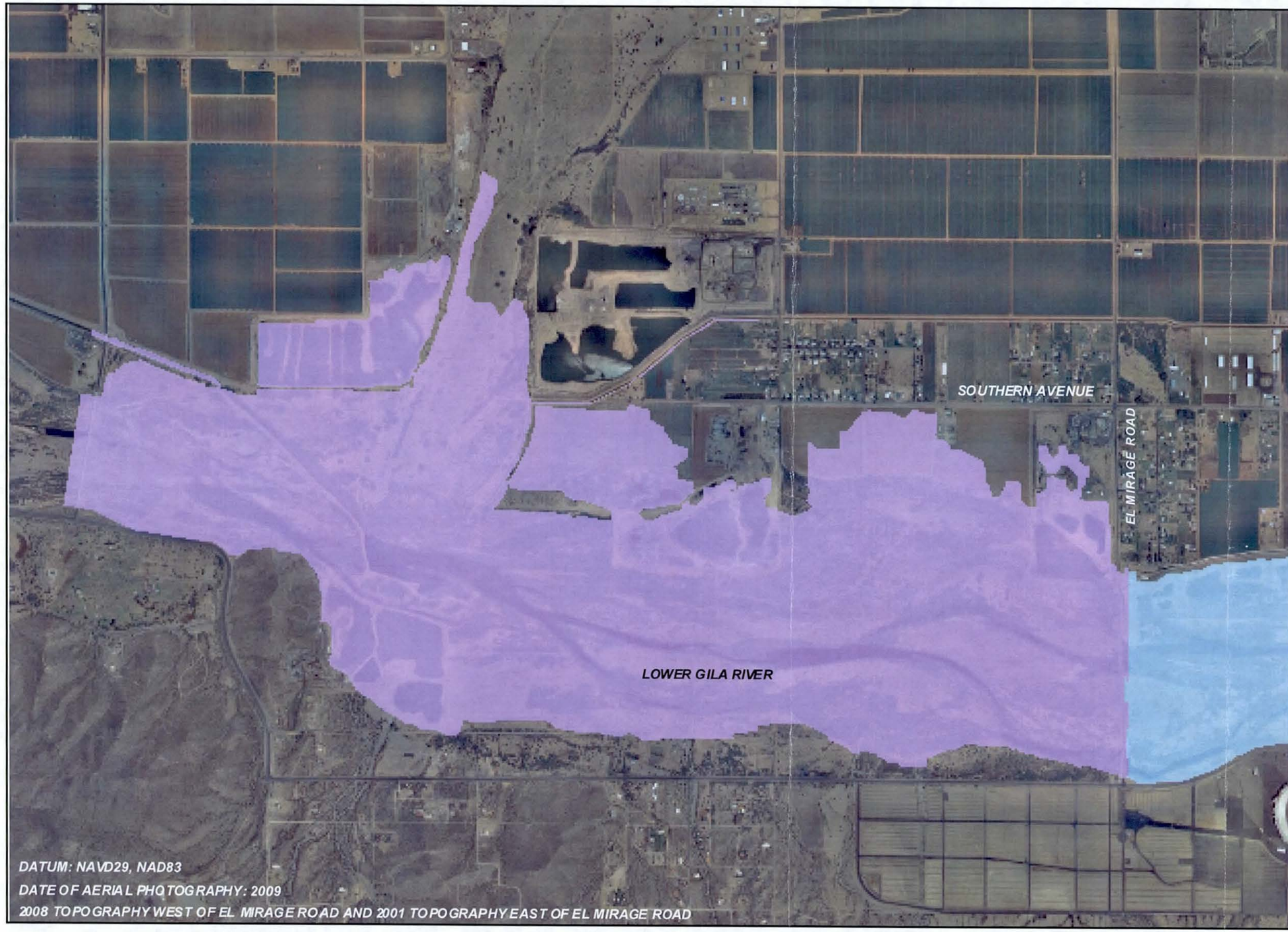
Tres Rios Environmental Restoration Project

TRES RIOS FLOODPLAIN & FLOODWAY DELINEATION PROJECT

May 2011

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 1: 100-yr Overflow Boundary East of El Mirage Road



Vicinity Map

PRELIMINARY

Legend

100-yr FP 2001 Topo E of El Mirage

100-yr 2008 Topo W of El Mirage

3

Miles
0 0.05 0.1 0.2 0.3 0.4

Tres Rios Environmental Restoration Project

TRES RIOS FLOODPLAIN & FLOODWAY DELINEATION PROJECT

May 2011

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 2: 100-yr Overflow Boundary West of El Mirage Road

CESPL-ED-HH 13 June 2011

MEMORANDUM FOR RECORD

SUBJECT: Submittal of Addendum No. 1 to Tres Rios Environmental Restoration Project May 2011 Hydraulic Analysis

1. The memorandum was originally transmitted on 3 June 2011, subject as above. Minor revisions were received on behalf of the Flood Control District of Maricopa County (FCD) and are described below.

2. Phase 1 of the Tres Rios Environmental Restoration Project consists of three distinct project phases: Phases 1A, 1B and 1C. Phases 1A and 1B consist of a new Tres Rios North Levee along the north bank of the Salt-Lower Gila River system that begins at approximately the 105th Avenue alignment and extends to 123rd Avenue (El Mirage Road). Phase 1C consists of a floodwall to be constructed along the west side of El Mirage Road from the Salt River to Southern Avenue. The purpose of the analysis described in the memorandum was to evaluate whether or not Phase 1C is still needed in light of new topographic data that has recently become available.

3. Based on the analysis described above, the 100-year overflow boundary will not overtop El Mirage Road and Phase 1C is no longer needed.

Van Crisostomo

VAN CRISOSTOMO, PE
Chief, Hydraulics Section

Tres Rios Review Comments from the FCDMC, 6/16/11
LACOE Response to FCDMC Comments, 6/30/11
LACOE Response to 7/7/11 Comments, 7/11/11

Modeling

RAS

1. Please explain why there is IFA with elevation at 936' within the bridge opening for 116th avenue (Avondale Boulevard), while the thalweg invert is 927'-928' – I would expect the full bridge opening to provide conveyance minus the pier widths – is the IFA meant to represent the cumulative pier widths?

   Based on field investigations by WEST conducted during the design phase, woody debris was observed to have accumulated along the river invert throughout the project reach. The observed debris was modeled as ineffective flow areas.

   Brian, do you agree with Mylene's reasoning now?

   No. The ineffective flow areas (IFA) at this location have nothing to do with woody debris on the piers. This set of IFAs (and most of the other IFAs on other cross-sections) was put there to confine the low flow to the main channel. This is why the IFA elevation is only 936'. The left/right limits of the IFA are set to the bank stations in order to confine the low flow to the main channel. Since these are not permanent IFA's, they will actually be "turned off" during higher flows (i.e., the 100-year flow) when the water surface elevation exceeds 936.0 feet, and are not limiting any flow area whatsoever.

   Richard, this is a common practice for multi-frequency steady models where several return interval flows are modeled within a single RAS model. Since the IFA's turn off at higher flows, they really only apply to one steady-state RAS profile.

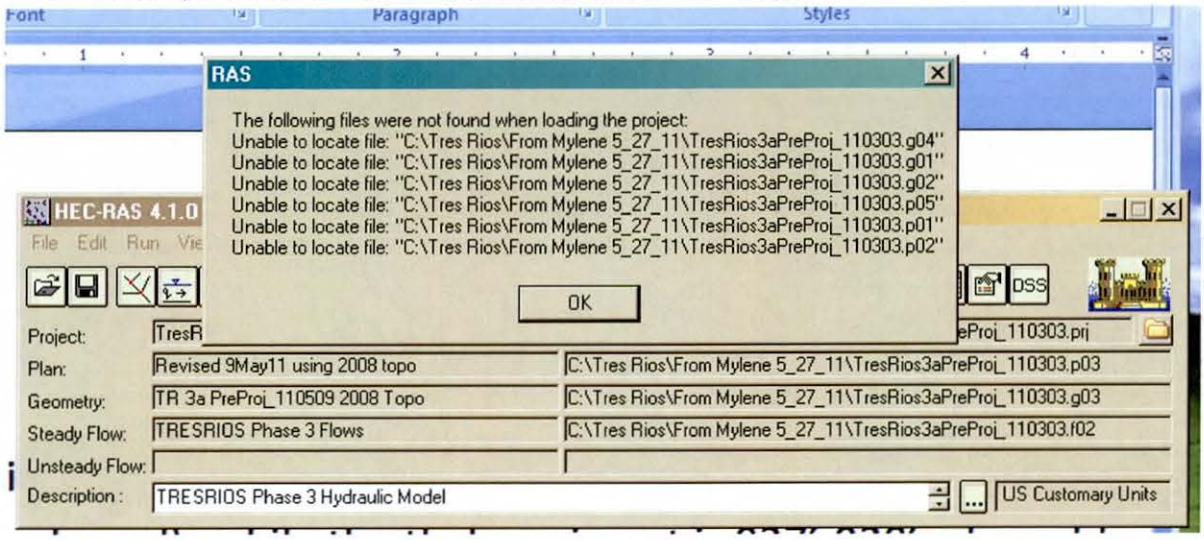
   Mylene, in Maricopa County, typically only the 100-year flow is modeled, so only one set of IFA's are required.

   For FCDMC purposes WEST can revise the model to delete IFA's for the other frequency discharges if needed. For USACE purposes these IFA's will need to be part of our modeling, which will be used as part of the Risk & Uncertainty Analysis.

2. As discussed, the modeling description appears to include a lot of text that is left-over from previous modeling efforts and no longer applies. Please update it to make sure that there is no statement that says the clearing for phase III is included. I think it will be good to say that all levee project constructed features have been input from as-built information, and list the extent of the levee project features in relation to cross section ID (such as: "the Phase IA and IB levee features extends from RS 198.3 to .....; the Phase II features extend from .....to .....", etc. There are a number of good examples I can provide to finalize the model Description, eventually. Most of the information will be related to administration. For now please update it as herein described.

   Concur. Description will be corrected to include only design features.

3. When opening up the current modeling I get an error message:



Apparently the RAS software is searching for different geometries and plans than what it can find. However, the file package I received has only one geometry and plan file, as far as I can tell. Perhaps the way to rectify this is to put all final files in a new folder and save the related project file in the same folder. Then the package should relate only to those files and not others created as drafts over time.

Concur.

The LACOE will have to "clean up" the RAS model before it is submitted to FEMA. In that process, they will need to get rid of the unused geometry, flow, and plan files that are not actually used as part of the overall project. WEST will help them with that later.

This action has been done in the latest hydraulic model.

4. Preliminary results show that the WSEL at the lower end of the study has dropped several feet compared to the effective data (see attached spread sheet). Therefore, a conventional tie-in where the vertical differences are within 0.5' per FEMA Guidelines will not be possible. Were we to submit this information as is to FEMA it would likely result in FEMA requesting we re-study the Agua Fria River as well, since the Gila and AF have a junction in that area. The current model does not include the AF River, and therefore the intention should be documented that the new analysis will not re-analyze the confluence area, but be re-studied above it. In this situation it would seem appropriate to consider applying backwater from the effective data to the new study as a starting condition. I propose that we look into this in more detail to validate it, and I will ask WEST to investigate. If it turns out we can't use this approach, the Scope of the analysis would have to be reconsidered and the model expanded to include the Agua Fria River and perhaps be extended downstream considerably in order to meet the conventional tie-in requirements.

   The hydraulic model was adjusted to account for the datum shift back up to 2.14 ft. Based on the latest model, tie-in locations per FEMA guidelines can be applied: at the upstream end along the Salt River (COE XS 203.48, FEMA XS I) where the difference in water surface elevation (WSE) is 0.49 ft lower then the FEMA WSE; at the downstream end along the Gila River (COE XS 195.16, FEMA XS BF) where the difference in WSE is 0.47 ft lower then the FEMA WSE.

   To myself and WEST: Investigate the tie-in locations when new model provided.

   WEST will resume tie-in conversations with the LACOE once we have an updated model from them.

   USACE has revised the model and will look into the tie-in locations (if changed from the previous model mentioned above) prior to submittal. WEST can comment and/or assist.

Checkras

1. The following messages are extracted from the Checkras NT output, and suggest the need to increase contraction and expansion coefficient values at the modeled structures:

TRANSITION LOSS COEFFICIENT CHECK

RS: 199.31

NT TL 01 This is section 4

Contraction and expansion loss coefficients are 0.1 and 0.3

They should be equal to 0.3 and 0.5 respectively.

RS: 199.21

NT TL 01 This is section 3

Contraction and expansion loss coefficients are 0.1 and 0.3

They should be equal to 0.3 and 0.5 respectively.

RS: 199.18

NT TL 01 This is section 2

Contraction and expansion loss coefficients are 0.1 and 0.3

They should be equal to 0.3 and 0.5 respectively.

Do not Concur. These cross sections are located upstream and downstream of the 116th bridge (Avondale Blvd). Contraction/Expansion coefficients were set to 0.1/0.3 respectively since these conditions do not exist. Bridge abutments do not protrude into the river causing these effects to exist.

OK – comment from WEST?

WEST agrees with Mylene. The bridge does not really protrude into the river and cause the increased expansion and contraction losses. Thus, raising the expansion/contraction loss coefficients is not necessary.

Ok.

Please address.

2. The Checkras NT output lists a number of locations with values of roughness = 0. This is probably a flaw in the output that shows the model can't handle vertical variations of N values. Since a FEMA review may not understand this, it will have to be documented in both text within the main TDN body, and should be listed as a note in the Checkras output itself. Please address.

   The roughness values should be documented in the Technical Data Notebook, which is part of WEST's contract.

   Any comment from WEST?

   WEST agrees that the best way to handle this short coming in CHECK-RAS is to thoroughly document why the n-values are reported as zero in the CHECK-RAS output.

   Ok.

3. We will need to validate the overall Floodplain and floodway N-values in comparison with the effective data. Please consider how this will be done – we know what the effective data model has in it – we should be able to have a table that compares the two, overall. Please address.

   Roughness values in the current model are documented in the WEST April 2004 report and adjusted per HTNB February 2011 Technical Memorandum. LACOE will include these

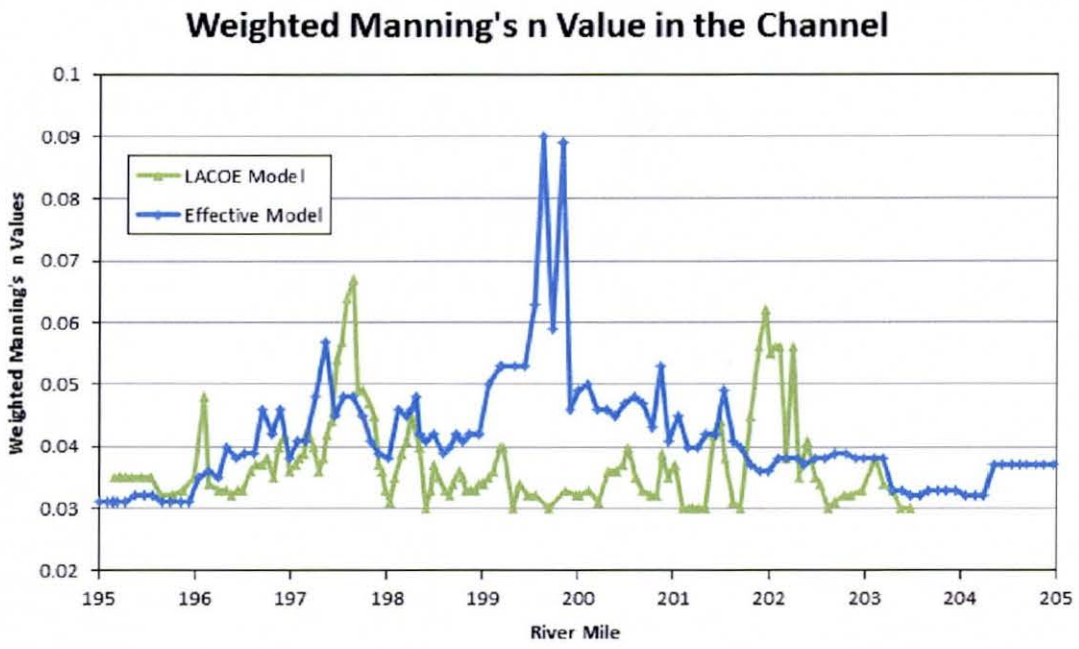
descriptions in the Levee Evaluation Report. The FEMA roughness values are briefly discussed in the Baker May 1999 report. Section 5.3.1 indicates that a complete listing of the assumptions and calculations used to determine these values are presented in Baker's n-value report.

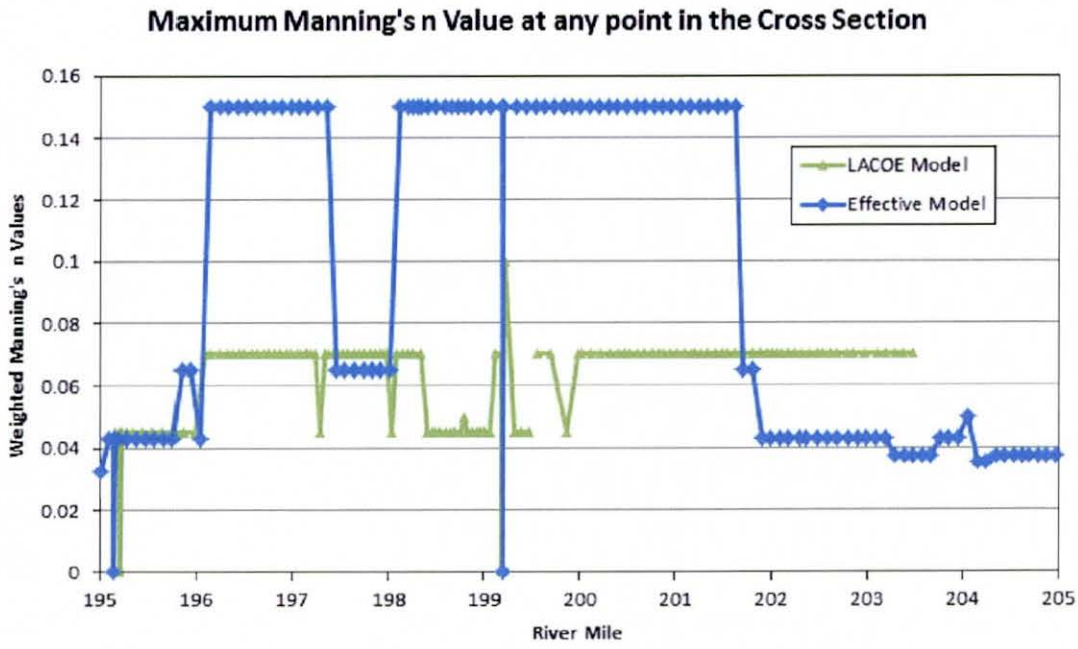
Does WEST concur?

Most of the roughness changes from the original WEST model were done by Fuller. Thus, this work should also be included in the discussion of roughness values. Having a table showing the effective (Baker) n-values and the proposed n-values would be useful, too.

Mylene, please consider the above table Brian mentions as a deliverable to accompany the updated model.

USACE can provide a table of n-value comparisons. However, a copy of the Baker n-value report has not been provided to the USACE. Please provide.





Note that the river miles for the two studies do not match exactly, and the figures above were not corrected precisely for these differences. However, the stationing is very close between the two models (never more than a tenth of a river mile difference between the two), and at the scale of a figure such as those shown above, the difference would not be noticeable. Based on these figures, it can be seen that the two models do differ in the weighted Manning's n values between approximately river station 198.5 and 201.5 (which includes the area of the Tres Rios North Levee). The updated model appears to primarily fall between 0.03 to 0.04 in this area, while the effective model fluctuates between 0.04 and 0.05, with a maximum value of 0.09.

Mylene, this may become something that requires a written explanation if it is to be maintained. Usually when such an item is intentional it becomes a written part of the Technical Data Notebook (for the LOMR) within a Hydraulics section sub-section called "Special Considerations". At this time please consider how this is to be handled.

All model n-values have already been explained in the above-mentioned reports. The Technical Data Notebook and as mentioned Hydraulics sub-section is part of WESTs contract. The information from all those reports can be explained in the Technical Data Notebook. However, USACE can assist.

4. Per the Checkras XS output, there are numerous areas with vertical extension on the channels to contain flow. This was not expected and should be rectified. We will need to discuss this in detail and make sure that the final model we submit to FEMA does not still have this issue.

Vertical extensions were added in the hydraulic model in the confluence area between the Salt River and Upper Gila River. The explanation to provide to FEMA as to why these are valid ineffective flow areas are described in WEST's Technical Memorandum, dated 14 March 2011 page 5 of 9.

Comment: there is one cross section along the Gila River (XS 197.75) that does not tie into existing ground along the north end. Do you have additional topo for this?

WEST to investigate and see if other topo can be used to supplement model geometry to remove this problem.

The 2008 Gillespie topography covers this area. WEST has talked to Mylene about this and she has already used the topography to extend this cross-section. There should be no more vertically extended cross-sections in the next model we receive from the LACOE.

USACE has updated XS 197.75 using the 2008 Gillespie topography. No additional extensions required.

STATUS OF THE REVIEW PROCESS FOR THE TRES RIOS HYDRAULIC MODEL IN SUPPORT OF A LOMR APPLICATION

TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS NORTH LEVEE LOMR

Date: July 6, 2011

To: Richard Harris – FCDMC

Cc: Amir Motamedi – FCDMC
Don Rerick – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to provide an update on the current status of the review process for the hydraulic modeling package to be submitted to FEMA in support of a LOMR application for the Tres Rios North Levee project. An update on the status of the review became necessary in response to confusion generated from an application for a permit to complete portions of Phase 3 of the Tres Rios Environmental Restoration Project, including re-grading and planting within the main channel of the Salt/Lower Gila River System. The purpose of this memorandum is to verify that the current HEC-RAS hydraulic model developed for the Tres Rios North Levee LOMR does not include any project elements for the Tres Rios Environmental Restoration Project Phase 3, and therefore cannot be used in support of permit application for the construction of Phase 3 features.

BACKGROUND OF TRES RIOS HEC-RAS HYDRAULIC MODELING PRODUCTS

In 2003, WEST Consultants, Inc. (WEST) completed the *Preconstruction Engineering and Design (PED) Hydraulic Design of Tres Rios North Levee* study for the US Army Corps of Engineers, Los Angeles District (LACOE). One product of this study was a HEC-RAS model representing the existing conditions at the time of the topographic data collection for that model (October 23, 2001). This is the first model in the progression of models developed for the Tres Rios North Levee LOMR project.

The LACOE tasked JE Fuller Hydrology and Geomorphology (JEF) with updating the original model developed by WEST for the design of the Tres Rios Environmental Restoration Project

Phase 3. JEF updated the existing conditions model from the PED study, and their study resulted in three additional models:

(1) an updated existing conditions model based on the 2001 topography and updated roughness values representing changes in land use and/or vegetation type and density since the completion of the PED study,

(2) an updated existing conditions model with the roughness changes mentioned above and Phases 1 and 2 of the Tres Rios Project included in the model (i.e., the "pre-project" model), and

(3) an updated existing conditions model with the roughness changes mentioned above and Phases 1, 2, and 3 of the Tres Rios Project included in the model (i.e., the "with-project" model).

Phase 1 of the Tres Rios Project included the construction of the Tres Rios North Levee structure itself, and Phase 2 included the construction of the overbank wetlands feature of the project upstream of the Tres Rios North Levee on the right overbank of the Salt/Lower Gila River System. Phase 3 includes re-grading and planting within the main channel of the Salt/Lower Gila River System.

Since JEF was tasked with aiding the LACOE in the design of Tres Rios Phase 3, the second model they developed (including Phases 1 and 2 of the project) was termed the "pre-project" model in their report. The third model they developed (including Phases 1, 2, and 3 of the project) was termed the "with-project" model in their report because it included Phase 3. Because the Tres Rios North Levee LOMR is supposed to reflect flood insurance rate map changes based on Phases 1 and 2 of the project, the second model developed by JEF and termed the "pre-project" model was used as the basis for Tres Rios North Levee LOMR HEC-RAS model. The third model developed by JEF, termed the "with-project" model, has not been reviewed during the Tres Rios North Levee LOMR process.

The LACOE then tasked HNTB to update the "pre-project" model developed by JEF (which includes Phases 1 and 2 of the Tres Rios North Levee project) for further design of Phase 3 of the Tres Rios Environmental Restoration Project. The updated model and technical memorandum were provided by HNTB to the Flood Control District of Maricopa County (FCDMC) in February 2011. Note that this updated HNTB model still represented conditions including Phases 1 and 2 but not Phase 3 of the Tres Rios project.

Since the delivery of the updated model by HNTB, the LACOE has continued to adjust the hydraulic model based on updated topography provided by the FCDMC and other salient information. As far as WEST and the FCDMC are aware, this model progression has never included any portion of the Tres Rios Phase 3 project features (i.e., only the model based on the JEF "pre-project" model not including Phase 3 has been examined, reviewed, and modified).

SUPPORTING INFORMATION DEMONSTRATING THAT TRES RIOS PHASE 3 FEATURES HAVE NOT BEEN REVIEWED OR APPROVED BY THE FCDMC

Item 1 – HEC-RAS model name

The name of the HEC-RAS model delivered by HNTB is "TresRios 3a PreProject," which HNTB states in their technical memorandum was a slightly revised version of the JEF "Tres Rios Phase 3 Pre-Project" conditions HEC-RAS model. As discussed above, the JEF "pre-project" hydraulic model includes Phases 1 and 2 of the Tres Rios project, but does not include Phase 3. Therefore, it was assumed that there were no proposed grading or vegetation improvements associated with Phase 3 within the current HEC-RAS geometry.

Item 2 – Monthly conference call meeting minute documents

Several documents summarizing meeting minutes for the monthly coordination calls that have occurred between the LACOE, the FCDMC, the City of Phoenix, and other stakeholders familiar with the project have stated that the hydraulic model provided by HNTB does not include any portion of Phase 3. These documents have been approved by all associated parties. Based on the statements in the conference call meetings and the approval of the meeting minutes, WEST assumed that everyone was in agreement that the model provided by HNTB did not include any Phase 3 elements.

CONCLUSIONS

WEST and the FCDMC believe that the current hydraulic model for the Tres Rios North Levee LOMR study does not include any portion of the Tres Rios Environmental Restoration, Phase 3. Additionally, the hydraulic modeling supporting the application for a LOMR should not include any portions of Phase 3 as that is not a currently constructed feature of the project. The LOMR process, by FEMA's definition, only applies to constructed features of a project.

However, if the HNTB model that was reviewed by WEST did have portions of the Phase 3 plantings or re-grading in the model, WEST and the FCDMC were not aware of these features. The lack of review comments on any Phase 3 features that may be in the model was due entirely to WEST's understanding that these features were not included in the model. The lack of comment does not imply that the Phase 3 features, if they were included in the HNTB model, were reviewed thoroughly because WEST was not aware they were in the model.

Additionally, regardless of what was included in the hydraulic model, the FCDMC still has not provided final approval to any hydraulic model provided by the LACOE or HNTB. The FCDMC will only provide final approval to the final LOMR model, and this model is currently being modified and updated by the LACOE. All levels of review associated with the Tres Rios North Levee hydraulic model up to this point have been preliminary and intermediate.

TIE-IN LOCATIONS FOR FIRM DEVELOPMENT
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: July 29, 2011

To: Richard Harris – District

Cc: Mylene Guron – LACOE
Don Rerick – District
Van Crisostomo – LACOE

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to identify appropriate tie-in locations for the updated hydraulic modeling results for the Tres Rios North Levee project to tie in to the currently effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) floodplain line work. These locations will be provided to the US Army Corps of Engineers, Los Angeles District (LACOE) to finalize the hydraulic modeling results for the post-project conditions HEC-RAS model and to develop the work maps as required by the Flood Control District of Maricopa County (District). This hydraulic model and all accompanying supporting documentation is supporting pending FEMA flood map revisions of the Salt/Gila River system near the Tres Rios North Levee project.

The remainder of this technical memorandum provides an explanation of the analysis performed by WEST to map the hydraulic modeling results from the LACOE HEC-RAS model as well as the reasoning for the selection of the final tie-in locations chosen by WEST.

TRES RIOS NORTH LEVEE FLOODPLAIN MAPPING PERFORMED BY WEST

WEST mapped the hydraulic modeling results of the most recent LACOE HEC-RAS model of the study reach using ArcGIS v9.2 by breaking the merged TIN representing the most recent topography utilized to develop the hydraulic model into several parts and then mapping the hydraulic modeling results using the built-in features of HEC-GeoRAS to map the floodplain on these "terrain tiles." This method is similar to the method being employed by the LACOE for floodplain mapping.

In an email dated July 13, 2011, the LACOE indicated their identified tie-in locations to be at the upstream end of the model (cross section 203.48 along the Salt River) and the downstream end of the model (cross section 195.16 along the Lower Gila River). At the upstream end of the model, the LACOE stated that computed water surface elevation is 0.49 feet lower than the effective water surface elevation; at the downstream end of the model, the computed water surface elevation is 0.47 feet lower than the effective water surface elevation. Both of these are within the 0.5 foot maximum vertical variance regulations enforced by FEMA for new studies to tie-ins to the effective floodplain profiles.

One significant issue with tying into the effective floodplain data at the downstream end of the modeled reach is that the confluence of the Agua Fria River occurs near cross section 196.08, which is upstream of the currently identified tie-in location of 195.16. Mapping a confluence area of a tributary that is also has a floodplain mapped by FEMA, as is the case with the Agua Fria, can become complex. It should be noted that the Upper Gila River is not currently mapped by FEMA, and it will not be mapped in the future since this area is on tribal land.

Based on the independent mapping of the LACOE hydraulic results performed by WEST, tie-in locations have been identified for the Tres Rios model to shorten the distance of updated floodplain mapping along the study reach. At the upstream end of the model, WEST has identified that the water surface elevation at cross section 203.1 ties into the effective floodplain profile in the vertical within the 0.5 feet limit. Cross section 203.09 in the effective model has a water surface elevation of 972.42 feet NGVD29, and the LACOE cross section 203.1 has a computed water surface elevation of 972.34 feet NGVD29, a difference of 0.08 feet with the updated information lower than the effective data. The floodplain ties in horizontally at this location as well.

In the portion of the model below the Tres Rios North Levee, WEST has identified that the water surface elevation at cross section 198.08 ties into the effective floodplain profile in the vertical within the 0.5 feet limit. Cross section 198.02 in the effective model has a water surface elevation of 934.16 feet NGVD29, and the LACOE cross section 198.08 has a computed water surface elevation of 933.74 feet NGVD29, a difference of 0.42 feet with the updated information lower than the effective data. Similarly, cross section 197.92 in the effective model has a water surface elevation of 933.47 feet NGVD29, and the LACOE cross section 197.98 also has a computed water surface elevation of 933.47 feet NGVD29, a difference of 0.00 feet. The floodplain ties in horizontally in this vicinity as well.

It should be noted that the cross sections listed above as comparable cross sections are no more than 50 feet apart spatially along the FEMA river centerline; the difference in river stationing is not a measurement of the distance between the cross sections due to a slightly different river stationing scheme from the effective model to the current LACOE model.

The final, tied-in floodplain for this study as determined by WEST is shown in Figure 1 below. It should be noted that WEST did not finalize the floodplain results in Figure 1 completely using post-processing techniques of HEC-GeoRAS output other than at the two tie-in locations and along the Tres Rios North Levee. "Holes" in the middle of the floodplain upstream of the levee and "holes" between the Salt and Upper Gila reaches were not removed in this analysis; however, these "holes" should be removed from the final mapping deliverable before being submitted to FEMA. Also, the Upper Gila River should not be mapped for the final deliverable.

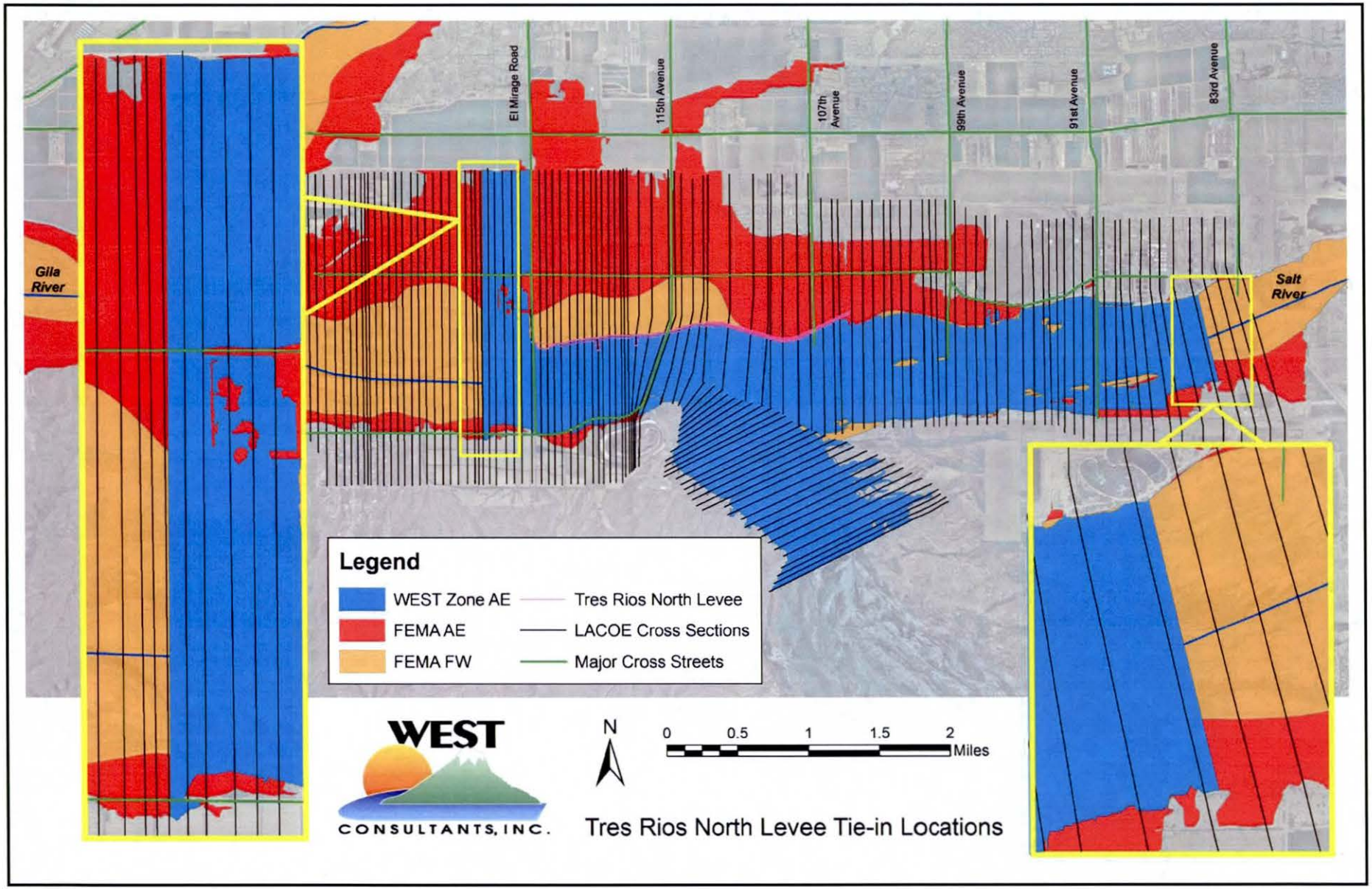


Figure 1. Tres Rios North Levee Tie-in Locations

ELEVATION REFERENCE MARKS FOR DFIRM DEVELOPMENT
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: August 5, 2011

To: Joe Goldstein – LACOE

Cc: Mylene Guron – LACOE
Richard Harris – District

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to identify appropriate data points to use as Elevation Reference Marks (ERMs) as required by the Flood Control District of Maricopa County (District) for work map development and by the Federal Emergency Management Agency (FEMA) for Flood Insurance Rate Map (FIRM) development. These data will be provided to the US Army Corps of Engineers, Los Angeles District (LACOE) to display on the work maps. The final deliverable accompanying this memorandum will be an ArcGIS shape file depicting ERMs throughout the study reach of the Tres Rios hydraulic model. This hydraulic model and all accompanying supporting documentation is supporting pending FEMA flood map revisions of the Salt/Gila River system near the Tres Rios North Levee project.

The following sections of this technical memorandum provide background information and guidance provided by the District to WEST regarding the selection of ERMs, and then the explanation and reasoning for the selection of the final ERMs as represented in the attached ArcGIS shape file.

DISTRICT GUIDANCE REGARDING THE BASIS FOR SELECTING ERMS

The District provided WEST with three ArcGIS shape files representing elevation points that could be used for ERMs in this study. These shape files are described briefly below:

1) National Geodetic Survey (NGS) monuments, maintained by the National Oceanic and Atmospheric Administration (NOAA), in the vicinity of the study reach.

2) Geodetic Densification and Cadastral Survey (GDACS) project monuments demarcating section and quarter section corners, maintained by the Maricopa County Department of Transportation (MCDOT), in the vicinity of the study reach.

3) Aerial control points for the Gillespie topography collected by the District in 2008.

It should be noted that the GDACS dataset is comprised of data including NGS monuments. The GDACS data is prioritized in the following order at all section and quarter section corners: (a) NGS published vertical monuments; (b) NGS published horizontal monuments of A or B order stability only; and (c) MCDOT surveyed section or quarter section corners. Therefore, GDACS monuments can be coincident with NGS monuments.

Based on guidance from the District, there are three primary criteria for selecting ERMs from these three datasets. First, there should be approximately one ERM per map panel if possible, and the highest quality monument available in a panel should be selected as the single ERM per map panel. If no monuments are available on a panel, that panel should not show an ERM.

Second, the quality of the monuments to be used as ERMs should be ranked in the following order: (a) NGS approved monuments and then (b) GDACS approved monuments. This is primarily for the area upstream of El Mirage Road (i.e., east of the roadway alignment) where the Gillespie topography was not used to develop the hydraulic model. For the area downstream of El Mirage Road (i.e., west of the roadway alignment), the ranking for monuments to be used as ERMs should be as follows: (a) Gillespie topography control points put in place by the contractor who collected the aerial photography and developed the topographic data in this area, (b) NGS approved monuments, and then (c) GDACS approved monuments. Once again, it should be noted that the District often specifies that monuments that are used as control for orthophotography development be GDACS points. Since GDACS points are often coincident with NGS points, the Gillespie topography control monuments are often coincident with both GDACS and NGS points.

Third, for any of these monument types, the ERMs should represent monuments that have been recorded in recent surveys as being easily identifiable, if possible. Additionally, if possible, the ERM monuments should be brass caps in concrete, not rebar or other survey markers that were found in place or put in place to represent section or quarter section corners.

Finally, the District indicated that as much backup documentation as is available should be included in the ArcGIS shape file developed as the final ERM deliverable to provide to the LACOE and attached to this technical memorandum. For example, supporting documentation for NGS and GDACS monuments are available online; the URLs to these websites providing supporting documentation for a specific site should be included in the attribute table of the shape file for that location. This data tagging will provide metadata for the ERM points built directly into the shape file that can eventually be delivered to FEMA in support of map changes based on the Tres Rios North Levee.

SELECTION OF ERM POINTS FOR THE TRES RIOS NORTH LEVEE STUDY

To select one ERM point per work map panel, the draft map panel layout that the LACOE will use for the hydraulic modeling output mapping exercise was required. The LACOE provided these data to WEST, and the draft layout is shown in Figure 1 below. It should be noted that this panel layout will likely be updated upon determination of final tie-in locations for the model.

Based on the different order of preference for elevation monument data based on location in the study reach (i.e., the inclusion of Gillespie topography monuments in the area of the model covered by the Gillespie topography product versus the exclusion of these data points for the area of the model not covered by the Gillespie topography), the selection of the ERM points was divided into two sections: upstream of El Mirage Road and downstream of El Mirage Road. These two areas will be discussed individually below.

ERMs for the area upstream of El Mirage Road

The area upstream of El Mirage Road as defined herein includes Panels 1 through 7 as shown in Figure 1 below. Panels 8 and 9 cover portions of the study reach upstream and downstream of El Mirage Road; however, they will be included in the area downstream of El Mirage Road for this analysis.

For the panels upstream of El Mirage Road, none of these panels include any NGS monuments. Panels 1, 2, 4, and 5 include GDACS monuments of varying quality (i.e., found rebar monuments, brass disk monuments set in concrete, and set stainless steel pipe monuments). Since no higher quality GDACS monuments were found on these panels (i.e., found brass disk monuments in concrete) these GDACS monuments will be used as ERMs for Panels 1, 2, 4, and 5. A table of these points with their corresponding identification data is provided in Table 1 below.

The remaining panels upstream of El Mirage Road (Panels 3, 6, and 7) do not include any monuments from NGS or GDACS within their boundaries. Therefore, these panels will not include ERMs on the final work maps.

Table 1. GDACS points used as ERM monuments upstream of El Mirage Road

Panel Number	Selected ERM Survey Point Monument Number	Selected ERM Survey Point Monument Name	Project Name	Description	Elevation (FT NAVD88)	URL (starting with http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/)
1	7608	54307-1M	GDACS	FD 1/2" RB W/O ID 1.3' DN, AFFIXED 2" MARICOPA COUNTY AL CAP STAMPED "T1NR1E S27 S27 S34 S35 2003 37174"	982.026	application/reportsurvey.cfm?gdacsplsspts=7608
2	4473	54319-Z1	GDACS	SET 3" MCHD BC FL STAMPED "T1NR1E 1/4 S33 S34 2004 37174" NOTE- SET CAP IN CONC	959.018	application/reportsurvey.cfm?gdacsplsspts=4473
4	7605	54318-Z1	GDACS	SET 1/2" ROUND SSTL METAL ROD 0.15' UP W/ 3" MARICOPA COUNTY BC STAMPED "T1NR1E 1/4 S32 S33 2004 37174"	950.858	application/reportsurvey.cfm?gdacsplsspts=7605
5	7600	54317-1M	GDACS	FD 1/2" RB W/O ID 0.2' DN, AFFIXED 2" MARICOPA COUNTY AL CAP 0.15' DN STAMPED "T1NR1E 1/4 S31 S32 2003 37174"	950.423	application/reportsurvey.cfm?gdacsplsspts=7600

ERMs for the area downstream of El Mirage Road

The area downstream of El Mirage Road as defined herein includes Panels 8 through 16 as shown in Figure 1 below.

For the panels downstream of El Mirage Road, three of these panels include five monuments provided by the District as having been used in the control for the Gillespie topographic data development. These five monuments fall on Panels 8, 9, and 16. One monument falls on both Panels 8 and 9, and the other four Gillespie control monuments in this area fall on Panel 16. Only the Gillespie topography monument that falls on Panels 8 and 9 was selected as an ERM for the final deliverable to the LACOE, though. This is because the points contained on this panel (titled XNG068, XNG069, XNG070, and XNG071) are all described in the attribute table for this data as follows:

SET #4 RE-BAR W/2" ALUM. CAP MARKED "(PT NUM)"

The other point on this panel is a GDACS corner that is a brass plate set into concrete. Therefore, the four (4) 5/8" rebar monuments for the Gillespie control points on this panel were assumed to be not as high of quality as the GDACS corner monument on this panel, and these monuments were not used as ERMs for the final product deliverable.

For Panels 8 and 9, the Gillespie topography control monument point titled TTZW (elevation of 1160.64 feet NAVD88) is coincident with one of the NGS points on Panels 8 and 9 (point number DV2123, URL http://www.ngs.noaa.gov/cgi-bin/ds_mark.prl?PidBox=DV2123). The description for this point is as follows:

> STATION MARK, A CORPS OF ENGINEERS SURVEY DISK STAMPED TT-ZW-9 ARMY MAP SERVICE 1961, IS SET IN TOP OF A 8 INCH SQUARE CONCRETE CYLINDER WHICH IS SET FLUSH WITH THE SURFACE OF THE GROUND. THE MARK IS SURROUNDED BY A CIRCLE OF WHITE PAINTED ROCKS, IS 4.5 FEET EAST OF FENCE AND 20 FEET WEST-NORTHWEST OF A [sic] OUTCROPPING BEDROCK FORMATION WHICH PROJECTS ABOUT 2 FEET ABOVE THE GROUND.

This point was selected as the ERM for Panels 8 and 9.

For the remaining panels downstream of El Mirage Road, four (4) panels include eight (8) additional NGS monuments: Panels 11, 12, 13, and 16. However, of these 8 monuments, 5 are described with the phrase "MARK NOT FOUND" in the attribute table, and therefore cannot be used as ERMs. The remaining 3 points fall within Panels 11, 12, and 13, with one point falling within each panel. For Panel 11, the NGS monument titled SOUTH 127 was selected as the ERM (point number DJ5916, stability rating D, elevation 284.73m NAVD88, URL http://www.ngs.noaa.gov/cgi-bin/ds_mark.prl?PidBox=DJ5916). This monument is coincident with the GDACS point 6434 (point name 54103-1, elevation 933.999 ft NAVD88, URL http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsplsspts=6434).

For Panel 12, the NGS monument titled SOUTH MCFCD was selected as the ERM (point number DJ5914, stability rating C, elevation 281.63m NAVD88, URL http://www.ngs.noaa.gov/cgi-bin/ds_mark.prl?PidBox=DJ5914). This monument is not coincident with any GDACS monuments.

For Panel 13, the NGS monument titled INDIAN SPRINGS was selected as the ERM (point number DJ5873, stability rating C, elevation 284.90m NAVD88, URL http://www.ngs.noaa.gov/cgi-bin/ds_mark.prl?PidBox=DJ5873). This monument is not coincident with any GDACS monuments.

The remaining panels downstream of El Mirage Road that do not contain a suitable monument from the Gillespie control monument dataset or the NGS monument dataset include Panels 10, 14, 15, and 16. GDACS monuments were available for each of these panels.

For Panel 10, GDACS point 6311 (point name 54118-1, elevation 934.462 intl ft NAVD88, URL http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsplsspts=6311, description *FD 3" MCHD BC IN HH 0.6' DN STAMPED "1/4 S35 S36 T1NR1W LS1591- 1991"*) was chosen to be the ERM.

For Panel 14, GDACS point 1378 (point name 54172-1, elevation 964.366 intl ft NAVD88, URL http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsplsspts=1378, description *FD 3" MCHD BC IN HH 0.3' DN STAMPED "N 1/4 COR SEC 4"*) was chosen to be the ERM.

For Panel 15, GDACS point 6295 (pt name 54106-1M, elevation 918.759 intl ft NAVD88, URL http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsplsspts=6295, description *FD 2" IP 5/8" RB W/ 2" MARICOPA COUNTY AL CAP 0.4' UP STAMPED "T1N R1W 27 28 33 34 2004 37174"*) was chosen to be the ERM.

For Panel 16, GDACS point 6298 (point name 54108-1, elevation 917.135 intl ft NAVD88, URL http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsplsspts=6298, description *FD 3" MCHD BC IN HH 0.6' DN NO STAMPING*) was chosen to be the ERM.

It should be noted that Panel 15 has a GDACS ERM that is a found rebar as opposed to a brass disk or plate set into concrete. The GDACS point that was selected was a found 2" iron pipe that seemed to be a better corner monument than the surrounding found rebar monuments.

SUMMARY OF THE FINAL ERM MONUMENTS

Of all of the panels, only Panels 8 and 9 include a monument of the highest quality as defined by the District, a monument corresponding to the Gillespie topography control points. These panels share a single monument from this group that falls on both panels. This point is coincident with a NGS monument. This Gillespie topography control point is included in the final ERM shape file deliverable attached to this memorandum to be forwarded to the LACOE.

Panels 11, 12, and 13 include NGS monuments with lower stability ratings (i.e., ratings of C and D). The NGS monument on Panel 11 is coincident with a GDACS monument; the NGS monuments on Panels 12 and 13 are not coincident with GDACS monuments. These NGS points are included in the final ERM shape file deliverable attached to this memorandum to be forwarded to the LACOE.

Panels 1, 2, 4, 5, 10, 14, 15, and 16 have at least one GDACS point within the extents of the panel. Panels 10, 14, and 16 have GDACS monuments that are brass disks set into concrete. Panels 1, 2, 4, 5, and 15 do not have GDACS points with a found disk set into concrete, but each of these has an approved monument of another variety that has been included by MCDOT into the final section or quarter section corners dataset for the GDACS project. These GDACS points are included in the final ERM shape file deliverable attached to this memorandum to be forwarded to the LACOE.

Panels 3, 6, and 7 do not include any monuments in the datasets provided by the District to WEST.

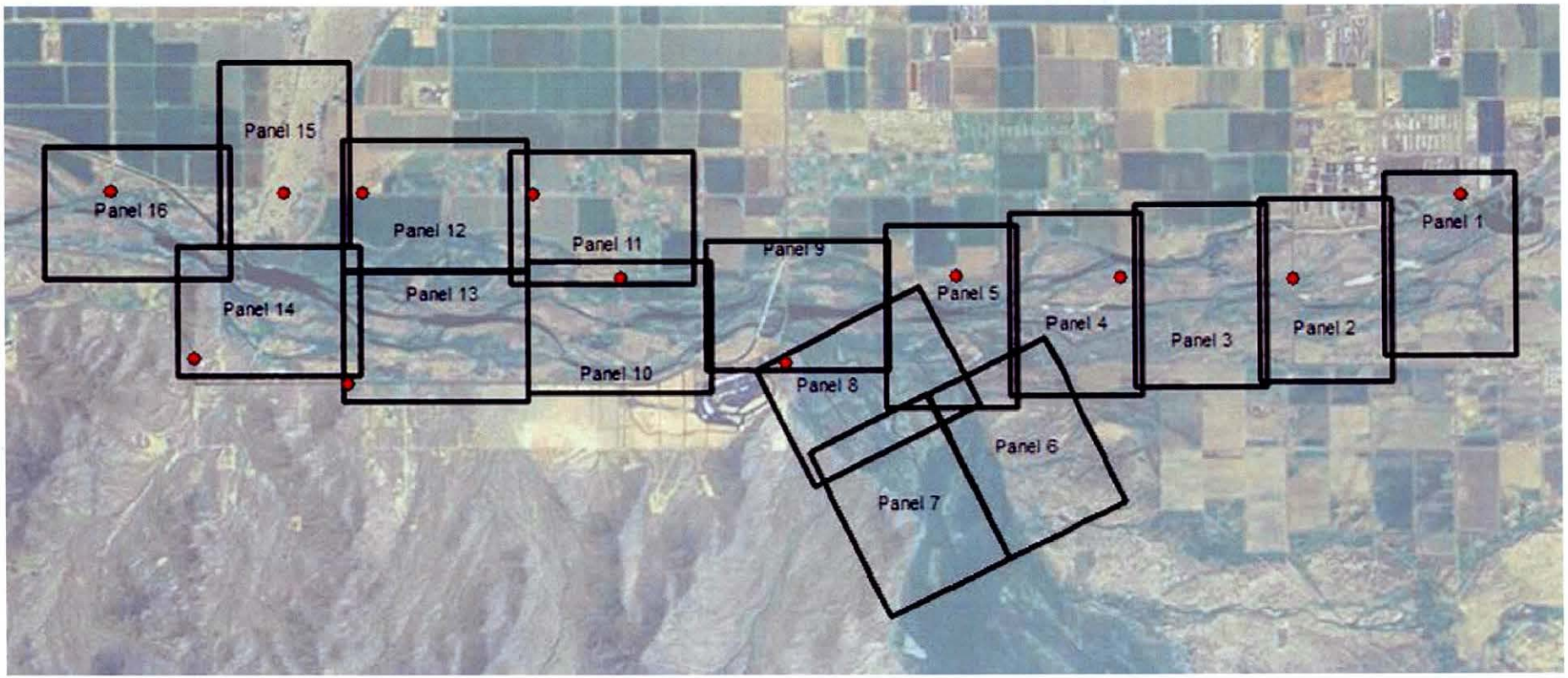


Figure 1. Draft Panel Layout as Provided by the LACOE and the Final ERM Points

CESPL-ED-HH 24 August 2011

MEMORANDUM FOR RECORD

SUBJECT: Submittal of Addendum No. 2 to Tres Rios Environmental Restoration Project May 2011 Hydraulic Analysis

1. The memorandum was originally transmitted on 3 June 2011, subject as above. Minor revisions were received on behalf of the Flood Control District of Maricopa County (FCD) and described in Addendum Memorandum, dated 13 June 2011. The following discussion describes the updated hydraulic model that was revised in July.

2. The May 2011 hydraulic analysis included a topographic vertical datum shift of minus 2.14 feet to convert from NAVD88 to NGVD29. However, it was recently discovered that the shift from NAVD88 to NGVD29 had already been completed prior to transmittal to the COE.

3. The FCD's contractor WEST Consultant's utilized FEMA's "Multiple Conversion Factors (Stream by Stream)" approach to develop a conversion factor to shift the elevation data provided in the 2008 mapping dataset from referencing the NAVD88 vertical datum to referencing the NGVD29 vertical datum. This was done to match the portion of the hydraulic model upstream of El Mirage Road based on 2001 COE topography that already references NGVD29. The FEMA method used is outlined in Section B.4.1.2 of Appendix B of FEMA's Flood Hazard Mapping Program Guidelines and Specifications for Flood Hazard Mapping Partners.

4. The FEMA document requires that, "Under this approach, the Mapping Partner performing the flood hazard analyses shall develop an average conversion factor for each flooding source by establishing separate conversion factors at the upstream end of the studied reach, at the downstream end, and at an intermediate point, and developing an average conversion factor from those data. If the maximum offset from the average conversion factor determined for a flooding source converted in this fashion exceeds 0.25 foot, the Mapping Partner shall follow the protocol described in subsection B.4.1."

5. As per the FEMA regulations, WEST took coordinates from the upstream end of the study reach, the downstream end, and several intermediate points corresponding to various locations along the Tres Rios North Levee and in the portion of the study reach downstream of El Mirage Road. Each of these coordinates were entered into the CORPSCON program, and a conversion factor between NGVD and NAVD was determined for each point. The average conversion for all of these points was calculated to be 2.10 feet. Therefore, a shift of minus 2.10 feet was applied to the elevation mass points of the 2008 topography. These shifted mass points along with the break lines in the mapping product were then used to create a TIN which references the NGVD29 vertical datum. This TIN was then utilized to update the geometry of the HEC-RAS model, and the hydraulic calculations were recomputed in HEC-RAS based on this geometry.

CESPL-ED

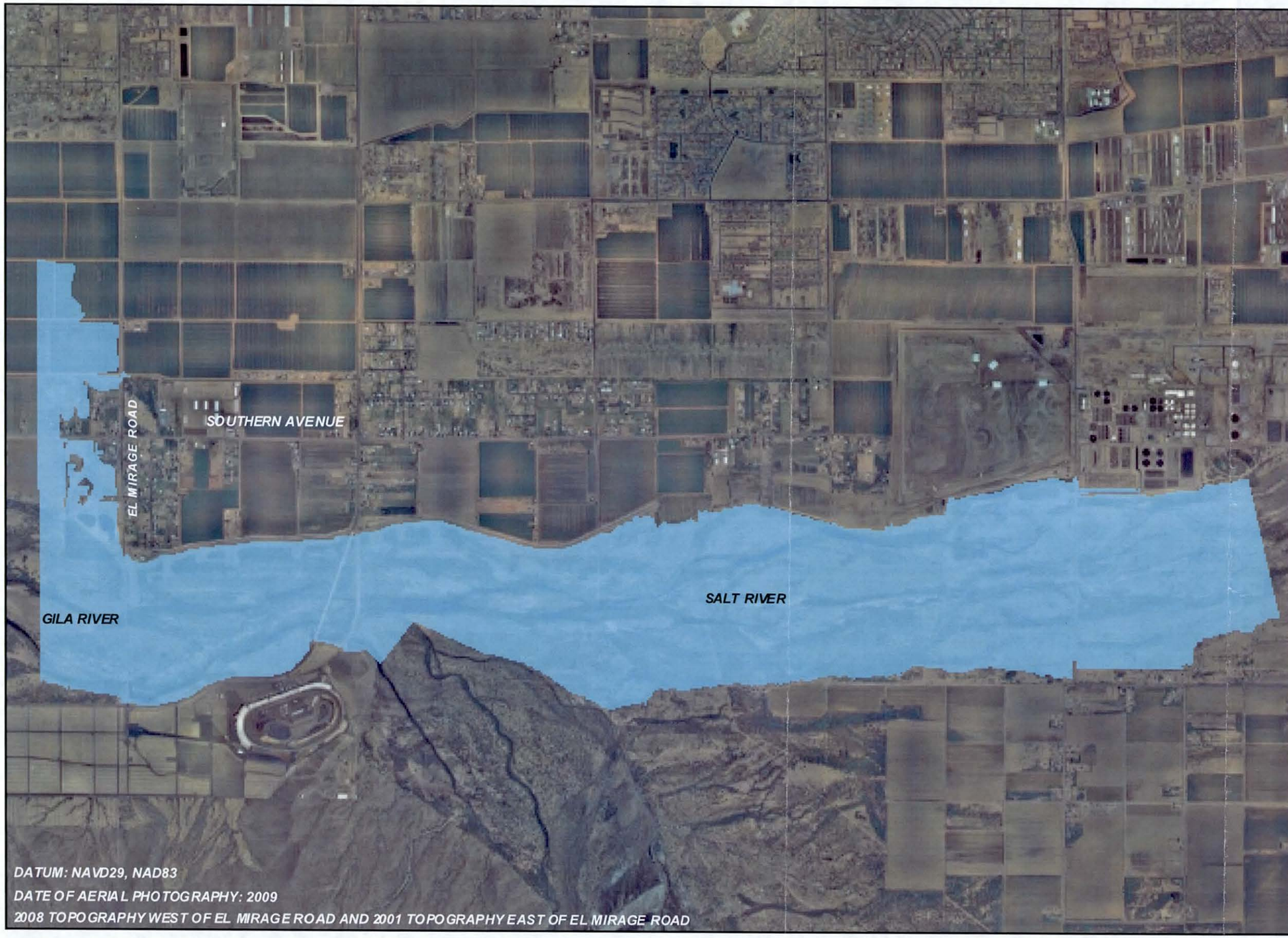
SUBJECT: Submittal of Addendum No. 2 to Tres Rios Environmental Restoration Project May 2011 Hydraulic Analysis

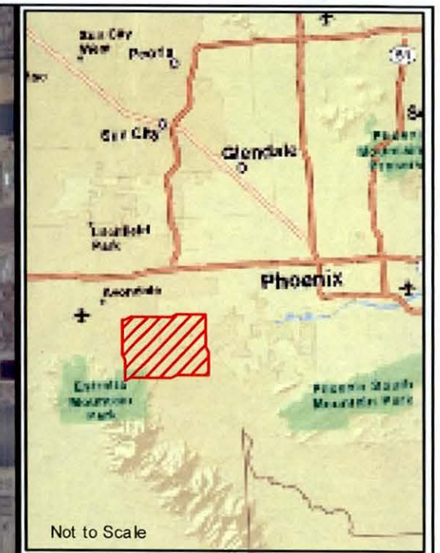
6. Based on the most current analysis described above, the 100-year overflow boundary will not overtop El Mirage Road and Phase 1C is no longer needed.

Van Cris

Encl

VAN CRISOSTOMO, PE
Chief, Hydraulics Section





Vicinity Map

PRELIMINARY

Legend

100-yr Floodplain

3

0 0.1 0.2 0.4 0.6 0.8 Miles

Tres Rios Environmental Restoration Project

TRES RIOS FLOODPLAIN & FLOODWAY DELINEATION PROJECT

AUGUST 2011

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 1

TECHNICAL MEMORANDUM COMPARING OF FEMA AND USACE REQUIREMENTS FOR TECHNICAL LEVEE DOCUMENTATION (FEMA'S TSDN VS. USACE'S NLSER)

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: September 15, 2011

To: Richard Harris – District

Cc: Jody Fischer – LACOE
Don Rerick – District

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to compare the technical documentation requirements for levee evaluation as completed by the US Army Corps of Engineers (USACE) and levee certification as required by the Federal Emergency Management Agency (FEMA) to accredit a levee system as providing protection from the base flood. This memorandum aims to expedite the process of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt/Gila River near the Tres Rios North Levee project by summarizing the requirements from both agencies into a single document to compare their similarities and differences. WEST is performing this work in conjunction with the Flood Control District of Maricopa County (District) and the US Army Corps of Engineers, Los Angeles District (LACOE).

The following sections of this technical memorandum provide background information on the technical documentation developed by both the USACE and FEMA outlining the requirements for levee certification, a brief comparison of these differing requirements, and technical appendices providing the table of contents as identified in the technical documentation from both the USACE and FEMA. It should be noted that for the purposes of this technical memorandum, the term "levee certification" is used generally to refer to either the USACE's levee evaluation process or to FEMA's levee certification process, unless the FEMA levee certification process is explicitly specified in the context of the use of the term "levee certification."

TECHNICAL DOCUMENTATION ADDRESSING THE REQUIREMENTS FOR LEVEE CERTIFICATION FROM BOTH THE USACE AND FEMA

The USACE has recently developed guidance for the assessment and evaluation of levee systems. The title of the document developed by the USACE for this guidance is *Engineering Circular 1110-2-6067: USACE Process for the National Flood Insurance Program (NFIP) Levee System Evaluation* (referred to herein as EC 1110-2-6067). EC 1110-2-6067 is a recent document (with a date on the draft version of August 31, 2010), and this guidance is still being revised by the USACE towards eventual finalization. The end product as specified in EC 1110-2-6067 is a National Levee System Evaluation Report (NLSER). The recommended table of contents for the final NLSER report as specified in EC 1110-2-6067 is provided in Appendix A included in this memorandum. The USACE's goal for the NLSER document, as stated in EC 1110-2-6067, is provided below:

> FEMA is verifying that all levees recognized on previous FIRMs meet the requirements outlined in Title 44 of the Code of Federal Regulations, Section 65.10 (44 CFR 65.10), *Mapping Areas Protected by Levee Systems*. Title 44 CFR 65.10 requires that specific structural requirements must be certified by a registered professional engineer or a federal agency with responsibility for levee design, such as USACE, that the levee has been adequately designed and constructed to provide reasonable assurance of excluding the base flood (as defined in 44 CFR 59.1) from the leveed area and thus meet NFIP levee system evaluation requirements. Should USACE be requested to provide an NFIP levee system evaluation, USACE will review all components of the entire levee system as outlined in this EC, not only design and construction issues as noted in the CFR... The purpose of an NFIP levee system evaluation is to determine how flood hazard areas behind levees are mapped on FIRMs.

FEMA has also developed guidance for the assessment and certification of levees. The primary guidance for documentation for FEMA's levee certification (and all technical flood hazard mapping for that matter) currently approved by FEMA is included in the *Guidelines and Specifications for Flood Hazard Mapping Partners*, a document deriving from FEMA's recent Map Modernization effort (or Map Mod) within FEMA's Flood Hazard Mapping Program. Specifically, Appendix M of this document—titled *Guidance for Preparing and Maintaining Technical and Administrative Support Data*—serves as a basis for documentation supporting levee certification and mapping. Appendix M details the requirements for the Technical Support Data Notebook (TSDN), the typical FEMA format for levee certification projects as mentioned by FEMA RIX representatives on a recent teleconference call for the Tres Rios North Levee project that occurred on August 29, 2011. Although the specific TSDN format is not a requirement for a federal agency completing a flood hazard mapping project in conjunction with FEMA (as is the case with the LACOE for the TRNL project), the information typically provided in a TSDN should still be provided by the LACOE to expedite the FEMA review process and provide a well-documented flood hazard study. Appendix M of the *Guidelines and Specifications for Flood Hazard Mapping Partners* document originally developed in 1989, and the most recent revision to this information was completed in April 2003. The recommended table of contents for the final TSDN report as specified in Appendix M is provided in Appendix B included in this memorandum.

More recently, FEMA has developed additional guidance specifically applicable to levees as outlined in FEMA's Procedure Memorandum No. 63: Guidance for Reviewing Levee Accreditation Submittals. The date of this document was September 2, 2010. FEMA's goal for this document, as stated in EC 1110-2-6067, is provided below:

> By regulations, communities and levee owners have the responsibility to provide 44 CFR Section 65.10-compliant data and documentation, when seeking recognition of a levee system on an NFIP map. Following issuance of Procedure Memorandum (PM) Nos. 34 and 43, dated August 22, 2005, and September 25, 2006, respectively, and revised PM 43 dated March 16, 2007, the Federal Emergency Management Agency (FEMA) has seen an increase in the number of accreditation request submittals. Therefore guidance is being provided to improve and clarify the process of review for compliance with 44 CFR Section 65.10. These reviews must be consistent for all accreditation submittals including, but not limited to new and continued accreditation requests as part of a mapping project, requests submitted as Letters of Map Change (LOMCs), Physical Map Revisions (PMRs), and Provisionally Accredited Levees (PALs)... The attached guidelines are being issued to improve and clarify the process of review for compliance with 44 CFR Section 65.10.

Appendices A, B, and C of this technical memorandum provide the general suggested outlines of documentation reports for the NLSER for the USACE, the TSDN for FEMA, and the PM No. 63 checklist for FEMA, respectively.

BRIEF COMPARISON OF THE DIFFERENCES IN THE REQUIREMENTS FOR LEVEE CERTIFICATION FROM THE USACE AND FEMA

This section aims to briefly highlight the conceptual differences between levee certification documentation for the USACE and FEMA.

The USACE states clearly in EC 1110-2-6067 that the goal of the NLSER is not solely to fulfill the requirements for a FEMA levee certification project or for NFIP mapping purposes as defined in 44 CFR Section 65.10. As stated in EC 1110-2-6067, "*USACE has chosen to use the phrase 'NFIP levee system evaluation' to emphasize that EC 1110-2-6067 is focused on the complete levee system's status with regard to requirements of both 44 CFR 65.10 and USACE guidelines.*" The USACE goes so far as to not use the "certification" term as used by FEMA for this type of analysis to differentiate this fact. This leads to some broad conceptual differences in the requirements for levee evaluation by the USACE and levee certification by FEMA. For example, items required for the NLSER such as "Probability of Failure and Consequences" and "System Capacity Exceedance Provisions" provide a risk and uncertainty component of the levee evaluation analyses that are not mandated by 44 CFR Section 65.10. Additionally, an Emergency Action Plan is required for an NLSER and only recommended by FEMA. This is another example of a system-wide approach to overall levee analysis by the USACE compared to the FEMA.

FEMA's requirements for the TSDN and additional guidance outlined in PM No. 63 differ primarily in one area from the NLSER: the level of detailed instruction regarding the format and technical aspects of the hydraulic modeling to support flood hazard mapping. Given FEMA's long history of regulating and maintaining flood hazard mapping for flood insurance purposes,

their requirements for technical information are much more specific than the USACE requirements. For example, the TSDN outline includes the following:

> Hydraulic support data and calculations for riverine flooding sources that were developed for the Flood Map Project are provided. Such data may include cross-section information (i.e., area, velocity, elevation calculations); floodway analyses; cross-section plots; computer models, calculations, and execution runs; and any other relevant data.

Additionally, a "with" and "without" levee hydraulic analysis is required by FEMA for application in mapping FEMA's shaded Zone X regions, while this type of analysis is not specified for the NLSER. Also, the TSDN requires draft output information from the analysis to be developed in the Flood Insurance Study (FIS) Report format developed by FEMA. These types of detailed requirements for technical data are much more common in the FEMA's Appendix M and PM No. 63 documentation.

In summary, the conceptual differences between the USACE and FEMA requirements for levee certification documentation drive significant detailed differences in the final products required by both agencies. The conceptual differences can be summarized by stating that the NLSER aims to assess and evaluate an entire levee system for long-term functionality of the flood protection feature, including risk and uncertainty analysis for possible failure scenarios, public safety, detailed operations and maintenance, as well as the level of protection provided for the base flood. FEMA's TSDN, on the other hand, is primarily aimed at defining the level of protection provided by a levee for the base flood—and specifically for the development of flood hazard mapping in respect to this level of protection—with less emphasis placed on the overall levee system evaluation. As such, the FEMA guidance provides much more technical guidance for development of detailed levee certification work products, specifically the hydraulic analyses. Additional differences in the requirements for the two methods can be seen in the suggested outlines for data submittals from the NLSER, the TSDN, and PM No. 63 in Appendices A, B, and C of this document, respectively.

APPENDIX A: USACE REQUIRED OUTLINE FOR THE NLSER

I. Table of Contents

II. Summary of the NFIP levee system evaluation findings (signed and approved by the Levee Safety Officer (LSO)). Summary should include key findings, assumptions, and expiration date of the validity period for positive NFIP levee system evaluations

III. System Description (location, levee system authorization, main features, local sponsor, etc). Determine entity responsible for operation and maintenance of the levee, and include pertinent information that illustrates easements, ROW, and ownership boundaries

IV. References (e.g., design documents, reports, as-builts, models, etc. used for the analysis)

V. NFIP Levee System Evaluation Team Members

VI. Previous NFIP levee system evaluation/FIRM or DFIRM (not available for TRNL)

VII. Letter of Intent, Memorandum of Agreement, Scope of Work (whichever applicable) between district and requester—*a discussion on page 4 of the EC 1110-2-6067 document states that "Upon request by a state, local, or tribal government, USACE may perform a NFIP levee system evaluation ... using funding provided by the requester, provided USACE has statutory authority to do so." This indicates that the local sponsor, which is the City of Phoenix for the TRNL, would be the requester for this project.*

VIII. Overall Performance History/O&M (from inspection reports, past flood events and associated flood-fighting activities, rehabilitation measures, etc.)

IX. Engineering Studies, Investigations, and Analyses
   a. Site Visit Summary (participants, scope, itinerary, and summary of findings)

   b. Hydrology and Hydraulics Evaluation
      i. Summary of Available Information
      ii. Characterization of the Flood Hazard
      iii. Capacity Exceedance/Criteria and System Performance

   c. Structural Evaluation
      i. Summary of Available Information
      ii. Closure Devices
      iii. Stability and Strength Requirements
      iv. Corrugated Metal Pipe (CMP) Condition Assessment

d. Geotechnical Evaluation
    i. Summary of Available Information
    ii. Embankment Erosion Protection
    iii. Seepage and Piping
    iv. Embankment and Foundation Stability
    v. Settlement
    vi. Seismic Issues

e. Electrical and Mechanical

f. Interior Drainage

g. Other Analysis/Pertinent Data

X. System Evaluation
    a. Emergency Response Plan and Status

    b. Probability of Failure and Consequences

    c. System Capacity Exceedance Provisions

XI. Residual Risk and Public Safety

XII. Appendices
    a. Site Visit Report

    b. Applicable Meeting Minutes and Decision Milestones

    c. Review Documentation

    d. Additional Appendices (as needed)

APPENDIX B: FEMA REQUIRED OUTLINE FOR THE TSDN FROM APPENDIX M

I. General Documentation;
   a. Special Problem Reports
   b. Contact Reports
   c. Meeting Minutes/Reports
   d. General Correspondence
   e. FEMA MT-2 forms for single-panel studies.

II. Engineering Analyses;
   a. Riverine Hydrologic and Hydraulic Analyses
      i. Formatting Requirements
         1. Data are arranged in alphabetical order according to the flooding source/stream name.
         2. Data are properly labeled to identify the submitting Mapping Partner and the name(s) of community(ies) and State.
         3. Information on the type of model used, date of analysis, and exhibit number(s) assigned to those analyses that cannot be physically included in the TSDN because of size or volume are included

      ii. Technical Data Requirements
         1. Hydrologic support data developed for the Flood Map Project are provided. Such data may include basin characteristics, normal depth calculations, log-Pearson Type III calculations, regional regression equation calculations, frequency-discharge curves, and other relevant data.
         2. Hydraulic support data and calculations for riverine flooding sources that were developed for the Flood Map Project are provided. Such data may include cross-section information (i.e., area, velocity, elevation calculations); floodway analyses; cross-section plots; computer models, calculations, and execution runs; and any other relevant data.
         3. The input files and results of the H&H analyses are delivered in both hardcopy (paper) and soft copy (electronic) format.
         4. If paper copies of the computer models used or generated for the Flood Map Project are too large to include in the TSDN, those copies are to be individually bound and labeled according to the community and flooding source to which they apply, properly identified by exhibit number, and listed on the appropriate index .
         5. Copies of computer models on diskette or CD-ROM are packaged in computer envelopes or binders, labeled properly, identified by exhibit number, and listed on the appropriate index.

   b. Key to Cross-Section Labeling and Key to Transect Labeling

III. Draft Flood Insurance Study (FIS) Report;

a. FIS report text;
b. Required tables (e.g., Summary of Discharges, Summary of Stillwater Elevations, Transect Locations, Surge Elevations, Floodway Data Tables), which may vary depending on the Flood Map Project;
c. Flood Profiles, if appropriate;
d. Transect Location Map, if appropriate;
e. Certification of compliance for work completed (Figure M-11); and
f. Other relevant text, tabular, and graphic materials.

IV. Mapping Information; and

a. Topographic maps;
b. Work maps;
c. Base maps;
d. Aerial photographs;
e. Soil and vegetation maps;
f. U.S. Geological Survey topographic quadrangle maps;
g. Flood Hazard Boundary Maps;
h. Community maps; and
i. All other maps (manual and digital).

V. Miscellaneous Reference Materials.

a. The submitting Mapping Partner shall include all other support materials developed or used during the Flood Map Project in the "Miscellaneous Reference Materials" section of the TSDN.

APPENDIX C: FEMA PROCEDURAL MEMORANDUM #63 REQUIREMENTS

I. Tier 1 Review

a. Step 1: All Items Signed by a registered P.E.

b. Step 2: Freeboard Check – The report must provide freeboard information showing the levee meets the requirements of 44 CFR Section 65.10(b)(1), including freeboard requirements for structures, constrictions, and ice jam situations (where warranted).

II. Tier 2 Review

a. Step 3: Regulations – The submittal must adequately address all applicable Federal, State, and local laws, regulations and requirements, including, but not limited to, Federal and local floodplain management laws, environmental laws, and permit requirements.

b. Step 4: Operations and Maintenance Plan – At a minimum the maintenance plans shall specify the maintenance activities, the frequency with which they will be performed, and the name or title of the person who will be responsible for ensuring that maintenance activities are accomplished… The maintenance plan should address the type of vegetation on and adjacent to the levee, the activities required to maintain the flood characteristics represented in the hydrologic and hydraulics (H&H) analyses and any special environmental considerations. Plans should also include provisions for inspection of the levee and maintenance of any mechanical systems, such as closure devices, pumps, valves and relief wells.

c. Step 5: "With Levees" and "Without Levees" Analysis – The "with levee" analysis is used to determine the BFEs on the riverine side of the levee. If the levee is accredited to provide protection from the base flood, the "without levee" analysis is used to determine the area that is protected by the levee. If it is not accredited, a second set of BFEs on the landward side of the levee is established.

III. Tier 3 Review

a. Step 6: Levee System and Cross Reference Check – The reviewer will verify that all components, as described in 44 CFR Section 65.10, use the same flooding elevations and conditions, and that the entire levee system (if a system consists of different segments) is considered in the submittal.

b. Step 7: Interior Drainage Analysis – The submittal must include an H&H study identifying the source(s) and extent of flooding due to interior drainage for any ponding area greater than I-foot in depth, and a topographic work map showing the extent of these areas.

c. Step 8: Structural Design Requirements
   i. Closure Structure Data: The submittal must include information for all levee openings and low points where closure structures are structurally part of the levee.

   ii. Embankment Protection: The design report must include an analysis addressing protection of the levee embankment from erosion. This analysis should include the embankment side slope, calculated flood water velocity, expected duration of the flood at various stages, wind and wave action, and ice and debris flow where applicable.

   iii. Embankment and Foundation Stability: The report must include an analysis of the embankment and foundation stability. This should include an examination of component material characteristics of the foundation and levee embankment, compaction design, seepage at critical locations, and penetrations and their associated filter materials. Additionally, the impact of any structure, including but not limited to bridges and roads crossing the levee must be addressed.

   iv. Settlement: The report must provide an engineering investigation that assesses the potential settlement of the levee and reduced freeboard over time. Consideration should be given to embankment loads, compressibility of foundation soils, age of the levee, and the construction methods used.

   v. All Other, as Applicable

d. Step 9: Inspection Reports – Documentation or reports on tests and inspections that are required by regulation under 44 CFR Section 65.10(c)(1)(iii) and Section 65.1O(c)(2)(iv) must be provided. All other applicable inspection reports from either the United States Corps of Engineers (USACE) or other sources must be considered as part of the FEMA review to ensure that any issues related to 44 CFR Section 65.10 have been addressed.

IV. Tier 4 – Mapping the Levee
   a. Step 10: Final Completeness Check

TECHNICAL MEMORANDUM COMPARING THE FEMA EFFECTIVE RAS MODEL TO THE ORIGINAL USACE RAS MODEL TO THE UPDATED WEST RAS MODEL, SPECIFICALLY IN THE VICINITY OF THE SALT/GILA CONFLUENCE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS NORTH LEVEE PROJECT

Date: October 6, 2011

To: Richard Harris – District

Cc: Van Crisostomo – LACOE
Joe Goldstein – LACOE
Reuben Sasaki – LACOE
Don Rerick – District

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The following memorandum is a comparison of three HEC-RAS models for the Salt River and Lower Gila River in the vicinity of the confluence of the Salt and Gila Rivers: (1) the FEMA effective HEC-RAS model, (2) the HEC-RAS model developed recently by the US Army Corps of Engineers, Los Angeles District (LACOE), and (3) updates to the LACOE model developed by WEST Consultants, Inc. (WEST). The purpose of this memorandum is to help expedite the process of producing hydraulic modeling and supporting documentation for pending FEMA flood map revisions of the Salt River and Lower Gila River near the Tres Rios North Levee project. This will be done by providing a model that is consistent with FEMA's requirements for floodplain mapping. This work is being performed for the Flood Control District of Maricopa County (District).

The following sections of this memorandum provide background information on the effective FEMA HEC-RAS model, the LACOE HEC-RAS model, and an explanation and reasoning for the further updates to the HEC-RAS model made at the request of the District.

EFFECTIVE FEMA HEC-RAS MODEL

FEMA's current effective HEC-RAS model was completed in 1999 by Michael Baker, Jr., Inc. The topography used for the model development and mapping was based on aerial photography dating from the early 1990's. The topography in the vicinity of the confluence of the Salt and Gila Rivers was based on aerial photogrammetry from 1991. The Upper Gila River above the confluence with the Salt River was not included in the hydraulic model. However, the flow increase associated with the Gila River was included as a flow change location in the HEC-RAS model of the Salt River and Lower Gila River. The cross section locations for the effective FEMA HEC-RAS model are shown in Figure 1.

LACOE HEC-RAS MODEL

During the Preconstruction Engineering and Design (PED) Phase for the Tres Rios North Levee (TRNL) completed by the LACOE in 2004, the LACOE decided to develop an updated hydraulic model of the study reach to better account for inflows from the Upper Gila River. Their HEC-RAS model (which was actually developed by WEST as a contractor for the LACOE) includes the Upper Gila River as a separate reach. By adding the Upper Gila River reach to their model and creating a junction to connect the Salt and Upper Gila Rivers before joining the Lower Gila River, the LACOE could better understand the possible project effects of the TRNL and the Tres Rios Environmental Restoration Project on the study reach. The tributary junction accounts for momentum changes due to tributary angle, a better understanding of possible backwater effects of one reach on the other, and other physical phenomena associated with tributary inflows. In light of the Tres Rios Environmental Restoration Project consisting of project features to be constructed on the Salt, Lower Gila, and Upper Gila Rivers, this hydraulic design approach was the most judicious for their purposes. The cross section locations for the LACOE HEC-RAS model are shown in Figure 2.

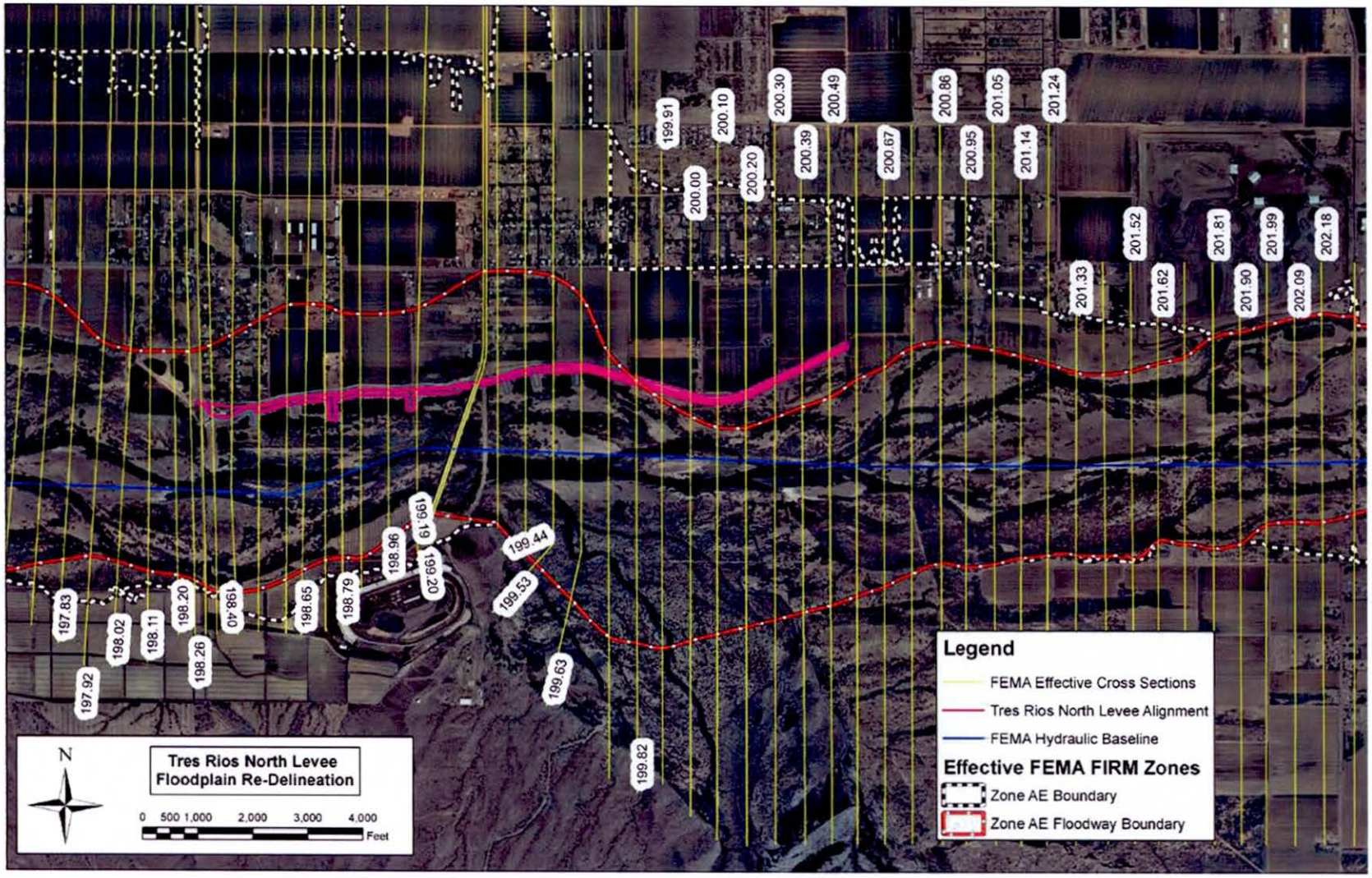


Figure 1. Cross section alignment of the currently effective FEMA HEC-RAS model

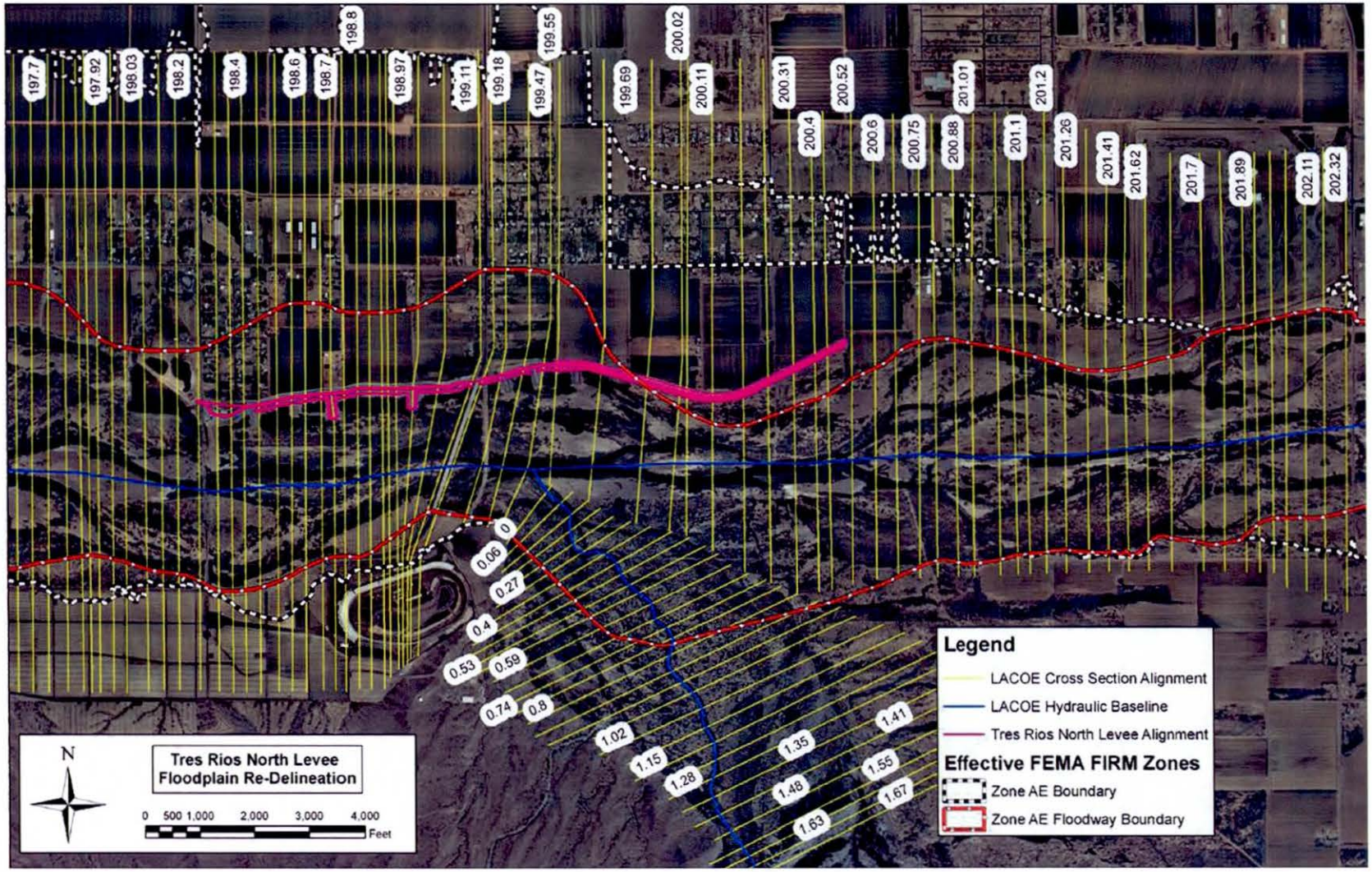


Figure 2. Cross section alignment of the LACOE HEC-RAS model for the Tres Rios Environmental Restoration Project design

NEED FOR UPDATING THE LACOE HEC-RAS MODEL

The area located to the south of the Salt River and Lower Gila River along the study reach is comprised of tribal lands of the Gila River Indian Community (GRIC). The GRIC does not participate in FEMA's National Flood Insurance Program (NFIP). Therefore, FEMA does not have any regulatory responsibilities to maintain Flood Insurance Rate Maps (FIRMs) for GRIC tribal lands, and does not have authority to enforce floodplain ordinances or flood insurance requirements in this area. As a result, FEMA has never developed hydraulic models, flood hazard maps, or FIRMs for the Upper Gila River. However, a portion of the Upper Gila River floodplain is mapped as being inundated in the effective Flood Insurance Study (FIS), as shown in Figure 1.

The FEMA effective flooding extents shown along the lower portion of the Upper Gila River floodplain are the result of flooding along the Salt River - Lower Gila River system and not from the Upper Gila River. In fact, the effective FEMA study truncated the floodplain at the boundary of the floodway, and did not extend the floodplain to the actual topographic boundary that would contain the flow (which would have been up to 2,000 feet further south of the current effective floodplain boundary). Figure 3 is a representative cross section from the effective model that overlaps both the Salt River and Upper Gila River. This figure shows that the flow is not contained in the left overbank, which is generally not allowed by FEMA modeling standards. This occurs at multiple cross sections that include both the Salt and Upper Gila Rivers.

WEST is not sure of this, but we are assuming that an exception to FEMA's modeling standards was allowed in this location because of the non-participating community status of the GRIC. WEST believes that the floodplain was allowed to be ended at the floodway to prevent the need for significant mapping on tribal lands. As a result, the effective FEMA hydraulic model likely produces a conservatively high base flood elevation in the area. In order to meet FEMA's current modeling and mapping requirements, the cross sections in the LACOE HEC-RAS model will need to be extended to include the entire floodplain area.

FEMA generally prefers that hydraulic models not include multiple reaches with junctions for flood studies. This helps avoid overly complex tributary or distributary HEC-RAS models submitted for mapping changes. As previously mentioned, the current effective model does not use a junction because the Upper Gila River is not included in the model. Rather, it is accounted for in the hydraulic analysis with a flow change at the transition between the Salt and Lower Gila Rivers. The multiple reaches and the junction with the LACOE HEC-RAS model would likely be considered too complex for FEMA's needs. Therefore, the Upper Gila River reach and the junction need to be removed from the LACOE HEC-RAS model.

Additionally, the effective river stationing is based on FEMA's currently effective hydraulic baseline, which the LACOE modified during their hydraulic modeling effort for the PED phase of the TRNL project. In order to correlate the updated river stationing based on the LACOE hydraulic baseline to the currently effective FEMA stationing, significant work would have to be performed to annotate the FIS report text and data (i.e., floodway data table, flood profiles, etc.) to account for this variation in river stationing based on the new hydraulic baseline. Therefore, the stationing in the LACOE HEC-RAS hydraulic model should be updated to be consistent with the effective FEMA study.

Finally, the LACOE HEC-RAS model also required an update to the overbank flow lengths in the right overbank to take into account the newly built Tres Rios North Levee. The original RAS model had a right overbank flow path which reflected a flow center-of-mass north of the TRNL. Since the levee will contain flows to the south of the levee, the right overbank flow path was adjusted to reflect this physically in the HEC-RAS geometry. Figure 7 shows the adjusted flow path of the right overbank in this area used to calculated downstream reach lengths for the right overbank.

Based on the recommendations listed above, it was collectively decided by the District, the LACOE, and WEST that the LACOE HEC-RAS model should be updated to: (1) remove the Upper Gila River from the model, (2) extend the Salt River cross sections further to the south to contain the flow, (3) update the model reach lengths to match the currently effective FEMA hydraulic baseline to maintain consistent regulatory river stationing for FEMA, and (4) update the model reach lengths to account for the changed flow paths based on the construction of TRNL. These changes will result in a HEC-RAS model with a single reach, and because this modeling approach is consistent with the approach used for the current effective model, they should help expedite the mapping update process for FEMA. This model has been updated, and the updated cross section locations are shown in Figure 5. Additionally, the modified river stationing is shown in Table 1. It should be noted that the coordinates of the cross sections did not change except for the 13 cross sections that were extended further to the south to contain the Salt River overflow in the vicinity of the Upper Gila River (RS 200.64 to 199.52); however, all the cross sections were renamed based on the updated river stationing based on the FEMA hydraulic baseline.

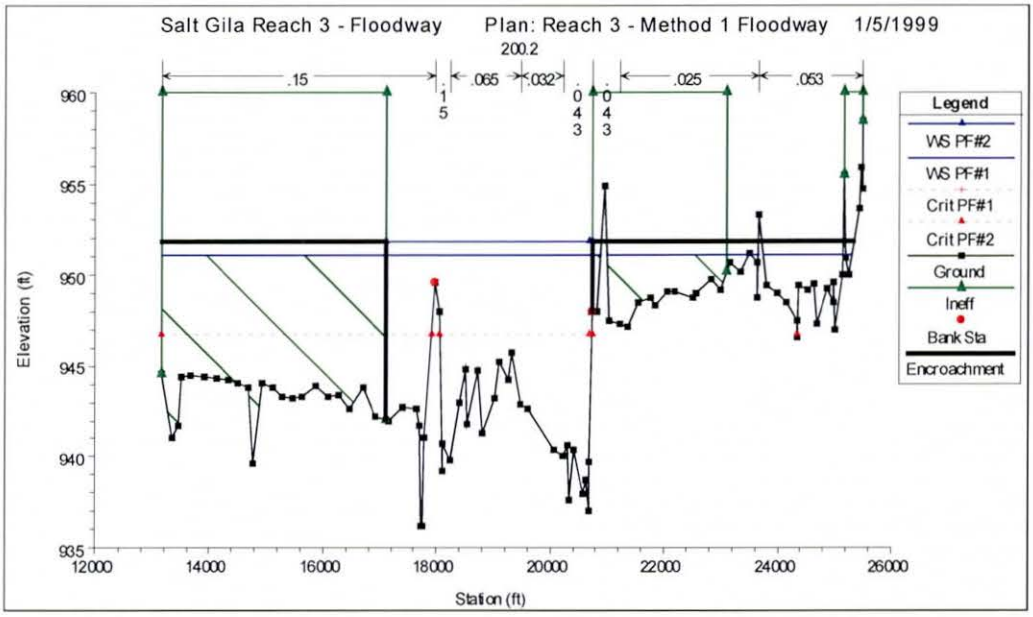


Figure 3. Cross section 200.2 from the effective HEC-RAS model showing water overtopping the left overbank

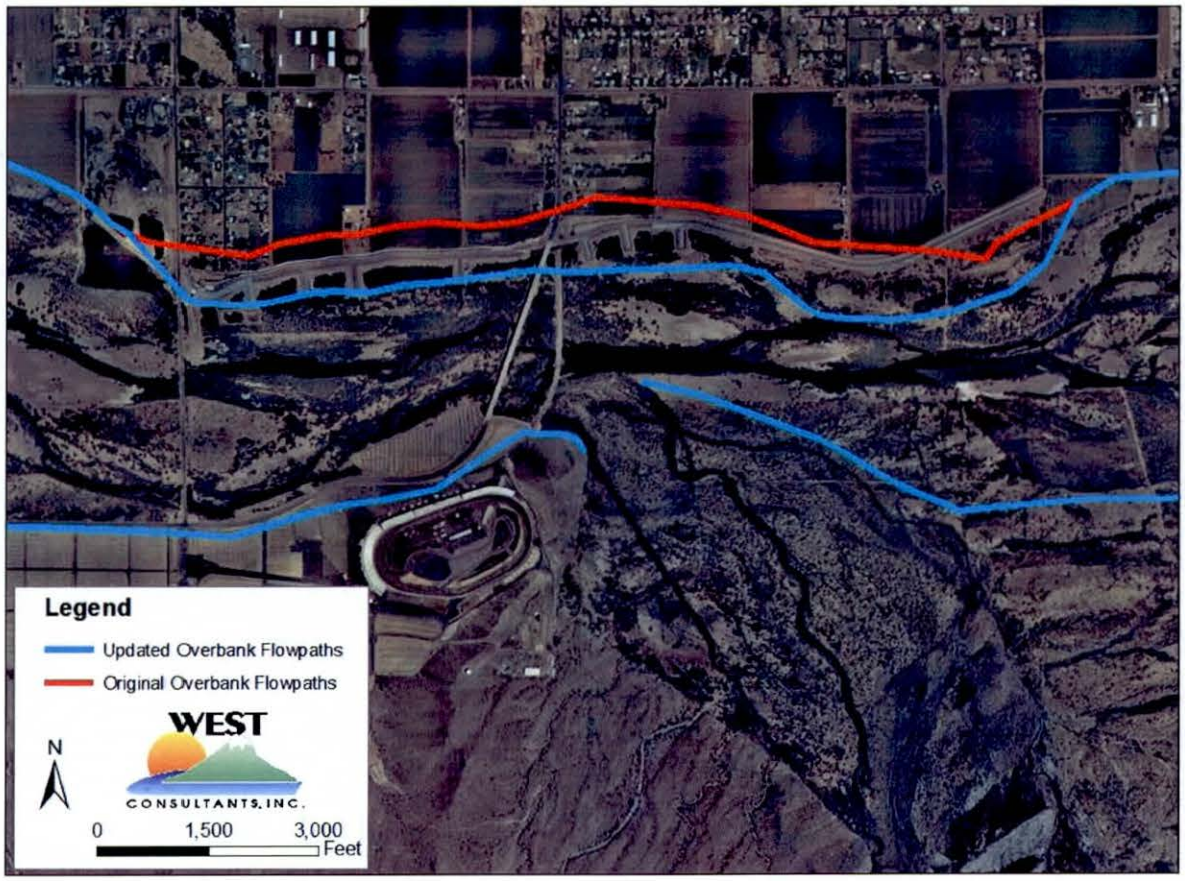


Figure 4. Adjusted right overbank flow line in the vicinity of the TRNL

Table 1. Key to river station updates to match the current effective FEMA river stationing

Original HEC-RAS RS		Updated HEC-RAS RS
203.48	→	203.46
203.38	→	203.36
203.3	→	203.28
203.2	→	203.18
203.1	→	203.08
202.97	→	202.94
202.85	→	202.82
202.78	→	202.75
202.69	→	202.65
202.61	→	202.57
202.54	→	202.49
202.48	→	202.43
202.4	→	202.35
202.32	→	202.26
202.24	→	202.19
202.18	→	202.12
202.11	→	202.06
202.06	→	202.01
202.01	→	201.96
201.96	→	201.91
201.89	→	201.84
201.81	→	201.77
201.7	→	201.66
201.62	→	201.58
201.54	→	201.5

Original HEC-RAS RS		Updated HEC-RAS RS
201.48	→	201.44
201.41	→	201.37
201.33	→	201.29
201.26	→	201.22
201.2	→	201.16
201.16	→	201.12
201.1	→	201.06
201.01	→	200.97
200.95	→	200.91
200.88	→	200.84
200.83	→	200.79
200.75	→	200.71
200.68	→	200.64
200.6	→	200.56
200.52	→	200.48
200.47	→	200.43
200.4	→	200.36
200.31	→	200.27
200.22	→	200.18
200.11	→	200.07
200.02	→	199.98
199.98	→	199.94
199.86	→	199.83
199.69	→	199.66
199.55	→	199.52

Original HEC-RAS RS		Updated HEC-RAS RS
199.47	→	199.44
199.38	→	199.36
199.31	→	199.29
199.21	→	199.2
199.18	→	199.16
199.11	→	199.09
199.06	→	199.02
199.02	→	198.98
198.99	→	198.95
198.97	→	198.93
198.93	→	198.88
198.88	→	198.83
198.83	→	198.78
198.8	→	198.75
198.76	→	198.7
198.7	→	198.64
198.65	→	198.59
198.6	→	198.54
198.54	→	198.48
198.49	→	198.43
198.45	→	198.38
198.4	→	198.34
198.33	→	198.27
198.26	→	198.2
198.2	→	198.14

Original HEC-RAS RS		Updated HEC-RAS RS
198.15	→	198.09
198.08	→	198.02
198.03	→	197.97
197.98	→	197.92
197.95	→	197.89
197.92	→	197.86
197.87	→	197.81
197.81	→	197.75
197.75	→	197.69
197.7	→	197.64
197.64	→	197.58
197.58	→	197.53
197.53	→	197.48
197.48	→	197.42
197.42	→	197.37
197.38	→	197.32
197.33	→	197.27
197.28	→	197.22
197.23	→	197.18
197.18	→	197.13
197.16	→	197.11
197.14	→	197.08
197.09	→	197.04
197.05	→	196.99
196.99	→	196.94

Original HEC-RAS RS		Updated HEC-RAS RS
196.94	→	196.88
196.87	→	196.81
196.81	→	196.75
196.75	→	196.7
196.69	→	196.63
196.63	→	196.57
196.57	→	196.51
196.5	→	196.44
196.44	→	196.37
196.38	→	196.31
196.32	→	196.26
196.23	→	196.16
196.14	→	196.07
196.08	→	196.01
195.98	→	195.91
195.86	→	195.79
195.77	→	195.7
195.65	→	195.58
195.55	→	195.48
195.45	→	195.38
195.34	→	195.27
195.28	→	195.21
195.22	→	195.15
195.2	→	195.13
195.16	→	195.09

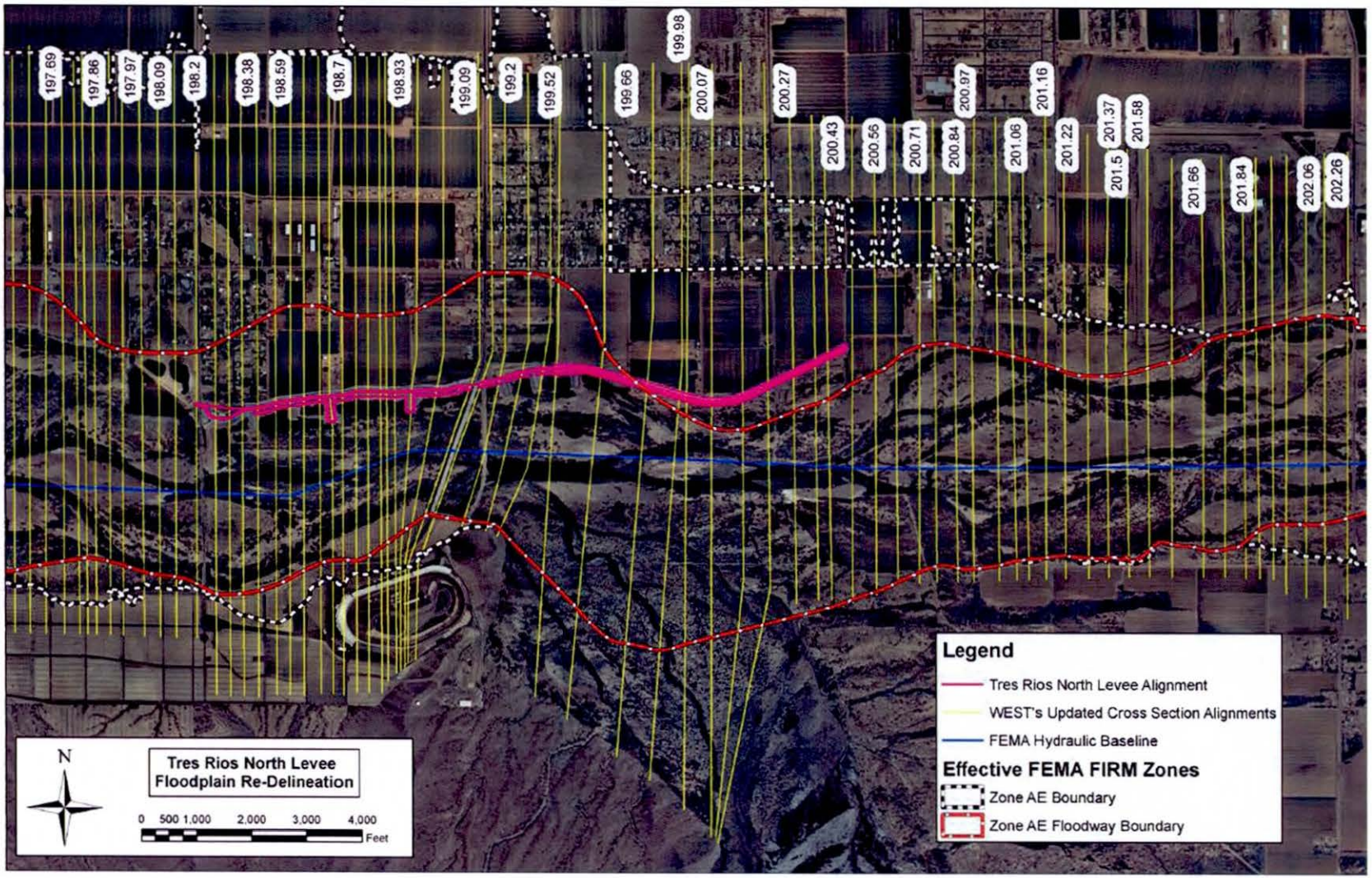


Figure 5. Cross section alignment of the updated WEST HEC-RAS model for the TRNL PMR to be submitted to FEMA

CHALLENGES AND RECOMMENDATIONS FOR THE UPDATED MODELING APPROACH

The revised cross section alignments for the updated HEC-RAS model shown in Figure 5 provide a modeling approach consistent with FEMA's guidelines. However, there are several challenges inherent to these updates that still needed to be addressed. First, the Salt River flood flows are contained to the south only by the high ground on the opposite side of the Upper Gila River approaching Monument Hill upstream of the Gila River confluence with the Salt River. Therefore, the updated floodplain would extend much further south than the current effective FEMA floodplain. As seen in Figure 6, the floodplain generated from the raw HEC-GeoRAS output of the updated HEC-RAS model extends much further to the south than the effective floodplain and floodway, occupying nearly the entire flow area of the Upper Gila River. It should be noted that the floodplain boundaries shown in Figure 6 are not finalized and that these boundaries will be revised for the final floodplain mapping deliverable. As previously discussed, the reason the effective FEMA floodplain does not extend as far south as the floodplain shown in Figure 6 is that the effective FEMA study truncated the floodplain at the floodway boundary in this location. The original topography from 1991, shown in Figure 6 as well, indicates that the ground elevations in the vicinity of the Upper Gila River confluence with the Salt River do not contain the effective base flood elevation flooding extents.

Since the GRIC does not participate in the NFIP, FEMA likely would not want to extend their flood hazard mapping further onto the GRIC tribal lands. Because of this, it is recommended that the current effective floodway boundary be used as the left encroachment station in the updated floodway analysis, and the floodplain boundary be truncated to be coincident with the floodway boundary in a manner that is consistent with the current effective FEMA study. It should be noted that three (3) cross sections (200.36, 200.43, and 200.48) that do not extend beyond the effective floodway/floodplain boundary in the left overbank. These cross sections do not extend beyond the effective floodplain because they end at high ground separating the Salt River from the Upper Gila River. If these cross sections were extended further to the south, the ground elevations would decrease towards the thalweg of the Upper Gila River. The discrepancy between the location of the high ground as shown by the ends of these cross sections versus the current effective floodplain boundary is likely due to the updated 1-foot contour-interval topography used in this study compared to the 4-foot contour-interval topography used for the current effective study. Therefore, the updated encroachment station for the floodway analysis cannot be set to same location as the current effective floodway boundary at these three cross sections.

Additionally, since the Upper Gila River floodplain is not expected to actively convey flow from the Salt River during a concurrent flood event between the Salt River and Upper Gila River, and since the floodway will act as the boundary of the floodplain based on the recommendations above, it is recommended to model the entire area of the Salt River cross sections that extended further to the south as ineffective flow area. This serves two purposes: (1) the hydraulics of the original LACOE model are not altered as significantly as allowing the entire additional flow area added by the cross section extension to actively convey flow, which will hopefully allow the LACOE's detailed analyses of risk and uncertainty, freeboard, seepage, bank protection, etc. based on the original LACOE model to remain consistent with the updated model that will be provided to FEMA, and (2) the water surface elevations are more conservative on the northern side of the Salt River and Lower Gila River, providing consistent regulatory elevations with the current effective FEMA model. For clarity, the stationing used in the updated model cross

sections for the Salt River that were extended to the south into the Upper Gila floodplain utilizes negative stationing values. As seen in Figure 7, the cross section geometry location from Station 0 to the north was part of the original cross section used in the LACOE HEC-RAS model while the geometry from Station 0 to the south is modeled as ineffective flow area.

Finally, the water surface elevations for the updated model were somewhat higher at various locations in the model, specifically in the vicinity of the Avondale Boulevard Bridge. Table 2 compares the water surface elevations between the original LACOE model and the updated model. Near the Avondale Boulevard Bridge (RS 199.19), water surface elevations increased by as much as 0.31 feet. The LACOE may want to give additional consideration to updating the roughness values in this area based on Phase IIIA grubbing and clearing to refine the model.

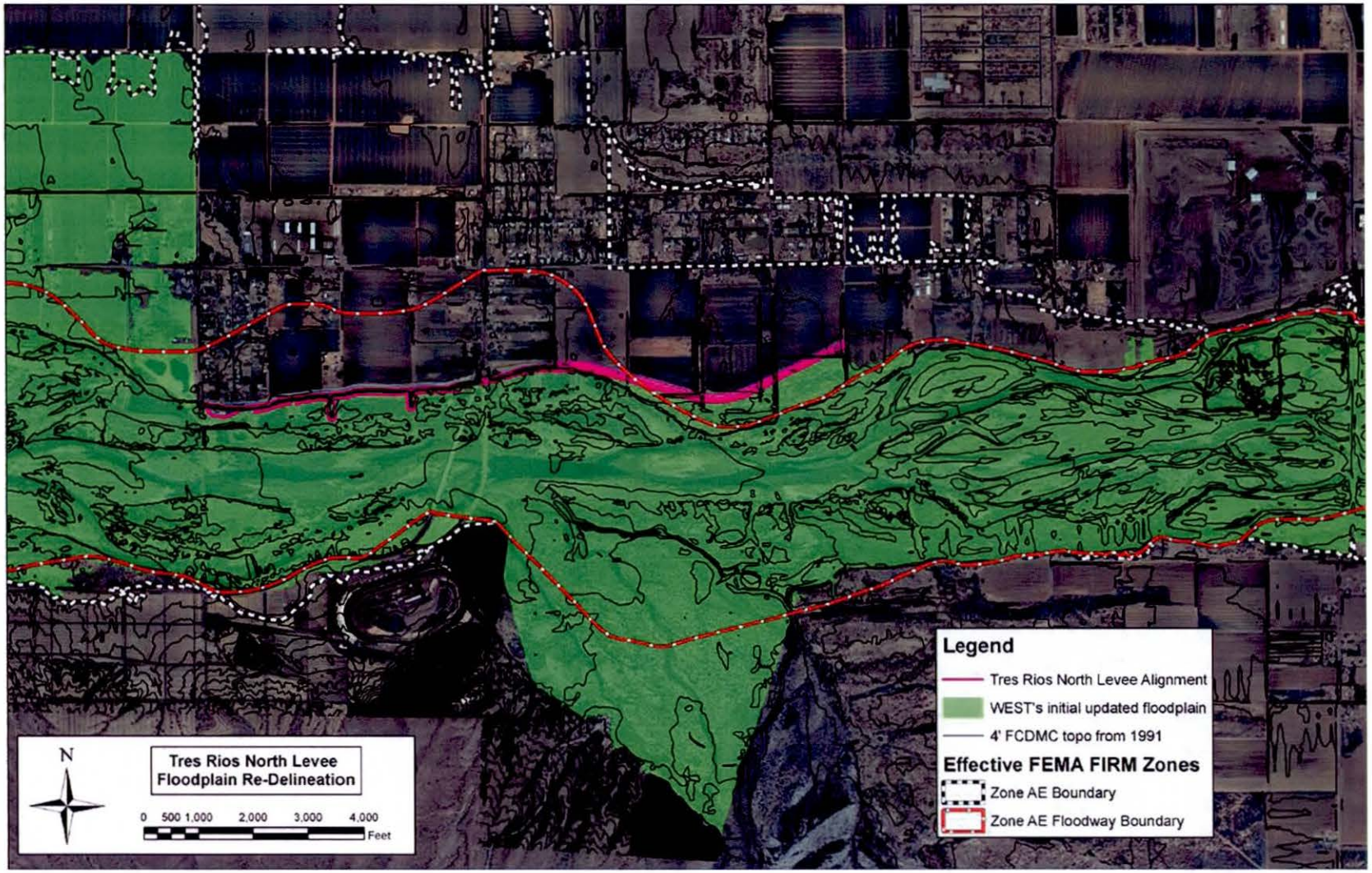


Figure 6. Updated initial floodplain boundaries (boundaries not final, to be revised) based on the new cross sectional alignment

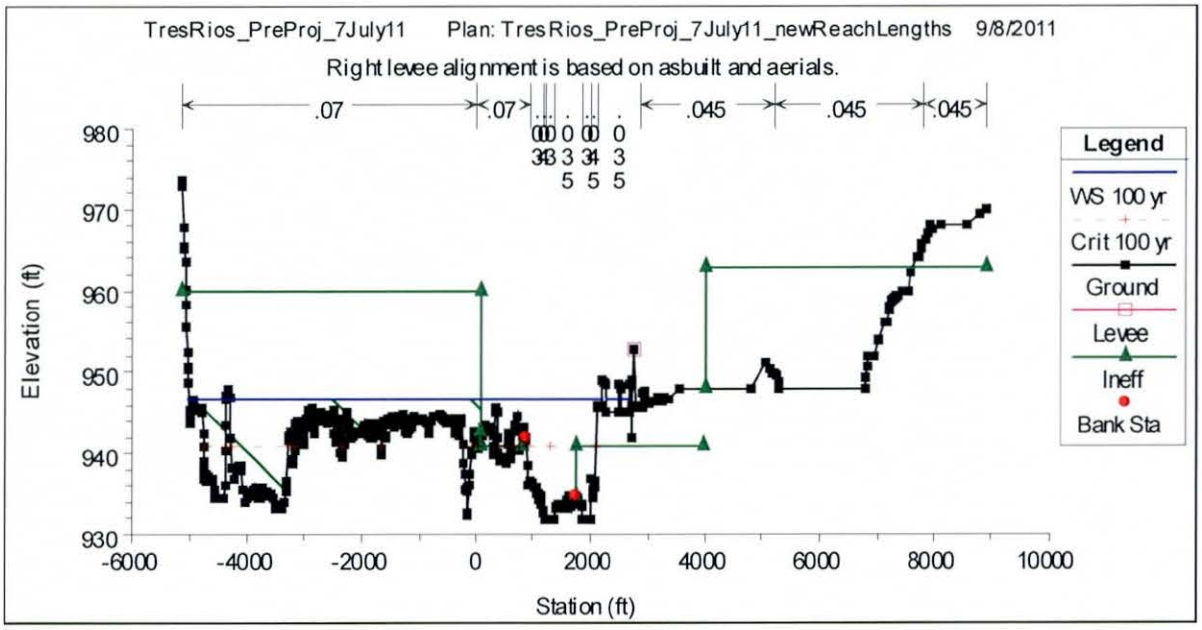


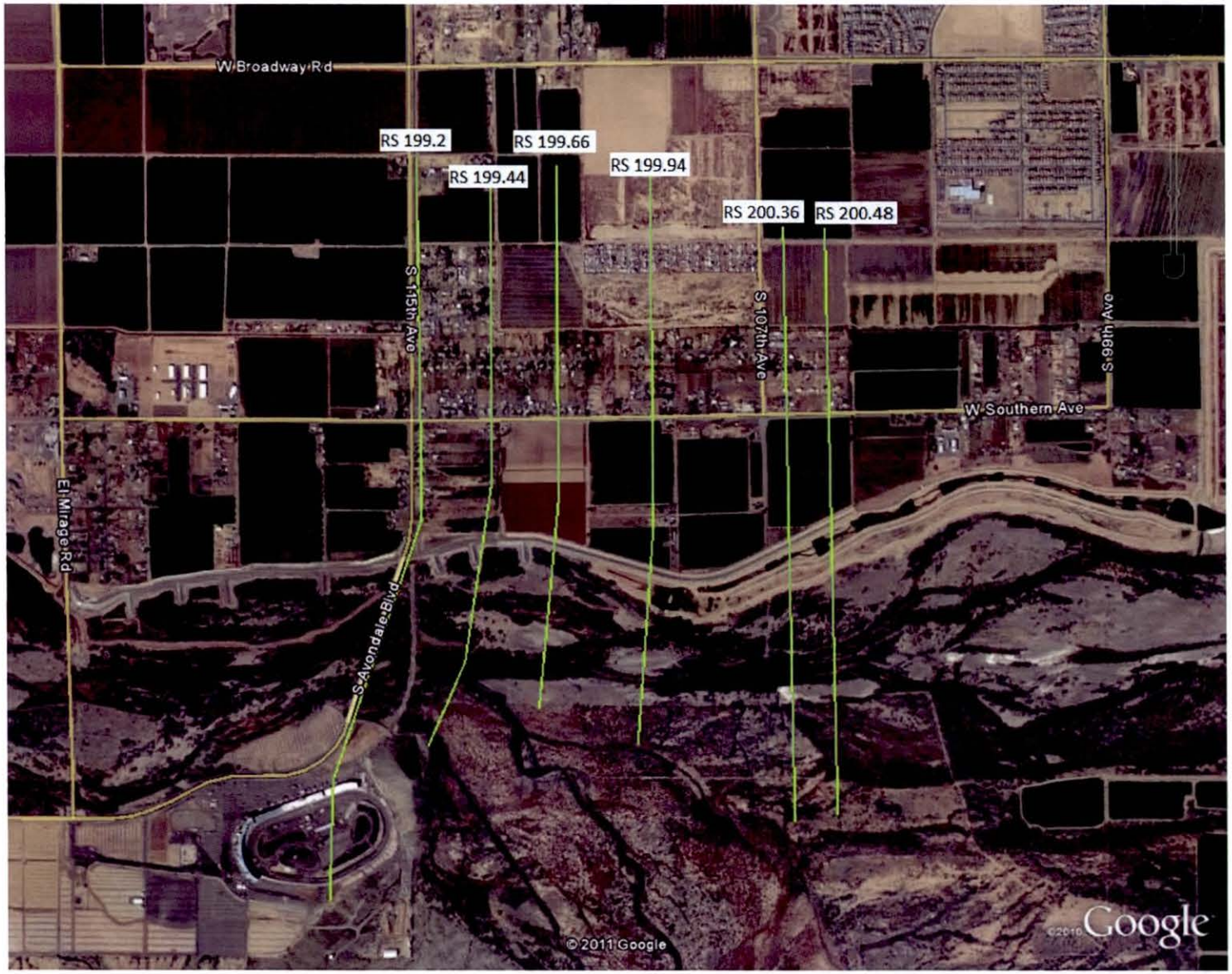
Figure 7. Cross section 200.11 from the HEC-RAS model extended by WEST showing ineffective flow in the left overbank (left of the 0 station) in the Upper Gila River flow area

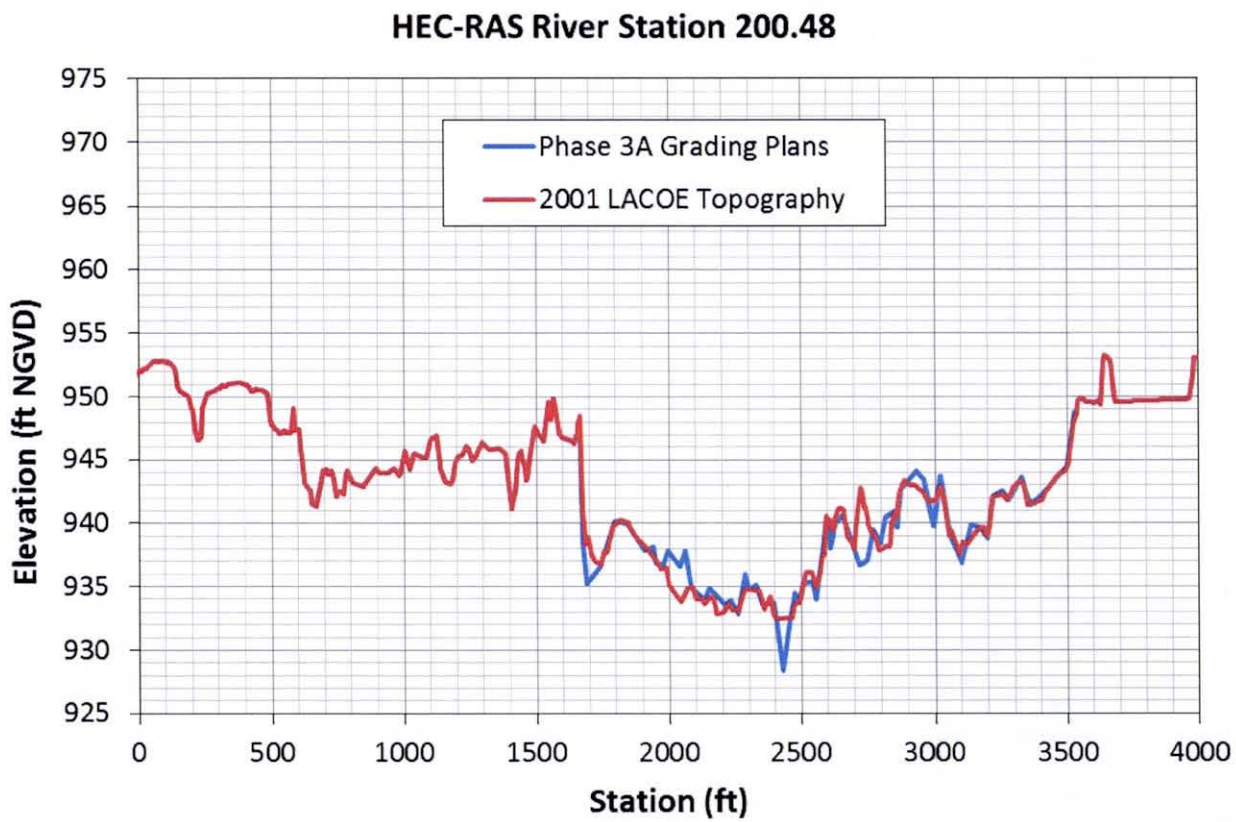
Table 2. Water surface elevation differences between the original and updated models

River Station (based on updated stationing)	Water Surface Elevation from the Original LACOE Model (ft NGVD)	Water Surface Elevation from the Updated Model (ft NGVD)	Difference in water surface elevations (ft), + values indicate LACOE model has a higher WSEL	River Station (based on updated stationing)	Water Surface Elevation from the Original LACOE Model (ft NGVD)	Water Surface Elevation from the Updated Model (ft NGVD)	Difference in water surface elevations (ft), + values indicate LACOE model has a higher WSEL
203.46	975.41	975.43	0.02	200.97	953.52	953.59	0.07
203.36	974.63	974.65	0.02	200.91	952.96	953.07	0.11
203.28	973.99	974.01	0.02	200.84	952.51	952.63	0.12
203.18	973.21	973.23	0.02	200.79	952.18	952.32	0.14
203.08	972.34	972.36	0.02	200.71	951.64	951.81	0.17
202.94	971.2	971.23	0.03	200.64	951.22	951.42	0.2
202.82	970.25	970.28	0.03	200.56	950.75	950.81	0.06
202.75	969.51	969.55	0.04	200.48	950.35	950.36	0.01
202.65	968.6	968.62	0.02	200.43	950.1	950.1	0
202.57	967.95	967.97	0.02	200.36	949.7	949.74	0.04
202.49	967.41	967.42	0.01	200.27	949.23	949.27	0.04
202.43	966.91	966.91	0	200.18	948.45	948.5	0.05
202.35	966.17	966.17	0	200.07	947.81	947.87	0.06
202.26	965.71	965.7	-0.01	199.98	947.39	947.45	0.06
202.19	964.97	964.96	-0.01	199.94	947.25	947.29	0.04
202.12	963.77	963.76	-0.01	199.83	946.72	946.74	0.02
202.06	963.14	963.14	0	199.66	945.48	945.5	0.02
202.01	962.87	962.87	0	199.52	944.39	944.45	0.06
201.96	962.31	962.31	0	199.44	943.72	943.98	0.26
201.91	961.6	961.59	-0.01	199.36	942.79	943.02	0.23
201.84	961.41	961.41	0	199.29	942.41	942.65	0.24
201.77	961.12	961.12	0	199.2	942.03	942.26	0.23
201.66	960.28	960.28	0	199.16	941.11	941.42	0.31
201.58	959.77	959.77	0	199.09	940.7	940.87	0.17
201.5	959.1	959.1	0	199.02	940.19	940.24	0.05
201.44	958.45	958.45	0	198.98	940.01	939.92	-0.09
201.37	957.76	957.76	0	198.95	939.87	939.7	-0.17
201.29	956.5	956.51	0.01	198.93	939.59	939.6	0.01
201.22	955.47	955.49	0.02	198.88	939.51	939.49	-0.02
201.16	954.96	955	0.04	198.83	939.28	939.29	0.01
201.12	954.72	954.76	0.04	198.78	939.1	939.03	-0.07
201.06	954.32	954.37	0.05	198.75	938.92	938.88	-0.04

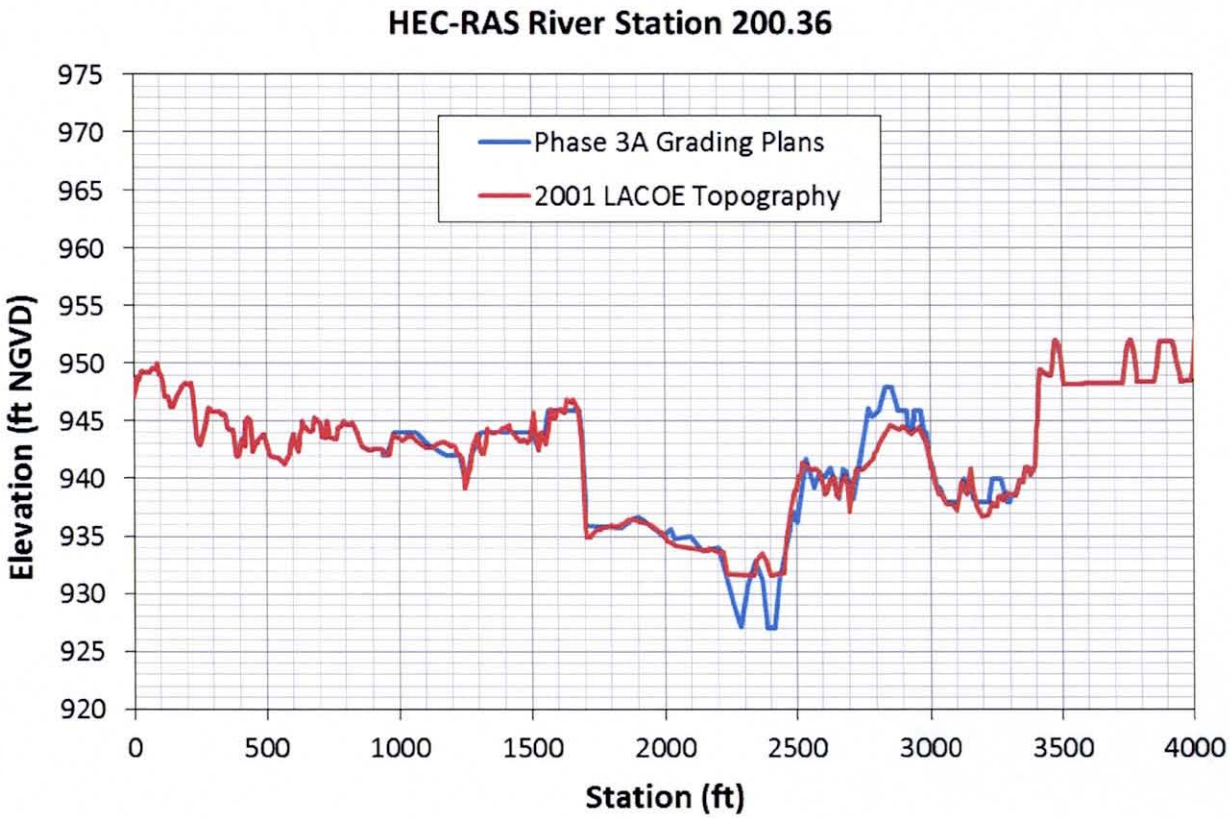
Table 2 (cont'd). Water surface elevation differences between the original and updated models

River Station (based on updated stationing)	Water Surface Elevation from the Original LACOE Model (ft NGVD)	Water Surface Elevation from the Updated Model (ft NGVD)	Difference in water surface elevations (ft), + values indicate LACOE model has a higher WSEL	River Station (based on updated stationing)	Water Surface Elevation from the Original LACOE Model (ft NGVD)	Water Surface Elevation from the Updated Model (ft NGVD)	Difference in water surface elevations (ft), + values indicate LACOE model has a higher WSEL
198.7	938.7	938.73	0.03	197.11	925.79	925.67	-0.12
198.64	938.54	938.53	-0.01	197.08	925.7	925.61	-0.09
198.59	938.22	938.21	-0.01	197.04	925.46	925.38	-0.08
198.54	937.96	938.01	0.05	196.99	925.15	925.09	-0.06
198.48	937.68	937.68	0	196.94	924.67	924.61	-0.06
198.43	937.5	937.46	-0.04	196.88	924.32	924.37	0.05
198.38	936.89	936.87	-0.02	196.81	923.98	923.95	-0.03
198.34	935.96	936.16	0.2	196.75	923.76	923.69	-0.07
198.27	935.19	935.54	0.35	196.7	923.56	923.52	-0.04
198.2	934.8	934.87	0.07	196.63	923.16	923.1	-0.06
198.14	934.44	934.49	0.05	196.57	922.22	922.08	-0.14
198.09	934.03	934.18	0.15	196.51	921.89	921.83	-0.06
198.02	933.74	933.72	-0.02	196.44	921.39	921.22	-0.17
197.97	933.53	933.52	-0.01	196.37	921.19	920.98	-0.21
197.92	933.47	933.39	-0.08	196.31	921.01	920.74	-0.27
197.89	933.38	933.29	-0.09	196.26	920.59	920.48	-0.11
197.86	933.13	933.12	-0.01	196.16	920.46	920.35	-0.11
197.81	932.74	932.81	0.07	196.07	920.27	920.1	-0.17
197.75	932.4	932.42	0.02	196.01	919.26	919.2	-0.06
197.69	932.18	932.2	0.02	195.91	918.75	919.03	0.28
197.64	931.83	931.88	0.05	195.79	918.44	918.6	0.16
197.58	931.47	931.53	0.06	195.7	917.47	917.79	0.32
197.53	931	930.98	-0.02	195.58	915.84	916.14	0.3
197.48	930.35	930.34	-0.01	195.48	915.11	915.46	0.35
197.42	929.45	929.63	0.18	195.38	914.2	914.75	0.55
197.37	928.19	928.04	-0.15	195.27	913.83	913.93	0.1
197.32	926.11	926.1	-0.01	195.21	913.14	913.35	0.21
197.27	925.87	925.87	0	195.15	912.98	912.84	-0.14
197.22	926.04	926.01	-0.03	195.13	912.56	912.56	0
197.18	925.78	925.76	-0.02	195.09	912.13	912.13	0
197.13	925.82	925.69	-0.13				

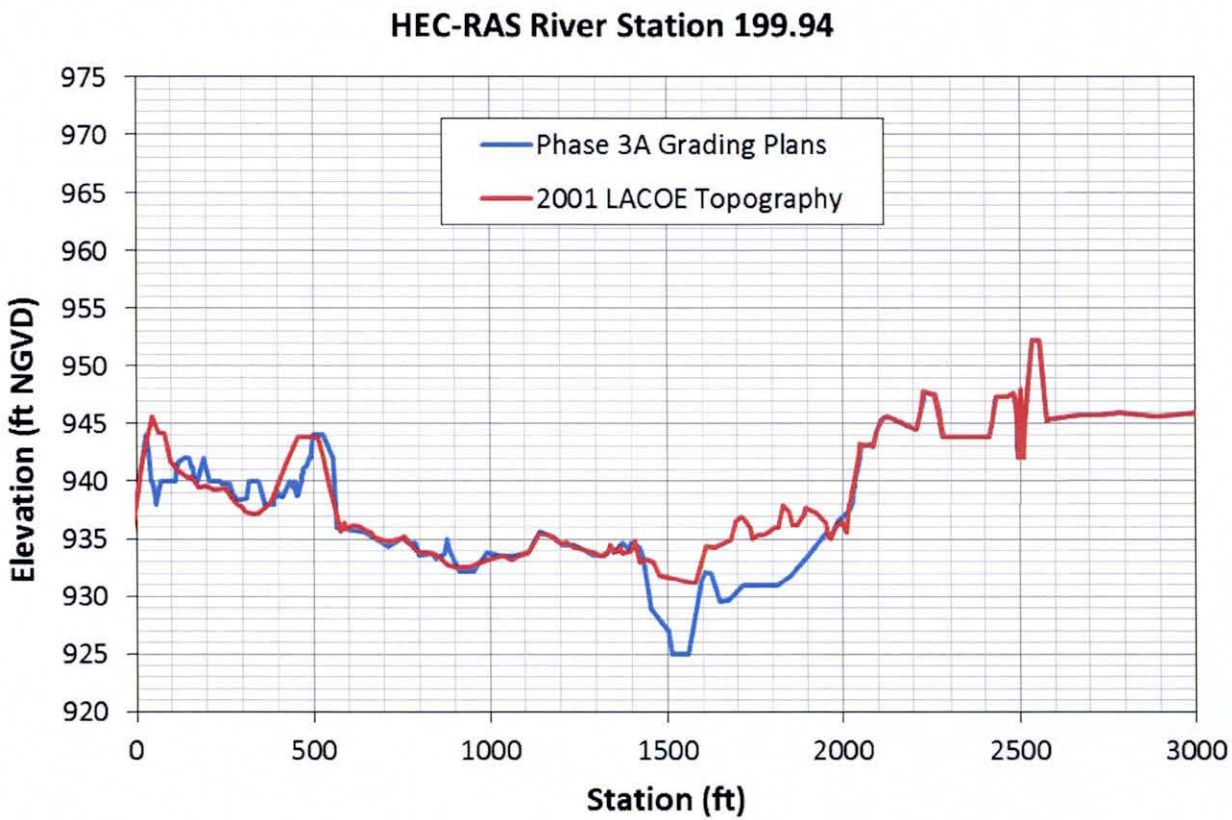

W Broadway Rd
RS 199.2
RS 199.66
RS 199.44
RS 199.94
RS 200.36
RS 200.48
S 115th Ave
S 107th Ave
S 99th Ave
W Southern Ave
El Mirage Rd
S Avondale Blvd
© 2011 Google
Google



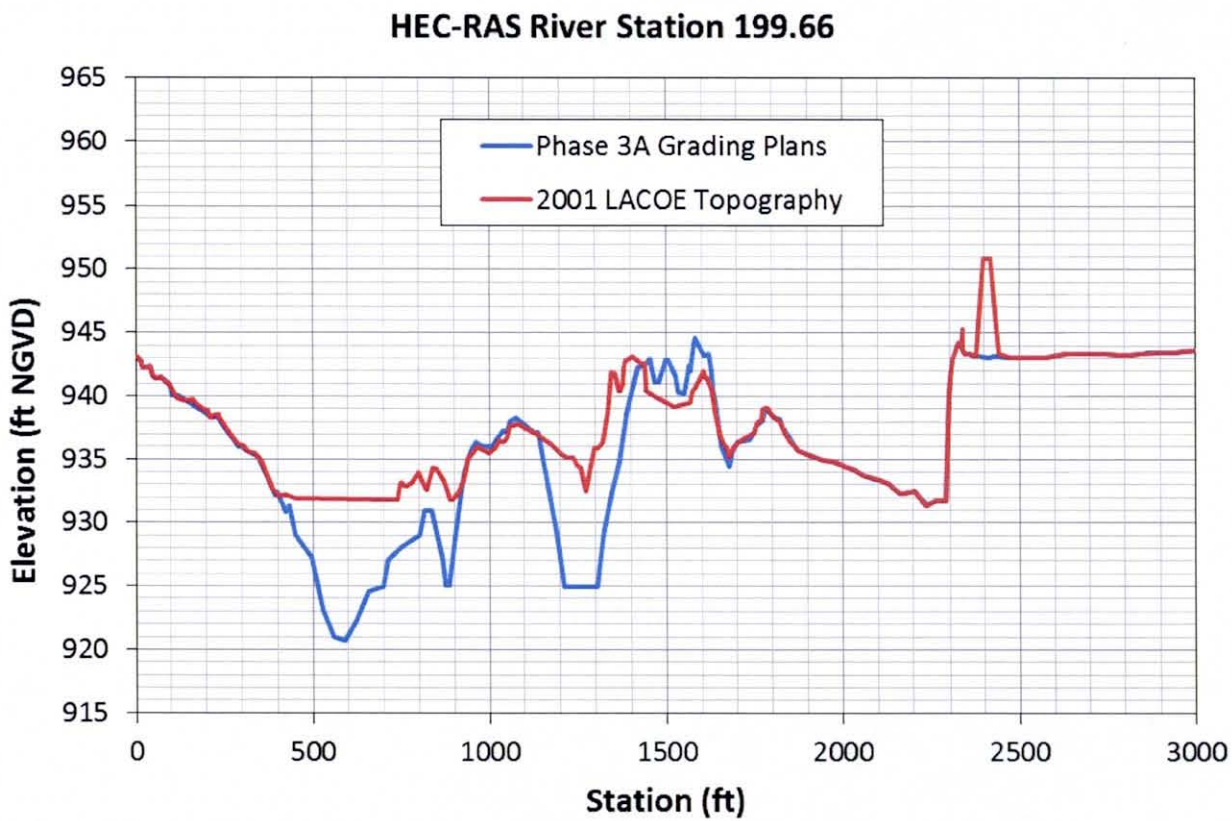
Total Difference in cross sectional area for RS 200.48 = +7.3 square feet FILL



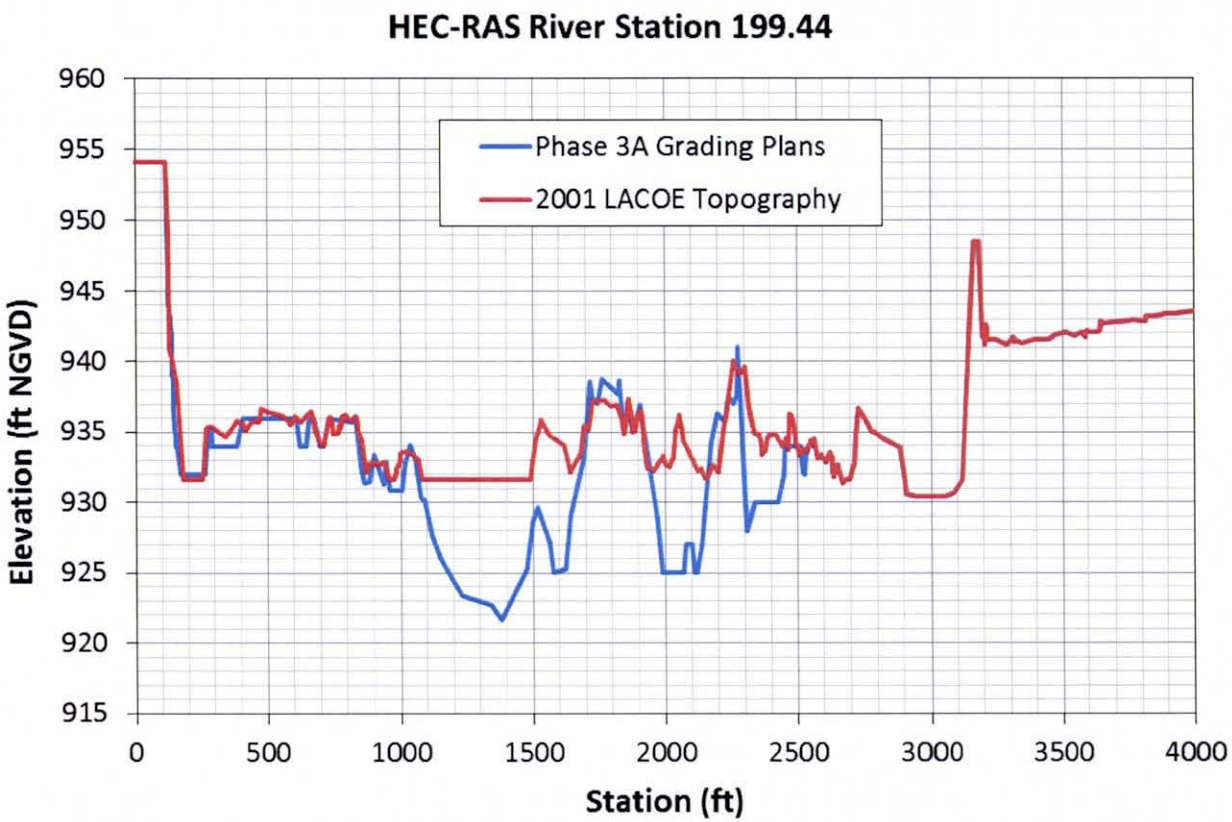
Total Difference in cross sectional area for RS 200.36 = +370.8 square feet FILL



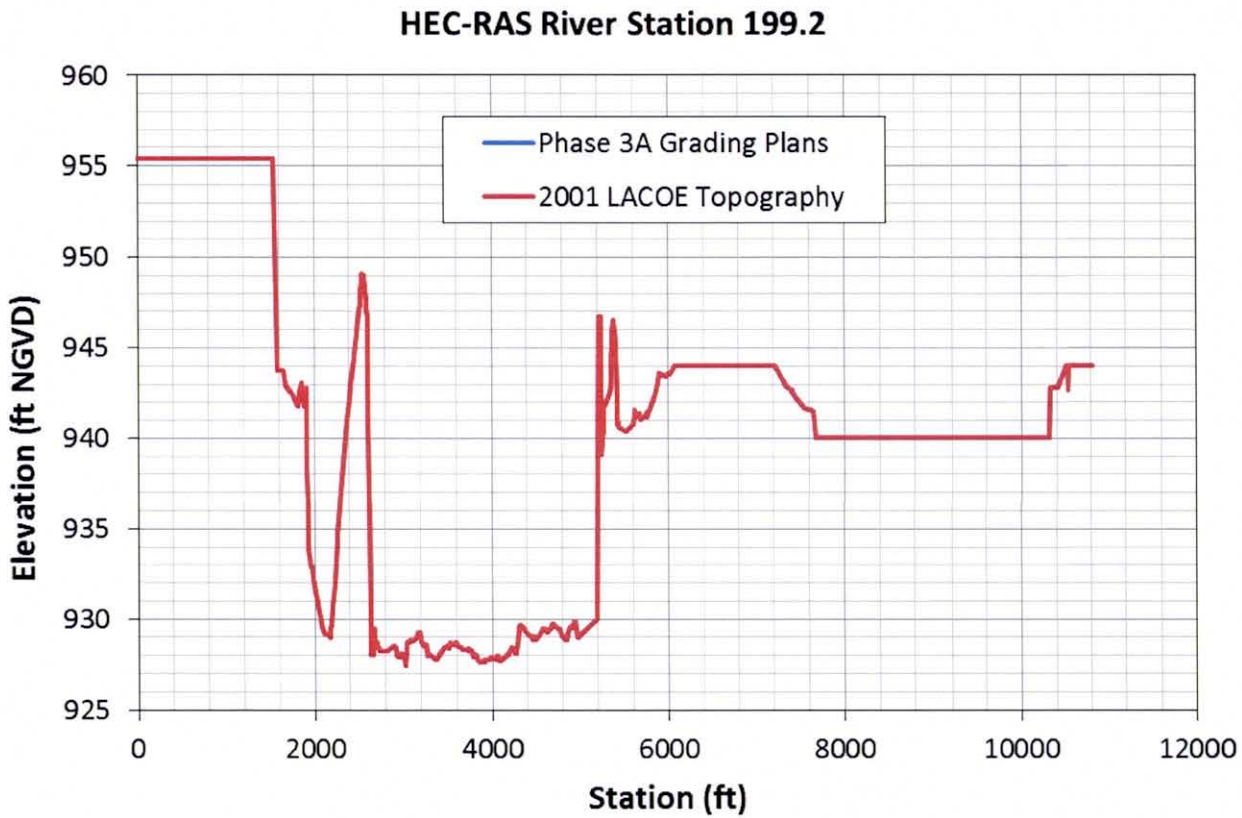
Total Difference in cross sectional area for RS 199.94 = -1,395.4 square feet CUT



Total Difference in cross sectional area for RS 199.66 = -4,793.4 square feet CUT



Total Difference in cross sectional area for RS 199.44 = -6,767.1 square feet CUT



Total Difference in cross sectional area for RS 199.2 = 0.0 square feet NO CUT OR FILL

TIE-IN LOCATIONS FOR FIRM DEVELOPMENT
TECHNICAL MEMORANDUM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS LOMR PROJECT

Date: October 20, 2011

To: Richard Harris – District

Cc: Don Rerick – District
Van Crisostomo – LACOE

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.

INTRODUCTION

The purpose of this Technical Memorandum is to identify appropriate tie-in locations for the updated hydraulic modeling results for the Tres Rios North Levee project to tie in to the currently effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) floodplain line work. These locations will be provided to the US Army Corps of Engineers, Los Angeles District (LACOE) to finalize the hydraulic modeling results for the post-project conditions HEC-RAS model and to develop the work maps as required by the Flood Control District of Maricopa County (District). This hydraulic model and all accompanying supporting documentation is supporting pending FEMA flood map revisions of the Salt/Gila River system near the Tres Rios North Levee project.

The remainder of this technical memorandum provides an explanation of the analysis performed to map the hydraulic modeling results from the LACOE HEC-RAS model updated by WEST as well as the reasoning for the selection of the final tie-in locations.

TRES RIOS NORTH LEVEE FLOODPLAIN MAPPING PERFORMED BY WEST

WEST updated the recent LACOE HEC-RAS model of the study reach as per the District's direction, and WEST mapped the hydraulic modeling results of this updated model using ArcGIS v9.2 by breaking the merged TIN representing the most recent topography utilized to develop the hydraulic model into several parts and then mapping the hydraulic modeling results using the built-in features of HEC-GeoRAS to map the floodplain on these "terrain tiles." This method is similar to the method being employed by the LACOE for floodplain mapping.

In an email dated July 13, 2011, the LACOE indicated their identified tie-in locations to be at the upstream end of the model (cross section 203.48 along the Salt River) and the downstream end of the model (cross section 195.16 along the Lower Gila River). At the upstream end of the model, the LACOE stated that computed water surface elevation is 0.49 feet lower than the effective water surface elevation; at the downstream end of the model, the computed water surface elevation is 0.47 feet lower than the effective water surface elevation. Both of these are within the 0.5 foot maximum vertical variance regulations enforced by FEMA for new studies to tie-ins to the effective floodplain profiles.

One significant issue with tying into the effective floodplain data at the downstream end of the modeled reach is that the confluence of the Agua Fria River occurs near cross section 196.08, which is upstream of the currently identified tie-in location of 195.16. Mapping a confluence area of a tributary that also has a floodplain mapped by FEMA, as is the case with the Agua Fria, can become complex. It should be noted that the Upper Gila River is not currently mapped by FEMA, and it will not be mapped in the future since this area is on tribal land owned by the Gila River Indian Community, a non-participating community in the NFIP.

Based on the mapping of the hydraulic results of the updated HEC-RAS model developed by WEST, tie-in locations have been identified for the Tres Rios model to shorten the distance of updated floodplain mapping along the study reach. At the upstream end of the model, WEST has identified that the water surface elevation at cross section 203.08 ties into the effective floodplain profile in the vertical within the 0.5 feet limit. Cross section 203.09 in the effective model has a water surface elevation of 972.42 feet NGVD29, and the updated WEST cross section 203.08 (which corresponds to cross section 203.1 in the original LACOE HEC-RAS model) has a computed water surface elevation of 972.36 feet NGVD29, a difference of 0.06 feet with the updated information lower than the effective data. The floodplain ties in horizontally at this location as well.

In the portion of the model below the Tres Rios North Levee, WEST has identified that the water surface elevation at cross section 198.02 ties into the effective floodplain profile in the vertical within the 0.5 feet limit. Cross section 198.02 in the effective model has a water surface elevation of 934.16 feet NGVD29, and the updated WEST cross section 198.02 (which corresponds to cross section 198.08 in the original LACOE HEC-RAS model) has a computed water surface elevation of 933.72 feet NGVD29, a difference of 0.44 feet with the updated information lower than the effective data. Similarly, cross section 197.92 in the effective model has a water surface elevation of 933.47 feet NGVD29, and the updated WEST cross section 197.92 (which corresponds to cross section 197.98 in the original LACOE HEC-RAS model) has a computed water surface elevation of 933.39 feet NGVD29, a difference of 0.08 feet. The floodplain ties in horizontally in this vicinity as well.

It should be noted that the cross sections listed above as comparable cross sections are no more than 50 feet apart spatially along the FEMA river centerline. Although the river stations are the same for these comparable cross sections, the horizontal locations are slightly different. These alignments are within 50 feet (i.e., approximately 0.01 miles) of one another at all the locations used for the comparisons above to determine model tie-in locations.

The final, tied-in floodplain for this study as determined by WEST is shown in Figure 1 below. It should be noted that WEST did not finalize the floodplain results in Figure 1 completely using post-processing techniques of HEC-GeoRAS output other than at the two tie-in locations and along the Tres Rios North Levee. "Holes" in the middle of the floodplain upstream of the levee were not removed in this analysis; however, these "holes" should be removed from the final mapping deliverable before being submitted to FEMA. Also, the currently effective FEMA study clipped the floodplain boundary along south side of the river (i.e., the left floodplain boundary looking downstream) to the location of the floodway boundary determined during the encroachment analysis for the currently effective study. The floodplain boundary mapped on the current FIRM panel does not reflect a natural topographic containment of the flow; this is an artificial floodplain limit dictated by the floodway encroachment analysis. Due to the Gila River Indian Community's non-participating community status in the NFIP, the District feels that this area should be analyzed and mapped in the same manner as the currently effective study, and that the currently effective left floodplain boundary at each cross section should be identical to the encroachment limit used for this updated study, if possible. This may not be feasible if the surcharge produced with the existing left encroachment station is greater than 1.0 foot at any point in the study reach; if this is the case, then the left encroachment station may need to be moved further to the south.

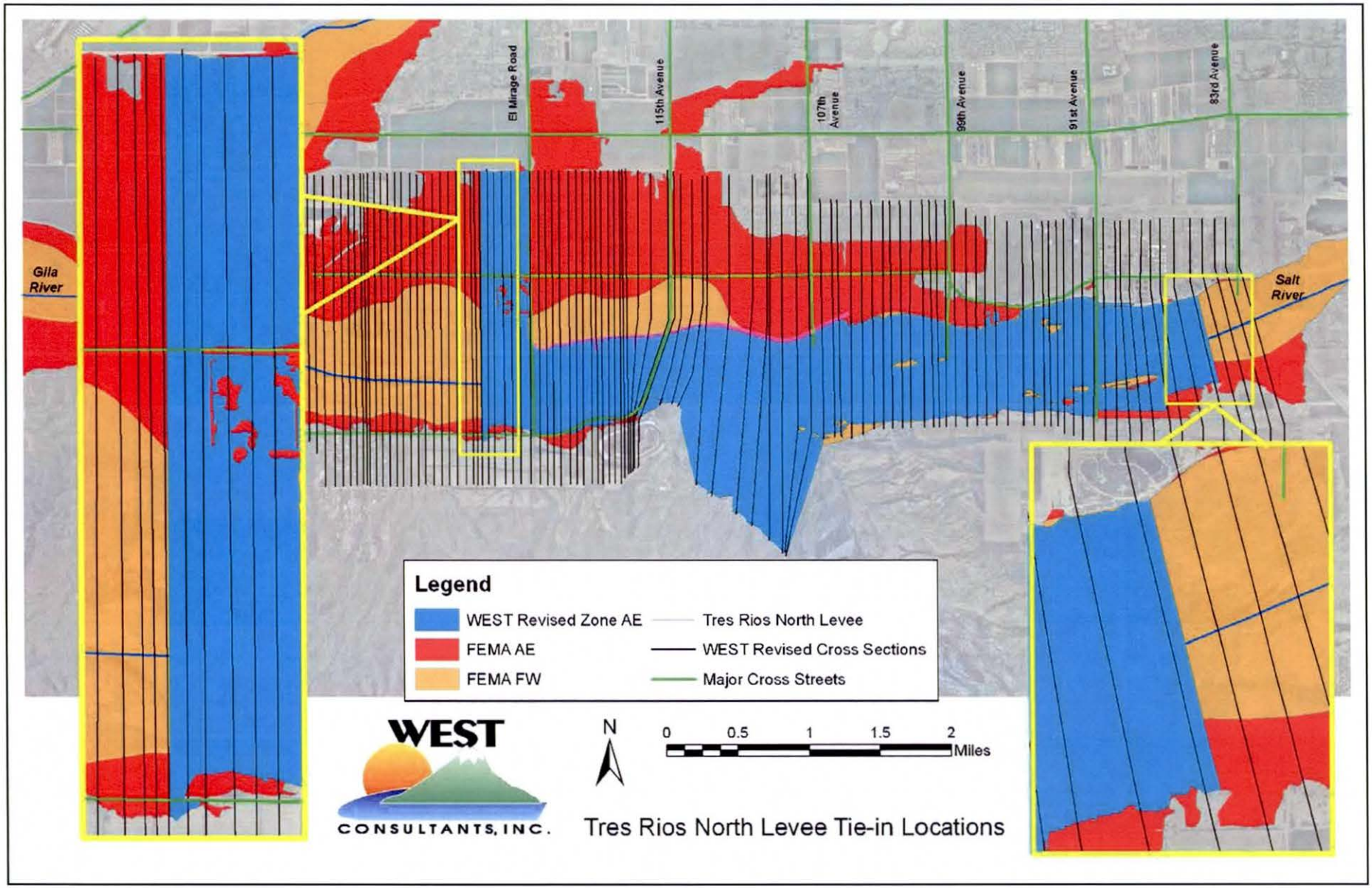


Figure 1. Tres Rios North Levee Tie-in Locations

Chuck Davis

Subject: FW: BFC Flooding Source Backwater Analysis
Attachments: BFC_XS_upstream_of_ElMirage.png; BFC_Backwater_Analysis.png; Approximate Inundation Extents - BFC backwater analysis.PDF

From: Chuck Davis
Sent: Monday, January 23, 2012 4:14 PM
To: Richard Harris (rph@mail.maricopa.gov)
Cc: Don Rerick (djr@mail.maricopa.gov); Brian Wahlin
Subject: BFC Flooding Source Backwater Analysis

Richard,

This email is in regards to the Buckeye Feeder Canal (BFC) Flooding Source backwater analysis at El Mirage Road due to the updated Salt/Gila model for the Tres Rios North Levee PMR submittal. A summary of our findings for the backwater effects of the Salt/Gila floodplain on the BFC model—specifically the tie-in of the BFC model with the Salt/Gila model at El Mirage Rd—is provided below, and this summary references three figures (attached to this email).

1) The most recent Salt/Gila model with the levee shows a water surface elevation of 935.60' immediately downstream of El Mirage Road (i.e., RS 198.27). This WSEL was used as a downstream boundary condition for an updated RAS model that clipped the original BFC RAS model at El Mirage Road.
2) The attached figure titled "BFC_Backwater Analysis" shows two water surface elevation profiles: the lower one is the original BFC study water surface profile, and the higher profile is the backwater analysis completed by WEST. As can be seen from this figure, a backwater elevation of 935.60 feet at El Mirage Road in the updated RAS model for the BFC shows a flat backwater for several cross sections upstream of El Mirage with a dip in the water surface elevation at RS 2.933 (approximately 1,656' upstream of El Mirage Road). To be conservative, we considered a flat backwater of 935.60' all the up to and including RS 2.933 (which had a WSEl of 935.46' in the original Dibble model) for the mapping exercise instead of including the dip shown in the updated RAS model profile.
3) Based on the topography used in the original BFC study (4' overbank topo, the same topo used in the overbanks for the Tres Rios PED model that WEST completed previously for the LACOE), the approximate updated horizontal inundation extents can be seen in the attached PDF file ("Approximate Inundation Extents - BFC backwater analysis.PDF"). A text description of this estimated inundation area shown as a red hatched area in the PDF figure is below.
    a. On the north side of the Buckeye Feeder Canal, WEST estimates that the flooding extent will increase in the upstream direction (i.e., to the east) to approximately the 121st Ave alignment, which corresponds to the embankment of a small lateral canal that runs from the BFC to the north at the edge of sheet 3 in the BFC work map sheet set. However, the increase in inundation area due to this backwater is very small. Additionally, the inundation area will not extend beyond the embankment at the north edge of the field that ends approximately 1/4 south of Broadway Road due to an embankment at the edge of this field.
    b. On the south side of the Buckeye Feeder Canal, the northern embankment of the Southern Avenue roadway still contains the WSEL, and the attached estimated inundation limits do not show the floodplain south of Southern Avenue. However, the flooding extent will be increased in the upstream direction (i.e., to the east) on the south side of the BFC to approximately the 122nd Ave alignment. Once again, the increased area of inundation due to the backwater from the Salt/Gila floodplain is very small.
4) We might have an issue with FEMA's "without embankment" analysis, however. The water surface elevation for the BFC upstream of El Mirage Road based on this analysis is 935.60'. The crest of the Southern Avenue roadway according to the current BFC model is 936.54', about one foot higher than the updated

WSEL. However, the topo used for that study shows an average ground elevation of approximately 934.0' in the left overbank on the south side of the Southern Avenue roadway immediately upstream of El Mirage Road. Therefore, we have a water surface approximately 1.5' higher than the ground surface elevation on the opposite side of the Southern Ave embankment, possibly triggering the need for a without embankment analysis for FEMA. The attached figure titled "BFC_XS_upstream_of_ElMirage" shows another embankment in the far left overbank, which represents the embankment of Alta Vista Road.

In summary, it appears that the updated tie-in for the BFC study might require a without embankment analysis for the BFC flooding source along the Southern Avenue embankment according to FEMA's regulations.

Please let us know if you have any questions about any of this information.

Thanks,

Chuck Davis, P.E., CFM
Hydraulic Engineer

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email: cdavis@westconsultants.com
www.westconsultants.com

RMSE Comparison of Various Topographic Data Sources in the Buckeye Feeder Canal/Sunland Avenue Tributary Area

Flood Control District of Maricopa County
Tres Rios LOMR Project

Date: March 2, 2012

To: Richard Harris – District

Cc: Don Rerick – District

From: Brian Wahlin – WEST
Chuck Davis – WEST
Riley Asburry – WEST

Multiple sources of topography exist in the Buckeye Feeder Canal (BFC) and Sunland Avenue Tributary (SAT) region near El Mirage Road and Southern Avenue. The BFC/SAT region lies in the right overbank of the Salt/Gila hydraulic model developed by the LACOE and WEST to re-delineate the floodplain due to the construction of the Tres Rios North Levee (TRNL). The recently developed Salt/ Gila hydraulic model uses 4-foot topography to model a large portion of the right overbank area and finer 1-foot topography to map the main channel region. The spatial extents of the 4-foot topography and 1-foot topography provided are shown in Figure 1 below. As part of the Maryvale ADMS, hydraulic models were created for the both the BFC and SAT using a 2-foot contour-interval topography. In an effort to evaluate the accuracy of the Salt/ Gila model in this region a root mean square error (RMSE) analysis was performed by WEST comparing the 4-foot topography with the 2-foot topography.

Comparisons of the cross sections were computed quantitatively using the averaged RMSE calculation as shown below:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(X_i - Y_i)^2}{n}}$$

where n is the number of points compared for an individual cross section between the two topographic data sources, and X and Y are the elevation values of an individual station i along the cross section to be compared from the two different topographic data sources.

RMSE values were calculated for a test area where the 4-foot topography and the 2-foot topography overlap. In this area, sample cross-sections in the Salt/ Gila model were clipped along Southern Avenue (see Figure 2). The trimmed cross sections were cut from the 4-foot topography and then again from the 2-foot topography. This method allowed for an exact comparison between the two sets of topography. The RMSE was then calculated to determine the significance in the differences between the two data sets.

Some differences were found in a few of the cross sections, such as cross section 198.34 (see Figure 5), where the 4-foot topography does not reflect the many variations in the ground surface reflected in the 2-foot topography. In general the surface represented by the 4-foot topography is flatter (reflecting less detail in the topographic dataset which is to be expected) but is generally near elevations in the 2-foot topography as is the case in cross sections 198.98 and 198.64 (see Figure 3 and Figure 4). A difference in thalweg elevation was noticed and is summarized in Table 1. The overall RMSE comparing the 2-foot topography and the 4-foot topography is 1.94 feet. An approximate floodplain comparison as a result of the change in topography shows the most significant differences north of the levee.

Thus, when FEMA specifies 2-foot contour interval mapping, for example, this is the same as specifying that digital topographic data, regardless of whether the data are digital contours, mass points and break lines, Triangulated Irregular Networks (TINs), or Digital Elevation Models (DEMs), should have a vertical RMSE of 0.6 foot for consistency with the NSSDA as shown in Table 2, while 4-foot contour interval mapping should have a vertical RMSE of 1.2 feet.

Table 1. Comparison of Thalweg Elevations

Cross section	Thalweg Elevations		
	4' topo (ft)	*2' topo (ft)*	*Difference (ft)*
198.34	927.69	926.39	1.3
198.64	926.98	928.13	-1.15
198.98	929.44	930.61	-1.17

Table 2. Comparison of Vertical Accuracy Standards

NMAS Contour Interval	NMAS VMAS 90% confidence level	NSSDA Accuracy 95% confidence level	NSSDA RMSE	ASPRS 1990 Class 1/2/3 Limiting RMSE
2 feet	1 foot	1.2 feet	0.6 foot 18.5 centimeters	0.7 foot (Class 1) 1.3 feet (Class 2) 2.0 feet (Class 3)
4 feet	2 feet	2.4 feet	1.2 feet 37.0 centimeters	1.3 feet (Class 1) 2.7 feet (Class 2) 4.0 feet (Class 3)

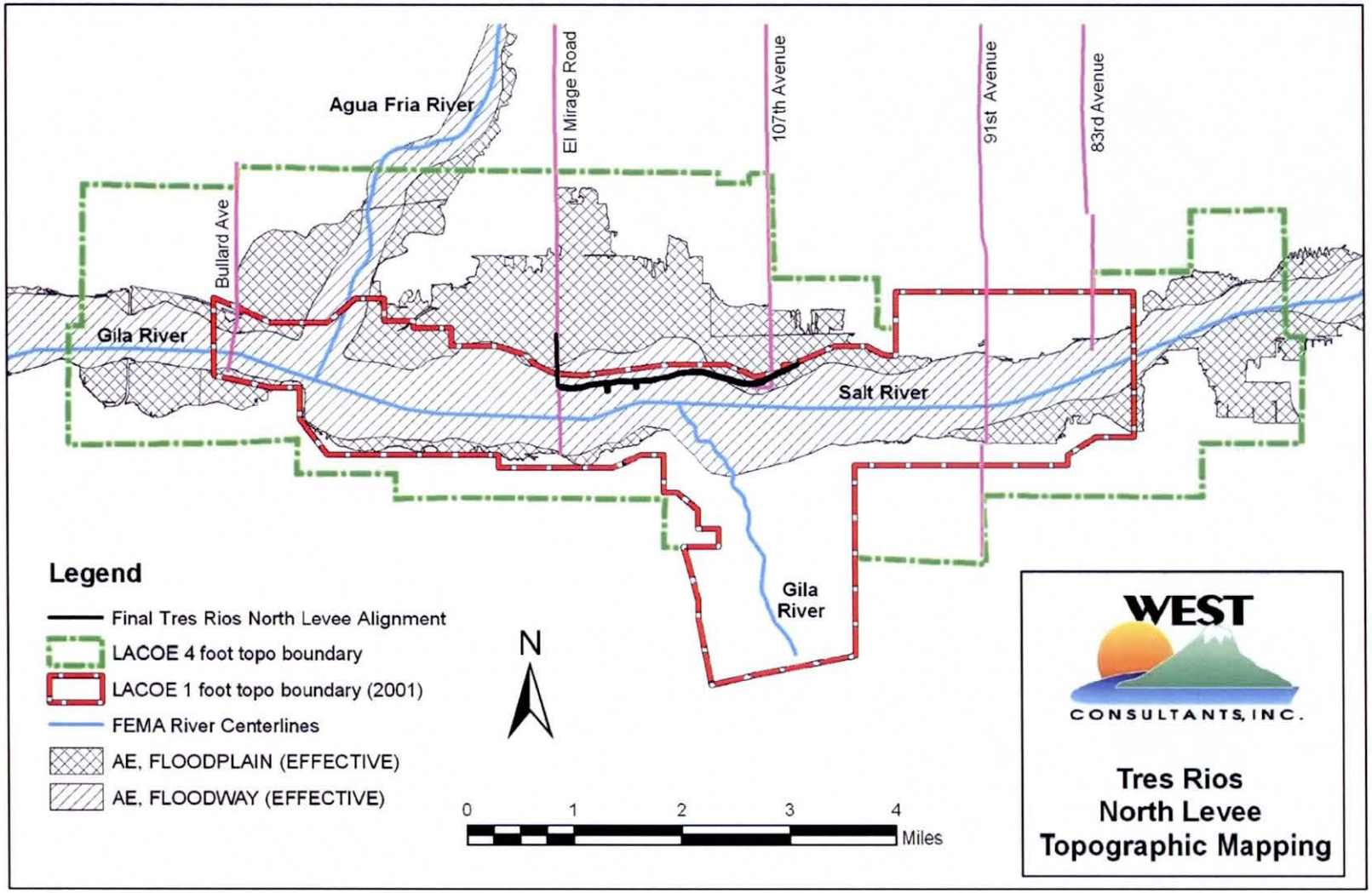


Figure 1. Extents of topography data sources received from the LACOE

Figure 2. Sample Cross Section Locations

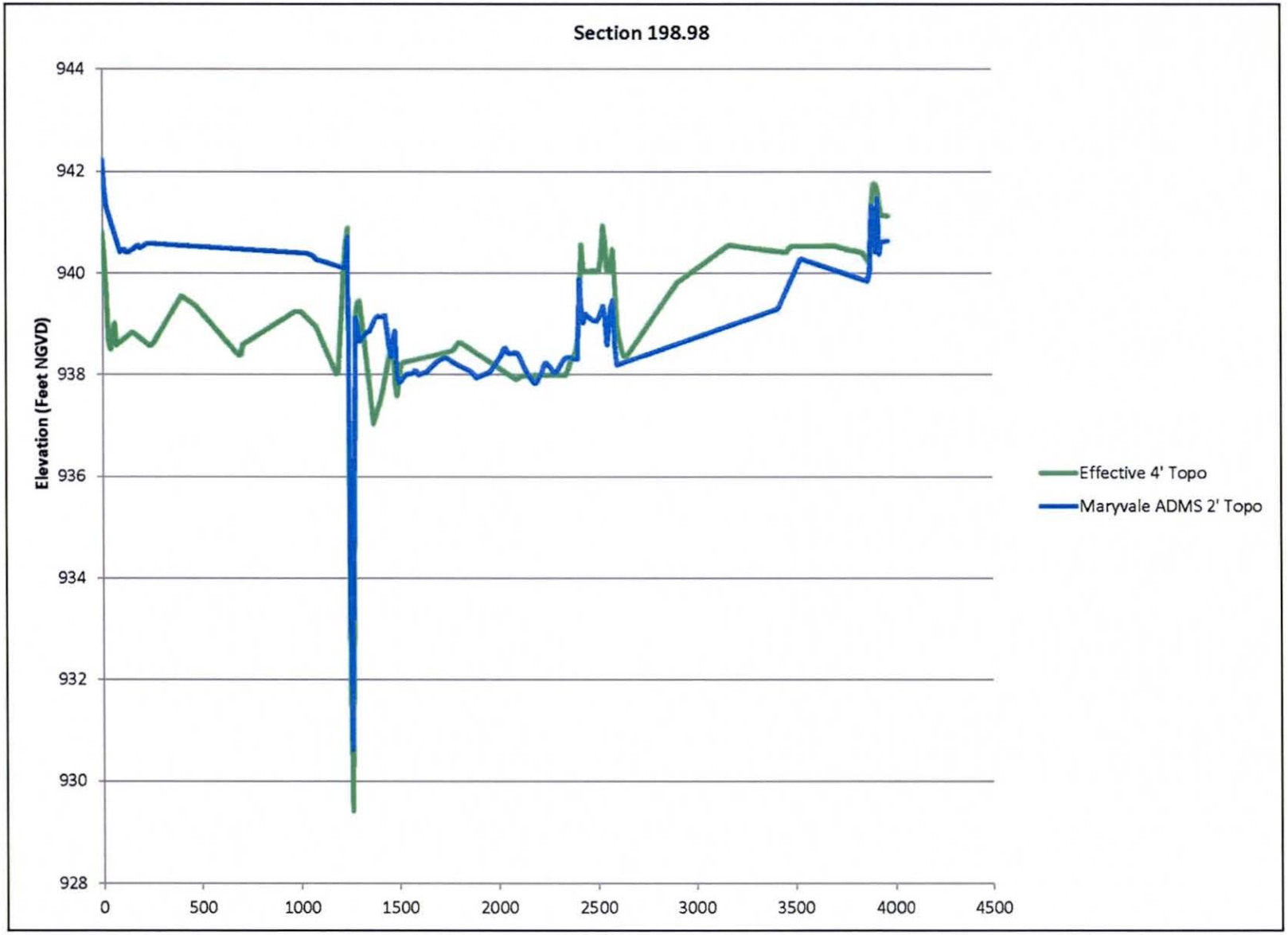


Figure 3. Cross Section 198.98 Comparison

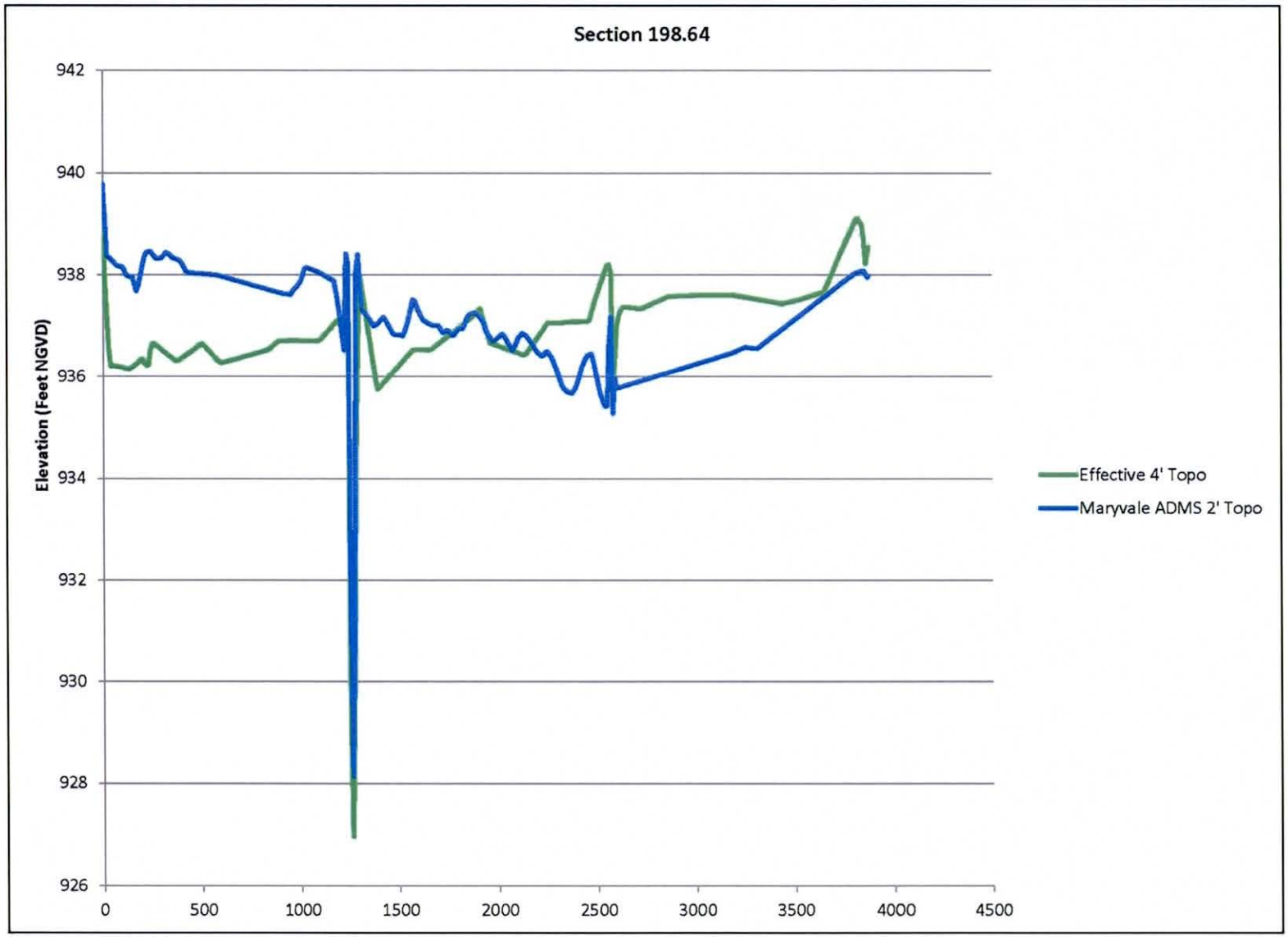


Figure 4. Cross Section 198.64 Comparison

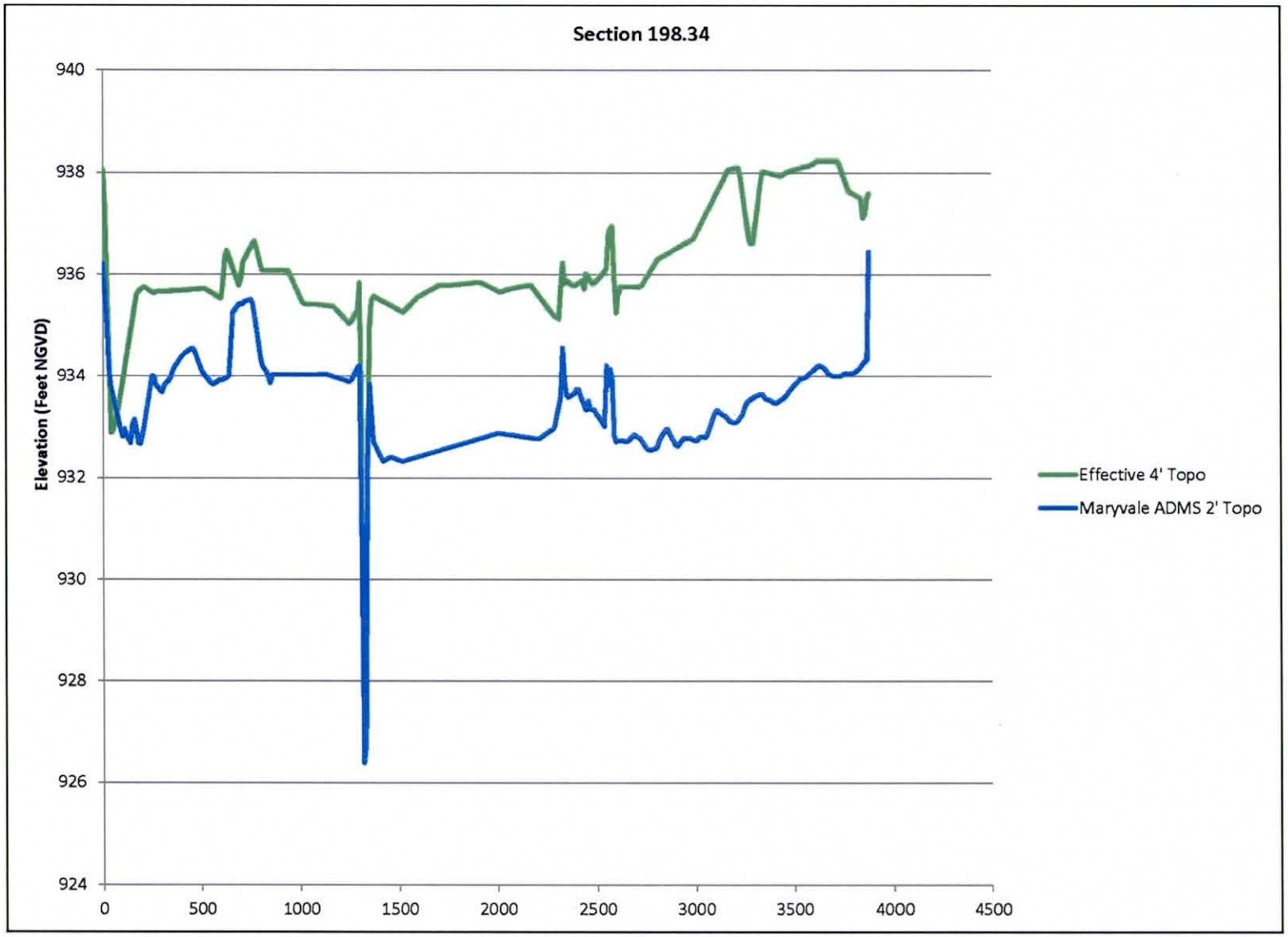


Figure 5. Cross Section 198.34 Comparison

Date: 3/16/12

Subject: Tres Rios North Levee FDS – Draft Hydraulics Submittal – RAS Modeling and Study Work Maps Submitted 3/6/12

Hi Brian and Chuck,

I have reviewed the subject updated materials and offer the below comments. I am also returning the tracked and red-lined materials to support the review comments. Not every red-lined remark is also a review comment, and vice versa. Therefore, please consider both types of materials for revisions. Please return the red-lined text and responses to my review comments as part of the next submittal package. The convention I have come up with for responding to my comments has been to insert textual responses below each of my comments.

If you have any questions or suggestions regarding the comments, please let me know at 602 506 4528.

Thanks,

Richard

Study Sheets

As discussed, I prefer a study sheet numbering system wherein the sheet numbers increase from downstream to upstream. Please address.
WEST Response: Revised numbering system as requested. See panel layout SHP.

A "True" cover sheet is needed (will be non-numbered or numbered, either way). Many good examples for cover sheet layout are not only available, but have been created by WEST in the past – please provide. One item we should consider on the cover sheet is a note stating that the contour mapping in the vicinity of the levee project (sheets x-xx) does not reflect as-built conditions due to the time-frame of the project. It may be added that the hydraulic modeling includes the as-built geometric information (or this will be described in the text section 5). Let's discuss.
WEST Response: A draft cover sheet has been included in this re-submittal, but it will change once again once the BFC mapping task has been completed. Once specific wording on the contour mapping note has been agreed upon, it will be added to the Index Sheet as per request.

Please check all street/avenue labels so they don't have an "S" in front of the name indicating "South", etc. This is not how the streets are identified in our data base.
WEST Response: Removed all "S" prefixes from street labels.

NOTE: The foregoing all are relevant to the existing study sheet numbering system, so once re-numbered, please provide a sheet number table to show the previous sheet number and the current (updated sheet number).
WEST Response: The sheet numbering table compared to the old sheet numbering table has been provided below.

Old Sheet Number	Revised Sheet Number
1	19
2	17
3	15
4	13
5	10
6	9
7	6
8	3
9	1
10	2
N/A	4
N/A	5
N/A	7
N/A	8
N/A	11
N/A	12

N/A	14
N/A	16
N/A	18

For any effective Zone D areas for which we propose Zone X instead, please check to make sure none are on the GRIC, and any others must be for areas that the modeling covers like over-bank areas. The difference is if there is a cross section extending over the proposed Zone X area (attached is a FEMA Zone guideline document for your reference). Otherwise the Zones should remain D, as-is.
WEST Response: Revised mapping does not affect existing Zone D. No changes needed.

It appears that the cross section stations 0+00 begin at the left end (looking downstream) of the cross section ID hexagonal labels. To improve appearance and facilitate the boundary station check, I suggest that tics be added there to indicate this. Also, for any labels within the floodplain/floodway, I suggest eliminating the halo behind the labels. Perhaps this should be done for all of them – let's discuss.
WEST Response: Revised XS hexagonal label symbology as requested and added tic marks near the beginning of the visible cross section (left end) to identify stationing along the cross section cut line.
Update 04/09/2012: The cross sections that were extended in the left overbank in the vicinity of the confluence of the Gila and Salt Rivers were extended with negative stationing, and the tic marks near the southern ends of these specific cross sections were not labeled with the correct stations. The correct tic mark labeling will be provided with the next round of work map revisions.

As discussed, the note for the aerial photogrammetry label on the study sheets should be for just the flight involving the 1' topography and should be shown at the bottom of the study sheets. An example of how this can be stated is "The contour mapping for the floodplain and floodway in the channel is based upon…1' photogrammetry, flight date: …." Doing this may also lead to describing the contour interval label as: "Contour Interval = 1' in channel, 2' and 4' elsewhere". Please address.
WEST Response: Note revised as per request.

Please remove the labels on all sheets that describe the flight dates where they appear over the aerial photo (see sheets for red-line comments).\
WEST Response: All flight date labels removed from sheets.

Sheet 1

The upstream Limit of Study cannot extend above the uppermost cross section. Please clip the boundary at the cross section with both cross section and gutter line indicated.
WEST Response: Corrected as per request.

The number of major contour elevation labels is too great and so they should be thinned out. Please address.
WEST Response: Thinned out contour labels as per request.

There appears to be a "pond" on this sheet – should this be addressed by adding a note regarding the nature of the pond as transitory?
WEST Response: The "pond" is an existing sand and gravel pit. A label has been added to identify it as such.

Sheets 2-4

See red-lined sheets
WEST Response: Corrections noted with green highlighter on sheets.

Sheets 5,6, 7 and 8

Please rotate the orientation of cross section labels as indicated by red-line. The orientation should be consistent.
WEST Response: Reoriented cross section labels as per request.

Please label the Gila River and proposed Zone AE Floodway.
WEST Response: Labels added as per request.

Please rotate the label for Avondale Boulevard as shown in red-line on sheet 8.
WEST Response: Rotated label as per request.

Sheet 9

Please label the Gila River and proposed Zone AE Floodway.
WEST Response: Labels added as per request.

Sheet 10

There is a need to show a number of different proposed flood Zone changes (they aren't labeled). Also, the next submittal should include the BFC information, which will likely lead to another sheet to match east of this sheet. Please address. We will need to discuss showing the thalweg for that element of the study.
WEST Response: Revisions to this sheet are forthcoming pending additional BFC mapping.

There are numerous repeats of ground elevation labels that are not relevant to the study (see red-lined sheet, SW corner). Please remove them.
WEST Response: Revisions to this sheet are forthcoming pending additional BFC mapping.

Richard, the following three notes were originally listed under the "Modeling" comments section. They were moved from that section to this section, as each of these comments had to do with the study sheets and not the models.

The WSELs listed for the cross section labels should all be consistent with respect to format – either one or two decimal places. Please consider rounding all values to the nearest 1/10th of a foot, and adding the ".0" labels for whole numbers, to be consistent (for example 438 should become 468.0). Perhaps the best approach is to specify the RAS output as such to seek conformity between the upcoming FIS FDT and District GIS data deliverable package. What this means is the FDT and the GIS data can show the same values.
WEST Response: Revised all cross section stationing labels on the worksheets as per request. This change will also be reflected in the HIS deliverable.

Please add the Cadastral Section Corners to the legend and show them on the study sheets.
As discussed, the convention for indicating floodway has been a dash-dot-dot-dash line. Please update accordingly.
WEST Response: Cadastral Section Corners have been added to the study sheets; however, due to space limitations, they are not included in the legend. Floodway symbology has been updated as per request.

Please add the date of the aerial photography to the study sheet borders. There may be available more current aerial photos from the District now, so we need to check and change out what can be updated.
WEST Response: Added date and source of aerial photography to all worksheets (not including Index Sheet).

Modeling

In the model Description, please add text to clarify that the plan named "TRNL_PostProj_FEMA_Encr" is the post-project model, and that the cross sectional geometry in the vicinity of the levee and attendant features is based upon as-built project data. Also describe the various RAS models that will also be in the submittal package. Please add the WEST company information, including project manager and office street address. Also please add the last run date, and reference the TDN text section/appendix where the memos that are already described will be found. The basis of cross section geometry and modeled discharges should be added to the model Description.
WEST Response: This text has been added to the model description.

In responding to this and the above comment about the Description, I suggest that we get a Word version for editing/tracking, work together to update, and continue thus until we have mutual acceptance for the final version. Please provide a Word version of this item.
WEST Response: The text added to the model description has been provided to the District in a Word document for editing/tracking.

Please add text to the model cross section Descriptions for locations that also show constructed features. For example, the description for cross section @ 198.34 could read "At El Mirage Road crossing of the Gila River"; those around the 116th Avenue Bridge should also read "Upstream of bridge" and "Downstream of bridge", etc. Please address.

WEST Response: The requested text has been added to cross section descriptions throughout.

I forwarded you the revised as-builts for the levee raise @ the west-end of the levee on 3/6/12. Please update the elevations used in the levee option modeling that may be affected by the related levee crest elevation changes.

WEST Response: Three cross-sections were affected by the levee raise. A table of the elevation changes is provided below

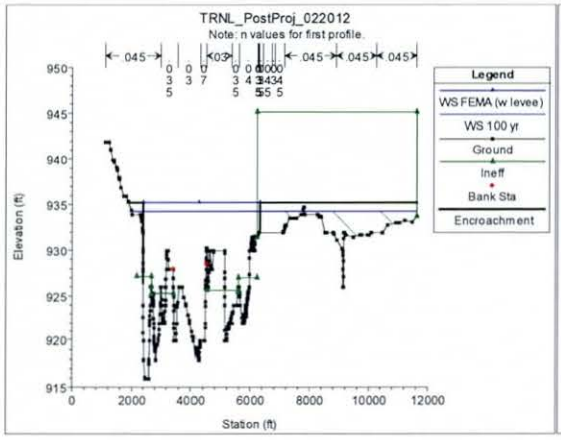
Levee Elevation Changes		
XS	**Previous levee elevation (ft)**	**Updated As-Built Levee Elevation (ft)**
198.34	939.34	939.9
198.38	939.34	940.2
198.43	940.34	940.6

The first few downstream cross section plots show extended WSELs in the right-hand sides, even though it is ineffective flow. I thought this issue had been rectified by updated cross section geometry? As it exists, there will be warnings in the CheckRas model runs for these areas. Please address.

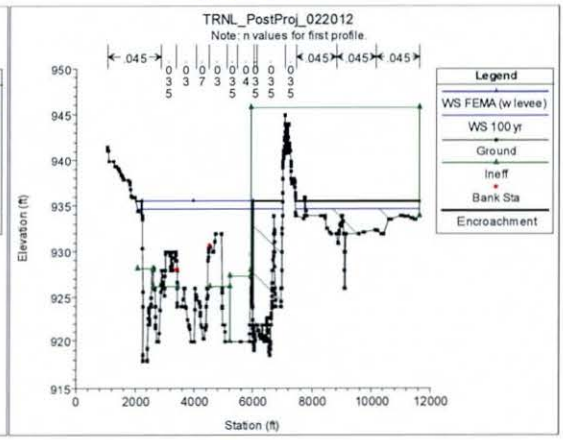
WEST Response: Seven cross sections at the downstream end of the model are below the downstream end of the Tres Rios North Levee. Four of these cross sections do not contain flow in the ROB: RS 198.2, RS 198.14, RS 198.09, and RS 198.02. Each of these four cross sections has a high ground point in the updated cross section geometry based on the Gillespie topography that does contain the flow. Also, a large majority of the ROB area for each of these cross sections, including the right end points of the cross sections, is entirely contained within an ineffective flow area, meaning that the water surface elevation overtopping the ground points in the far ROB of these cross sections will not affect the hydraulics at all. Therefore, for consistency with the LACOE cross section definition upstream and downstream of these four cross sections, WEST decided to not cut the cross sections at the high point in the geometry (although this could be done if requested by the District).

Plots of these four cross sections are provided below to show that a high point contains the water surface elevation in the right overbank at each of these cross sections.

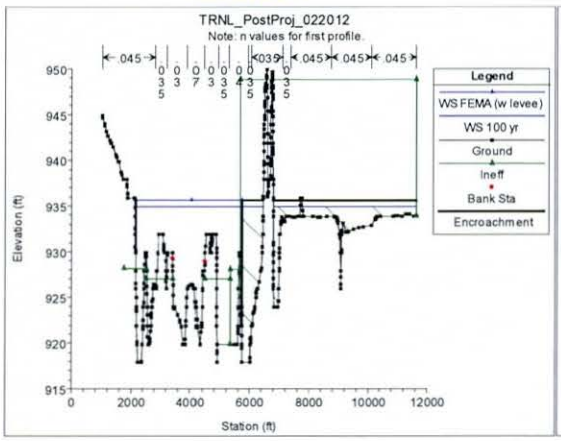
RS 198.02



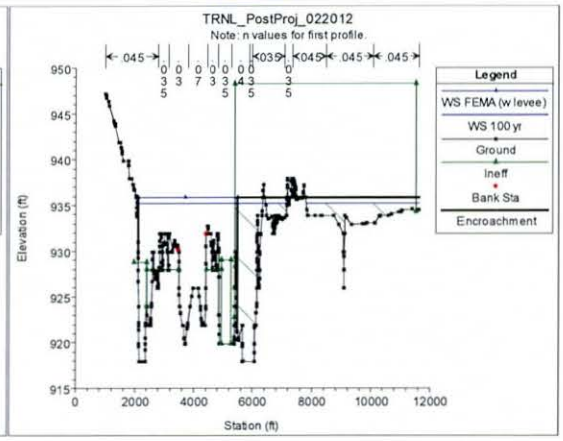
RS 198.09



RS 198.14



RS 198.2



For the next submittal please include the Effective model and the Duplicate/Corrected Effective Models. Also, the pre-project model may be added as a plan to the post-project model, but then all such included plans will have to be described in the model Description. Please address.

WEST Response: The effective and duplicate effective models have been included in the deliverable. No corrected effective model will be submitted for the TRNL project.

The RAS output had several locations for which negative surcharges are shown for encroachment. Please look into this so that they can be removed.

WEST Response: The minimum negative surcharge value is -0.04 in the encroachment model. It is general WEST practice to not address any negative encroachment value that are between -0.05 and 0

feet, as these will not show as negative in the FIS Floodway Data table since those numbers are rounded to the tenth of a foot. This has been acceptable to FEMA on all previous projects with negative surcharges between 0 and -0.05.

Per my spreadsheet entitled " XS Length Check 3_6_12.xlsx", please check those lengths that are listed as over 500'. These lengths are within the solid red cells. Should they be broken down so none are over 500'? Also, there proved to be a slight discrepancy between modeled lengths and the river-mile ID's, when the lengths were converted to river mile and added to the downstream cross sections. Please check those listed and revise the model cross section ID's accordingly.
WEST Response: As per Brian's responses to this comment via email on Friday, March 23, WEST feels that the RS calculated using RAS are the correct RS. RS have not been updated in the revised model. See that email and the Excel worksheet attached to that email titled "WEST XS Length Check 3_23_12.xlsx" for additional supporting information. Regarding the reach lengths, reducing the reach lengths so that they are all less than 500 feet is not necessary for this model.

GIS

As discussed, please send include draft shape files for all the hydraulic analysis with the next submittal.
WEST Response: Provided HIS deliverable of worksheet panel layout. All other shape files are pending finalization of additional BFC mapping.

From:	Brian Wahlin
To:	rph@mail.maricopa.gov; djr@mail.maricopa.gov; Chuck Davis
Subject:	Fwd: TRNL question
Date:	Monday, May 07, 2012 10:06:34 AM

Sent from my Verizon Wireless Phone

----- Forwarded message -----
From: "Bezek, Robert" <Robert.Bezek@fema.dhs.gov>
Date: Mon, May 7, 2012 9:47 am
Subject: TRNL question
To: "Brian Wahlin" <bwahlin@westconsultants.com>
Cc: "'Brownell, Geoff'" <gbrownell@mbakercorp.com>

Brian,

No worries. I did discuss this briefly with our Baker folks that will be reviewing this. General thought is that you will have to stick with what's in the FIS unless that change becomes part of the PMR request and submittal. Given that the amount is small in relation to the 1% and is more of an interpretation issue from the same source document, I don't think we will have a concern with the change.

Let me know if this helps. Give me a call if you want to discuss it more, I'll be around all week.

Bob

Bob Bezek, Regional Engineer, 510-627-7274

From: Brian Wahlin [mailto:bwahlin@westconsultants.com]
Sent: Monday, May 07, 2012 8:33 AM
To: Bezek, Robert
Subject: FW: TRNL question

Hi Bob,

I talked to Riley Asburry who talked to you at the AFMA conference. He mentioned that you had not had the time to look at my question yet. I hate to bother you, but I am getting hounded by the Flood Control District to get an answer to this question.

I hope all is going well for you.

Thanks.

Brian

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From: Brian Wahlin
Sent: Friday, April 27, 2012 2:17 PM
To: Robert Bezek (robert.bezek@fema.dhs.gov)
Subject: TRNL question

Bob,

I wanted to give you a quick update on the Tres Rios North Levee (TRNL) project and get your advice on one aspect.

The TRNL is coming along nicely. We have most of the work maps developed and the Technical Data Notebook is almost done. On the USACE side, they have completed their Data Documentation Report (DDR) and are working towards completing the LSER. The USACE also performed a levee inspection this week. We are still on track to completing our work by the end of June. The Flood Control District of Maricopa County is working with the Baker to get a PMR review set up.

With all the good news, we do have one stumbling block: the hydrology. The USACE and the FIS are both using the same source for the hydrology: a 1996 USACE report on the hydrology for the Salt/Gila River. The 1996 USACE report is vague in its description of the flows near the Salt/Gila River confluence. Because of this vagueness, the USACE and the FIS are using slightly different values for flows in the Salt River near the confluence with the Gila. The FIS reports a value of 164,000 cfs. The USACE is using a slightly smaller value of 162,000 cfs. There is about a 1% difference in the two flow rates. In reading the 1996 USACE hydrology report, I can verify that the hydrology is vaguely described for the area near the Salt/Gila confluence. I can also see the rationale behind choosing either 164,000 cfs and 162,000 cfs. From the beginning of this project, over 10 years ago, the USACE made the decision to interpret their own hydrology report as 162,000 cfs near the Salt/Gila confluence. This flow value was used in all the design work for the levee (i.e., scour analysis, freeboard, etc.) over the last 10+ years.

Now when it comes to the floodplain portion, there is a discrepancy in the hydrology because the FIS reports the flow should be 164,000 cfs and not 162,000 cfs that the USACE is using. Preliminary modeling suggests that this small of a change in flow changes water surface elevations at a few cross-sections by only 0.05 feet and less. These changes in WSE are only for a handful of cross-sections; the rest remain unchanged. The change in the width of the floodplain is on the order of a few feet, less than the thickness of the floodplain line shown on the maps. Essentially, there is no

difference in hydraulic modeling results when using the 162,000 cfs or the 164,000 cfs.

What can we do about this discrepancy? The difference in flow makes almost no difference in the floodplain results. It is also unreasonable to expect the USACE to go back and change all of their design and documentation for a change in flow that really will not impact the design or any of the results.

Please keep in mind that this discrepancy in hydrology is really a result of two agencies interpreting the same hydrology report (i.e., the USACE's 1996 hydrology report) in slightly different manners.

Is there some easy way to remedy this discrepancy?

Thanks for your time.

Also, unfortunately, I cannot make it to the AFMA conference next week. That would have been a perfect time to discuss this with you, but isn't an option this time around.

Thanks.

Brian

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Date: 5/08/12

Subject: Tres Rios North Levee FDS – Draft Final Hydraulics and TDN Submittal – RAS Modeling and Study Work Maps Submitted 4/26-5/7/12

Hi Brian and Chuck,

I have reviewed the subject updated materials and offer the below comments. I am also returning the tracked files and red-lined materials to support the review comments. Not every red-lined remark is also a review comment, and vice versa. Therefore, please consider both formats for revisions. Please return the red-lined text and responses to my review comments as part of the next submittal package. The convention I seek for responding to my comments has been to insert textual responses below each of them.

If you have any questions or suggestions regarding the comments, please let me know at 602 506 4528.

Thanks,

Richard

Study Sheets – Main Set

Cover Sheet

Please increase the font size for the "Tres Rios North Levee Floodplain Delineation Study", the ERM's and for the Salt and Gila River labels.
WEST Response: The font size for these labels has been increased.

Please show the outline of the effective floodplain both upstream of and downstream of the Limits of Study. Also, please show the proposed FP as a shaded but transparent area.
WEST Response: The outline of the effective floodplain is now shown both upstream of and downstream of the Limits of Study. Also, the proposed FP is now shown as a shaded but transparent area.

I suggest adding an icon near the Elevation Reference Marks table similar to that used in the plan view.
WEST Response: Since the ERM icon already appears in the legend on the Cover Sheet, an icon was not added near the Elevation Reference Marks table similar to that used in the plan view.

I suggest changing the date of the study to May 2012.
WEST Response: The date of the study has been changed to May 2012 on the sheets.

Sheet 1

I plotted the horizontal tie-ins for the lowermost cross sections along the Gila River and the plot points do not fall on the WS's for RS 197.92 and 197.97 (pdfs enclosed). There appears to be several hundred feet of discrepancy on the left-hand side. This should be explained in the TDN text. Please consider stating differences in topographical mapping products relating to effective vs. proposed delineations, and the issue of widening at the tie-in for conservative measures, etc.
WEST Response: Text has been added to the TDN to explain the differences in topographical mapping products relating to effective vs. proposed delineations, and the issue of widening at the tie-in for conservative measures. The text that was added to the first paragraph of Section 5.5 'Modeling Considerations' has been reproduced below:

It should be noted that the horizontal tie-in of the floodplain for this lowermost cross section along the Salt/Gila River model required artificial widening beyond the containment of the water surface elevation by the final topographic product used herein for mapping purposes, even though the vertical agreement was excellent between the water surface elevations calculated in the effective and the final post-project models. This artificial floodplain widening was on the order of hundreds of feet in the left overbank of the cross section. This type of inconsistency in horizontal extents is due to the differences in topographical mapping products between the effective and the proposed delineations, with the effective mapping being based on 4' C.I. topography while the proposed mapping is based on 1' C.I. topography with assumed better accuracy than the effective study. Additionally, artificial widening of the floodplain at the tie-in location provides a conservative measures floodplain mapping methodology.

Sheet 2

Please remove the Dibble contract number callout from the BFC/SAT Limit of Modeling shown on this sheet (this part of the BFC FP analysis is done by WEST not Dibble).
WEST Response: The Dibble contract number callout has been removed from the BFC/SAT Limit of Modeling shown on this sheet.

Sheet 3

As discussed, please extend the BFE for WS = 941' across the PIR parking area annex, and show gutter lines around the Avondale Blvd. Bridge (applies also to sheet 6). Remove the floodplain/floodway line-work that shows overtopping of the bridge structure.
WEST Response: The BFE for WS = 941' has been extended across the PIR parking area annex, and gutter lines are now shown around the Avondale Blvd. Bridge instead of floodway line work (applies also to sheet 6). The floodplain/floodway line-work that showed overtopping of the bridge structure has been removed from the sheet.

Sheets 4, 5

Please explain in the TDN text why the discharges aren't listed in the study sheets for the BFC/SAT above the Limit of Study east of El Mirage Rd.
WEST Response: This discussion has been added to the text of the TDN in Section 5.2 'Work Study Maps'. The text that was added has been reproduced below:

Additionally, any cross section in the BFC/SAT models not modified as a result of this study (i.e., not included in the post-project conditions model for the BFC) does not have the full cross section label on the study maps that are included for all of the Salt/Gila model cross sections and for the BFC cross sections that were included in the post-project model for the BFC. The full cross section label includes the river station identifier, the flow rate at the cross section, and the floodplain and floodway elevations computed for the cross section; the labels for the BFC/SAT cross sections not affected by this study only include the river station identifier and the floodplain elevations computed for the cross section.

Sheet 6, 7, and 8

N/A

Sheet 9
Please rotate the BFE labels shown on this sheet so the conform to the adjoining sheets.
WEST Response: The BFE labels shown on this sheet have been rotated to conform to the adjoining sheets.

Sheet 10

Please change the match line label on the right-hand side of the sheet 10 to Match Line Sheet 9 instead of 6.
WEST Response: The match line label on the right-hand side of sheet 10 has been changed to Match Line Sheet 9.

Sheet 11

N/A

Sheet 12

Please remove the Limit of Study label from this sheet as it does not represent work by this project. A gutter line to separate the FEMA cases will suffice.
WEST Response: The Limit of Study label has been removed from this sheet as it does not represent work by this project, and this differentiation is now marked by a gutter line to separate the FEMA cases.

Sheets 13, 14, 15, 16, 17, 18, and 19

N/A

Study Sheets –1" = 500' Scale Set

Please show the effective FP both above and below the limits of study.
WEST Response: The effective FP is now shown both above and below the limits of study for the index panel and for the corresponding sheets.

The cross section label orientation shown on sheet 2 does not match those of the adjoining sheets. Please rectify.
WEST Response: The cross section label orientation shown on sheet 2 has been updated to match those of the adjoining sheets.

Please update the label for these sheets to say "1" = 500' Scale at Full Size Plot".
WEST Response: WEST was confused as to the need for this label on the 500' scale study sheets. The scale bar is provided, and general cartographic practices dictate that the engineering scale presented on the sheet apply to the sheet at full size. Since the label 'at Full Size Plot' was not added to the 200' scale study sheets, our internal QA/QC reviewers suggested not including this label for consistency, especially since the engineering scale bar printed on the sheets implies that the scale is only applicable for full size plots.

Please label the Gila River on sheet 2. Also, please move the cross section labels to the left end-points for RS 200.07, 200.18, and 200.27.
WEST Response: The Gila River has been labeled on sheet 2. The cross section labels have been moved to the left end-points for RS 200.07; however, there was not enough room to move the cross section labels to the left end-points for RS 200.18 or for RS 200.27.

The cross section label for RS 200.36 on sheet 2 should either be moved closer to the FW boundary of the Salt River, or, the modeling encroachment station should be updated to represent the plotted location. In the plotted cross section, the distance from the left end-point to the left FW boundary is only @ 10', while on study sheet 2 it is @ 150' please rectify.
WEST Response: WEST would like to thank the reviewer for catching this error. This was actually due to an incorrect mapping of the floodway and floodplain boundary at this location. Both the floodway and floodplain boundary have been updated at this cross section to match the RAS modeling, and this update resolved the comment from the reviewer as well.

On sheet 3 the cross section label font size is different than that on the other sheets. Please rectify.
WEST Response: The cross section label font size has been updated on Sheet 3 to match the other sheets.

As discussed in the modeling section of these review comments, sheet 4 red-lines list recommended locations for artificial levee placement to ensure that flows will not enter un-connected areas in the left over-bank.
WEST Response: See the response to this comment in the modeling comments section below. WEST does not feel that these additions of artificial levees are warranted at this time.

TDN

For the next submittal (Draft Final), please provide two TDN disks for 1) Technical Data, including the TDN in pdf format, and 2) All study sheets in pdf along with GIS files. We will want to be able to easily transfer files to the City's and Baker as the project progresses.
WEST Response: For the Draft Final submittal, two TDN disks were provided for 1) Technical Data, including the TDN in pdf format, and 2) all study sheets in pdf along with GIS files.

For each of the five affected FIRM panels, please verify that all LOMA/LOMR re-validations have been checked.
WEST Response: The email to Richard dated Tuesday, May 8, 2012, provided a summary of all LOMA/LOMR re-validations, and these have all been checked. WEST will include this email in the TDN Appendix B, and the LOMA/LOMR letters downloaded from the FEMA Map Service Center will be included on a disk in an appendix to the TDN.

I have included some extra documents with the review comments that relate to the FEMA review. One of the guidance documents is entitled: "levee_mapping_44cfr6510[1].pdf". It has a five-part approach to

Levee Mapping and Complying with 44 CFR 65.10, with one part being the Operations and Maintenance of the levee structure. My brief review of the related DDR has led me to believe that the Operations and Maintenance component details are to be provided outside of both that document and the LSER. Please consider providing an appendix/sub-appendix where the O & M manuals (also enclosed) and agreement will be on disk, along with the DDR and remaining certification documents once they become available.
WEST Response: The approach to Levee Mapping and Complying with 44 CFR 65.10 from this document will be used to structure our TDN appendix regarding data received from the LACOE.

FYI, the spur dikes for phase 1b are only partially outlined in color on "Figure 1-1. Project Location Map". Some of them are not outlined – is this what the final should look like?
WEST Response: This was based entirely on line work provided by the LACOE. That line work only included some of the spur dikes for some reason. As WEST was not provided line work for the final constructed spur dikes at all locations, WEST removed the few spur dikes that were shown in Figure 1-1 from the line work entirely. Now only the levee itself is shown in the figure.

Please provide tabbed card-stock dividers for each of the major sections and appendices. Also, please add colored sheets to separate the sub-appendices.
WEST Response: Tabbed card-stock dividers have been added for each of the major sections and appendices. Also, please add colored sheets to separate the sub-appendices.

FYI, I over-viewed the March 2012 DDR and found a section that incorrectly describes the datum of the hydraulic design, FYI. Also, I did not see a section that explicitly defines freeboard amounts as they relate to the CFR 65.10, so the TDN text itself (see comments in tracked TDN by RPH) may have to be updated with such a table – we need to check with Baker on this.
WEST Response: Without supporting documentation as to the final risk and uncertainty analysis, this table will likely only garner additional confusion. We cannot provide detailed documentation relating to the conditional non-exceedance probability (i.e., assurance) calculations at each cross section. Without full documentation, WEST does not feel confident providing a table of freeboards in the text of the TDN. That would be similar to providing a table of in-channel velocities without the additional information of water surface elevations. Without more thorough documentation from the USACE, WEST feels it best to defer entirely to the DDR/LSER for this information. Based on the meeting minutes with the meeting held with Baker on 5/17/2012, Baker agrees that this is the best method to utilize moving forward with the freeboard and risk and uncertainty issues. Therefore, no table of freeboard or assurance values will be included in the TDN; everything in section 5.5.3 of the TDN will reference the DDR directly.

I have concern that the Phase 1C floodwall may be mentioned somewhere, but its' elimination may not be clear. I suggest we place a copy of the correspondence in appendix B (to facilitate this I am including a copy of the memo with these review comments). Please address.
WEST Response: The memorandum from the LACOE with all supporting addenda towards the removel of the Phase 1C floodwall have been added to Appendix B.

For the Draft Final, please print out all memo's/correspondence in color so the images make more sense.
WEST Response: All memos and correspondence were printed in color for the Draft Final TDN.

Please make sure *all* RMSE calculations sheets and related statements are put into appendix C. This should include items relating to the Gillespie and the Maryvale topographic products (I have enclosed a zip file that contains most of the necessary data). The data should be provided on disk, but the TDN section 3 should reference the disk. Please address.
WEST Response: All RMSE calculations sheets and related statements have been placed into appendix C.

As of now the appendix D is fully expanded with many sub-appendices that are not necessary. Please condense to a disk with the USACOE study of updated hydrologic analysis on it (U.S. Army Corps of Engineers, 1996), and whatever else may be considered necessary now that we are proposing a revision to the effective discharge.
WEST Response: WEST generally includes tabbed dividers for all sub-appendices that are specified in the ADWR State Standards Attachment 1-97. WEST will mark each of these sub-appendices with additional text below the heading indicating that 'no data provided for the final TDN' in italics or some other distinguishing text.

As we now know WEST to update section 4 hydrology table 4-1 to include the effective discharge of 164,000 cfs AND the proposed discharge of 162,000 cfs as a revision to the FIS. Doing so will allow us to move forward completing the TDN. As a result of this update, we will need to include detailed text explaining the request and source of the discharge revision (and as described above, copying the document on disk to for Appendix D Hydrologic data/analysis). Let's discuss.
WEST Response: WEST has updated table 4-1 of Section 4 to include the effective discharge of 164,000 cfs and the proposed discharge of 162,000 cfs as a revision to the FIS. WEST has also included detailed text in the TDN explaining the request and source of the discharge revision, and the report supporting this requested change has been copied on disk to in Appendix D.

Please refer to the tracked and commented version of the TDN that I am adding to the response package. Please add your responses to the same version for each, and provide an additional draft final TDN (with a date of May 2012) for final review/comment by the District and the Cities.
WEST Response: WEST has responded to the reviewer's comments in the tracked and commented version of the TDN, and WEST has provided an additional draft final TDN (with a date of May 2012) for final review/comment by the District and the Cities.

As discussed, please include text to explain to future reviewers the apparent difference in elevations between the artificial levees in the cross section plots and the ground elevation points. It seems likely that the levee-raise had something to do with it @ RS 198.43 (right-hand side) – after performing any model geometry updates, there may remain a reason to explain why other locations along the constructed levee show the artificial levee elevations below the nearby ground elevation. Chuck Davis

told me about the approach by the LACOE to purposely position them this way, so I suggest that this explanation be added to the TDN text section 5.7.1.
WEST Response: This discussion has been added to the text of the TDN. The text that was added has been reproduced below:

Two Post-Project Conditions Models were created for the Salt/Gila River. Both of these models started with the Pre-Project Conditions Model (i.e., Corrected Effective Model) and added the features of the TRNL. The as-built geometry of the levee and attendant features were added to the HEC-RAS geometry by altering the station/elevation records of the ground points on a cross section by cross section basis by the LACOE. Additionally, the levee elevations using the 'levee feature' of HEC-RAS were defined by the LACOE as well. It should be noted that the levee elevations defined in the final post-project model appear to be below the top of the constructed as-built features reflected in the station/elevation records of the cross section ground points for all cross sections that include the levee feature. This was done by the LACOE to reflect the lowest point along the top of the levee not including any riprap height above the earthen mass of the embankment; the lowest point for this levee corresponds to the break in slope from the riverward levee face to the top of the embankment. The top of the levee was built with a 2% slope from the landward edge of the top of the levee embankment down to the riverward edge of the top of the levee embankment. By defining the levee height below the top of the constructed features, the LACOE was able to account for additional possible erosion processes that could affect levee freeboard during a flood event, such as wave erosion eroding some amount of the top of the levee. WEST also corrected the levee heights to agree with the as-built drawings provided by the LACOE for the small portion of the levee near El Mirage Road that was raised in March 2012 (see technical memorandum in Appendix B).

Modeling

Salt/Gila Post-Project

Old Modeling Comments:

This submittal did not include updated RAS models. Therefore, the review comments below still apply. New comments have been added for what has been checked more thoroughly from the previous submittal. Please address all.

Please change the name of the BFC post-project RAS model to include the letters "BFC". This may help future reviewers keep track of which area the model is for.
WEST Response: The name of the BFC post-project RAS model was changed to include the letters "BFC" in the model title. The new model title is now "BFC_Post_proj."

Should the models include pre and post versions of Reach3? If so these weren't found in the submittal.

WEST Response: Reach3 is the effective model; that naming convention was not used for anything other than the effective model. A duplicate effective model was provided for Reach3 with the title Reach3. No pre- and post-project models will be required for Reach 3.

There appears to be more than one levee modeled for the TRNL crest @ RS 198.43. Also, other cross sections show the levee is modeled at locations below the crest (198.54, 198.64, etc.). This gives the appearance of an incomplete revision. Could leaving things as they are turn into a review comment, later, or should the cross section geometry be modified to match the modeled levee elevations? Please address.

WEST Response: The final as-built geometry input to HEC-RAS as well as the final approved levee elevations defined using the levee option in HEC-RAS were provided and approved by the LACOE. WEST has no electronic information to update the as-built cross section geometry, and picking the ground elevations off of the as-builts manually to update the STA/ELEV information for the cross sections in HEC-RAS would be a large undertaking. Also, changing the elevations of the levee defined using the levee option in HEC-RAS in the model would require additional review by the LACOE beyond their previously approved values for levee elevations in the model.

BFS/SAT Post-Project

The following cross section description should have the words added "See Model Description and Study Report for more details".

"RM 2.622, El Mirage Rd. HEC-1 CPCB1 1270 CFS

115 cfs was subtracted at this cross section location to approximate flow that would be conveyed via the existing culvert. In other words, this is the HEC-1 flow rate. **See Model Description and Study Report for more details."** Please address.

WEST Response: WEST added the text "See Model Description and Study Report for more details" to the cross section description for RM 2.622 as per the reviewer's comment. However, WEST did not vary the flow rates from the effective model at all, as this was not within the scope of our study. The goal of WEST's updates to the model was to only modify the downstream boundary condition and the mapping of the inundation extents for all cross sections affected by the backwater from the Salt/Gila model; the rest of the modeling parameters (including hydrology, Manning's coefficients, etc.) were intended to remain identical to the original FEMA-approved study as completed by the previous consultant.

The basis for the Starting WSEL should be added to the model description. Please relate the river mile, WSEL from the Salt/Gila model, and the datum.

WEST Response: The basis for the starting WSEL (i.e., the downstream boundary condition) was added to the model description, including the river mile and WSEL from the proposed Salt/Gila data, as well as the datum for the proposed data.

New Modeling Comments:

I recommend artificial levee placement for the left-overbank area of several cross sections near the upper limit-of-study of the Salt River to ensure that flows will not enter un-connected areas in there.
WEST Response: Based on an email dated February 2, 2011 (time stamp of 11:51 AM) sent from Van Crisostomo of the LACOE H&H group, the LACOE has approved that "only the actual flood control levee will be modeled as 'levees' in HEC-RAS." This response was based on an earlier comment submitted by WEST and approved by the District in regards to the HEC-RAS modeling. At this point, the flow in the left overbank near the upper limit-of-study for the Salt River is significantly disconnected from the main flow path within a LOB IFA, and this can be explained in the text of the TDN. Changing the IFA's to levees in this area will not change the hydraulic calculations, and this will likely add more confusion in the overall review of the model since this is a model that will specifically be used for levee certification review and approval. Since the use of levees in the left overbank would need to be explained in the text of the TDN regardless, WEST recommends explaining the reason for disconnected ineffective flow in this area using IFA's as opposed to changing these modeling features to levees at this point due to (1) previous input from the LACOE and (2) the chance for greater confusion moving forward regarding which 'levees' in HEC-RAS represent certifiable embankments and which do not.

GIS

Please provide all required shape files with the next submittal, including an updated study sheet outline file.
WEST Response: The HIS deliverables have been provided to Richard, along with an updated study sheet outline file.

Miscellaneous/Left-Overs (please respond to the latest tracking shown in red)

RPH Comment #12: We need to discuss the modeling approach before this type of explanation can be finalized. Are the OBW embankment geometries removed or allowed to stay but over-topped? It should be explained that final proposed results are worst-case scenario.

WEST Response #12: WEST agrees that this should be discussed more in the text. The following text has been added to the TDN for clarification.

In this study, the models including and not including the OBW embankment showed almost no difference in water surface elevation (maximum difference at a cross section less than +/- 0.2 feet). The differences

in water surface elevation (WSEL) at these cross sections showed no discernible difference in horizontal inundation extents at the scale of the 1" = 200' work maps. For example, the cross section showing the of maximum difference in WSEL between the two plans was RS 202.43 which showed a WSEL increase of 0.17' for the plan with the OBW compared to the plan without the OBW. This vertical difference of 0.17' in WSEL at RS 202.43 showed a difference in horizontal inundation extent of 0.27' in the right overbank. These very minimal differences led to the use of only the with OBW plan as the final hydraulic model used for floodplain mapping and FIS data development. Results for the without OBW model are included in the tables in Section 5 of this TDN for information purposes, but results from this plan are not included in the FIS data of Section 7.

Please explain your modeling approach for the with-embankment scenario – are the IFA options used, and how are they applied (your addition hasn't yet appeared in my review copy of the TDN)?

WEST Response: The following sentence has been added to the second paragraph of Section 5.1.5 to explain the modeling approach for the with-embankment scenario: "*Water shown to the north of the OBW embankment in Model 1 was treated as ineffective flow area.*" Additionally, the addition shown above has been added to the second paragraph of Section 5.1.5 as well.

RPH Comment #13: Let's discuss

WEST Response #13: WEST can continue discussing the Appendix labeling with Richard. Would you rather not have the annotated FIRM panels and flood profiles included in Appendix G?

This could be integrated into the overall Hydraulics appendix, or, placed in Section 7 of the TDN since it is FIS related. I personally have seen many TDN's with Appendices used for this item, often next to the folded full-size study sheets. The latter should be contained in plastic sleeves to promote longevity.

WEST Response: WEST will plan to place the Annotated FIRM Panels in the appendix next to the folded full-size study sheets. As discussed previously, Baker will provide the flood profiles for this study as it is a PMR submittal.

LEVEE ELEVATION UPDATE FOR THE FINAL TRNL HEC-RAS MODELS BASED ON THE LEVEE RAISE EFFECTING THE TRNL PHASE 1B

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS NORTH LEVEE PMR PROJECT

Date: May 18, 2012

To: Richard Harris – District

Cc: Don Rerick – District
Van Crisostomo – LACOE
Mylene Perry – LACOE
Joe Goldstein – LACOE

From: Brian Wahlin – WEST
Chuck Davis – WEST

Based on recent conversations between WEST Consultants, Inc., (WEST) and the U.S. Army Corps of Engineers, L.A. District (LACOE)—specifically during a phone call between Chuck Davis and Joe Goldstein on Friday, May 4—WEST has updated the post-project conditions HEC-RAS model with slightly updated levee elevation information to reflect the levee raise construction recently completed by Kiewit near the portion of Phase 1B of the Tres Rios North Levee (TRNL) near El Mirage Road. The LACOE originally updated the levee as-built geometry in the HEC-RAS cross sections based on manually picking points off of the as-built plans. The levee elevation entered into the 'levee feature' option of HEC-RAS that generates the infinitely thin levee (i.e., defined at a single horizontal station) in the model was defined by the LACOE as the elevation of the riverward point of the top of the levee (top of the levee defined as the aggregate base course [ABC] finish used for vehicular access). As can be seen from the typical levee cross section from the updated TRNL as-built sheet reflecting the levee raise provided by Kiewit in Figure 1 below, the riverward point of the top of the levee is the lowest point of finished ABC, as the top of the levee has a 2% slope towards the river.

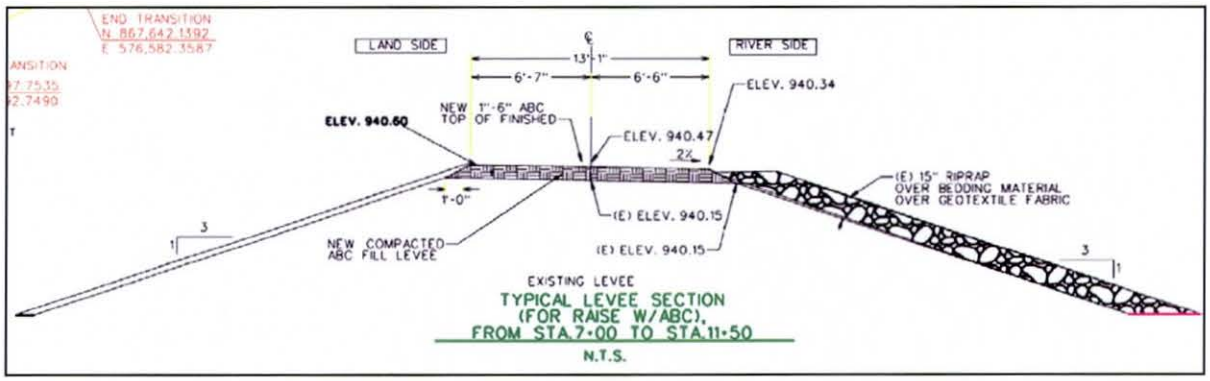


Figure 1. Typical levee cross section from the updated TRNL as-built sheet reflecting the levee raise provided by Kiewit and the LACOE

In the as-built HEC-RAS geometry provided by the LACOE, the top of the levee was defined using two points, and these two points reflect the top of the levee elevation (i.e., the elevation of the ABC on the landward edge of the top of the levee). For example, the screenshot in Figure 2 below of RS 198.34 shows the top of the levee represented by two points in the HEC-RAS geometry, and both of those points represent the highest elevation of the top of the levee. The one-station levee elevation defined using the 'levee feature' in HEC-RAS (noted by a pink square) is lower than these two ground points, as it represents the riverward point of the top of the levee.

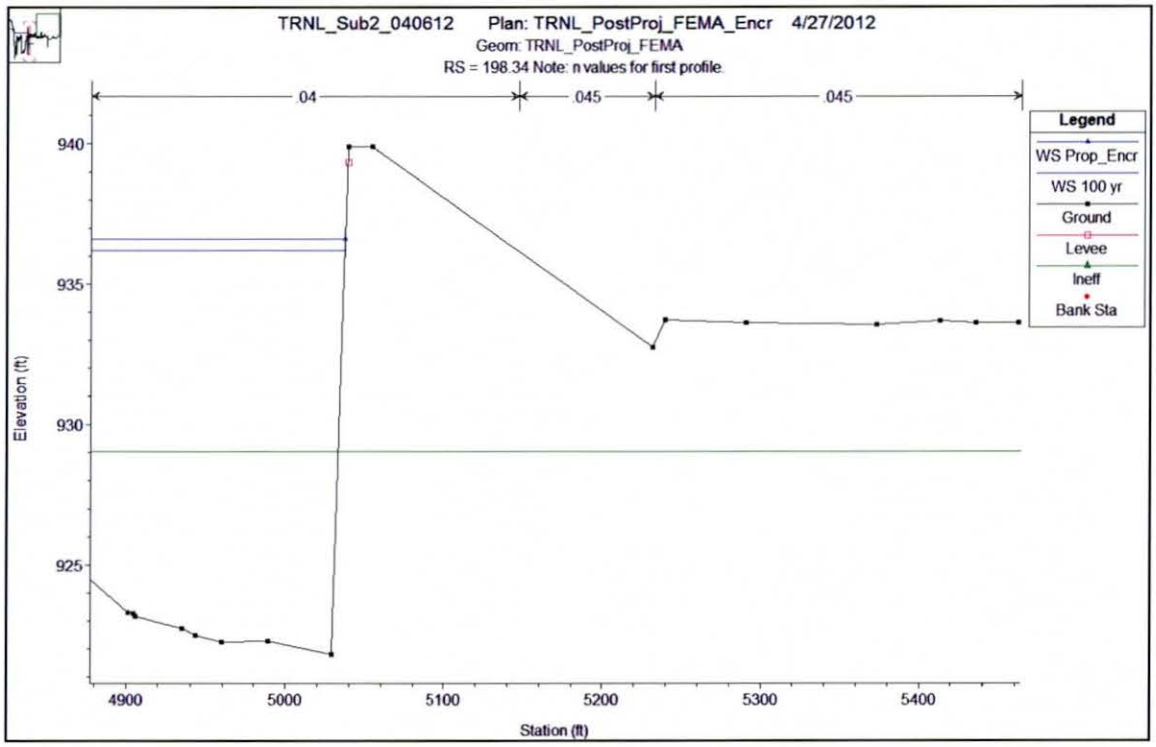


Figure 2. View of a portion of RS 198.34 in the final post-project HEC-RAS model

Three cross sections in the HEC-RAS model cross the levee where the levee was raised: RS 198.34, 198.38, and 198.43. Table 1 below shows the original and updated levee elevations defined using the 'levee feature' in HEC-RAS for the post-project model. Table 2 below shows the original and updated levee embankment elevations defined in the station/elevation records of the HEC-RAS cross section geometry for these cross sections. For consistency, WEST maintained the methodology of representing the top of the levee in the HEC-RAS cross section geometry with two points (at the horizontal stations previously identified by the USACE) and using the elevation of the landward edge of the ABC to define the elevation of those two points. This elevation corresponds to the highest point of the top of the levee. Also, since the updated as-builts for the levee provided by Kiewit only provide survey updates for the riverward edge of the existing ABC downstream of the portion of the levee that was raised (i.e., downstream of approximate station 6+20, which does not include RS 198.34 or 198.38), then only the elevation at the highest point of the top of the levee along the landward edge of the ABC was known for XS 198.34 and 198.38. Due to this, the updated as-built levee elevations entered into the HEC-RAS model using the 'levee feature' (which represent the riverward edge of the ABC) could not be updated for XS 198.34 and 198.38. The Kiewit team provided updated survey for the riverward edge of the ABC only for the portion of the levee that was raised (approximately station 6+20 to 11+30 along the top of the levee). XS 198.43 crosses the levee at approximately levee station 8+70. As can be seen from Figure 3 below, survey points were collected on the landward and riverward edge of the ABC for the portion of the levee that was raised by Kiewit; survey points 9 and 25 correspond to the landward (elevation of 940.61') and riverward (elevation of 940.35') edges, respectively, of the ABC at approximately the location of XS 198.43. For this cross section, the two ground points representing the levee top were updated to reflect the elevation of survey point 9 (i.e., 940.61'), and the levee elevation at this cross section was updated to reflect survey point 25 (i.e., 940.35').

Table 1. Update to the levees defined by the 'levee feature' in HEC-RAS

XS	Previous levee elevation defined by the LACOE (ft)	Updated As-Built Levee Elevation (ft)
198.34	939.34	939.34
198.38	939.34	939.34
198.43	940.34	940.35

Table 2. Update to the levee embankments defined in the station/elevation data of the cross section geometry in HEC-RAS

XS	Station (ft)	Original ground elevations for top of levee defined by the LACOE (ft)	Updated ground elevations for top of levee (ft)
198.34	5039	940.45	939.9
198.34	5054	940.45	939.9
198.38	5051	940.45	940.2
198.38	5066	940.45	940.2
198.43	5193.06	940.45	940.61
198.43	5206.40	940.45	940.61

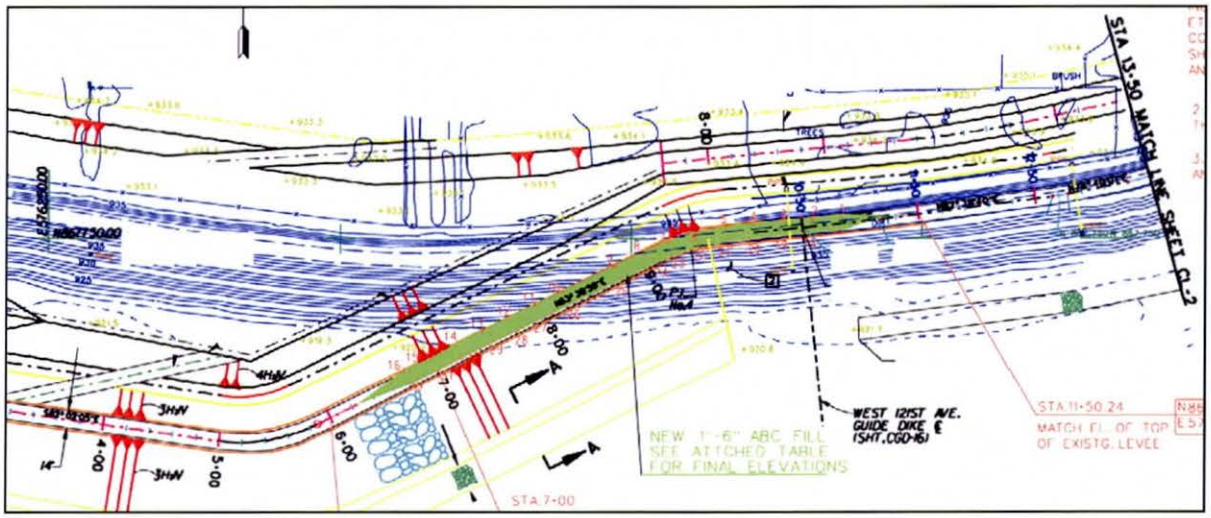


Figure 3. View of the levee survey points from the updated TRNL as-built sheet reflecting the levee raise provided by Kiewit and the LACOE

Date: June 4, 2012

Subject: Tres Rios North Levee FDS Technical Documentation.

Team,

I have finished my review of the subject draft products and offer the below review comments towards finalization. I am also providing a tracked version of the TDN in electronic format, separately. Please review both in context with the final deliverable. Not all tracked items are comments, and vice versa.

Please provide written responses to both with the next submittal. If you have any question in the meantime, please let me know.

Thanks,

Richard

TDN

Please refer to the tracked version of the TDN for a number of suggestions and comments, and respond to each directly on it.
WEST Response: WEST has responded to each comment in the tracked changes version of the TDN.

Please update the TDN Appendix B with the most recent meeting minutes, including the teleconference with Tom Smith of Baker/AECOM.
WEST Response: WEST has included meeting minutes from all recent meetings in Appendix B, including the teleconference with Tom Smith of Baker/AECOM.

Please add tabbed dividers to the main TDN text sections.
WEST Response: WEST has added tabbed dividers to the main TDN text sections.

My guess is that the As-built plans for the 115th Avenue Bridge are not included in the DDR, but I may be wrong. In any case, they should be included in the TDN somewhere and their location referenced in text section 5.5.2. Please address.
WEST Response: The as-built plans for the 115th Avenue Bridge have been included in the TDN.

For the next submittal please include the FIS Flood Profiles in NGVD 29 in the report with a data files copy in NAVD 88. It may turn out that Baker wants the hard-copy to be in both – *let's discuss with Baker.*
WEST Response: WEST has included the FIS Flood Profiles in NGVD 29 in DXF format on the disc.

Displays

Study Work Maps

200 Scale

For the next submittal, please provide a hard-copy set that is sealed/signed for our flat-files. Also, can we have geo-rectified version data files of the study sheets that can be loaded directly onto an MXD?
WEST Response: WEST will provide a hard-copy set of the final sealed/signed work maps for the FCDMC flat-files. Also, WEST will provide geo-rectified version data files of the study sheets that can be loaded directly onto an MXD.

500 Scale

No Comments

Annotated FIRM Panel (AFP) Sheets

Please note: The comments below that include italics should be considered together as part of a discussion with Baker before updating the sheets. Please let me know after you have finished reading all of them so that I can schedule a meeting to address them. Of course, please let me know if you have any questions before we meet with Baker.

It appears that the AFP sheet 2095F-1 does not include the effects of more recent mapping by FEMA associated with LOMR 04-09-933P. Please address.
WEST Response: AFP panel 2095F-1 includes the most recent mapping provided by the District and FEMA, which is the same mapping shown on the work maps.

We will need to coordinate with Baker on whether or not they will need to see "Proposed Zone X" on the AFP sheets or not – there are a lot of areas that are currently Zone AE that will be thus re-mapped and Baker may need to have visual direction on this. *Let's discuss.*
WEST Response: Based on further discussion with the District and Baker, WEST added the Proposed Zone X label throughout the work maps.

Please update the Index so that the Dibble study information for the Zone A of the BFC is shown as "revised Zone A" shading (peach color). *I believe this will be helpful for the PMR review in terms of updating the respective panels by Baker. However, this may be a good issue to discuss with them directly before finalizing the Index.*
WEST Response: Based on final comments from Baker, the effective Zone A has been shown with a dashed outline, and the proposed Zone A has been shown with a peach shading.

Should the peach colored "Revised Zone A" be cross hatched so that the effective and the revised can be shown combined on the Index? *Let's discuss.*
WEST Response: Based on final comments from Baker, the effective Zone A has been shown with a dashed outline and no hatching or shading; therefore only the proposed Zone A has been shown with shading.

Suggest a gutter line be added at baseline on the panel Index and attendant sheets for the change between effective and proposed @ Baseline Rd (BFC study element). Also, the same line type change for the SAT near the eastern end AFP sheet 2095F-3. Please address.
WEST Response: This gutter line was added to AFP panel 2095F-3. The same line type change was also implemented for the SAT near the eastern end of AFP panel 2095F-3.

On the AFP Index and all attendant AFP sheets, please label the Salt and Gila Rivers (unless already done as part of the effective data).
WEST Response: All sheets have now been labeled with the Salt and Gila River identifiers.

It may prove useful for Baker staff to have the BFC and SAT Baselines labeled on all displays. *Let's discuss.*
WEST Response: All sheets have now been labeled with the BFC and SAT identifiers.

GIS

Please provide an updated NDXPRJ.shp file. This file will be used to generate the mailer list for the public OHM.
WEST Response: WEST has provided and updated NDXPRJ.shp file.

If you want to minimize the mailing list from other than the study sheet outline as a boundary, please prepare a shape file to use for cutting out all properties for which there are proposed floodplain zoning changes, including areas to be replaced as Zone X.
WEST Response: WEST does not have another boundary to provide as an outline for the floodplain zone changes.

Please update the file "FPZNFCD.shp" and resubmit with the Code for Zone X as "X1". This is defined in more detail within our data delivery specifications.
WEST Response: WEST has updated the code for Zone X from "X" to "X1" in the final FPZNFCD.shp file.

WEST Consultants, Inc. **MEMORANDUM**

TO: **Teri George and Richard Harris**

FROM: **Brian Wahlin**

DATE: **June 12, 2012**

SUBJECT: **Meeting minutes for meeting on June 12, 2012**

On June 12, 2012, Richard Harris (Flood Control District of Maricopa County), Teri George (Michael Baker, Jr.), and Brian Wahlin (WEST Consultants) met to discuss changes or modifications to the annotated FIRM panels, work maps, technical data notebook, and GIS deliverables for the Tres Rios North Levee Physical Map Revision.

Annotated FIRMs

The following is a summary of changes that should be made to the annotated FIRM panels.

1. The effective floodplain for the Buckeye Feeder Canal (BFC) is shown on annotated FIRM panel 04013C2095F-2 as a dashed line. This is correct and should remain.
   WEST response: Concur.

2. The effective floodplain for the Sunland Avenue Tributary (SAT) should be shown as a dashed line on annotated FIRM panels 04013C2095F-1 and 01013C2095F-3 just as it was done for the BFC.
   WEST response: The effective floodplain for the Sunland Avenue Tributary (SAT) is now shown as a dashed line on annotated FIRM panels 04013C2095F-1 and 01013C2095F-3.

3. When the annotated FIRM panels are turned over to Baker for review, they should be printed at full size.
   WEST response: WEST will print these FIRM panels at full size when turned over to Baker.

4. Gutter lines should be added between all proposed and existing floodplains, even if the proposed zones are the same type (i.e., both Zone AE or both Zone A). An example of this is shown in Figure 1.
   WEST response: WEST added gutter lines between all proposed and existing floodplains.

5. The effective Zone A area on the annotated FIRM panels should not be highlighted in red. These areas are effective and should be dashed outlines like the effective floodplains for the BFC and SAT.
   WEST response: The effective Zone A areas on the annotated FIRM panels are now shown with dashed outlines like the effective floodplains for the BFC and SAT and are no longer highlighted.

6. The dark red portion shown in Figure 1 on annotated FIRM panel 04013C2095F-2 is not actually a Zone A. According to Dibble's original study of the area, the dark red portion should be Zone AE. FEMA changed the designation to Zone A for mapping purposes. The annotated FIRM panel should show this area as a Proposed Zone AE as was done for the original Dibble study.
   WEST response: This is shown on the final work maps and annotated FIRM panels.

7. The index sheet should be updated to reflect the Zone A to AE change as described in Item 6 above.
   WEST response: The index sheet has been updated to reflect the Zone A to AE change as described in Item 6 above.

8. The areas that are to be removed from the floodplain due to the Tres Rios North Levee should be labeled as Proposed Zone X (no shading).
   WEST response: Areas that are to be removed from the floodplain due to the TRNL have been labeled as Proposed Zone X in the updated AFP deliverable.

9. The existing floodplains at the upstream areas for BFC and SAT will reflect approved LOMRs and not the effective floodplains.
   WEST response: WEST has made the existing floodplains at the upstream areas for the BFC and SAT reflect the final approved LOMRs with the typical dashed outline.

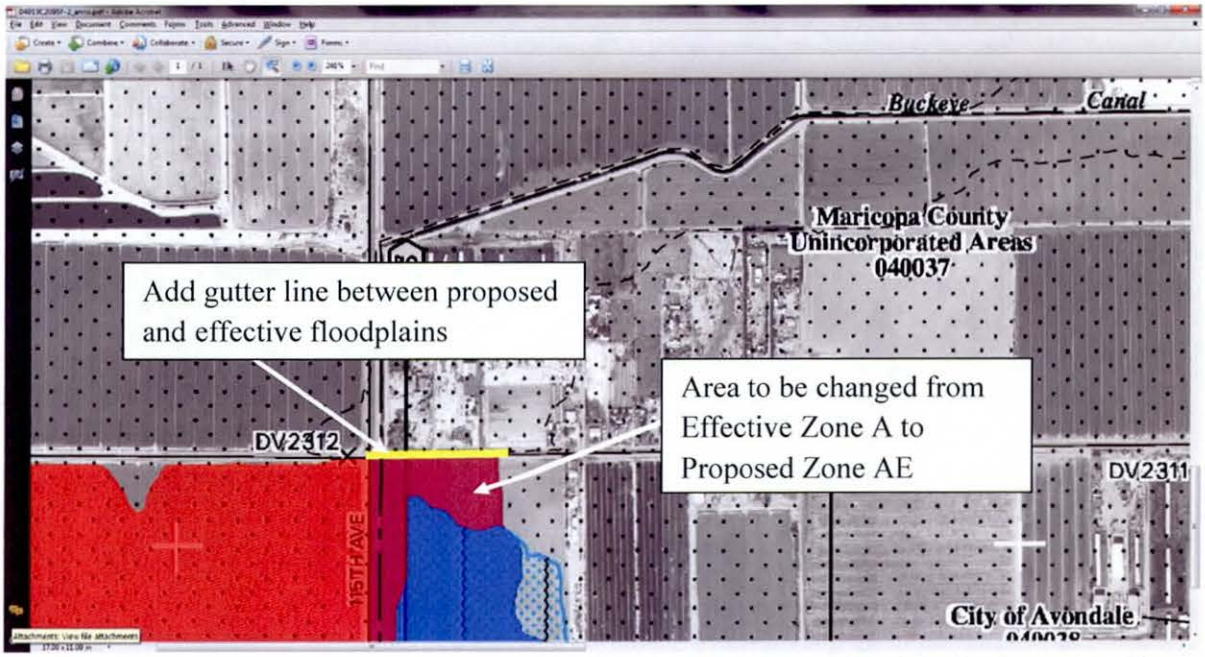


Figure 1. Gutter line (yellow line) between effective BFC floodplain (dashed area north of yellow line) and proposed BFC floodplain (dark red area south of yellow line)

Work Maps

The following is a summary of changes that should be made to the work maps.

1. On work maps 7 and 8, update the Effective Zone A defined by FEMA to reflect the Proposed Zone AE in the Dibble study (same as Item 6 in the annotated FIRM section).
   WEST response: Work maps 7 and 8 now reflect the proposed Zone AE in the Dibble study.

2. The areas that are to be removed from the floodplain due to the Tres Rios North Levee should be labeled as Proposed Zone X (no shading).
   WEST response: These areas have been labeled Proposed Zone X.

3. WEST will create geo-rectified work maps. However, this task will wait until the work maps are finalized.
   WEST response: These have been completed and submitted to the District.

Technical Data Notebook

1. The as-built plans for the 115th Avenue Bridge have been added to the TDN.
   WEST response: WEST has added the as-built plans for the 115th Avenue Bridge to the TDN.

2. WEST will create only digital copies of the flood profiles in both NGVD29 and NAVD88. No paper copies will be necessary. The flood profiles should have markers indicated cultural features such as bridges, the Salt/Gila confluence, the start of the levee, the end of the levee, etc.
   WEST response: WEST will create digital copies of the flood profiles in both NGVD29 and NAVD88 with markers indicating cultural features such as bridges, the Salt/Gila confluence, the start of the levee, and the end of the levee.

3. A hard copy of the TDN will be submitted to Baker for final review.
   WEST response: WEST will submit a hard copy of the TDN to Baker for final review.

GIS Deliverables

1. WEST will update the GIS deliverables to show the Proposed Zone X areas (i.e., areas to be removed from the Salt/Gila floodplain). Note that the FCDMC standard code for Zone X is actually X1.
   WEST response: WEST will update the flood hazard zone code for Proposed Zone X areas in the GIS deliverables from X to X1 in the corresponding shapefile attribute column.

CESPL-ED-H 11 July 2012

MEMORANDUM FOR CESPL-ED-GL, Attn: Jody Fischer

SUBJECT: Tres Rios Environmental Restoration Project Hydraulic Model Acceptance

1. The Tres Rios Environmental Restoration Project is located southwest of the Phoenix metropolitan area in Maricopa County, Arizona and includes an eight-mile reach of the Salt and Gila Rivers beginning at 91st Avenue and extends west to the confluence of both Gila and Agua Fria Rivers. The Feasibility Report completed in April 2000 describes and outlines project alternatives that were considered for basis of design of the Tres Rios Environmental Restoration Project. The project recommended plan included the North Levee (Phase I); Pump Station, Regulating and Overbank Wetlands (Phase II); Riparian Corridors (Phase III); and an underground reclaimed water pipe (Phase IV). The North Levee and regulating and overbank wetland features have been constructed. The pump station and riparian corridor are near completion and the water pipe design is currently on hold as it currently is not required.

2. The local Sponsor, City of Phoenix, has a memorandum of agreement with the Flood Control District of Maricopa County (FCDMC) for the following tasks: (i) to submit the technical documentation necessary to update the Federal Emergency Management Agency's Digital Flood Insurance Rate Maps to reflect the impact of the North Levee on flooding risk in the area and (ii) to operate and maintain the North Levee and attendant features upon completion of construction by the Corps. The FCDMC contracted services to WEST Consultants, Inc. (WEST) for submittal of the Tres Rios North Levee Floodplain and Floodway Re-delineation Study as a Physical Map Revision (PMR) request to the Federal Emergency Management Agency.

3. In February 2012, Hydraulics Section received the most current HEC-RAS hydraulic model supplied by WEST for review. Based on our review of the hydraulic model for the post-project condition, WEST incorporated all of our comments. The Corps accepts the HEC-RAS model version 4.2 dated 20 February 2012 and labeled as TRNL_PostProj_022012 as a final hydraulic model. This review will be made part of the District Quality Control.

4. The Hydraulics Section completed the Risk and Uncertainty (R&U) Analysis based on output from the hydraulic model and the results indicate that the North Levee passes the 95% conditional non-exceedance probability (CNP) for the 1% annual chance exceedance flood with the top of levee having the minimum of two feet of freeboard elevation requirements. Our hydraulic assessment indicates that the as-built project meets hydraulic criteria for the local Sponsor to pursue a PMR. Modeling details and the R&U analysis were documented in the 2012 Hydraulics Appendix of the Tres Rios Environmental Restoration Project Design Document Report for Flood Control North Levee Phase 1A & 1B.

5. Please direct any questions or comments regarding this memorandum to Mylene M. Perry, Hydraulics Section, at (213) 452-3551 or mylene.m.perry@usace.army.mil.

Rene Vermeeren

RENE VERMEEREN, PE
Chief, Hydrology & Hydraulics Branch

CESPL-ED-H
SUBJECT: Tres Rios Environmental Restoration Project Hydraulic Model Acceptance

CF:

RV -7-11-12

CESPL-ED-HH (3)

VERMEEREN
CESPL-ED-H
VC 7/11/12

CRISOSTOMO
CESPL-ED-HH

MP 7/11/12

PERRY
CESPL-ED-HH

RESPONSES TO THE FIRST ROUND OF BAKER COMMENTS FOR THE TRNL TDN

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
TRES RIOS NORTH LEVEE PMR PROJECT

Date: September 4, 2012

To: Teri George – Baker

Cc: Richard Harris – District
Don Rerick – District

From: Brian Wahlin – WEST
Chuck Davis – WEST

This document provides responses to Baker's comments regarding the submitted draft hydraulics data for the Tres Rios North Levee (TRNL) Floodplain and Floodway Re-Delineation Study - Technical Data Notebook (TDN). The TDN was prepared by WEST Consultants, Inc. and dated July 2012 (FCD 2010C027 & 2012C0005). Baker's response comments on this draft submittal were provided to WEST on August 1, 2012. WEST has responded to each comment below and provided an updated TDN package to Baker. As per Baker's direction after providing WEST with the comments on August 1, WEST will consider this submittal the final version of the TRNL TDN.

General

Comment 1: The Buckeye Feeder Channel model ties in to the overall Gila HEC-RAS model and it was Baker understood that no changes were going to be made to the FEMA approved model. However it appears there are changes to Dibble's HEC-RAS model for cross sections 2.62 to 2.838 and a similar change to the floodplain delineation between 2.838 to 3.028. It is understood that the model would be converted to NAVD but that no other changes would be made. Please correct.

WEST Response: This is by far the most significant comment received from Baker. As discussed, the BFC model will no longer be included in the TDN or technical documentation. WEST has removed all reference to the BFC modeling effort from the TDN.

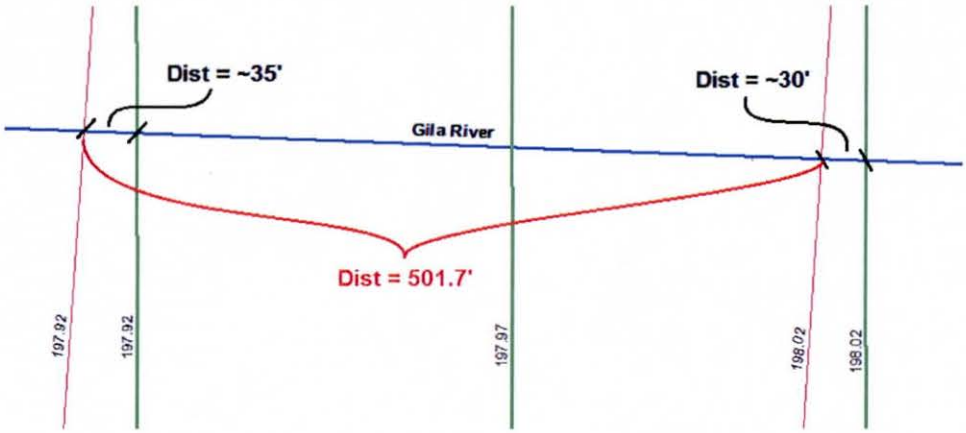
Comment 2: Per Section C.3.2 of FEMA G&S, TDN and all documentation should be in NAVD88 vertical datum. Supplemental HEC-RAS models were submitted, however, TDN tables and output files need to be in NAVD88. NVGD29 tables could also be included to satisfy USACE but please also include NAVD88 to satisfy FEMA requirements. If both sets of data will be submitted in tabular form, make sure they specify the appropriate datum.

WEST Response: Tables and output files have now been submitted in NAVD88 as well as NGVD29 format.

Comment 3: The starting water surface elevation (WSEL) for the Gila River (TRNL) model requires a known water surface elevation from the effective study. Please provide additional explanation in Section 5.5 for the source of the **933.52** ('29) WSEL or 935.62 ('88). Our calculations, using BK of 932.0 and BL of 936.5, results in WSEL of **933.86** ('29) or 935.96 ('88).

WEST Response: WEST used intermediate cross sections between BK and BL from the effective modeling output to perform a similar linear interpolation to arrive at our estimate of the downstream boundary condition. The screenshot below shows the distances between the cross sections in question near the downstream end of the model. The effective cross sections are shown in red, and the updated cross sections are shown in green. The floodplain elevation at RS 197.92 from the effective study is listed as 933.47', and the floodplain elevation at RS 198.02 in the effective study is 934.16'. Linearly interpolating between these two values, we arrive at an elevation of 933.52' for the downstream boundary condition.

$$\frac{35'}{501.7'} * (934.16' - 933.47') + 933.47' = 933.52'$$



Comment 4: The boundary condition for the starting WSEL for the Floodway model should reflect the effective floodway WSEL, not a 1' rise. Please revise.

WEST Response: Using the same calculations of distance as shown in the response to Comment #3 above, WEST has calculated a known water surface elevation for the downstream boundary condition for the floodway. The floodway elevation at RS 197.92 from the effective study is listed as 934.29', and the floodway elevation at RS 198.02 in the effective study is 934.95'. Linearly interpolating between these two values, we arrive at an elevation of 934.34' for the downstream boundary condition.

$$\frac{35'}{501.7'} * (934.95' - 934.29') + 934.29' = 934.34'$$

Comment 5: The boundary condition for the BFC model utilized a known WSEL based off the revised TRNL model. Unless coincident peaks can be proven, downstream boundary condition should be normal depth. Then backwater effect from TRNL model would be mapped until the two profiles intersect. Please revise.

WEST Response: As mentioned in the response to Comment 1 above, the BFC model was removed from the TDN along with all technical documentation (models, etc.) that modified the BFC model from the original Dibble study.

Comment 6: Please confirm that topographic data acquired in 1991 has been reviewed within the last 7 years. Documentation for the other three sources of data were located in the TDN.

WEST Response: The TDN text has been expanded to indicate that absolutely no flooding extent for the 1% annual chance flood was mapped on the 1991 4' contour interval mapping; it was all contained in the newer topography north of the 4' contour interval mapping that was used in the final TIN. Therefore, the need to review this topographic data source is not necessary. This discussion has been added to the fifth paragraph of Section 3.2.

HEC-RAS

Comment 7: Please review XSEC's to verify that the main stream is included between the bank stations. For example XSEC's 200.07 & 199.98 need to have right bank station revised to include main stream which is clearly included in the upstream & downstream XSEC's. A similar condition occurs on the left channel bank for XSEC's 199.2 & 199.16.

WEST Response: WEST has moved the bank stations for the cross sections listed below as per the Baker instructions. It should be noted that the horizontal and/or vertical variation in Manning's n values have been utilized at all locations in the model; therefore, changing the horizontal station of the bank stations will not affect the final hydraulic computations based on roughness calculations. However, changing the location of the bank stations could impact the final water surface elevation due to the nature of the conveyance-weighted discharge calculations in RAS. These calculations are based on the conveyance in the LOB, CH, and ROB considered separately and then combined using a weighted approach based on the LOB, CH, and ROB reach lengths. Therefore, by changing the bank stations, a modeler assigns more of the flow area to the channel and less to the overbanks (or vice versa depending on the location of the channel banks), and therefore can change the final computation of water surface. This can be seen in at RS 199.16, where changing the bank station slightly (as per the request of the reviewer) caused the water surface elevation to increase by 0.14'. This will not affect the risk and uncertainty calculations at this location, however, as ample freeboard was calculated near the bridge.

RS 202.65 – Shifted LB to sta 3530.02
RS 202.57 – Shifted LB to sta 3381.02
RS 202.49 – Shifted LB to sta 3071.13
RS 202.43 – Shifted LB to sta 2952.84
RS 202.35 – Shifted LB to sta 2780.49
RS 202.26 – Shifted LB to sta 2688.08 and shifted RB to 3940.14
RS 202.19 – Shifted LB to sta 2072.9
RS 202.12 – Shifted LB to sta 1878.06
RS 202.06 – Shifted LB to sta 1644.21

RS 202.01 – Shifted LB to sta 1527.01
RS 201.96 – Shifted LB to sta 1864.24
RS 201.29 – Shifted LB to sta 1216.8
RS 201.22 – Shifted LB to sta 1107.68
RS 201.16 – Shifted LB to sta 1129.58
RS 201.12 – Shifted LB to sta 1072.18
RS 201.06 – Shifted LB to sta 976.51
RS 200.64 – Shifted RB to sta 3005.29
RS 200.07 – Shifted RB to sta 2010.96
RS 199.98 – Shifted RB to sta 1803.44
RS 199.94 – Shifted RB to sta 1709.59
RS 199.29 – Shifted LB to sta 270.43
RS 199.2 – Shifted LB to sta 2634.128 and shifted RB to sta 4299.075
RS 199.16 – Shifted LB to sta 2784.532
RS 199.09 – Shifted LB to sta 2999.73
RS 198.98 – Shifted LB to sta 2941.79
RS 198.95 – Shifted LB to sta 2959.69
RS 198.93 – Shifted LB to sta 3144.67
RS 198.88 – Shifted LB to sta 3043.22

Comment 8: Vertical extensions occurred at XSEC's 203.08 & 202.65 that must be resolved.

WEST Response: These cross sections have been trimmed to avoid this issue.

RS 203.08 was trimmed at STA 994.45 in the left overbank.
RS 202.65 was trimmed at STA 628.49 in the left overbank.

Comment 9: Much lower Manning's *n* values were utilized for this study, much lower than the effective study. Provide justification for the use of these *n* values, especially the use of 0.06 on the downstream side of the bridge where effective study used 0.15 and from XSEC 201.5 downstream, effective study used 0.15 while this study applies 0.07. Provide documentation not just the source i.e. JEF study the HNTB letter. One option is to provide the Manning's *n* value report along with the correlation to where the values are applied in this study.

WEST Response: Roughness coefficients were developed initially by JE Fuller Hydrology and Geomorphology for the Tres Rios Phase 3 Environmental Restoration Project Hydraulic Analysis. This analysis is documented in Appendix D to the Design Documentation Report (DDR) for Phase 3 of the Tres Rios Environmental Restoration Project. It should be noted that the DDR included in the TRNL TDN is the DDR for Phase 1 of the Tres Rios Environmental Restoration Project, which is the flood control levee DDR. The DDR for Phase 3 is for the channel clearing portions of the project, not the flood control levee. However, Appendix D of the Phase 3 DDR (again, Appendix D is the hydraulic analysis report prepared by JE Fuller) has been provided to Baker on the electronic data deliverable DVD accompanying the TDN (in the electronic portion of Appendix E5). The assignment of Manning's roughness coefficients was then modified by HNTB for the final model that was used in the TDN per the direction of the LACOE. This response will summarize the original assignment of Manning's roughness coefficients by JE Fuller, then the corresponding updates to those values by HNTB.

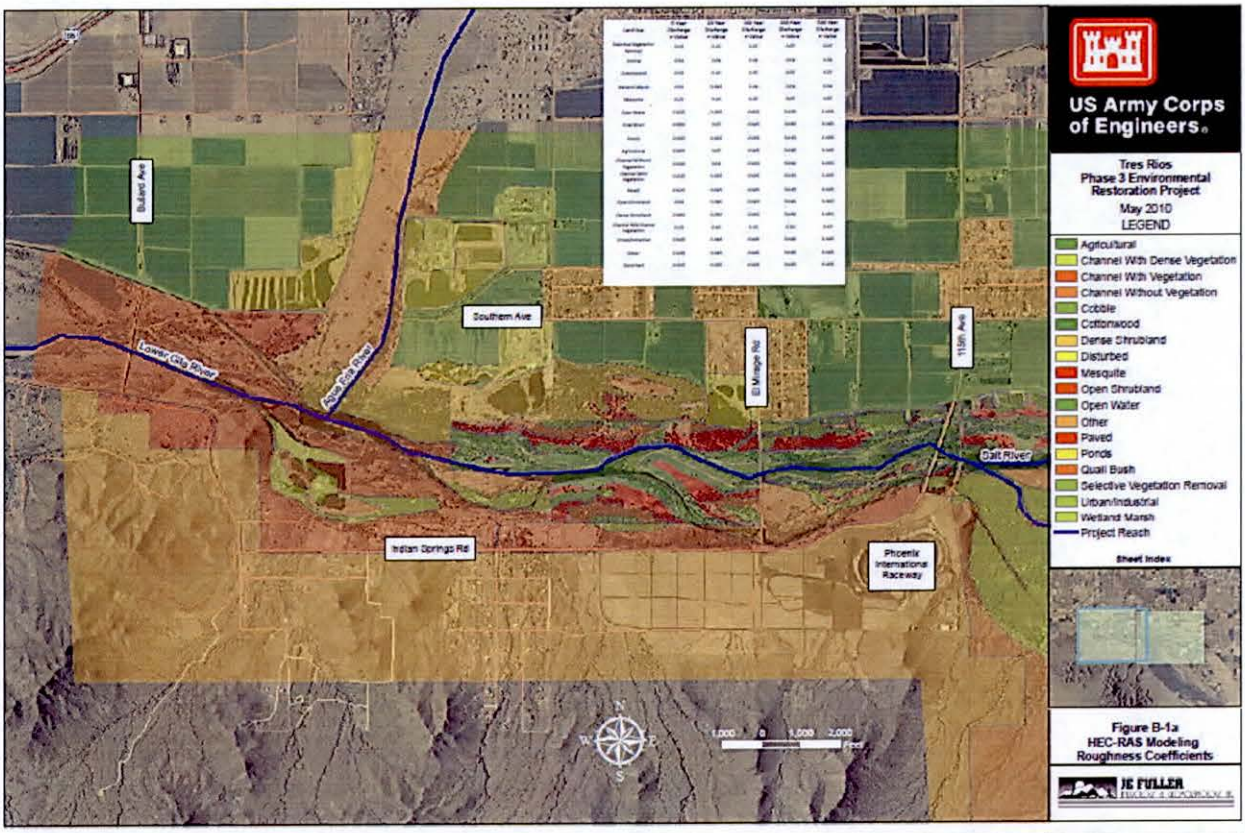
JE Fuller Hydraulic Analysis (Appendix D of the DDR for Tres Rios Phase 3)

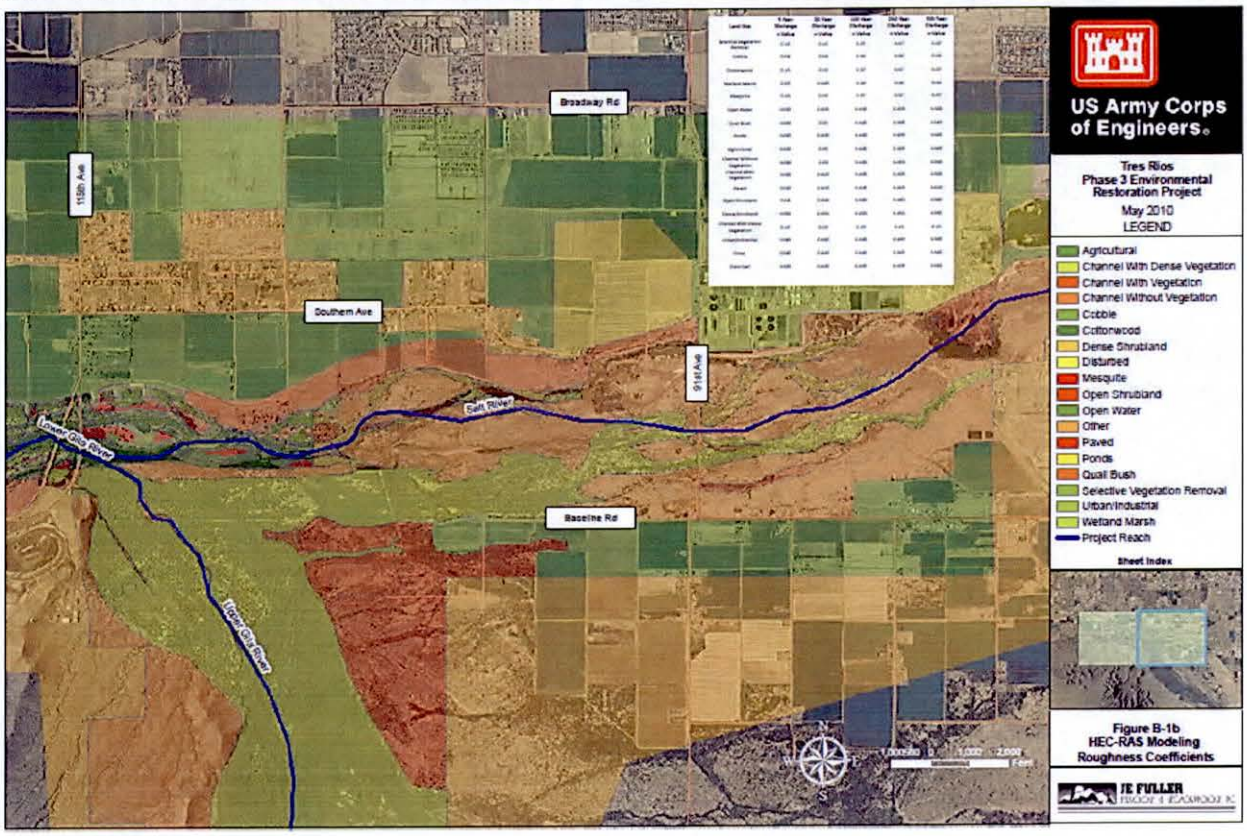
The assignment of Manning's roughness coefficients for this report was based on aerial coverages of vegetation type or other land uses across the cross section. Page 3-4 of this report includes the discussion of the development of these coverages. Also, it should be noted that the base conditions model used for this TDN was what was termed by the LACOE as the "Phase 3 pre-project conditions" model, which corresponds to the post-project conditions model for this TDN (i.e., the model includes the levee and all attendant features but no Phase 3 project features). The types of land uses identified in aerial photographs by JE Fuller included the following according to Table 3-2 on page 3-6 of that report for the pre-project conditions model, and the original notes from Table 3-2 regarding the source of the definition for these land use types have been included below as well:

1. Agricultural[2]
2. Channel Without Vegetation[2]
3. Channel With Vegetation[2]
4. Paved[2]
5. Open Shrubland[2]
6. Dense Shrubland[2]
7. Channel With Dense Vegetation[2]
8. Urban/Industrial[2]
9. Other[2]
10. Disturbed[2]

[2.] Per HEC-RAS modeling performed for Feasibility Study and North Levee PED

Finally, low-resolution figures of the aerial coverages used by JE Fuller to develop the horizontal variation in Manning's roughness coefficients across the cross sections can be found below. Higher-resolution versions of these images are included in Appendix B, Figure B-1a-b "HEC-RAS Modeling Roughness Coefficients" of JE Fuller report (i.e., Appendix D of the Phase 3 DDR).





As can be seen from the list above and in the figures from the JE Fuller documentation on Manning's roughness coefficients in the reach, much of the floodplain in the study reach had roughness values

influenced by earlier reports with more detailed assignment of land use areas than used in the effective study. The Manning's roughness coefficients in the reach are much lower than the effective study because the effective study represented very dense vegetation as being representative of the entire channel (primarily overgrown Salt Cedar across the entire width of the river corridor) which could arguably be represented with a roughness coefficient as high as a 0.15. However, the more detailed assessment of land use types in the study reach would represent the more accurate conditions of limited pockets of dense salt cedar (i.e., "Channel With Dense Vegetation" as it was termed for their report). Therefore, WEST feels that the use of a much lower Manning's roughness coefficient is warranted for this study.

Technical Memorandum from HNTB dated 12/23/2010 titled "Revised Draft Tres Rios Phase 3 Pre-Project Hydraulic Analysis Review" accompanying the final HEC-RAS model utilized for this TDN HNTB summarized their task order for the HEC-RAS modeling revisions in the first paragraph of this technical memorandum as follows:

> *This memorandum summarizes a review of the HEC-RAS hydraulic modeling documented in the "Tres Rios Phase 3 Environmental Restoration Project Design Documentation Report - Hydraulic Analysis Appendix" completed by JE Fuller May 2010. The 100-year water surface profiles generated by the Fuller models were determined to differ from those generated by the 2004 USACE analysis used to design the Phase 1 and Phase 2 Tres Rios project features. The intent of this review is to evaluate the source of discrepancies between the two models and to determine whether model assumptions might reasonably be adjusted to develop a design model for the Tres Rios Phase 3 project that is consistent with the previous USACE modeling.*

Once again, the HNTB technical memorandum indicates that the model includes all of the features from Phases 1 and 2 in the modeling effort, but not Phase 3. As stated on page 2 of the HNTB technical memorandum, "The model of interest represents the condition that includes the features from both Phase 1 and Phase 2; this is referred to as the Pre-Project condition for the Tres Rios Phase 3 project." Finally, for one additional clarification, WEST personnel contacted Van Crisostomo of the LACOE on 1/6/2011, and Van verified this once again.

The remainder of the technical memorandum submitted by HNTB addresses HNTB's revisions to the HEC-RAS model delivered by JE Fuller. As stated in the HNTB technical memorandum, the changes that LACOE asked HNTB to address in the JE Fuller model included the following:

1. The modeled north bank levee location was shifted riverward from Station 198.4 to 198.49 and to lesser degree from Station 198.54 to 199.11.
2. Roughness values were increased and reassigned to have vertical variation as a function to discharge.
3. Horizontal roughness variation was revised based on updated land cover information.

In regards to the roughness values, HNTB suggests lowering the Manning's roughness coefficients for the cottonwood areas along the edge of the channel from 0.07 to 0.04 for 100-year flows. They indicate that this is based on engineering judgment and that JE Fuller's roughness coefficients for cottonwood stands are conservative. In addition, it should be noted that at no cross section of the HEC-RAS model that was revised to reflect this roughness change does the cottonwood land-use designation make up a large majority of the active flow width. When calculating water surface elevations, HEC-RAS utilizes a conveyance-weighted Manning's n value for the channel, right overbank, and left overbank areas.

Changing portions of a cross sections' Manning's roughness coefficients will have a minimal impact on the overall average roughness coefficients, especially when most of the cottonwood stand land-use designations are along the channel edges which will be weighted less heavily in the overall average roughness calculations than the coefficients in the deep portion of the channel near the thalweg using a conveyance-weighted approach. WEST suggests that lowering the Manning's n value for small areas of particular cross sections is defensible based on engineering judgment.

In summary, the use of lower Manning's n values compared to the effective study has been documented significantly. The PDF file titled "TresRios_90%_DDR_Appendix D.pdf" provided on the electronic data deliverable disc accompanying the TDN is the report that JE Fuller wrote defending their selection of Manning's roughness values. (The title of the report itself is "Tres Rios Phase 3 Environmental Restoration Project Design Documentation Report, Hydraulic Analysis Appendix," and the fact that the title of the PDF includes DDR seems to indicate that the LAOCE wrote this document. However, WEST chose to keep the same name of the PDF as it was provided by the LACOE for record-keeping purposes.) Additionally, the HNTB reports that documented their changes to the assignment of roughness values of the reach were printed and included in Sub-Appendix E.5 of the hard copy of the TDN submitted to Baker. (For reference, Sub-Appendix E.5 should have included 19 printed pages not including the cover sheet of the sub-appendix. WEST has reprinted these technical memoranda from HNTB and provided them to Baker to insert into their hard copy of the TDN if this was not done previously by mistake.)

Comment 10: There are many XSEC's (for example 200.64, 200.84, 201.37, 201.44, 202.12, 202.19, etc) that exceed criteria for top width for both floodplain and floodway limits. Please revise for better correlation between HEC-RAS results and what is actually mapped on Study Work Maps.

WEST Response: These cross sections exceed criteria for top width for both floodplain and floodway limits due to the use of ineffective flow areas for large portions of overbank conveyance area that is disconnected from the main flow path by high ground. As per the direction from the District, asterisks have been added to the floodway data table to note this occurrence as opposed to trimming these cross sections.

The table below shows a calculation of the measured width from the final mapping product and the width output from HEC-RAS. An asterisk and a note have been added to each row of Tables 5-10, 5-11, 7-2, and 7-3 that shows a difference greater than 10%.

		Measured in GIS		Final Tables from HEC-RAS		% Difference (diff / RAS width)		% Difference (diff / GIS width)	
Reach	XSEC	Floodway width (ft)	Floodplain width (ft)	Floodway width (ft)	Floodplain width (ft)	Floodway width	Floodplain width	Floodway width	Floodplain width
Salt-Gila	203.08	2,477	3,305	2,442	3,951	-1%	16%	1%	-20%
Salt-Gila	202.94	2,484	3,315	2,475	3,306	0%	0%	0%	0%
Salt-Gila	202.82	2,560	3,314	2,560	3,495	0%	5%	0%	-5%
Salt-Gila	202.75	2,639	3,537	2,639	3,512	0%	-1%	0%	1%
Salt-Gila	202.65	2,684	3,871	2,491	3,562	-8%	-9%	7%	8%
Salt-Gila	202.57	2,712	3,958	2,473	4,533	-10%	13%	9%	-15%
Salt-Gila	202.49	2,898	3,995	2,654	3,864	-9%	-3%	8%	3%
Salt-Gila	202.43	3,040	3,969	2,810	4,009	-8%	1%	8%	-1%
Salt-Gila	202.35	3,198	3,960	3,041	3,760	-5%	-5%	5%	5%
Salt-Gila	202.26	3,282	4,242	3,158	4,175	-4%	-2%	4%	2%
Salt-Gila	202.19	3,777	4,374	3,590	5,214	-5%	16%	5%	-19%
Salt-Gila	202.12	3,747	4,276	3,606	4,925	-4%	13%	4%	-15%
Salt-Gila	202.06	3,689	4,146	3,603	4,039	-2%	-3%	2%	3%
Salt-Gila	202.01	3,631	4,062	3,438	4,044	-6%	0%	5%	0%
Salt-Gila	201.96	3,604	3,883	3,197	4,187	-13%	7%	11%	-8%
Salt-Gila	201.91	3,762	3,815	3,395	3,447	-11%	-11%	10%	10%
Salt-Gila	201.84	3,870	3,870	3,528	3,526	-10%	-10%	9%	9%
Salt-Gila	201.77	3,726	3,825	3,646	3,761	-2%	-2%	2%	2%
Salt-Gila	201.66	3,314	3,328	3,314	3,543	0%	6%	0%	-6%
Salt-Gila	201.58	3,162	3,251	3,287	3,374	4%	4%	-4%	-4%
Salt-Gila	201.5	3,286	3,372	3,201	3,274	-3%	-3%	3%	3%
Salt-Gila	201.44	3,254	3,281	3,290	3,916	1%	16%	-1%	-19%
Salt-Gila	201.37	3,267	3,291	3,297	3,443	1%	4%	-1%	-5%
Salt-Gila	201.29	3,313	3,317	3,313	3,347	0%	1%	0%	-1%
Salt-Gila	201.22	3,463	3,463	3,408	3,439	-2%	-1%	2%	1%

		Measured in GIS		Final Tables from HEC-RAS		% Difference (diff / RAS width)		% Difference (diff / GIS width)	
Reach	XSEC	Floodway width (ft)	Floodplain width (ft)	Floodway width (ft)	Floodplain width (ft)	Floodway width	Floodplain width	Floodway width	Floodplain width
Salt-Gila	201.16	3,607	3,607	3,527	3,732	-2%	3%	2%	-3%
Salt-Gila	201.12	3,687	3,687	3,680	3,713	0%	1%	0%	-1%
Salt-Gila	201.06	3,840	3,840	3,843	3,886	0%	1%	0%	-1%
Salt-Gila	200.97	3,927	3,927	3,729	3,738	-5%	-5%	5%	5%
Salt-Gila	200.91	3,972	3,972	3,757	4,198	-6%	5%	5%	-6%
Salt-Gila	200.84	3,840	3,840	3,844	3,877	0%	1%	0%	-1%
Salt-Gila	200.79	3,831	3,831	3,835	3,871	0%	1%	0%	-1%
Salt-Gila	200.71	3,624	3,986	3,631	3,650	0%	-9%	0%	8%
Salt-Gila	200.64	3,564	4,021	3,558	3,577	0%	-12%	0%	11%
Salt-Gila	200.56	3,367	4,041	3,338	3,843	-1%	-5%	1%	5%
Salt-Gila	200.48	3,398	4,189	3,234	3,782	-5%	-11%	5%	10%
Salt-Gila	200.43	3,400	4,164	3,312	3,642	-3%	-14%	3%	13%
Salt-Gila	200.36	3,468	4,116	3,466	3,882	0%	-6%	0%	6%
Salt-Gila	200.27	3,729	4,311	2,982	8,189	-25%	47%	20%	-90%
Salt-Gila	200.18	3,681	4,231	2,528	7,750	-46%	45%	31%	-83%
Salt-Gila	200.07	3,610	4,258	2,009	7,609	-80%	44%	44%	-79%
Salt-Gila	199.98	3,900	4,469	1,857	7,294	-110%	39%	52%	-63%
Salt-Gila	199.94	4,139	4,623	2,002	6,821	-107%	32%	52%	-48%
Salt-Gila	199.83	4,609	4,678	2,447	6,661	-88%	30%	47%	-42%
Salt-Gila	199.66	4,287	4,287	2,378	6,164	-80%	30%	45%	-44%
Salt-Gila	199.52	3,703	3,703	2,155	5,855	-72%	37%	42%	-58%
Salt-Gila	199.44	3,015	3,015	3,016	3,025	0%	0%	0%	0%
Salt-Gila	199.36	2,794	2,856	2,800	2,861	0%	0%	0%	0%
Salt-Gila	199.29	2,620	2,814	2,622	2,709	0%	-4%	0%	4%
Salt-Gila	199.2	2,590	3,311	2,602	3,186	0%	-4%	0%	4%
Salt-Gila	199.16	2,519	3,396	2,518	3,105	0%	-9%	0%	9%

		Measured in GIS		Final Tables from HEC-RAS		% Difference (diff / RAS width)		% Difference (diff / GIS width)	
Reach	XSEC	Floodway width (ft)	Floodplain width (ft)	Floodway width (ft)	Floodplain width (ft)	Floodway width	Floodplain width	Floodway width	Floodplain width
Salt-Gila	199.09	2,471	3,167	2,470	2,901	0%	-9%	0%	8%
Salt-Gila	199.02	2,542	3,106	2,480	2,867	-3%	-8%	2%	8%
Salt-Gila	198.98	2,602	3,064	2,482	2,887	-5%	-6%	5%	6%
Salt-Gila	198.95	2,713	3,076	2,517	2,970	-8%	-4%	7%	3%
Salt-Gila	198.93	2,796	3,101	2,635	2,991	-6%	-4%	6%	4%
Salt-Gila	198.88	2,961	3,177	2,960	3,067	0%	-4%	0%	3%
Salt-Gila	198.83	2,962	3,212	2,941	3,090	-1%	-4%	1%	4%
Salt-Gila	198.78	2,922	3,222	2,921	3,176	0%	-1%	0%	1%
Salt-Gila	198.75	2,888	3,185	2,910	3,172	1%	0%	-1%	0%
Salt-Gila	198.7	2,948	3,192	2,948	3,159	0%	-1%	0%	1%
Salt-Gila	198.64	3,037	3,231	3,039	3,206	0%	-1%	0%	1%
Salt-Gila	198.59	3,159	3,387	3,157	3,287	0%	-3%	0%	3%
Salt-Gila	198.54	3,234	3,389	3,232	3,278	0%	-3%	0%	3%
Salt-Gila	198.48	3,262	3,364	3,260	3,260	0%	-3%	0%	3%
Salt-Gila	198.43	3,269	3,372	3,285	3,304	1%	-2%	-1%	2%
Salt-Gila	198.38	3,167	3,275	3,166	3,184	0%	-3%	0%	3%
Salt-Gila	198.34	3,158	3,188	3,165	3,165	0%	-1%	0%	1%
Salt-Gila	198.27	3,250	9,710	3,058	6,514	-6%	-49%	6%	33%
Salt-Gila	198.2	3,389	9,534	3,274	8,792	-4%	-8%	3%	8%
Salt-Gila	198.14	3,571	9,496	3,515	9,084	-2%	-5%	2%	4%
Salt-Gila	198.09	3,773	9,429	3,687	9,016	-2%	-5%	2%	4%
Salt-Gila	198.02	3,912	9,457	3,818	8,775	-2%	-8%	2%	7%
Salt-Gila	197.97	3,911	9,660	3,911	9,053	0%	-7%	0%	6%
Salt-Gila	197.92	4,029	9,961	4,029	9,016	0%	-10%	0%	9%

Comment 11: Provide explanation on how the baseflow from the 91st Avenue Treatment Facility is accounted for in XSEC?

WEST Response: The approximate width of the baseflow from the 91st Avenue Treatment Facility in the cross section accounts for between 60' and 70' of flow top width for the cross section and between 300 and 600 square feet of flow area. This is compared to a top width on the order of 4,000' with a total flow area of 25,540 square feet for this cross section. Therefore, the baseflow area was ignored in this analysis since this only accounted for 1 to 2% of the total flow area.

Comment 12: The 7 most downstream XSEC's are hard to follow. Please extend XSEC's to zero or state where the baseline is located on each XSEC to resolve why there appears to be a discrepancy between the floodplain and floodway locations per the HEC-RAS data which doesn't seem to match the Study Work Maps.

WEST Response: Tic marks along the left edge of these cross sections near the southern border of Workmap Sheet 1 identify the reference stationing. The stationing was checked against the RAS model and appears to be correct.

Also, the station at which the baseline crosses each of these cross sections is provided below:

XSEC	***Hydraulic Baseline Station***	***XSEC***	***Hydraulic Baseline Station***
197.92	1672.85	198.14	2137.88
197.97	2001.79	198.2	2092.72
198.02	2245.31	198.27	1874.63
198.09	2225.81		

Comment 13: The ground elevations on the right side from XSEC 200.36 to 201.29 appear to be inconsistent with topo. Maybe a top of wall elevation was used instead of ground. Please review and adjust accordingly.

WEST Response: WEST feels that the ground elevations on the right side of the cross section from XSEC 200.36 to 201.29 are consistent. WEST has provided four possible explanations for the reasons Baker may have determined the ground elevations were inconsistent in this area, including (1) miscommunication regarding the location of the cross sections on the work maps, (2) miscommunication regarding the datum of the topo and/or models, (3) appearance of as-built features for the overbank wetlands features in the right overbank of the HEC-RAS model that are not reflected in the topography data, and (4) appearance of a wall in the far right overbank in the aerial photos that WEST does not believe is reflected in the final topo lines or final TIN used for mapping and delineation.

COMMENT 13, EXPLANATION OF POSSIBLE INCONSISTENCIES #1: MISCOMMUNICATION REGARDING THE LOCATION OF THE CROSS SECTIONS ON THE WORK MAPS

Due to the decision to include the BFC and SAT cross sections on the work maps for informational purposes, and due to the relatively wide widths of the Salt/Gila RAS model cross sections compared to the floodplain width mapped on those cross sections, WEST and the District decided to not include the entire length of the Salt/Gila RAS model cross sections on the 200' scale set work maps. This was also the primary reason that the 500' scale work map set was developed, to be able to see more of the cross sections (especially the left overbank endpoints) and be able to scale the floodplain widths based on that.

Based on this decision, all of the Salt/Gila cross sections on Panels 3, 6, 10, 13, 15, 17, and 18 all appear to terminate at the northern boundary of those sheets, when in reality the cross sections continue onto the area covered by Panels 4, 7, 11, 14, and 16 (for Panels 3, 6, 10, 13, and 15, respectively) or continue onto area not covered by any work map panels developed for this study (for Panels 17 and 18). Therefore, if the review of the cross section end point topography or total cross section width is based on the 200' scale set study maps, then there could be confusion as to the correct location of the cross section end points and what topography should be represented at that location.

The only exception to this is Panel 1 and Panel 2. The cross sections for the Salt/Gila RAS model shown in the main channel of the Gila River for Panel 1 continue onto Panel 2 for these two panels, because the floodplain downstream of El Mirage Road on Panel 2 is based on the Salt/Gila model, not on the BFC/SAT model (as is the case for the floodplain shown on Panels 4, 5, 7, 8, 11, 12, 14, and 16, panels for which only cross section lines from the BFC/SAT models are shown).

COMMENT 13, EXPLANATION OF POSSIBLE INCONSISTENCIES #2: MISCOMMUNICATION REGARDING THE DTAUM OF THE TOPO AND/OR MODELS

WEST wanted to point out that the topo shown on the work maps references the NGVD29 datum. If the inconsistency in the ground topography in HEC-RAS and the topo shown on the linework was that the RAS model reflected ground elevations 2.1 feet higher than the topography (2.1 feet is the conversion factor calculated in VERTCON between NGVD29 and NAVD88 for the study reach), then it is possible that the reviewer was comparing the NAVD88 model ground points with the topo lines on the work maps which reference NGVD29 (or the topo lines provided electronically as a GIS deliverable which also reference NGVD29).

COMMENT 13, EXPLANATION OF POSSIBLE INCONSISTENCIES #3: APPEARANCE OF AS-BUILT FEATURES FOR THE OVERBANK WETLANDS IN HEC-RAS THAT ARE NOT IN THE TOPOGRAPHY

WEST was given a model that already included the as-built information for the levee and other features associated with the Tres Rios project Phase 2 (i.e., overbank wetlands, pump station infrastructure, etc.). However, WEST and the District were never provided with electronic topography reflecting these final overbank features. The cross sections that include Phase 1 (i.e., the levee) and/or Phase 2 (i.e., overbank wetlands and associated components) features were noted in the cross section descriptions of HEC-RAS. The comments that were included in the RAS model are shown below.

RS	XSEC Description in RAS
203.08 to 202.35	No comment
202.26 to 200.56	Comment "OBW as-builts"
200.48 to 199.94	Comment "Levee and OBW as-builts"
199.83 to 198.34	Comment "Levee as-builts"
198.27 to 197.92	No comment

As can be seen from this table, there were many cross sections upstream of the levee (from XSEC 202.26 to 200.56) for which the final cross section geometry in HEC-RAS varied from the topography for some amount of the right overbank because the overbank wetland as-builts were included in the cross section. The example shown at the end of the explanation number 4 of this response to comment shows an example of this at XSEC 200.64. The RAS geometry reflects the overbank wetland features, but the cross section WEST cut from our final TIN does not show these features in the cross section.

Unfortunately, WEST never received final as-built topography for the levee or any overbank wetland features. Therefore, we could not include final topography in the TIN or grid surfaces used for the mapping exercises. When we mapped the water surface elevations from the HEC-RAS model, we had to do our best to interpret the ground elevations in the RAS model (which were the correct as-built features) compared to the topo that we had. As an example, this is most evident along the portion of the levee upstream of 115th Avenue. As can be seen in the figure below, the final recommended mapping of the floodplain along the levee is shown in blue. This portion of the mapping was easy to delineate as far as the difference in the geometry of the RAS model and the topography shown on the work maps because the levee is very apparent in the aerial photographs. However, compared strictly to the topography, we are showing a floodplain that is crossing perpendicular to several topo lines, an obviously erroneous mapping technique if the topography shown were correct. However, this was the result of effort to map based on what was shown in the RAS model and what we know the final topography to be approximately, even though we don't have that information available electronically for the actual mapping effort.

Although this is not as evident upstream of the levee in the vicinity of the as-built overbank wetlands features, a similar process was undertaken to complete the mapping from XSEC 202.26 to 200.56. Where there were obvious discrepancies in the topography shown on the study sheets and the ground elevation information in the RAS model in the right overbank, WEST attempted to map based on the RAS model results (WSEL stations exported to GeoRAS, consistent top widths, etc.).

Finally, it should be noted that the as-builts for the OBW can be found on a disc provided to Baker accompanying this comment response package. WEST thought these as-built plans had been delivered previously to Baker, but after checking our records, they had not been. It should be noted that these plans were provided by the LACOE nearly two years ago. If any updates have been made to the as-built plans of the overbank wetlands since that time, they have not been provided to FCDMC or WEST. However, Phase 2 was completed well ahead of Phase 1, so it would likely be safe to assume that the as-built plans for the overbank wetlands were finalized much earlier than the as-built plans for the levee.

COMMENT 13, EXPLANATION OF POSSIBLE INCONSISTENCIES #4: APPEARANCE OF A WALL IN THE FAR RIGHT OVERBANK FOR THESE XSEC'S IN THE AERIALS

WEST noticed that a wall is visible in the aerial photographs in the far right overbank for most of the cross sections mentioned in this comment; WEST does not believe this wall was reflected in the base topo lines or final TIN used for mapping and delineation.

The screenshots below verify that the Maryvale ADMS topography (which was used in this area to cut cross sections) reflects the topography shown in the RAS model from XSEC 200.36 to 201.29, and special consideration was given to the wall that appears in the aerial photographs in this location.

RS 201.29 – over the last ~ 150 feet of the cross section, increase from 964.28 to 970.51 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 964.28 to 970.51 feet over this same distance (see Figure 13-2 below).

RS 201.22 – over the last ~ 200 feet of the cross section, increase from 964.94 to 973.35 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 964.94 to 973.35 feet over this same distance (see Figure 13-2 below). From the aerials, there does appear to be a wall approximately 15 feet south of the right endpoint of the cross section; however, the ground topography reflects an elevation of 973.35 feet at this location. Therefore, WEST assumes that the wall would be higher than this elevation, and the current RAS geometry reflects the true ground elevation at this location.

Figure 13-2. Maryvale topo near the ROB limit of RS 201.29 and 201.22

RS 201.16 – over the last ~ 200 feet of the cross section, increase from 966.52 to 973.0 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 966.52 to 973.0 feet over this same distance (see Figure 13-3 below). From the aerials, there does appear to be a wall approximately 20 feet south of the right endpoint of the cross section; however, the ground topography reflects an elevation of 973.0 feet at this location. Therefore, WEST assumes that the wall would be higher than this elevation, and the current RAS geometry reflects the true ground elevation at this location.

RS 201.12 – over the last ~ 300 feet of the cross section, increase from 964.32 to 972.85 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 964.32 to 972.85 feet over this same distance (see Figure 13-3 below). From the aerials, there does appear to be a wall approximately 15 feet south of the right endpoint of the cross section; however, the ground topography reflects an elevation of 972.85 feet at this location. Therefore, WEST assumes that the wall would be higher than this elevation, and the current RAS geometry reflects the true ground elevation at this location.

RS 201.06 – over the last ~ 200 feet of the cross section, increase from 964.92 to 973.05 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 964.92 to 973.05 feet over this same distance (see Figure 13-3 below). From the aerials, there does appear to be a wall approximately 15 feet south of the right endpoint of the cross section; however, the ground topography reflects an elevation of 973.05 feet at this location. Therefore, WEST assumes that the wall would be higher than this elevation, and the current RAS geometry reflects the true ground elevation at this location.

Figure 13-3. Maryvale topo near the ROB limit of RS 201.16, 201.12, and 201.06

RS 200.97 – over the last ~ 170 feet of the cross section, increase from 965.24 to 972.92 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 965.24 to 972.92 feet over this same distance (see Figure 13-4 below).

RS 200.91 – over the last ~ 3,000 feet of the cross section, the LACOE had simplified the model geometry to reflect a straight line from station 5202.88 (elevation of 956.24') to station 8415.61 (elevation of 972'). WEST added additional detail to this portion of the cross section using 8 more points (since 492 points had already been assigned to the cross section and only 500 points can be used for any single cross section). Over the last ~ 230 feet of the modified cross section, elevations increase from 964.42 to 972 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 964.42 to 972 feet over this same distance (see Figure 13-4 below).

RS 200.84 – over the last ~ 240 feet of the cross section, increase from 964.72 to 972.72 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 964.72 to 972.72 feet over this same distance (see Figure 13-4 below).

Figure 13-4. Maryvale topo near the ROB limit of RS 200.97, 200.91, and 201.84

RS 200.79 – over the last ~ 200 feet of the cross section, increase from 965.01 to a maximum of 973.25 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 965.01 to a maximum of 973.25 feet over this same distance (see Figure 13-5 below).

RS 200.71 – over the last ~ 200 feet of the cross section, increase from 962.91 to a maximum of 972.71 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 962.91 to a maximum of 972.71 feet over this same distance (see Figure 13-5 below).

RS 200.64 – over the last ~ 170 feet of the cross section, increase from 962.54 to 972.75 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 962.54 to 972.75 feet over this same distance (see Figure 13-5 below).

Figure 13-5. Maryvale topo near the ROB limit of RS 200.79, 200.71, and 201.64

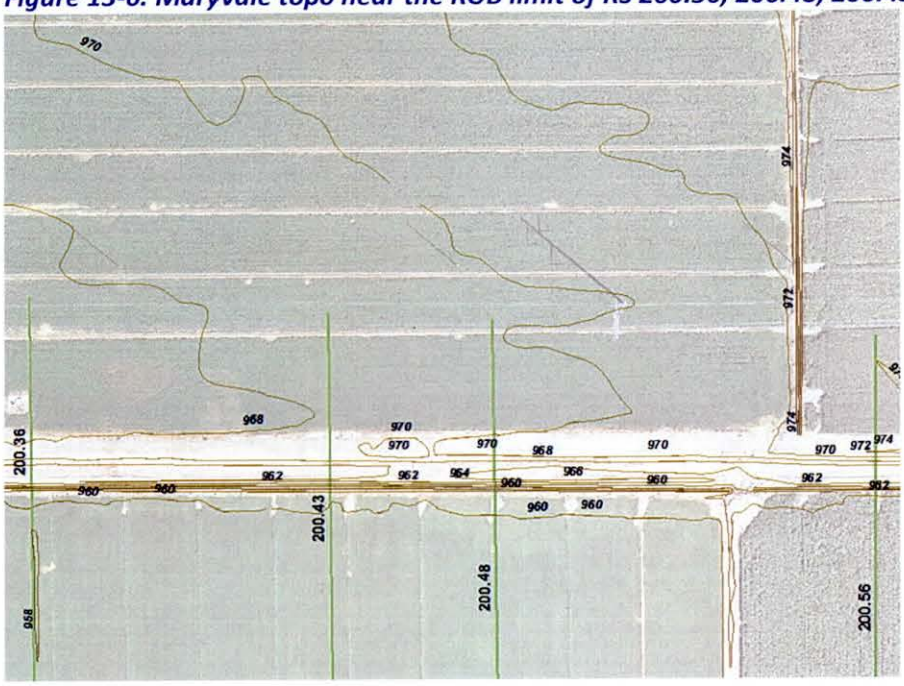
RS 200.56 – over the last ~ 220 feet of the cross section, increase from 961.92 to a maximum of 973.68 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 961.92 to a maximum of 973.68 feet over this same distance (see Figure 13-6 below).

RS 200.48 – over the last ~ 230 feet of the cross section, increase from 960.75 to a maximum of 970.44 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 960.75 to a maximum of 970.44 feet over this same distance (see Figure 13-6 below).

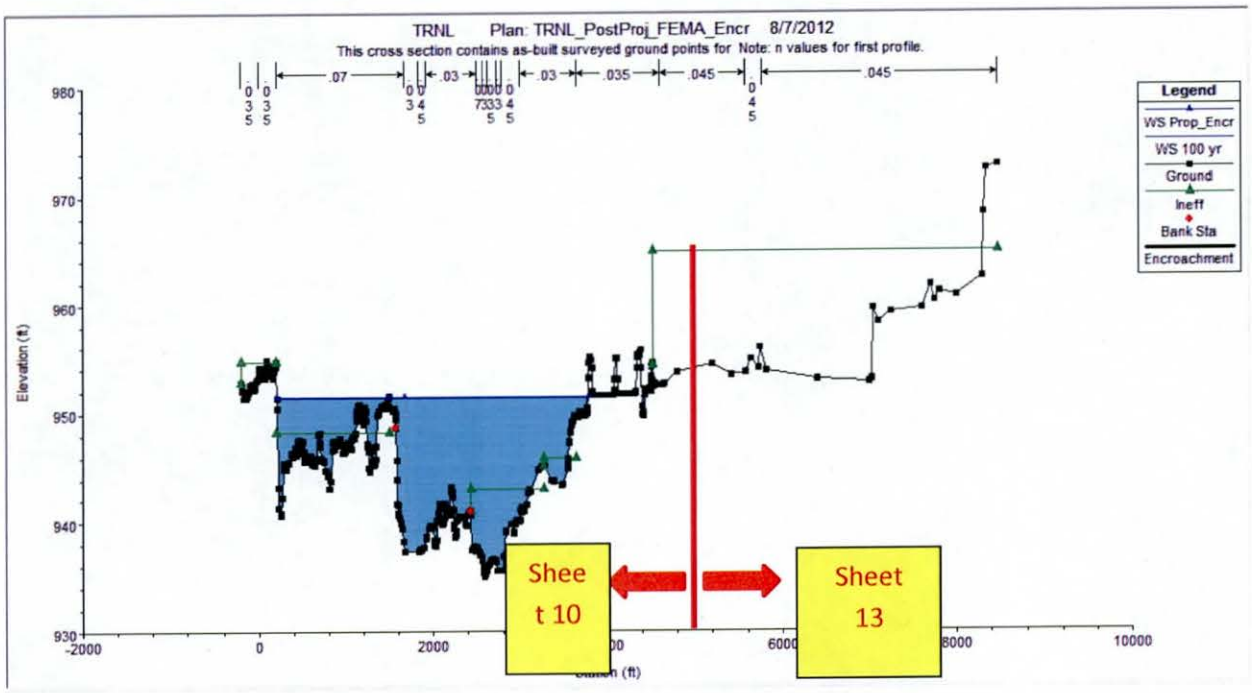
RS 200.43 – over the last ~ 260 feet of the cross section, increase from 959.95 to a maximum of 969.86 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 959.95 to a maximum of 969.86 feet over this same distance (see Figure 13-6 below).

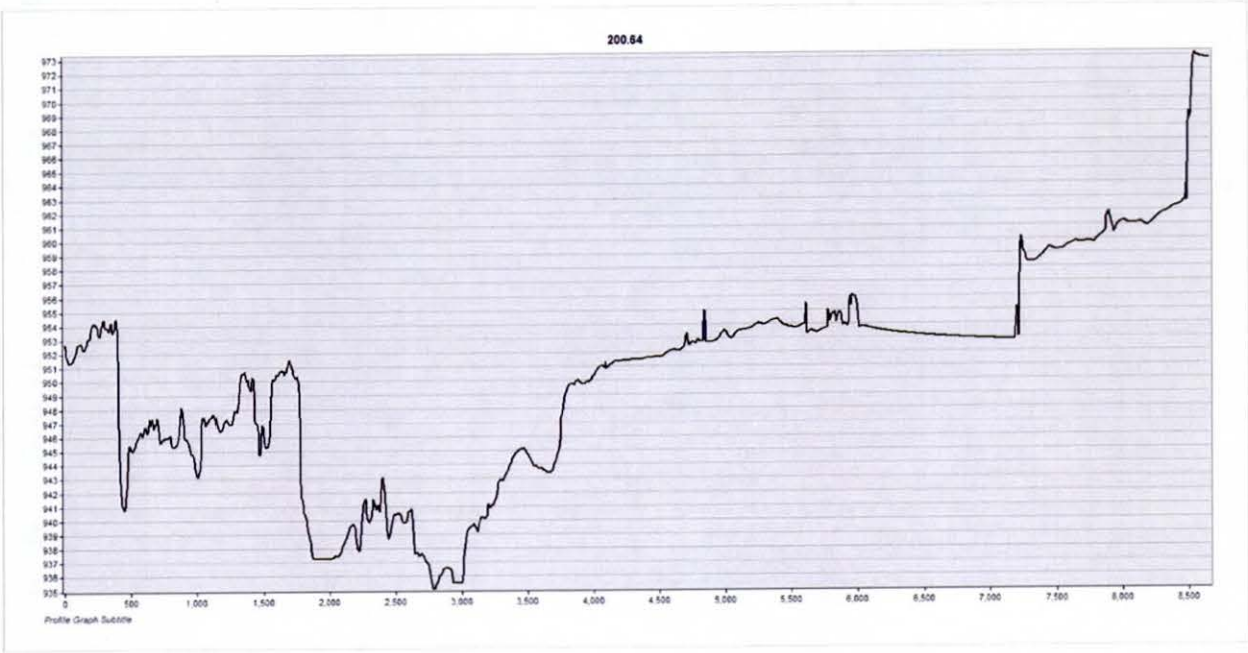
RS 200.36 – over the last ~ 270 feet of the cross section, increase from 960.44 to a maximum of 968.04 feet. The topo reflects what appears to be a road in the aerials with an increasing elevation to the north in the agricultural field. The topo line labels show that the topography reflects a ground surface increase from 960.44 to a maximum of 968.04 feet over this same distance (see Figure 13-6 below).

Figure 13-6. Maryvale topo near the ROB limit of RS 200.56, 200.48, 200.43, and 201.36



Finally, an example of a cross section provided by the LACOE in RAS (this specifically is RS 200.64, which includes as-built features for the levee and overbank wetland facilities) is shown below compared to the same cross section cut from the WEST TIN. Notes are included in the "description" box of this and every individual cross section in HEC-RAS that includes as-built features entered by the LACOE.





Comment 14: The floodplain boundary on the right side for XSEC's 200.48 to 200.71 isn't consistent with the contours. This is evident in many of the XSEC's not just 200.48 to 200.71. Please review and adjust accordingly.

WEST Response: Verified that the ROB floodplain between stations 200.48-200.71 is mapped correctly based on the topographic contours. This is also something of an imperfect method in this region, as we do not have as-built topography for the levee and attendant features (i.e., overbank wetlands) available electronically. Therefore, we must map based on the as-built features shown in the RAS model and evident in the aerial photography while ignoring the topography, since the topography does not reflect the levee and attendant features. A more detailed explanation of this condition can be found as item #3 in the response to Comment 13 above (the sub-section titled "Appearance of as-built features for the overbank wetlands in HEC-RAS that are not in the topography").

As-builts for the OBW can be found on a disc provided to Baker accompanying this comment response package. WEST thought these as-built plans had been delivered previously to Baker, but after checking our records, they had not been. It should be noted that these plans were provided by the LACOE nearly two years ago. If any updates have been made to the as-built plans of the overbank wetlands since that time, they have not been provided to FCDMC or WEST. However, Phase 2 was completed well ahead of Phase 1, so it would likely be safe to assume that the as-built plans for the overbank wetlands were finalized much earlier than the as-built plans for the levee.

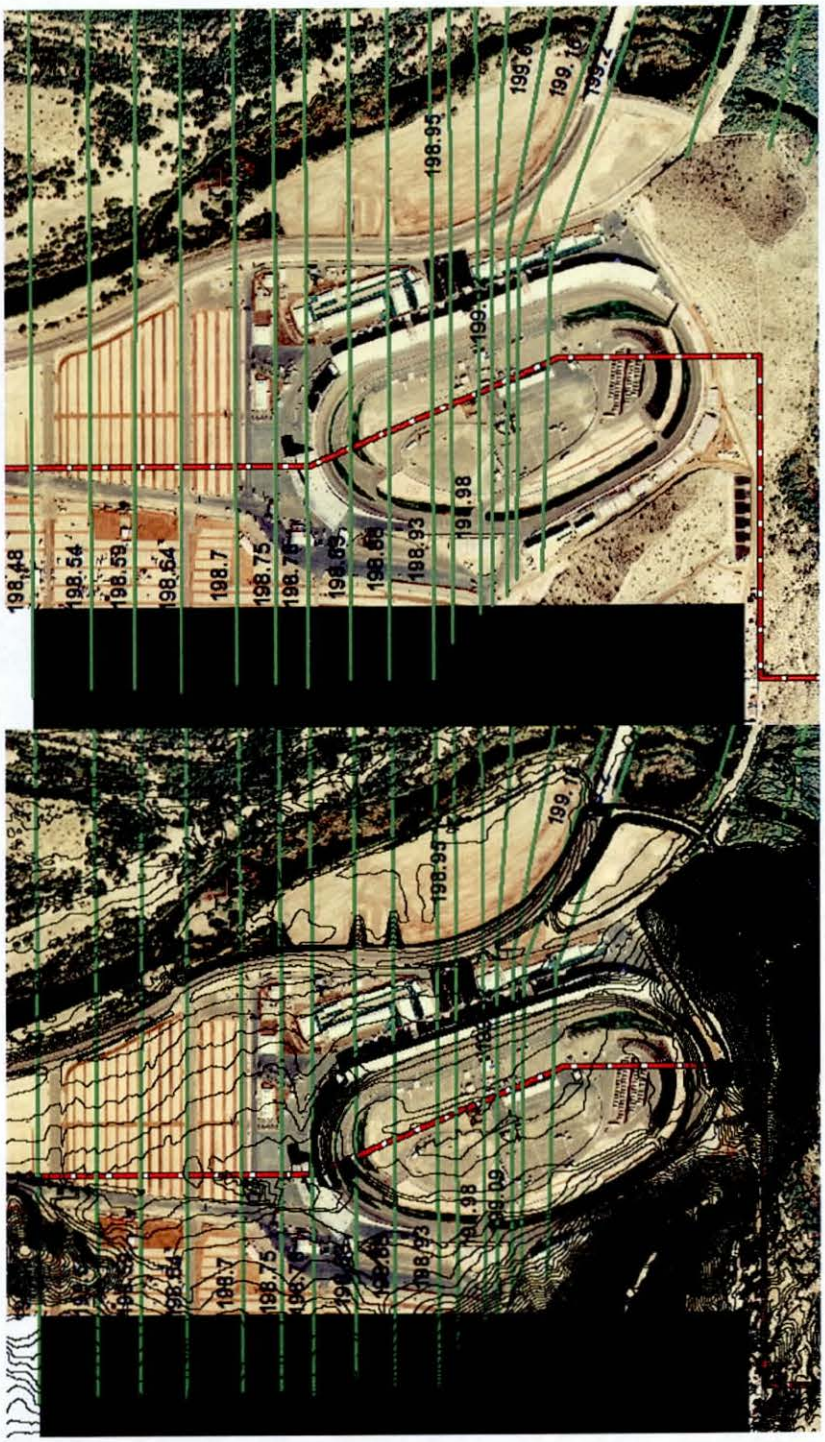
Comment 15: Provide justification for the elevation of 960.9 on left side of XSEC's 198.95, 199.02, & 199.09. It doesn't appear consistent with contours. Generally the HEC-RAS ground data isn't consistent with contours on left side from XSEC's 198.34 to 199.2.

WEST Response: The geometry of the extreme LOB of sections 198.34-199.2 has been updated in RAS to reflect the topographic contours. The original "chopped off" topography was done to ensure that the model cross sections did not exceed 500 ground points, especially considering this elevation was well above the flooding elevation. To rectify this issue, WEST added a few points in the left overbank to better reflect the topography in this area.

The HEC-RAS ground data has been checked compared to the contour data from 198.34 to 199.2, and the ground elevations appear to be consistent with the contours.

It should be noted that the 2001 topo provided by the LACOE included about half of the PIR Race Track. In the images below, the red-and-white line is the boundary of the 2001 topography provided by the LACOE; south of this line, the 4-foot contour interval topography from the effective study was used to complete the TIN. The first image below shows the aerial and cross sections, and the second image below shows the aerial, topo lines, and cross sections. The image with the topo lines shows a sharp increase in elevations for both the north and south portions of the race track structure itself (corresponding to the 2001 topography and the effective topography, respectively). WEST was never tasked with removing this feature from the topography, as this likely would have required survey to do effectively. Therefore, the structure of the race track that is reflected in the topography is shown in the HEC-RAS cross sections as well. Therefore, the cross sections that obviously reflect the structure of the race track itself in the RAS model (XSEC 198.83 to XSEC 199.2) have been further noted with the following text in the cross section description in HEC-RAS:

The ground elevations in the left overbank of this cross section include the physical structure of the Phoenix International Raceway. The topography data used to develop this model included the features of the structure, and these features were not removed from the ground elevation data in HEC-RAS due to the fact that the structure was significantly higher than the flooding elevations for the 1% annual chance flood event.



Comment 16: Explain the use of ineffective flow on left side of XSEC 202.12, upstream & downstream XSEC's don't show the use of the ineffective flow option.

WEST Response: The ineffective flow area on the left side of XS 202.12 has been lowered for consistency.

More generally, the consistency of the use of ineffective flow areas (IFA's) in the upper portion of the reach was checked throughout. The following changes have been made to ineffective flow areas in this entire portion of the reach.

LEFT OVERBANK IFA'S

1) RS 202.35 – the second IFA block from the left was lowered from an elevation of 966.17' to 963.86'.
2) RS 202.26 – the second IFA block from the left was lowered from an elevation of 965.68' to 964.23'.
3) RS 202.12 – the second IFA block from the left was lowered from an elevation of 964.36' to 961.30'.
4) RS 202.06 – the second IFA block from the left was lowered from an elevation of 963.05' to 959.95'.
5) RS 201.96 – the second IFA block from the left was lowered from an elevation of 962.59' to 959.10'.
6) RS 201.91 – the second IFA block from the left (elev 961.69) was deleted.
7) RS 201.84 – the second IFA block from the left was lowered from an elevation of 961.54' to 959.68'.

RIGHT OVERBANK IFA'S

1) RS 202.19 – the second IFA block from the right (elevation 964.75, starting station 4904.42) was removed, the third IFA block from the right (elevation 961.76, starting station 4161.2) was removed, and the fourth IFA block from the right (elevation 962.00, ending station of 4161.2) was extended to meet the right-most IFA block; thereby, the fourth IFA block became the second IFA block from the right in the right overbank. The right-most IFA block was moved back from station 5134.23 to 5307.37.
2) RS 202.12 – the second IFA block from the right (elevation 964.36, starting station 4653.92) was removed, and the third IFA block from the right (elevation 961.11, ending station of 4646.79) was extended to meet the right-most IFA block; thereby, the third IFA block became the second IFA block in the right overbank.
3) RS 202.06 – the second IFA block from the right (elevation 963.59, starting station 4556.36) was removed, and the third IFA block from the right (elevation 959.9, ending station of 4556.36) was extended to meet the right-most IFA block; thereby, the third IFA block became the second IFA block in the right overbank.
4) RS 201.96 – the second IFA block from the right (elevation 962.14, starting station 4254.76) was removed, and the third IFA block from the right (elevation 961.3, ending station of 4254.76) was extended to meet the right-most IFA block; thereby, the third IFA block became the second IFA block in the right overbank.
5) RS 201.91 – the second IFA block from the right (elevation 961.44, starting station 4212.74) was removed, and the third IFA block from the right (elevation 960.61, ending station of 4212.74) was extended to meet the right-most IFA block; thereby, the third IFA block became the second IFA block in the right overbank.
6) RS 201.58 – The right-most IFA block was moved back from station 3711.49 to 3884.16.
7) RS 201.84 – the second IFA block from the left was lowered from an elevation of 961.54' to 959.68'.

Comment 17: Explain the use of ineffective flow on the left side of XSEC's 201.84 to 201.96.

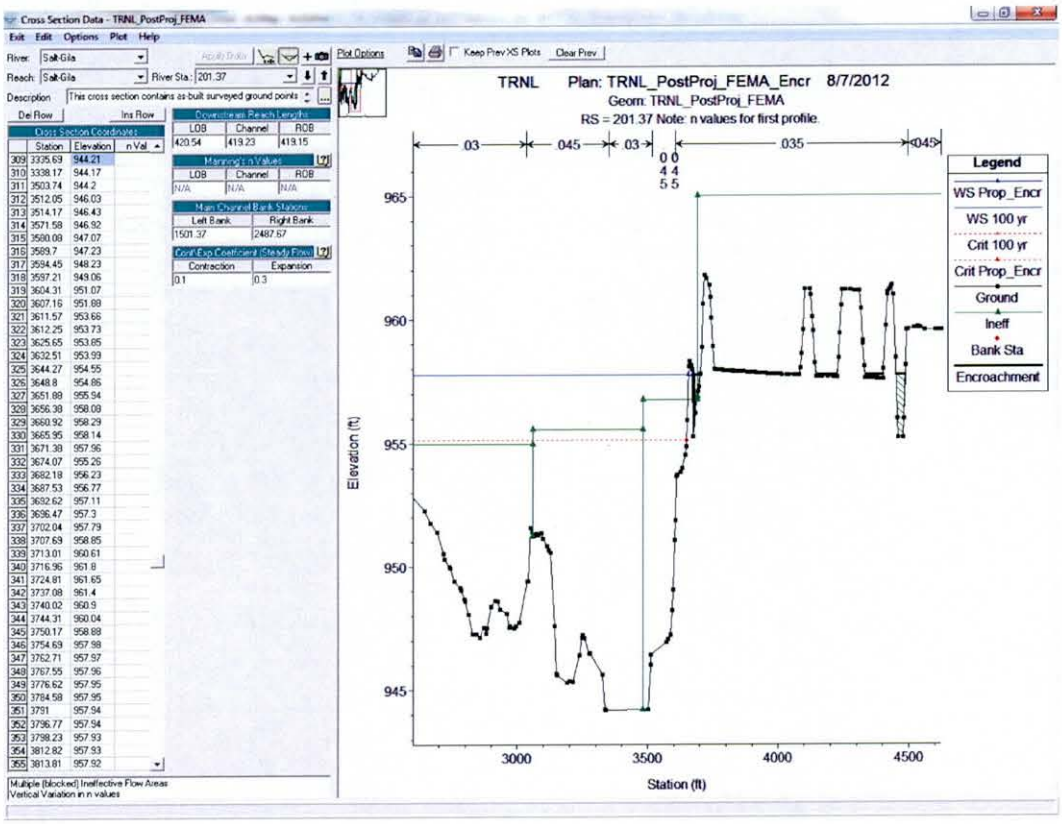
WEST Response: The left ineffective flow areas of these three cross sections have been lowered for consistency. See the response to Comment 16 above.

Comment 18: Explain why the elevation of ineffective flow area on right side of XSEC 202.19 is set at an elevation that is not a factor at the design flow but the two XSEC's downstream of it (202.12 & 202.06) the ineffective flow elevation is set higher resulting in this area being considered. It appears the same condition exists for all 3 XSEC's.

WEST Response: Right ineffective flow areas have been lowered at cross sections 202.12 & 202.06 for consistency with upstream and downstream cross sections. See the response to Comment 16 above.

Comment 19: There are several areas across XSEC's 201.37 to 202.01 that reflect a Manning's n value of only 0.03, however, there is considerable vegetation along the 91st Ave treatment facility discharge stream. Explain why horizontal n values were not considered here.

WEST Response: The screenshot below is from XSEC 201.37. The Manning's n value of 0.03 was ascribed only to areas of open water in the 91st Ave treatment facility discharge stream. The areas of dense vegetation in the overbanks of this stream are assigned a value of 0.045, corresponding to a definition of the "quail bush" land use type.



Comment 20: Based on channel reach length in HEC-RAS model and confirmed by GIS linework, XSEC's 199.29, 199.66, 199.94, & 199.98 should be revised to 199.23, 199.59, 200.00, & 200.06

WEST Response: XSEC's 199.29, 199.66, 199.94, & 199.98 were not renamed based on a conversation with Baker and WEST. This was finalized via an email sent by Teri George on August 30, 2012, at 12:58 PM.

Structures

Comment 20: Include the datum conversion for the bridge As-built plans to NAVD88.

WEST Response: No information regarding the datum for the bridge plans was obtained by WEST. One note in the as-built plans indicates that "All dimensions are in millimeters (mm) and all elevations are in meters (m)."

In comparing the bridge plans to the plans entered into HEC-RAS, WEST determined that the bridge plans reference the NGVD29 datum based on two spot checks at the high and low chords of the bridge at its highest point across the channel (i.e., corresponding to the station of Pier 9 at 3,814.37' in the RAS model). From page 8 of 47 in the bridge plan set given to WEST in PDF format, the high chord elevation of the bridge at Pier 9 is 296.946 m. When converting this value to ft using a conversion of 3.28084 feet, one arrives at an elevation of 974.23', which is very similar to the final value coded into the RAS model for the bridge high chord at Pier 9 of 974.07'. Similarly, from page 27 of 47 in the bridge plan set given to WEST in PDF format, the low chord elevation of the bridge at Pier 9 is 294.525 m. When converting this value to ft using a conversion of 3.28084 feet, one arrives at an elevation of 974.29', which is very similar to the final value coded into the RAS model for the bridge high chord at Pier 9 of 974.28'. From these two spot checks, it seems that the bridge was coded into the RAS model using a direct conversion from meters to feet. Since the final RAS model was provided to WEST referencing the NGVD29 datum; we are assuming that the original referenced datum for the bridge plans was also NGVD29, and the only necessary conversion will be to multiply listed elevation values by 3.20804 (the conversion from meters to feet).

Comment 21: Please address the inconsistency between the Manning's n values from the upstream side of bridge to the downstream side. For example, the upstream side uses n=1.0 on right side but downstream side reflects n=0.06.

WEST Response: WEST is assuming herein that the review meant to state 'n=0.1' instead of 'n=1.0' in the comment above. The remainder of this response continues with that assumption.

The area defined at 0.1 corresponds to the "channel with dense vegetation" land use type as defined by JE Fuller in their report. It seems that JE Fuller defined the area upstream of the 115th Avenue Bridge as dense vegetation in the channel and possibly added some additional loss due to the low-flow crossing immediately upstream of the 115th Avenue bridge (i.e., the old 115th Avenue alignment low-flow crossing). The screenshot below shows that area with a 2007 aerial photograph. As can be seen from this photo, flow would be "redirected" near the left (i.e., southern) bank of the river over the low-flow crossing. Although the vegetation appears visually to be similar upstream and downstream of the bridge, additional loss may have been included in the model by increasing Manning's n values to account for the additional loss from the non-regular flow conditions between the low-flow crossing and the bridge.

Floodway

Comment 22: There are several XSEC's where the floodway boundary extends beyond the floodplain boundary (Example 198.48 but there are many, many others). Please verify that all floodways are coincident or contained within 100-yr floodplain.

WEST Response: Encroachment stations have been updated in RAS at the following sections to create a floodway width less than the floodplain width. Five cross sections (noted with yellow highlighting) edited the floodway encroachment stations to better reflect the on-the-ground features shown in the aerials as opposed to only being edited to create a floodway width less than a floodplain width.

RS	Original encroachments		Updated encroachments		Difference in encroachments		Notes
	Left	Right	Left	Right	Left	Right	
203.08	4692	7169.5	4692	7133.57	0	35.93	
202.94	4499.1	6983.5	4499.1	6974.13	0	9.37	
202.35	2123.1	5457.8	2123.1	5325.19	0	132.61	Updated to not cross the 91st Ave WWTP outfall channel
202.26	1822.4	5470.9	1822.4	5105.38	0	365.52	Updated to not cross the 91st Ave WWTP outfall channel
202.19	1512	5294.8	1512	5292.23	0	2.57	
202.12	1331.4	5086.1	1331.4	5078.12	0	7.98	
202.06	1256.6	4952.6	1256.6	4945.79	0	6.81	
202.01	975.6	4611.6	975.6	4606.1	0	5.5	

201.96	875.4	4539.1	875.4	4479.51	0	59.59	
201.91	667.7	4466.7	667.7	4430.21	0	36.49	
201.84	512.9	4411.8	538.54	4382.61	-25.64	29.19	
201.58	473.5	3791.4	504.89	3791.4	-31.39	0	
201.5	313.4	3701.6	398.18	3599.02	-84.78	102.58	
201.44	345.7	3666.2	372.35	3662.66	-26.65	3.54	
201.29	422.9	3770.1	425.62	3738.3	-2.72	31.8	
201.22	385	3894.4	388.28	3846.49	-3.28	47.91	
201.16	369.3	4011.2	369.3	3976.21	0	34.99	
201.12	358.8	4077.1	362.93	4043.34	-4.13	33.76	
201.06	284.1	4145	284.1	4127.49	0	17.51	
200.97	223.6	4246.1	285.35	4211.08	-61.75	35.02	
200.91	249	4310.3	273.62	4244.3	-24.62	66	
200.84	298.3	4338.8	310.25	4194.17	-11.95	144.63	
200.79	193.9	4301.2	263.24	4098.55	-69.34	202.65	
200.71	35.1	4088.7	219.82	3853.02	-184.72	235.68	
200.64	-124.1	3858	204.86	3773.57	-328.96	84.43	
200.56	-209.89	3713.6	280.99	3633.24	-490.88	80.36	Updated to not cross the Tres Rios Environmental Wetlands Outfall Channel
200.48	-87.01	3553.2	156.98	3553.2	-243.99	0	
200.43	-66.27	3492.6	92.05	3492.6	-158.32	0	
200.36	-59.8	3420.8	-47.21	3420.8	-12.59	0	
200.07	-1507.52	2316.5	-1507.52	2100.17	0	216.33	Updated to better reflect the OBW pond
199.98	-1894.2	2269.4	-1894.2	2008.08	0	261.32	Updated to better reflect the OBW pond
199.94	-2093.35	2268.8	-2093.35	2046.44	0	222.36	Updated to better reflect the OBW pond
199.66	-1889.87	2399.2	-1889.87	2383.76	0	15.44	
199.52	-1540.63	2173.33	-1540.63	2156.39	0	16.94	
199.44	138.1	3167.49	138.1	3153.71	0	13.78	
199.36	142	2951.8	142	2942.01	0	9.79	
199.29	251.4	2886.3	251.4	2873.07	0	13.23	
199.2	2672.7	5224.02	2613.3	5214.87	59.4	9.15	
199.16	2702.5	5230.47	2702.51	5220.82	-0.01	9.65	
199.09	2602	5084.4	2602	5072.4	0	12	
199.02	2516.6	5066.38	2516.6	5055.38	0	11	
198.98	2475.8	5088.63	2475.8	5077.51	0	11.12	
198.95	2526.9	5250.94	2526.9	5239.94	0	11	
198.93	2650.5	5467.05	2650.5	5456.32	0	10.73	

198.88	2486	5455.75	2486	5445.54	0	10.21	
198.83	2402.5	5449.11	2478.69	5440.55	-76.19	8.56	
198.78	2463.3	5432.94	2503.39	5424.14	-40.09	8.8	
198.75	2427.2	5393.72	2468.62	5378.8	-41.42	14.92	
198.7	2373.1	5381.35	2425.45	5373.67	-52.35	7.68	
198.64	2282.1	5388.24	2340.51	5379.85	-58.41	8.39	
198.59	2116	5337.37	2172.37	5328.97	-56.37	8.4	
198.54	2002.2	5286.83	2046.56	5278.14	-44.36	8.69	
198.48	1934.3	5243.3	1975.13	5235.18	-40.83	8.12	
198.43	1863.4	5193	1899.29	5184.32	-35.89	8.68	
198.38	1846.3	5051	1880.36	5046.72	-34.06	4.28	
198.34	1838	5039	1872.39	5037.04	-34.39	1.96	

Comment 23: The floodway boundaries on right side of XSEC's 199.94 to 200.07 are drawn through the middle of a pond. Rise in WSEL did not exceed 1' rise, in fact there is no rise in FW elevation. Please explain why the boundary does not correlate to conditions on the ground or revise accordingly.

WEST Response: The floodway has been updated in this area to match conditions on the ground. See the response to Comment #22 above.

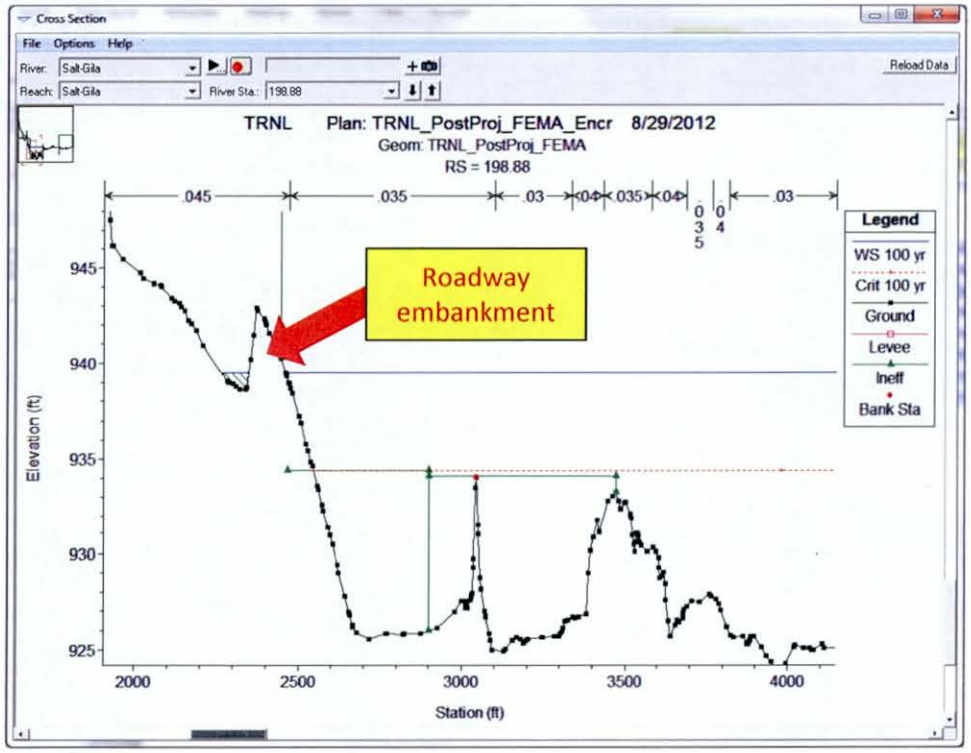
Mapping

Comment 24: There is inconsistency with floodplain on left side at XSEC 198.48 (and maybe others) that show the floodplain and floodway only a few feet apart yet GIS linework shows a much larger separation. The GIS mapping should reflect the HEC-RAS results.

WEST Response: The floodplain boundary in this area is the result of a mapping exercise where it is assumed that water will pass freely through the roadway embankment of 115th Avenue and rejoin the main stem floodplain below section 198.78. This is not reflected in the RAS model because this entire area is mapped as ineffective flow. The reason this is not reflected in the RAS model is explained in the first paragraph of Section 5.7.1 in the TDN; additionally, this specific situation has been explained in greater detail below.

First, there is hydraulic connectivity between the main stem of the Gila River and the mapped floodplain south of the 115th Avenue embankment through a large (approximately 10' x 10') box culvert that runs through the 115th Avenue embankment connecting PIR's overflow parking immediately adjacent to the river (north of the 115th Avenue embankment) to the main parking lot and primary facilities of PIR for pedestrian traffic. From a site inspection performed by WEST employees, there appeared to be no facilities in place to close this box culvert in the event of flooding. Therefore, WEST assumed that this pipe provided hydraulic capacity to flood during a high water event in the Gila River. A map showing the location of the pipe and a zoomed-in view of the high-resolution aerial photography of the pipe feature itself are shown below.

However, the roadway embankment itself actually separates the area of active conveyance in the Gila River from the area that will not be actively conveying flow south of the roadway embankment. Therefore, the area was modeled as ineffective flow, but the mapping reflects this area south of the roadway embankment because of the hydraulic connectivity of the large box culvert for pedestrian traffic.



Comment 25: Small Zone X "island" exists near XSEC 202.43 and 202.49 on the right side representing a high point. The high point is not outside of the Zone AE hazard immediately downstream. Provide justification in TDN why this sliver should remain and that the embankment won't fail.

WEST Response: The Zone X "island" has been removed, and the area has been changed to Zone AE.

Comment 26: There are several XSEC's where the floodplain does not meet the ground at same elevation, for example XSEC's 201.84 and 202.12 on the right side. Please review all XSEC's to ensure they meet ground correctly. Also make sure the floodplains and floodways do not cross the contours twice between cross sections as it appears to do so in several locations.

WEST Response: The ROB of the floodplain/floodway has been revised between sections 201.84-202.26.

Comment 27: There are several XSEC's where the floodplain and floodway limits are off. For example, HEC-RAS results show floodplain & floodway should be offset approximately 80' on right side of XSEC 201.58 but GIS linework shows them to be coincident. Please check all XSEC's to ensure mapping is consistent with HEC-RAS results.

WEST Response: Mapped right overbank limit of floodplain to ground topography and offset right encroachment of floodway by 87' to be consistent with the RAS model. More generally, all XSEC's have been checked to ensure mapping of the distance between the floodplain meeting the ground and the floodway encroachment station is consistent with what is shown in the RAS cross sections.

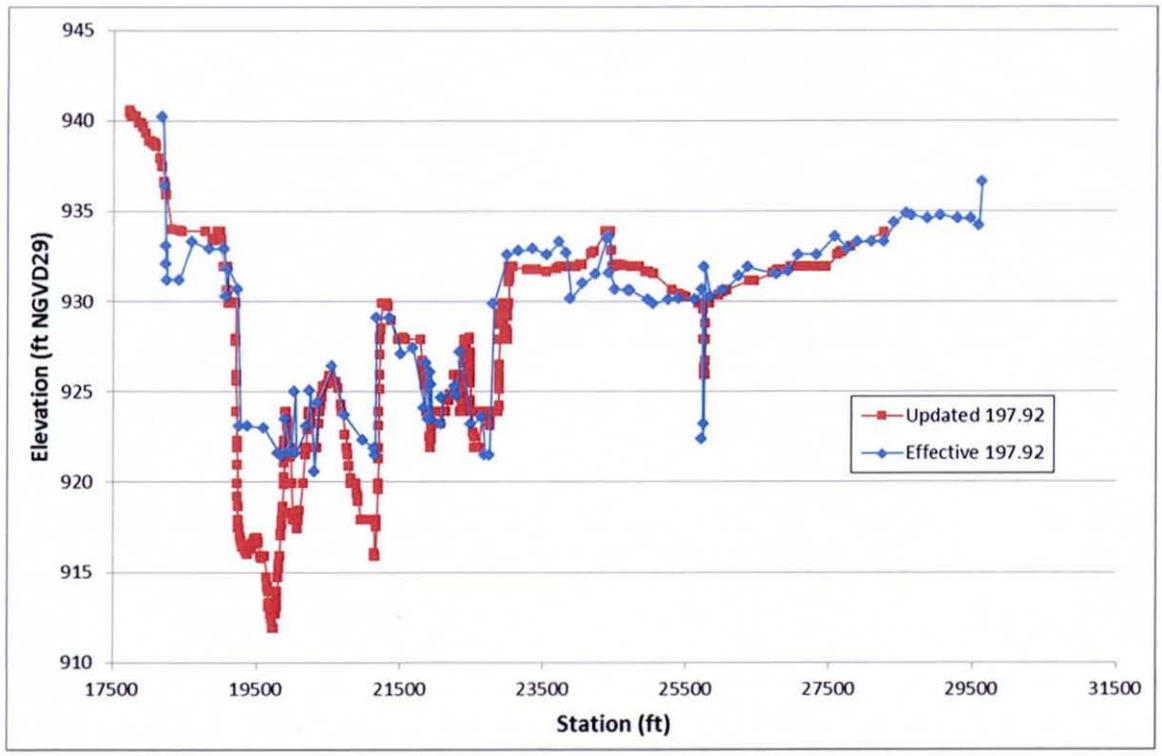
Comparison to Effective

Comment 28: Explain why the baseline/invert for the effective study downstream limit per the FIS profile is 923.1 ('88) yet XSEC 197.92 of the TRNL HEC-RAS model reflects an invert of 914.00. Similarly the baseline/invert at the upstream limit is 960.9 ('88) yet XSEC 203.08 reflects an invert of 958.00. Please explain.

WEST Response: The topography used just upstream of the west end of this study reach is the Gillespie topography. Therefore, the downstream boundary at XSEC 197.92 reflects the shift from the Gillespie topography to the effective topography.

The topography used just downstream of the east end of this study reach is the 2001 LACOE topography. Therefore, the upstream boundary at XSEC 203.08 reflects the shift from the LACOE topography to the effective topography.

WEST verified that our cross sections reflect what was in the Gillespie and LACOE topo data sources. Therefore, we have to assume that the topography we were provided is correct. Also, it should be pointed out that both at XSEC 197.92 and 203.08, the invert elevations are local features (and in the case of XSEC 197.92, the invert you mentioned is not located within the primary flow path of the main river); a average channel bed elevation for the current model versus the effective model would likely be much closer. Finally, XSEC 197.92 from the effective study and XSEC 197.92 from the updated model are both shown in the figure below. The overbank features seem to match in elevation; therefore, we would assume that the difference in channel elevations is actually reflecting a change in the geometry from the time of data collection for the effective topo (1991-1992) to the time of collection of the Gillespie topo (2008).



TDN

Comment 29: On page 2 last paragraph, include explanation that the source of the discharge data is from the 1996 LACOE Study (as further explained in Section 2 Part 2.1.10 and reiterated in Section 4). Considering there was a new flow used for this segment of the Salt River, to say that the flow was obtained from the 2005 FIS is not completely accurate.

WEST Response: The explanation that the source of the discharge data is from the 1996 LACOE Study has been included in the TDN. It has also been clarified that the flow was not obtained from the 2005 FIS.

Comment 30: Section 2 Part 2.1.3, remove Michael Baker Jr., Inc. name. Baker is not the *FEMA* Technical Review Contractor for this PMR.

WEST Response: Baker's name has been removed from the text of the TDN.

Comment 31: Section 4, page 10, 2nd paragraph – Table 3 in FIS states the Salt River drainage area above the confluence with the Gila River is 12,962 sq mi (not 13,700). Please revise.

WEST Response: This number has been updated in the text of the TDN.

Comment 32: Section 5.1.3, page 14, end of 2nd paragraph – the Tres Rios North Levee Floodplain & Floodway Re-Delineation Study will not be re-validating the BFC and SAT study data. That is why it's required that the exact HEC-RAS data, except for datum conversions, from the Dibble study be used for the tie-in for the TRNL study.

WEST Response: Based on earlier discussion, we will now be utilizing the BFC study in its original form. Therefore, we will not need to address any re-validation of the BFC or SAT study data.

Comment 33: Section 5.1.5 page 15, last paragraph – as explained above, unless it can be shown that coincident peaks occur, normal depth must be used as downstream boundary condition, not a known water surface elevation.

WEST Response: Based on earlier discussion, we will now be utilizing the BFC study in its original form. Therefore, we will not need to address the boundary condition for the BFC.

Comment 34: Tables 5-1, 5-2, 5-4, 5-5, 5-6, and 5-7 should state that elevations are NGVD29 and as previously mentioned, TDN must be submitted with NAVD88 elevations. One suggestion is to include 2 tables, one in NGVD29 to satisfy LACOE requirements and one in NAVD88 to satisfy FEMA requirements.

WEST Response: WEST has included one table in NGVD29 and one table in NAVD88 for each of the tables listed above, except those removed as a result of removing the analysis of the BFC and SAT flooding sources (i.e., Table 5-2). It should be noted that Table 5-5, 5-6, and 5-7 became Tables 5-6, 5-8, and 5-10, respectively, after the removal of Table 5-2 and the addition of other tables for NAVD88 output. Tables 5-3 and 5-4 kept their original numbers.

Comment 35: Table 5-1 – it appears the last 3 Cross Sections (RM) should be 198.83, 198.48, and 198.20. Please make sure that *FIS XS Shift* is measured along the baseline. Revise accordingly.

WEST Response: These RS labels have been updated accordingly.

Comment 36: Section 5.5 – Revise explanation about starting WSEL based on Comment 3 above. Downstream tie in must be within 0.0', not 0.5'.

WEST Response: This discussion has been updated accordingly. It is now indicated in the text of the TDN that the downstream end of the model ties in to the effective data to 0.0'.

Comment 37: Add explanation why study was originally performed in NGVD29 to aid in the understanding.

WEST Response: A section has been added to the text explaining why the study was originally performed in NGVD29. This briefly describes the background of the project from the LACOE being completed in NGVD29, and the decision by the LACOE and the District to maintain a consistent vertical datum throughout the project.

Comment 38: Last paragraph of Section 5.5 – revise text regarding the downstream tie-in for BFC. Normal depth is required in this case unless coincident peaks can be proven.

WEST Response: Based on earlier discussion, we will now be utilizing the BFC study in its original form. Therefore, we will not need to address the boundary condition for the BFC.

Comment 39: Section 5.7.2, Floodway Check FW FW 04 – It is assumed you mean the effective "flood*way*" was maintained as much as possible throughout the study reach. The creation of "dry" encroachment is unusual and likely unnecessary. As mentioned above in Comment 23, where these "dry" encroachments occur, there is no rise in floodway WSEL and the floodway boundary, although consistent with the effective study, is no longer consistent with conditions on the ground now versus the conditions at the time of the effective study. It is suggested these boundaries be adjusted or provide detailed explanation for the rationale behind their delineation, example why the boundary cuts through a pond.

WEST Response: WEST tried to utilize the effective FEMA encroachment stations exactly wherever possible. Based on other Baker comments herein, those floodway stations have already been modified slightly. Any areas where they were not adjusted have been explained further in the text.

Comment 40: Section 5.7.2, Starting Water Surface Elevation Check – revise explanation of simply raising starting floodway elevation by 1'. Need to start modeling at known floodway water surface elevation.

WEST Response: See the response to Comment #4 above. Using the same calculations of distance as discussed in comment #3, we have calculated a starting floodway elevation of 934.34'. The text in the TDN was modified to reflect this.

Comment 41: Section 5.7.2, XS Boundary Condition Check – revise explanation of simply raising starting floodway elevation by 1'. FEMA G&S limit increase in floodway WSEL to 1'. This doesn't apply to tying in with an effective study, i.e. simply increasing floodplain WSEL by 1'.

WEST Response: See the response to Comment #4 above. Using the same calculations of distance as discussed in comment #3, we have calculated a starting floodway elevation of 934.34'. The text in the TDN was modified to reflect this.

Comment 42: Section 5.7.2, XS Boundary Condition Check (BFC) – Normal depth should be used unless coincident peaks can be proven.

WEST Response: Based on earlier discussion, we will now be utilizing the BFC study in its original form. Therefore, we will not need to address the boundary condition for the BFC.

Comment 43: Add note to Table 7-4 that explains any difference in "Floodway Width" in table if it doesn't match width shown in Study Work Maps. This accounts for islands, ineffective flow areas, etc.

WEST Response: These notes and asterisks have been added to Table 7-4.

Comment 44: Last two entries are incorrect for XSEC 202.43. Please revise.

WEST Response: WEST is assuming this comment is in regards to Table 7-4. The last two entries have been checked for XSEC 202.43 and revised.

Comment 45: Make sure revised HEC-RAS XSEC's are not placed into notebook upside down (as was done on the submitted copy).

WEST Response: WEST will ensure the HEC-RAS XSEC's are not placed into the TDN upside down for the final version.

Comment 46: Update HEC-RAS explanation section regarding downstream boundary condition.

WEST Response: See the response to Comment #3 above. This explanation has been included in the section regarding downstream boundary condition.

Comment 47: 500 scale sheet 2 of 4, XSEC just upstream of Avondale bridge is labeled 199.16; it should be corrected to 199.20

WEST Response: This label has been corrected on the 500 scale sheet 2 of 4.

Comment 48: Remove all "Draft" designations on next submittal, example the Study Work Maps.

WEST Response: The "Draft" designations have been removed from all reporting, documentation, and data for the final submittal.

Comment 49: Please update TDN to reflect any revisions.

WEST Response: The TDN has been updated to reflect all revisions alluded to in this response package.

Baker

Michael Baker Jr., Inc.

2929 North Central Avenue
Suite 800
Phoenix, AZ 85012

Phone: 602-279-1234
FAX: 602-279-1411

September 12, 2012

Mr. Richard Harris, P.E.
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

Dear Mr. Harris,

We have completed a review of the submitted hydraulics data for the Tres Rios North Levee Floodplain and Floodway Re-Delineation Study - Technical Data Notebook (TDN). The TDN was prepared by WEST Consultants, Inc. and dated September 2012 (FCD 2010C027 & 2012C0005). Our second review found several items that should be addressed prior to acceptance of this study. The purpose of this letter is to summarize our review comments. It should be noted that the review of the levee requirements have not been completed yet due to the LSER not having been included in September 2012 version provided to Baker.

General

Comment 1: The Cover sheet was sealed but the Table of Contents also needs to be sealed. Please provide updated pages. *WEST already notified of this item in 9/11/12 e-mail.*

WEST Response: The Table of Contents has now been updated to include Brian's stamp.

Comment 2: Richard raised a concern about nothing being filled in under Section 2.1.3 FEMA Technical Review Contractor. Because we are not working directly for FEMA but under a CTP grant, please change the Section 2.1.3 title to 'CTP Technical Review Contractor' and fill in Michael Baker with the Phoenix address. Provide replacement page. *WEST already notified of this item in 9/11/12 e-mail.*

WEST Response: The title for Section 2.1.3 has been changed to 'CTP Technical Review Contractor'.

Comment 3: There are 3 locations in the text of the TDN that didn't properly link to the tables. These locations are on pages 13-15. Currently the references state in bold "Error! Reference source not found". Please correct. While you are on page 15, you might as well correct a typo that I saw during my first review but isn't a big deal. It's in the 2nd paragraph, please delete "of" in the sentence that begins "For example, the cross-section showing the **of** maximum …..". Provide replacement pages. *WEST already notified of this item in 9/11/12 e-mail.*

WEST Response: The TDN has been checked to verify that all references properly link to tables. Additionally, the 'of' has been removed from the sentence referenced above.

Comment 4: Page 41, Section 7.2, revise 2nd sentence to read "….**NAVD88** vertical datum is listed in Table 7-3.". Provide replacement page. *WEST already notified of this item in 9/11/12 e-mail.*

WEST Response: The erroneous reference to NGVD29 has been changed to NAVD88 in this sentence.

Comment 5: Please provide letter from supervisor of H&H Department with the Corps that documents their approval of the hydraulic analysis that utilizes the revised Manning's n values as supported in the Technical Memorandum from HNTB that directs the use of lower Manning's n values than called out in the 2010 JEFuller report. Add note in TDN text explaining this. Provide replacement page. *WEST provided letter from Corps (Rene Vermeeren dated 11 July 2012). No further action required.*

WEST Response: Comment resolved.

Section 5.1.5 of the TDN was updated to include an explanation of the few major changes made to the HEC-RAS model after WEST received the final version from the LACOE. These major changes are now described in the text of the TDN, and it is explained in the text of the TDN that the LACOE approved these major changes for the model delivered by WEST to the LACOE on 02/20/2012. After the LACOE approved the 02/20/2012 model provided by WEST, a few minor changes were made to the model, including shortening or widening cross section alignments for cross sections that contained vertical extensions for flow behind ineffective flow areas (which did not affect the hydraulics at all due to the fact that the cross sections areas removed were behind ineffective flow areas), slight revisions to the levee elevations for the downstream portion of the levee based on the levee raise construction completed by Kiewit, and changes to the model tie-in location. Since none of these changes affected the hydraulic calculations, none of these were included in the final text of the TDN. The final addition to Section 5.1.5 to reference the LACOE approval of the final model is shown below:

> *Finally, it should be noted that the LACOE provided a signed letter on July 11, 2012, stating that the model provided by WEST to the LACOE on February 20, 2012, had been fully reviewed and approved by the LACOE towards FEMA mapping (see a copy of this letter in Appendix B.4 dated 07/11/2012). This approval date of 02/20/12 postdates all major revisions to the model made by WEST after receiving the model from the LACOE, including downstream reach length adjustment and station renaming to agree with the FEMA baseline stationing, removal of the Upper Gila River reach, and all edits to cross-section lengths (i.e., extensions or reductions to cross-section length).*

Section 5.3.1 was updated to explain that the LACOE's approval of the RAS model on 02/20/2012 included the final Manning's n values utilized in the floodplain model. The initial Manning's n value selection for this model was developed for by JE Fuller in their Appendix D report for the Tres Rios Phase 3 DDR, then it was updated by HNTB, then the LACOE approved the final values proposed by HNTB in their 02/20/2012 approval letter. The final text added to Section 5.3.1 for this explanation is shown below:

> *It should also be noted that the letter provided by the LACOE approving the updated model provided by WEST to the LACOE on February 20, 2012, included approval of the final Manning's n values used in the model (see a copy of this letter in Appendix B.4 dated 07/11/2012).*

Comment 6: The response to the original Comment 24 addressed a different issue. The issue was that the floodplain is much narrower for XSEC 198.48 based on the results of the HEC-RAS when compared to what you mapped. HEC-RAS reflects a narrowing of the floodplain when compared to the floodplain upstream & downstream of XSEC 198.48. Your resulting floodplain is wider, more conservative and due to consistency with upstream & downstream floodplain, we will accept that. No need to make any changes or respond.

WEST Response: None requested.

Comment 7: 2nd request, please remove "Draft" from work maps. Also Sheet 13 of 18 didn't plot properly. *WEST already notified of this item in 9/11/12 e-mail.*

WEST Response: "Draft" has been removed from the work maps. Sheet 13 has been re-plotted for Baker.

Comment 8: Based on the HEC-RAS results, XSEC 198.34 should show the left floodplain and floodway boundary to be coincident. But the GIS linework (and work maps) show a separation of approximately 30'. Please adjust the boundary to tie in quicker between XSEC 198.38 and XSEC 198.34. In fact a correction should be made to the HEC-RAS model to adjust the encroachment on XSEC 198.34. Currently the results reflect a left FP station of 1872.4 and a left FW station of 1872.19, therefore, the FW is outside the FP by 0.21'. Similarly the right side for this XSEC shows a FP station of 2037.04 and a FW station of 5037.10; again the FW is outside of the FP. Please provide updated pages for any affected by this change. *WEST responded adequately to comment on September 11, 2012 e-mail. Please provide updated HEC-RAS model on CD.*

WEST Response: Comment response from email on 09/11/2012 was adequate. The final HEC-RAS model will be provided on the final TDN data deliverable CD. The floodway data table was not affected by this change.

Comment 9: The revised floodplain boundary between XSEC 198.64 and XSEC 198.83 shows a narrow strip of Zone X; too narrow to be shown on 1"=1,000' DFIRM. Please close Zone X boundary downstream of XSEC 198.83, thereby removing narrow strip of Zone X and combine it with the Zone AE floodplain boundary. This matter was discussed with Cathy Regester and she concurred. *WEST responded adequately to comment on September 11, 2012 e-mail and provided updated 09102012 shape file on their e-ftp site.*

WEST Response: Comment response from email on 09/11/2012 was adequate.

Comment 10: Revise floodplain boundary for 6 most downstream cross sections as discussed on phone call on September 10th to better reflect HEC-RAS results. *WEST responded adequately to comment on September 11, 2012 e-mail. Again, please provide updated HEC-RAS model on CD.*

WEST Response: Comment response from email on 09/11/2012 was adequate. The HEC-RAS model was edited slightly for this comment, and the final HEC-RAS model will be provided on the final TDN data deliverable CD.

Comment 11: Per District request, please provide plastic folders for work maps.

WEST Response: Plastic folders have been provided to Baker for their copy of the TDN. Additionally, a CD sleeve for a 3-ring binder has been provided with the final CD as well.

Comment 12: Please include final report in pdf format once changes are addressed. Also replace all affected pages of the TDN and exhibits that changed considerably i.e. cover, Sheet 1, Sheet 3, and Sheet 13 (black stripe across the copy provided to Baker). Again be sure to remove "draft" from both 200 and 500 scale exhibits prior to creating pdf of entire TDN.

WEST Response: The final TDN has been provided to Baker in pdf format. All pages of the TDN affected by this response document along with exhibits that changed considerably (i.e. cover, Sheet 1, Sheet 3, and Sheet 13) have been reproduced and provided to Teri. "Draft" was removed from both 200 and 500 scale exhibits prior to creating the PDF versions of the work maps.

It should be noted that this review continued to not include an exhaustive review of all items included in Appendix B. Final approval awaits NLSER. If you have any questions, please contact us at 602-294-2257.

Sincerely

Teri George, P.E., CFM, PMP

Brian Wahlin

From: Brian Wahlin
Sent: Tuesday, November 27, 2012 3:55 PM
To: 'Richard Harris - FCDX'
Cc: Don Rerick - FCDX
Subject: RE: Area protected by levee question - affirmation to proceed

Richard,

We will print this email and include it in Appendix B of the TDN. We understand that Baker will be utilizing one of the methods discussed in Tom's email for determining the area protected by the levee.

Thanks.

Brian

Brian Wahlin, Ph.D., P.E., D.WRE
Office Manager/Senior Hydraulic Engineer

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From: Richard Harris - FCDX [mailto:rph@mail.maricopa.gov]
Sent: Tuesday, November 27, 2012 2:49 PM
To: Brian Wahlin
Cc: Richard Harris - FCDX; Don Rerick - FCDX
Subject: Area protected by levee question - affirmation to proceed

Hi Brian,

Please read below. This email is confirmation of all the foregoing dialogue, including suggestion of approach by Tom Smith and Geoff's approval to proceed in a fashion that should be conservative. Please place copy of this in the TDN Appendix B and proceed with the final TDN packaging. If you have any questions please let me know.

Thanks,

Richard

From: Brownell, Geoff [mailto:gbrownell@mbakercorp.com]
Sent: Tuesday, November 27, 2012 2:10 PM
To: Richard Harris - FCDX
Cc: Brian Wahlin (bwahlin@westconsultants.com)
Subject: RE: levee question

Richard,

Yes, we will proceed with updating the work maps.

Geoff

From: Richard Harris - FCDX [mailto:rph@mail.maricopa.gov]
Sent: Tuesday, November 27, 2012 1:33 PM
To: Brownell, Geoff
Cc: Richard Harris - FCDX; Brian Wahlin (bwahlin@westconsultants.com)
Subject: RE: levee question

Thanks Geoff – sounds much simpler than I thought. My preference is to have Baker follow the last method that Tom says the USACE does, and tie elevations of levee top to ground unless the elevations run into the edges of the BFC/SAT floodplains. In that case, stop the boundaries there (unless they exceed the north FP boundaries also). I prefer the legend for these areas to be titled "Zone X (shaded) protected by Levee".

Sound good? If so, please write back that you will proceed and we will be looking forward to reviewing the updated PMR work maps.

Thanks, Richard

From: Brownell, Geoff [mailto:gbrownell@mbakercorp.com]
Sent: Tuesday, November 27, 2012 12:58 PM
To: Richard Harris - FCDX
Cc: Bezek, Robert (Robert.Bezek@fema.dhs.gov)
Subject: FW: levee question

Richard,

Here is the response I received from Tom Smith in our Alexandria office. Tom is the levee SME within Baker. I think the bottom line is that whether West (Corps)or Baker makes the determination, we can make some conservative assumptions based on the effective mapping, levee height, contours etc. to minimize the effort.

Geoff

From: Smith, Tom
Sent: Tuesday, November 27, 2012 12:28 PM
To: Brownell, Geoff
Subject: RE: levee question

Geoff:

There is really no real guideline for determination of the "area protected by levee." Often, you are going from an existing analysis that doesn't consider the levee to be providing protection, so the effective FIRM would normally have a Zone AE or Zone A area showing the levee as not providing protection; and that boundary could be used as the shaded Zone X. If the effective FIRM has no existing SFHA then under the LOMR process, we would ask the community (requester) to provide the area which would be protected by the levee.

As long as they submit something that makes sense, we would normally accept it. The submittal could include:

- As I said before, the existing SFHA from the FIRM, or
- If the reach has a HEC-RAS model and the cross sections all for it, just do a without levee run, or
- They could simple extend the w/levee BFEs to the landside of the levee to delineate the area, or

- They could extend the top of levee to intersect the ground landside of the levee (typically what the USACE does).

The main point is to conservatively estimate the extent of the area that could, flood if the levee does not function as intended.

Tom

From: Brownell, Geoff
Sent: Tuesday, November 27, 2012 11:50 AM
To: Smith, Tom
Subject: levee question

Hi Tom,

Our office is contracted with the local flood control agency (Flood Control District of Maricopa County) to do a ~100 panel PMR through Prelim. The PMR is a combination of studies done by other contractors and a couple we completed. One of the studies done by another contractor is new floodplain mapping resulting from the construction and certification of a Corps levee on the Gila River in Phoenix. The Corps just issued their LSER. It appears that their contractor did not do any behind levee mapping. I do not believe there is any funding left for them to go back and do it either. My questions are; does the shaded X (area protected by levee) require vigorous engineering (ie. do they need to absolutely provide it), or is it something we can 'pencil in' based on contours when we are preparing the map panels? Thanks.

Geoff Brownell, PE, CFM
Michael Baker Jr., Inc.
2929 N. Central Avenue, Suite 800
Phoenix, AZ 85012
602.798.7558 (ofc)
775.722.4713 (cell)
www.mbakercorp.com

Baker

Baker

Michael Baker Jr., Inc.

2929 North Central Avenue
Suite 800
Phoenix, AZ 85012
Phone: 602-279-1234
FAX: 602-279-1411

December 4, 2012

Subject: Review and Approval of Technical Flood Study Data for the Tres Rios FDS, Contract FCD 2010C027 and FCD 2012C005

To whom it may concern,

In relation to the FEMA Region IX Grant: EMF-2009-GR-0909, Physical Map Revision (PMR)/Map Maintenance for Maricopa County, AZ., we have reviewed the data submitted in the application package (with appendices) entitled Tres Rios North Levee Floodplain and Floodway Re-Delineation Study, prepared for the Flood Control District of Maricopa County by WEST Consultants, Inc., dated September 2012. Based upon our review, it is our finding that the technical data and supporting documentation for this study should satisfactorily meet criteria set forth in FEMA's "Guidelines and Specifications for Flood Hazard Mapping Partners", 2002 and revisions. We have found that the submitted data, which will be submitted to FEMA for their review, concurrence, and acceptance, should meet the minimum floodplain management criteria of the National Flood Insurance Program (NFIP). The Preliminary Map Products and Flood Insurance Study data, being prepared by Michael Baker Jr., Inc., Phoenix, will be submitted to FEMA for their review, concurrence, and acceptance for use and incorporation into effective map products.

Sincerely,

Geoff Brownell

Geoff Brownell, P.E., CFM

Copies to:

Mr. Brian Cosson, CFM
NFIP Coordinator
Office of Dam Safety and Flood Mitigation
Arizona Department of Water Resources

Robert J. Bezek
Risk MAP Regional Engineer
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

W:\Proj\FCDMC\01_PMR_On_Call\14_Tres Rios\Review\Tres Rios G&S Letter.docx

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

Date: December 27, 2012

Ms. Jody Fischer, P.E.
Levee Safety Program Manager
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd, Suite 1101
Los Angeles, CA 90017

Subject: Tres Rios North Levee Floodplain and Floodway Re-delineation Study, Technical Data Notebook

Dear Jody,

We are pleased to provide you with the Final Draft of the subject documentation. As you know, the Tres Rios North Levee FDS has been a very challenging, and at the same time, productive endeavor for all parties involved. Your cooperation and assistance with the team remains highly appreciated and I want to personally thank you for your efforts and diligence during the study process.

The enclosed Technical Data Notebook (TDN) contains the technical supporting documentation in its entirety. The hydraulic models, floodplain work maps, levee certification documents, and review approval letters can all be found within it. I have also included the District's own Data Acceptance Memo, fully signed, which states that the information contained in the TDN can and will be used for floodplain management by the District between now and the time that the DFIRM updates are finalized by FEMA. We are hoping this will occur within two years.

Again, thanks for your help, and if you have any questions or would like to discuss this, please email me at: rph@mail.maricopa.gov, or call me at 602 506 4528.

Sincerely,

Richard P. Harris, P.E., CFM

Copies with Enclosure to:

Ms. Jody Fischer, P.E.
Levee Safety Program Manager
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd, Suite 1101
Los Angeles, CA 90017

Mr. Charles W. Andrews Sr., P.E.
Assistant City Engineer
11465 W. Civic Center Drive, Suite 120
Avondale, AZ 85323-6804

Mr. Hasan Mushtaq, P.E., Ph.D., CFM
Planning, Design, & Programming Division
Street Transportation Department
200 W. Washington Street
Phoenix, Arizona 85003-1611

Copies without Enclosure to:

Mr. Robert J. Bezek, P.E.
Regional Engineer
FEMA Region IX, Mitigation Division
1111 Broadway, Suite 1200
Oakland, CA 94607

Mr. Geoff Brownell, P.E., CFM
Michael Baker Jr., Inc.
2929 N. Central Avenue, Suite 800
Phoenix, AZ 85012

Mr. Brian Cosson, CFM
State NFIP Manager
AZ Dept. of Water Resources
3550 N. Central Ave.
Phoenix, AZ 85012-2105

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
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2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
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TT: 602-505-5897

Date: December 27, 2012

Mr. Hasan Mushtaq, P.E., Ph.D., CFM
Planning, Design, & Programming Division
Street Transportation Department
200 W. Washington Street
Phoenix, Arizona 85003-1611

Subject: Tres Rios North Levee Floodplain and Floodway Re-delineation Study, Technical Data Notebook

Dear Hasan,

We are pleased to provide you with the Final Draft of the subject documentation. As you know, the Tres Rios North Levee FDS has been a very challenging, and at the same time, productive endeavor for all parties involved. Your cooperation and assistance with the team remains highly appreciated and I want to personally thank you for your efforts and diligence during the study process.

The enclosed Technical Data Notebook (TDN) contains the technical supporting documentation in its entirety. The hydraulic models, floodplain work maps, levee certification documents, and review approval letters can all be found within it. I have also included the District's own Data Acceptance Memo, fully signed, which states that the information contained in the TDN can and will be used for floodplain management by the District between now and the time that the DFIRM updates are finalized by FEMA. We are hoping this will occur within two years.

Again, thanks for your help, and if you have any questions or would like to discuss this, please email me at: rph@mail.maricopa.gov, or call me at 602 506 4528.

Sincerely,

Richard P. Harris, P.E., CFM
Enclosure: Technical Data Notebook

Copies with Enclosure to:

Ms. Jody Fischer, P.E.
Levee Safety Program Manager
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd, Suite 1101
Los Angeles, CA 90017

Mr. Charles W. Andrews Sr., P.E.
Assistant City Engineer
11465 W. Civic Center Drive, Suite 120
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Mr. Hasan Mushtaq, P.E., Ph.D., CFM
Planning, Design, & Programming Division
Street Transportation Department
200 W. Washington Street
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Copies without Enclosure to:

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Regional Engineer
FEMA Region IX, Mitigation Division
1111 Broadway, Suite 1200
Oakland, CA 94607

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Michael Baker Jr., Inc.
2929 N. Central Avenue, Suite 800
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Flood Control District
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Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

Date: December 27, 2012

Mr. Charles W. Andrews Sr., P.E.
Assistant City Engineer
11465 W. Civic Center Drive, Suite 120
Avondale, AZ 85323-6804

Subject: Tres Rios North Levee Floodplain and Floodway Re-delineation Study, Technical Data Notebook

Dear Charles,

We are pleased to provide you with the Final Draft of the subject documentation. As you know, the Tres Rios North Levee FDS has been a very challenging, and at the same time, productive endeavor for all parties involved. Your cooperation and assistance with the team remains highly appreciated and I want to personally thank you for your efforts and diligence during the study process.

The enclosed Technical Data Notebook (TDN) contains the technical supporting documentation in its entirety. The hydraulic models, floodplain work maps, levee certification documents, and review approval letters can all be found within it. I have also included the District's own Data Acceptance Memo, fully signed, which states that the information contained in the TDN can and will be used for floodplain management by the District between now and the time that the DFIRM updates are finalized by FEMA. We are hoping this will occur within two years.

Again, thanks for your help, and if you have any questions or would like to discuss this, please email me at: rph@mail.maricopa.gov, or call me at 602 506 4528.

Sincerely,

Richard P. Harris, P.E., CFM
Enclosure: Technical Data Notebook

Copies with Enclosure to:

Ms. Jody Fischer, P.E.
Levee Safety Program Manager
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd, Suite 1101
Los Angeles, CA 90017

Mr. Charles W. Andrews Sr., P.E.
Assistant City Engineer
11465 W. Civic Center Drive, Suite 120
Avondale, AZ 85323-6804

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Planning, Design, & Programming Division
Street Transportation Department
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Copies without Enclosure to:

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Regional Engineer
FEMA Region IX, Mitigation Division
1111 Broadway, Suite 1200
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Mr. Geoff Brownell, P.E., CFM
Michael Baker Jr., Inc.
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Phoenix, AZ 85012

Mr. Brian Cosson, CFM
State NFIP Manager
AZ Dept. of Water Resources
3550 N. Central Ave.
Phoenix, AZ 85012-2105

Appendix B: General Documentation and Correspondence

B.5 Contract Documents

FLOOD CONTROL DISTRICT of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

NOTICE TO PROCEED

TO: Brian Wahlin, Vice President
WEST Consultants, Inc.
8950 South 52nd Street, #210
Tempe, AZ 85284

September 13, 2010

SUBJECT:	PCN	126.01.31	Low Org	6975
	FCD Contract No.	2010C027		
	Assignment No.	2		

Tres Rios Levee Floodplain and Floodway Re-dlineation Project

Your not-to-exceed cost estimate of [redacted] for Assignment No. 2 has been received and accepted for this project with a completion date of 3/14/2011. You are hereby authorized to proceed with the work for the referenced project as originally described in the Scope of Work. Please specify the contract title, contract number, assignment number, and the dates of the completed service on all related correspondence, including the invoice. Send the invoices and certificates of performance to the attention of Finance Department, Flood Control District of Maricopa County. The certificate of performance must be dated on or after the final invoice date and must accompany the final invoices.

The purpose of this assignment is to collect and develop project data with an ultimate goal to update the Zone AE floodplain and floodway delineations of the Gila River in context with the Tres Rios Levee Phases la, 1b, and 1c construction features. The location of this project is roughtly from 91st avenue extending westward to 123rd avenue along the Gila River alignment, a distance of nearly six (6) miles. The project data will be reviewed and categorized with relevance to a LOMR request package that will be produced under another (future) work assignment. All work will proceed as described in the attached Scope of Work and be processed within the time frame of the attached schedule. Variations to this will be permitted only by written request and District authorization. The schedule is subject to variation because related work will be influenced to some degree by the ability of the Corps of Engineers to provide the data.

If at any time during the project assignment a material change in the scope of services to be provided occurs, causing an increase in the original cost estimate shown here, you must provide the District with a written explanation of the additional work along with an estimate of additional costs. No additional work shall commence prior to written authorization by the District. No claims for additional work shall be accepted that have not received prior District approval.

SIGNED:

Richard P. Harris, P.E., CFM
Project Manager

Timothy S. Phillips, P.E.
Chief Engineer and General Manager

SCOPE OF WORK

CONTRACT FCD 2010C027 Work Assignment #2

Tres Rios Zone AE Floodplain and Floodway Re-Delineation Study: Coordination, Data Collection and Summary Reports

GENERAL SCOPE OF WORK

The purpose of this work assignment is to collect and categorize available data in context with a LOMR package development and submittal that will result in a re-delineation of the Salt River and Gila River Floodplain and Floodway from approximately 91st Avenue to 123rd Avenue in context with the Army Corps of Engineers (COE) Tres Rios Levee construction project. The work will include reviewing public notification to date, leading to a Coordination Report that will guide further notification and produce results to satisfy FEMA requirements for public notification of changes in Floodplain and Floodway. The collected data will be reviewed and a plan of action will be prepared for further data collection and data production that will ultimately result in a Data Collection Report and a Summary Report recommending further documentation development. These Reports should then lead to a future work assignment to provide services leading to a LOMR and FIS updates for the area.

Tasks will include but not be limited to reviewing and checking of modeling and documents provided by the COE relative to a conventional re-delineation study and Levee Certification, reviewing previous activities towards developing a plan for public information, legal advertising in context with FEMA requirements, and any other tasks relevant to Public Information and Data Collection that normally occur during a floodplain delineation study, in order to determine to what extent existing data will be sufficient to meet FEMA standards, or, to what extent additional activities must be performed before sending a LOMR package to FEMA.

This COE study re-delineated approximately 6 linear-miles of existing Zone AE Floodplains and Floodways using recent 1-foot-contour topographic mapping that the COE will provide to the Flood Control DISTRICT of Maricopa County (DISTRICT), as the mapping basis.

The CONSULTANT will check hydraulic models prepared by the COE to validate that they meet FEMA criteria and/or to develop a strategy to develop models that would meet those requirements. The CONSULTANT must use sound engineering judgment in the development of the models. The CONSULTANT must analyze the results of the models carefully and make refinements to the input parameters in order to obtain the most realistic results. The CONSULTANT will also check the Levee Evaluation Report produced by the COE to verify that it will meet FEMA standards.

All work must meet the requirements of the DISTRICT's Consultant Guidelines, Third Edition - December 1, 2003 - Revision 1. All work must also meet the latest versions of the Arizona Department of Water Resources (ADWR) Standards and the Federal Emergency Management Agency (FEMA) Guidelines and Specifications for floodplain delineations. Prior to the finalization of this assignment all items called for in this Scope of Work must be delivered, reviewed, and approved by the DISTRICT.

1.5 The CONSULTANT will be responsible for investigating and reporting what level of public notification remains to be done and will provide guidance to the DISTRICT in the form of a Coordination report. This report will be in context with FEMA requirements defined within the MT-2 instructions manual and will relate the re-delineation study/flood map change goals.. This report must be submitted to the DISTRICT within sixty (60) days of the NTP. The DISTRICT will be responsible for placing legal advertising at the beginning of the study and any additional notification recommended by the Consultant. The advertisement will be run in a widely circulated newspaper. A display advertisement will also be run twice in a local newspaper that serves the area being studied, with approximately one (1) week between runs. The DISTRICT also will be responsible for placing any legal advertisements for any public open house meetings if they are recommended.

1.6 The DISTRICT has prepared a separate set of guidelines for CONSULTANT on conducting public involvement and public information activities for the DISTRICT. A copy of these guidelines is available from the Public Information Office and shall be used by the CONSULTANT if or when preparing public information related materials in conjunction with FEMA requirements.

1.7 The CONSULTANT shall plan and conduct public involvement and prepare information as required in the following public involvement activities and in accordance with the DISTRICT Public Involvement and Information Guidelines.

1.8 The DISTRICT will create a critical path calendar for planning any public open house meetings.

1.9 The DISTRICT will generate mailing lists of the residents and property owners located within the study area boundary and which have properties that will be affected by the study results once the results become available.

1.10 The CONSULTANT shall provide the preliminary language for inclusion in a brochure mailing that will be developed by the DISTRICT. The mailing will be to notify affected property owners of the study results and to provide invitations to any open house meetings, if they are to be held.

1.11 The DISTRICT will prepare (design) the text of the mailing described in task 1.10. The Notification of Study Results brochure will be mailed out after the DISTRICT has approved draft floodplains. The DISTRICT will be responsible for mailing out the brochure.

1.12. The DISTRICT may develop PDFs of the brochures for placement on District's Web site if such an activity is recommended by the Consultant.

1.13 The CONSULTANT shall also be responsible for providing images (PDF) of the study area for the District's website to be used as part of the project description within the Projects and Structures folder. The DISTRICT shall post the images and project information on the District's Web site.

1.14 For any open house meetings, The DISTRICT will secure the public meeting venue and certificate(s) of insurance.

1.15 The CONSULTANT shall be responsible for producing approximately two (2) study area display images for the public open house meeting, if they are to be held. The DISTRICT will be responsible for mounting the displays and providing sign-in sheets, comment sheets, name tags, etc., and any additional handouts regarding the study at the meetings.

1.16 The CONSULTANT shall assist in the development of any PowerPoint presentations (layout and content) for any open house meeting, if this type of format is deemed appropriate for the meeting venue.

TASK 3 - TOPOGRAPHIC MAPPING

3.1 Topographic mapping, with 1-foot contour intervals, will be provided by the Corps to the DISTRICT. This mapping will then be turned over to the CONSULTANT for review and analysis. It is expected that this mapping will be in the Arizona State Plane Coordinate System Central Zone, 1983 North American Datum (NAD), horizontally; and the North American Vertical Datum 1988 (NAVD 88), vertically. It is hoped that the projection is also with respect to the HARN. If it is not, the CONSULTANT will report on what needs to be done in order to bring the mapping up to these standards. The CONSULTANT will also review any provided accuracy checks to verify that the topographical mapping upon which the Hydraulic analyses are based meets FEMA's standards for Floodplain Delineation Studies, and can therefore be used for any further hydraulic modeling that may be necessary in the upcoming Work Assignment #3. The CONSULTANT will report on any data deficiencies that would otherwise be included to verify the mapping accuracy, and provide recommendations to verify accuracy. These recommendations will be included in the Summary Report, and may include field survey data to verify the ground control used to produce the mapping and spot elevation data collection to verify the appropriate RMSE. The outcome of these recommendations may require further cross sectional surveys and subsequent topographical mapping certification.

FLOOD CONTROL DISTRICT of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

NOTICE TO PROCEED

TO: Brian Wahlin, Vice President
WEST Consultants, Inc.
8950 South 52nd Street, #210
Tempe, AZ 85284

March 29, 2011

SUBJECT:				
	PCN	126.01.31	Low Org	6975
	FCD Contract No.	2010C027		
	Assignment No.	6		

Tres Rios Levee Floodplain and Floodway Re-delineation Project

Your not-to-exceed cost estimate of [redacted] for Assignment No. 6 has been received and accepted for this project with a completion date of 3/29/2013. You are hereby authorized to proceed with the work for the referenced project as originally described in the Scope of Work. Please specify the contract title, contract number, assignment number, and the dates of the completed service on all related correspondence, including the invoice. Send the invoices and certificates of performance to the attention of Finance Department, Flood Control District of Maricopa County. The certificate of performance must be dated on or after the final invoice date and must accompany the final invoices.

The purpose of this work assignment is to collect and develop project data for a technical data notebook and LOMR request package to update the Zone AE floodplain and floodway delineations of the Gila River in context with the USACE Tres Rios Levee and attendant Phase I features. The location of this project is roughtly from 91st avenue extending westward to 123rd avenue along the Gila River alignment, a distance of nearly six (6) miles. The project data will be collected, reviewed, and organized to provide a LOMR request package that will be submitted to FEMA for mapping changes. All work will proceed as described in the attached Scope of Work and with reference to the attached Summary Report.

If at any time during the project assignment a material change in the scope of services to be provided occurs, causing an increase in the original cost estimate shown here, you must provide the District with a written explanation of the additional work along with an estimate of additional costs. No additional work shall commence prior to written authorization by the District. No claims for additional work shall be accepted that have not received prior District approval.

SIGNED:

Richard P. Harris, P.E., CFM
Project Manager

Timothy S. Phillips, P.E.
Chief Engineer and General Manager

EXHIBIT A

GENERAL SCOPE OF WORK

CONTRACT FCD 2010C027
Assignment # 6

Tres Rios Levee Zone AE Floodplain and Floodway Re-delineation Study

EXHIBIT A

GENERAL SCOPE OF WORK

CONTRACT FCD 2010C027 Work Assignment #6
Tres Rios Levee Zone AE Floodplain and Floodway Re-Delineation Study: Technical Data Notebook and LOMR Preparation and Support Services

The purpose of this work assignment is to define CONSULTANT (WEST) services for collecting, reviewing, and organizing data from the U.S. Army Corps of Engineers, Los Angeles District (LACOE) in context with developing a Technical Data Notebook (TDN) and Letter of Map Revision (LOMR) request package for submittal to the Federal Emergency Management Agency (FEMA), that will result in a re-delineation of the Salt River and Gila River Floodplain and Floodway from approximately 91st Avenue to 123rd Avenue. The request will be in context with the LACOE Tres Rios Levee construction project. The work will include the creation of any necessary additional supporting documentation by WEST. All such work will be a cooperative effort between the DISTRICT, WEST, and the LACOE. The production of the TDN and the LOMR request will be in reference to a TDN outline and summary of necessary work identified within the Data Collection and Summary Reports finalized by WEST in March 2011 under work Assignment #2, Contract FCD 2010C027, as well as collection and review of any other necessary supporting materials such as the LACOE Levee Certification documentation.

Tasks will include, but not be limited to, reviewing and checking of modeling and supporting documents provided by the LACOE relative to a conventional re-delineation study and Levee Certification, reviewing related previous public information activities and assisting with public information activities, providing support services for legal advertising in context with FEMA requirements, and any other relevant tasks leading up to the DISTRICT sending a TDN and LOMR request package to FEMA. WEST will also provide support services during the FEMA review process of the technical data. The degree of performance of most tasks for which WEST will provide will depend at least in part on the quality of submitted data from the LACOE.

All work must meet the requirements of the DISTRICT's Consultant Guidelines most current edition. All work must also meet the latest versions of the Arizona Department of Water Resources (ADWR) Standards and FEMA) Guidelines and Specifications for floodplain delineations. Prior to the finalization of this assignment all items called for in this Scope of Work must be delivered, reviewed, and approved by the DISTRICT.

All tasks will be performed primarily as outlined in this Scope of Work with reference to the attached document entitled, "Salt and Gila River, Tres Rios North Levee Summary Report, Contract FCD 2010C027 Work Assignment #2, March 22, 2011 by WEST Consultants, Inc.

All work must be completed within seven hundred and thirty (730) calendar days from the Notice to Proceed (NTP) which includes one hundred and twenty (120) days for DISTRICT reviews and three hundred sixty-five (365) days for FEMA reviews. WEST shall have the final study results ready for submittal to FEMA within three hundred sixty-five (365) calendar days from the Notice to Proceed (NTP).

TASK 1 – COORDINATION

1.1 Within seven (7) days of the NTP, WEST will submit a project schedule to the DISTRICT's Project Manager showing coordination meetings and completion dates for each task identified in the Scope of Work (SOW). WEST will update this project schedule when appropriate.

1.2 WEST will participate in regular coordination meetings with the DISTRICT (at least monthly) and attend teleconference call meetings with the LACOE every three weeks, or be granted any exception to skip a meeting and/or call from the DISTRICT. Monthly coordination meetings can be by phone if pre-authorized by the DISTRICT, and may double along with teleconference calls to the LACOE staff and other associated parties. WEST is responsible for the minutes of any meetings. Draft meeting minutes must be prepared and delivered to the DISTRICT within 7 calendar days of all meetings.

1.3 WEST will submit an estimate of the monthly billing within seven (7) calendar days of the NTP. Thereafter, this estimate will be updated and submitted to the DISTRICT's Project Manager as necessary but at least ten (10) calendar days before the end of each quarter whereas the end of a quarter in any given calendar year is March 31, June 30, and September 30, and December 31.

1.4 WEST will submit monthly progress reports at least five (5) days before submittal of monthly invoices. The report shall be brief and should be no longer than two (2) typed pages. Earned Value reporting is recommended to track progress throughout the project. At a minimum, the monthly report shall contain the following:

a. A description of the work accomplished by task during the reporting month.
b. Percent (%) completed for the period and percent (%) cumulative completed for each task.
c. A brief description of the work to be accomplished in the following month.
d. A description of any problems encountered.

1.5 WEST will review the technical data provided by the LACOE and make recommendation to the DISTRICT regarding the level of Public Information that will be required to meet FEMA's MT-2 requirements for proposed changes in BFE and Floodway. Both the DISTRICT and WEST will work cooperatively drafting notification documents. The DISTRICT will be responsible for notification mailing and placing any legal advertising required for the study. The legal advertisement will be run once in a widely circulated newspaper. A display advertisement will also be run once in a local newspaper that serves the area being studied, if one is available. After the ads run in the newspapers, the DISTRICT will provide WEST with the original affidavits of publication for inclusion in the Technical Data Notebook (TDN). The DISTRICT also will be responsible for placing any legal advertisements for public open house meetings.

1.6 The DISTRICT has prepared a separate set of guidelines for consultants on conducting public involvement and public information activities for the DISTRICT. A copy of these guidelines is available from the DISTRICT Public Information Office and shall be used by WEST when preparing public information related materials.

1.7 WEST shall help to plan and conduct public involvement and prepare information as required for the public involvement activities and in accordance with the DISTRICT's Public Involvement and Information Guidelines.

1.8 The DISTRICT will create a critical path calendar for planning one (1) public open house meeting. The public meeting will be held at the end of the study, but prior to the submittal to FEMA, and will present the final results of the study. The meeting will be held at a location either within the study area or very near the study area based upon available accommodations. At least two (2)

representatives from WEST will attend the public meeting. For the open house meeting, the DISTRICT will secure the public meeting venue and certificate(s) of insurance.

1.9 The DISTRICT will generate mailing lists of the residents and property owners that will be affected by the study results once the results become available.

1.10 WEST shall provide the preliminary language for inclusion in a brochure mailing that will be developed by the DISTRICT. A Notification of Study Results brochure mailing will notify affected property owners of the study results and to provide invitations to the public meeting.

1.11 The DISTRICT will prepare (design) the format of the mailing described in Task 1.10. The Notification of Study Results brochure will be mailed out after the DISTRICT has approved draft floodplains. The DISTRICT will be responsible for mailing out the brochure.

1.12 The DISTRICT may post the Notification of Study Results brochure and any other project documentation on the DISTRICT web site.

1.13 WEST shall also be responsible for providing PDF images of the study area to be used as downloadable documents on the project page within the Projects and Structures section of the DISTRICT Web site. The DISTRICT shall post the images and project information on the web site.

1.14 WEST shall be responsible for producing a minimum of two (2) study area display exhibit boards for the public open house meeting. The board size shall be 24" x 36" or 36" x 48". The display exhibit board format shall conform to the DISTRICT consultant guidelines (see Task 1.6). The DISTRICT shall be responsible for mounting the displays exhibits and providing sign-in sheets, comment sheets, name tags for staff, and any additional handouts regarding the study at the meeting. Additionally, Google Earth visualization could be provided by WEST to show residents very detailed views of their parcels with the effective and updated mapping products at the public open-house meeting.

1.15 Performance Evaluations will be performed by both the DISTRICT and WEST at the completion of the project.

TASK 2 - DATA COLLECTION

2.1 WEST will collect and review pertinent data from the LACOE, the DISTRICT, the Maricopa County Planning and Development, and other outside sources. Data to be collected will include previous flood hazard reports and hydrology for the study area, existing topographic mapping, historical flooding information, as-built plans for existing hydraulic structures (final Levee as-built plans to be provided by the LACOE), highways and bridges, operations and maintenance manuals, relevant storm drain infrastructure information, drainage design reports for the adjacent properties, FEMA Flood Hazard Boundary Maps, FEMA Letters of Map Amendment/Revision, and other pertinent information. Prior to any public presentation or meeting to discuss preliminary study results, WEST will obtain the most current aerial photography from the DISTRICT to use as background for the project study sheets during data review and at any presentation.

2.2 WEST will prepare the ADWR abstract forms for the study TDN, as well as assist in completing the MT-2 forms.

2.3 The DISTRICT will provide WEST with its GIS information such as streets, effective DFIRMs, effective floodplain/floodway boundaries, latest aerial photography, topographic mapping, and other data as needed in terms of project review and completion.

2.4 A Data Collection Summary will be submitted to the DISTRICT for review and approval in context with the findings of the previously noted Summary Report. A preliminary draft is due within one hundred twenty (120) days of the NTP. The final draft will be due in one hundred sixty (160) days of the NTP. The final draft will be included in Appendix A of the TDN.

2.5 WEST will review the LACOE Levee Evaluation Report (LER) when it becomes available from the LACOE, to verify that the technical data contained therein will be sufficient to obtain Certification from FEMA. WEST will list their findings in a Data Collection Report. If it is found that parts of the LER can be considered supplemental to the LOMR technical data, WEST will make recommendations towards incorporating that data into the LOMR. Another purpose of this review will be to see what data will not be presented in the LER but may still be necessary for the LOMR package.

TASK 3 - TOPOGRAPHIC MAPPING AND FIELD SURVEY

Topographic Mapping

3.1 Two sets of topographical mapping have been merged into a single product for this project: 4-foot contour interval and 1-foot contour interval mapping. The merged topographic mapping product shall be included on a disk along with a certification statement for the 1-foot topography provided by the LACOE, in the TDN, Appendix C. The extents of the 4-foot topography provided by the DISTRICT and the 1-foot topography provided by the LACOE are shown in Figure 3-1. The 4-foot mapping covers mostly the river overbank areas, while the 1-foot mapping covers the main channel areas. The DISTRICT will provide any additional topographic mapping necessary outside this primary survey data area. WEST will specify any necessary conversions to NAD 83, State Plan coordinates, Arizona Central Zone, and NAVD 88, and conversion factors to NGVD 29 as necessary. The vertical datum of products to be submitted to FEMA when the project is near completion will depend on what is expected by FEMA at the time the TDN/LOMR package is ready to be sent to them.

3.2 Additional 2-foot topography for the area was recently flown in 2009 for the Gillespie Area Drainage Master Plan Update. WEST will merge this topography with the topography mentioned in Task 3.1 and map the floodplain in the area of El Mirage Road near the Tres Rios Levee. This mapping exercise will be used to evaluate the need for the Phase 1C floodwall along El Mirage Road.

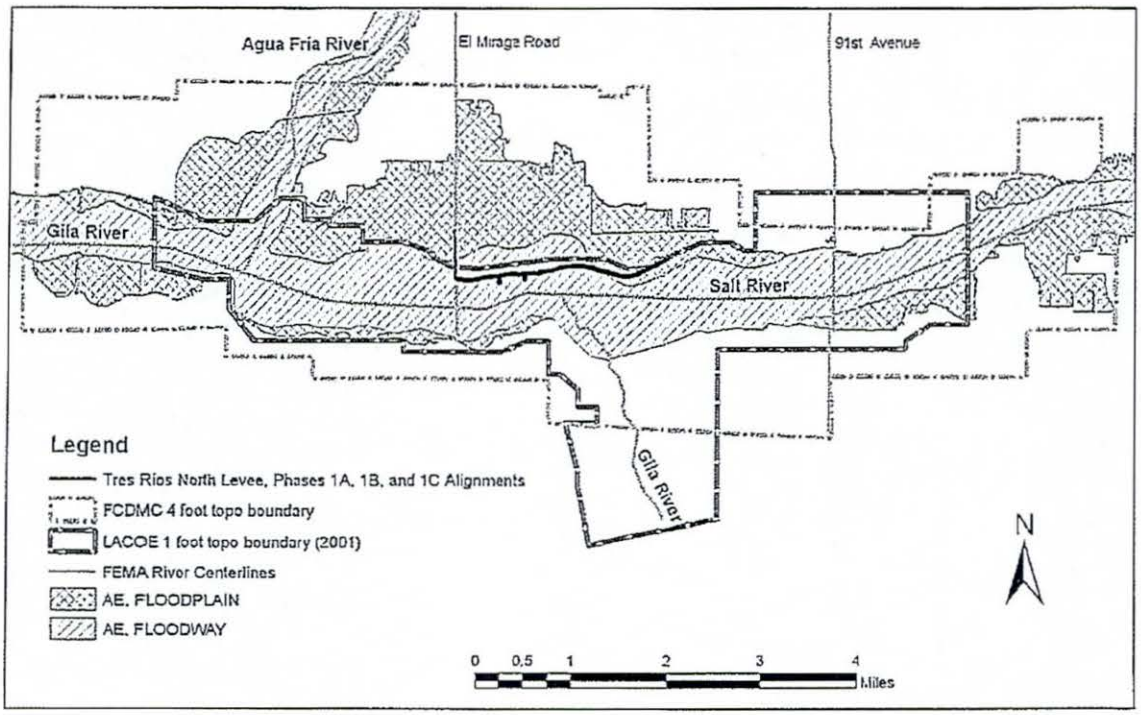


Figure 3-1. Extents of the Topographic Datasets Used for the Study

Field Survey

3.3 Primary data regarding the field survey information has been delivered by the LACOE. Supporting documentation for the survey data can be found in the TDN, Appendix C. These data include As-built plans for the Levee System features. Independently verifying the 1-foot contour interval topographic dataset by field survey, if completed, will fall to the DISTRICT. WEST may be asked to recommend 3 to 5 cross-sections to be verified independently for this task item. Locations of these cross-sections should coincide with cross-section alignments in the post-project conditions model, and these cross-section locations will be determined upon further investigation and review of the post-project conditions model. WEST may recommend locations of likely similitude between the current topographic conditions and 2001 topographic conditions based on a comparison of recent and pre-project aerial photographs. It is assumed the actual survey will be performed by the DISTRICT.

TASK 4 - HYDROLOGY

4.1 No new hydrologic modeling will be performed for this study; all discharges will either be those from the existing FIS data, or those used in the PED report for the LACOE by WEST, March 2003. Therefore, there will not be a need to obtain the normal modeling and GIS files that are required for a conventional study.

The current FEMA regulatory 100-year discharge for the Salt River study reach is 164,000 cfs, with a drainage area of 13,700 square miles (FEMA, September 30, 2005). The current FEMA regulatory 100-year discharge for the Gila River study reach below the Salt River confluence is 227,000 cfs, with a drainage area of 42,900 square miles immediately below the confluence of the

Gila and Salt Rivers – the Gila River upstream of the Salt River confluence drains approximately 29,200 square miles. Of this 42,900 square miles, approximately 60% of the drainage area (25,400 square miles) has regulated and controlled runoff, primarily due to the operation of Roosevelt Dam on the Salt River and Coolidge Dam on the Gila River (USACE, 2011).

The current Flood Insurance Study hydrology is based on Michael Baker's 1999 analysis of the 100-year flood for the Salt and Gila Rivers, which was largely based on a report completed by the LACOE in 1996 titled *Section 7 Study for Modified Roosevelt Dam, Arizona (Theodore Roosevelt Dam): Hydrologic Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam* (USACE, 1996).

Table 4-1 lists the discharges at flow change locations for the pre-project conditions and the post-project conditions HEC-RAS models. As can be seen from this table, the flows are equivalent for both the pre-project conditions and post-project conditions hydraulic models.

Table 4-1. Discharges Used in the Main Channel of the Hydraulic Model

Flow Change Location (HEC-RAS Cross-Section ID Number)	Pre-project Conditions Discharge (cfs)	Post-project Conditions Discharge (cfs)
203.48 (River: Salt, Reach: Salt)	162,000	162,000
199.47 (River: Gila, Reach: Lower Gila)	227,000	227,000
1.67 (River: Gila, Reach: Upper Gila)	65,000	65,000

As expected, the post-project conditions HEC-RAS model delivered by the LACOE used the hydrology originally delivered to the LACOE as part of the PED model deliverable, which are slightly different that the FIS flows. Therefore, the current flows in the HEC-RAS model are 162,000 cfs in the Salt River, 65,000 cfs in the Upper Gila, and 227,000 cfs in the Lower Gila. These flows may be changed in the final hydraulics model to reflect the FIS flows (164,000 cfs in the Salt River, 227,000 cfs in the Lower Gila River, and 63,000 cfs in the Upper Gila River); however, the calculated freeboard might be slightly less with a flow of 164,000 cfs in the Salt River. On the other hand, using the original flow value of 162,000 cfs as per the PED model could cause consternation with FEMA during the review process. The decision was made by the DISTRCT to request that FEMA update the hydrology in the FIS to the hydrology reported in the PED report. Since the flow rates are based on the same report (Section 7 Study), this hydrology update should be trivial.

4.2 Hydrology for the interior drainage features has been completed by the LACOE and will not require further review or updating by WEST for this project. Documentation will be provided in the TDN appendix D.

TASK 5 - FLOODPLAIN/FLOODWAY RE-DELINEATION

5.1 Method Description

Floodplain/Floodway re-delineations will be conducted using methodology outlined by FEMA. The LACOE will prepare the floodplain/floodway delineations using the guidelines established in FEMA's most current Guidelines and Specifications for Flood Hazard Mapping Partners, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993 WEST will verify that the LACOE floodplain mapping meet FEMA's guidelines. Several hydraulic models for the Tres Rios North Levee project area will be required for the TDN/LOMR request package The first model is the effective Flood Insurance Study (FIS) HEC-RAS model (Michael

Baker, 1999); the other models either will be developed by LACOE using HEC-RAS version 4.1. Following is a brief description of the hydraulic models necessary for the TDN/LOMR package that the LACOE will provide:

1. Effective Model. The existing Michael Baker FIS HEC-RAS, version 2.1, model generated through DISTRICT contract FCD 92-01.

2. Duplicate Effective Model. The effective HEC-RAS model run in HEC-RAS version 4.1 with modifications made to duplicate the hydraulics and water surface elevations of the original FIS HEC-RAS, version 2.1, model. An encroached version of this model was also created.

3. Corrected Effective Model. The duplicate effective model with corrections made to roughness parameters, structure data, ineffective flow areas, and other parameters which appeared to be outdated or otherwise incorrect in the effective model. An encroached version of this model was created. (*NOTE: This model may or may not be necessary for the final LOMR depending on the differences between the duplicate effective model and the pre-project conditions model.*)

4. Pre-project Conditions Model. A hydraulic model using the 1-foot and 4-foot merged topography obtained from photogrammetric methods. This model was based on the 2001 topography and does not include any of the constructed Tres Rios North Levee project features.

5. Post-project Conditions Model. A hydraulic model with the constructed Tres Rios North Levee project features. This model has been developed using the most recent topography plus the As-Built plans of the levee and other project features such as the overbank wetlands (OBW) near 9^{1st} Avenue. An additional post-project conditions model showing a "without OBW embankment" scenario will be required for the LOMR submittal as well.

More details for all models can be found in the attached Summary Report, Section 5 Hydraulics, by WEST, March 2011.

The DISTRICT may authorize WEST to complete any or all of the above models should LACOE be unable to fulfill these requirements.

5.2 Study Documentation

WEST will prepare the study documentation (i.e., the TDN) using the guidelines established in FEMA's most current Guidelines and Specifications for Flood Hazard Mapping Partners, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993., and, if applicable, FEMA 265, *Managing Floodplain Development in Approximate Zone A Areas*, April 1995. The mapping scale shall be as approved by the DISTRICT.

5.3 Field Reconnaissance

WEST will conduct a field reconnaissance of the study area. This may include but is not limited to observation of channel and floodplain conditions for validating Manning's "n" values; photographic documentation of floodplain characteristics; determination of channel bank characteristics; observation of possible overflow areas; observation of levees or other flood control structures. The DISTRICT will be given notice and invited to this field trip.

5.4 WEST will review the work maps provided by the LACOE for conformance to FEMA and DISTRICT standards. WEST may modify the work maps if it is found they have deficiencies, with approval from the DISTRICT.

5.5 The findings of the floodplain delineation study will be presented in Section 5 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT standards, following SSA 1-97 format.

5.6 WEST will check the hydraulic modeling for deficiencies and will correct them with approval from the DISTRICT.

5.7 WEST shall assist the DISTRICT and the LACOE in their work to fill out all the forms required by FEMA for the submittal of a Floodplain and Floodway Re-delineation Study.

5.8 WEST may assist preparing draft FIS Report data consisting of applicable tables, annotated FIRM panels, and RASPLOT used to generate flood profiles, with approval from the DISTRICT. The profiles should be submitted in dxf format also.

TASK 6 - DIGITAL DATA

Digital data shall be delivered by WEST in accordance with the Data Delivery Modified Shape File Specifications Version 1.2. Preliminary floodplains must be delivered to the DISTRICT at the time the study TDN is ready to be mailed to FEMA for review. After review, this preliminary data will be included on the pending floodplain layer in the DISTRICT's database. The following files are required at the time of FEMA submittal for placement on the pending layer:

- PRJ: Project Boundary
- PRJDAT: Project Identification
- DQ: Data Quality
- FPZNFCD: Floodplain Zones

The following themes will be required from WEST before FEMA submittal:

- NDXPRJ: Map Sheet Index
- FPSRFFCD: Water Surface Elevation / Base Flood Elevation
- FPXFCD: Cross Sections
- FPBLN: Hydraulic Baseline

The HEC-RAS Report file, for which the flow distribution option has been turned on, must accompany the above files.

Files listed below could be developed by WEST for a Floodplain Delineation Study. Only those themes for which there is new data need to be delivered to the DISTRICT. If WEST has data that does not fit one of the themes listed, the DISTRICT's Project Manager shall be contacted to determine the appropriate theme for that data.

- CARTO: (Cartographic Features) (separate submittals for Mapping and Flood Delineation)
- CORNERS: (if any)
- CTRL: (Miscellaneous Control Survey Points)
- LNDUSECUR: (Current Land Use)
- STRCT: (Structure)
- FPCTLFCD: (FCD Reference Marks)
- CNL: (Canal System, if any)
- RR: (Railroad System, if any)
- STRTDTL: (Street Detail)

- ELV: (Elevation (Land))
- CULVERTS: (if any)
- LAKE: (if any)
- RIVER: (if any)

TASK 7 – DELIVERABLES AND THE FEMA SUBMITTAL

7.1 Both paper and digital deliverables will be provided for each review and at the completion of each task.

7.2 **FEMA Submittal:** WEST will work with the LACOE to ensure they submit the following items to the DISTRICT for review by FEMA and any other appropriate governmental agency within three hundred sixty-five (365) calendar days from the Notice to Proceed (NTP).

All of the following products are considered deliverables for the FEMA submittal:

7.2.1 Two (2) complete sets of black line paper topographic base maps with the floodplain delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). A specific statement as to what service each registrant performed may be required.

7.2.2 Two (2) complete copies of the Technical Data Notebook, including completed FEMA forms, annotated Flood Insurance Rate Maps showing the proposed delineation, and HEC-RAS input/output files on disks. The Technical Data Notebook will be prepared and organized in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97).

7.3 Response to FEMA Comments: WEST will assist the DISTRICT and the LACOE respond to comments from FEMA and assist with providing any additional/revised material necessary to address FEMA's comments.

TASK 8 - FINAL DELIVERABLES

8.1 The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued. These products may be provided by WEST but should be provided primarily from the LACOE:

8.1.1 Any revised floodplain/floodway delineation data in conformance with the DISTRICT's CADD Data Delivery or modified Shape file Specifications.

8.1.2 Three (3) complete copies of the Technical Data Notebook including HEC-RAS input/output files, final study work sheets, and the report in pdf on disks. This submittal of the Technical Data Notebook shall include any correspondence and/or meeting minutes with the reviewing agencies and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, addressing FEMA's comments, modifications to the delineation maps, the HEC-RAS models, and/or the Final Report.

FLOOD CONTROL DISTRICT of
Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

Notice to Proceed

To: Brian Wahlin, Vice President
WEST Consultants, Inc.
8950 South 52nd Street, #210
Tempe, AZ 85284

November 10, 2011

Subject: PCN: 126.01.31
FCD Contract No: 2010C027
Low Org: 6975
Assignment Number: 6, Amendment A
Tres Rios Levee Floodplain and Floodway Re-delineation Project

Your not-to-exceed cost estimate of [redacted] for Assignment No. 6, Amendment A has been received and accepted for this project with a completion date of 3/29/2013. Total work assignment amount not-to-exceed [redacted]. You are hereby authorized to proceed with the work for the referenced project as originally described in the Scope of Work. Please specify the contract title, contract number, assignment number, and the dates of the completed service on all related correspondence, including the invoice. Send the invoices and certificates of performance to the attention of Finance Department, Flood Control District of Maricopa County. The certificate of performance must be dated on or after the final invoice date and must accompany the final invoices.

The purpose of this work assignment is to collect and develop project data for a technical data notebook and LOMR request package to update the Zone AE floodplain and floodway delineations of the Gila River in context with the USACE Tres Rios Levee and attendant Phase I features. The location of this project is roughtly from 91st avenue extending westward to 123rd avenue along the Gila River alignment, a distance of nearly six (6) miles. The project data will be collected, reviewed, and organized to provide a LOMR request package that will be submitted to FEMA for mapping changes. All work will proceed as described in the attached Scope of Work and with reference to the attached Summary Report.

The fees for this work are being increased by approximately [redacted] for the Consultant to provide coordination and study technical data production in a compressed time frame. Whereas the original work was to collect, review, organize, and assist in the finalization of materials produced by the LACOE so that they could provide a LOMR request package, this amendment is for production of the bulk of study materials by the Consultant for a Physical Map Revision (PMR), to be performed locally through the Cooperating Technical Partner (CTP) program the District has with FEMA. This additional work has already been addressed as contingency in the existing work assignment Scope of Work. Therefore the Scope of Work will not need to be updated.

If at any time during the project assignment a material change in the scope of services to be provided occurs, causing an increase in the original cost estimate shown here, you must provide the District with a written explanation of the additional work along with an estimate of additional costs. No additional work shall commence prior to written authorization by the District. No claims for additional work shall be accepted that have not received prior District approval.

SIGNED:

Richard Harris, P.E., CFM Project Manager	Timothy S. Phillips P.E. Chief Engineer and General Manager

FLOOD CONTROL DISTRICT of
Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

Notice to Proceed

To: Brian Wahlin, Vice President
WEST Consultants, Inc.
8950 South 52nd Street, #210
Tempe, AZ 85284

April 5, 2012

Subject: PCN: 126.01.31
FCD Contract No: 2012C005
Low Org: 6975
Assignment No: 1
The BFC/SAT Data Incorporation for the Tres Rios North Levee FDS with EAP Updates

Your not-to-exceed cost estimate of [redacted] for Assignment No. 1 has been received and accepted for this project with a completion date of 3/21/2014. Total work assignment amount not-to-exceed [redacted]. You are hereby authorized to proceed with the work for the referenced project as originally described in the Scope of Work. Please specify the contract title, contract number, assignment number, and the dates of the completed service on all related correspondence, including the invoice. Send the invoices and certificates of performance to the attention of Finance Department, Flood Control District of Maricopa County. The certificate of performance must be dated on or after the final invoice date and must accompany the final invoices.

Work will include incorporating the Buckeye Feeder Canal/Sunland Avenue Tributary FDS data from the Durango ADMP with the developing Tres Rios North Levee (TRNL) FDS Data, and updating the attendant Emergency Action Plan. These activities are necessary to complete floodplain and floodway Study Data documentation. Once completed, the documentation will be submitted to FEMA for processing map changes in context with the Levee structure.All tasks will be completed within the existing project schedule (reference work assignment #6 and associated Amendment A of contract FCD 2010C027).

If at any time during the project assignment a material change in the scope of services to be provided occurs, causing an increase in the original cost estimate shown here, you must provide the District with a written explanation of the additional work along with an estimate of additional costs. No additional work shall commence prior to written authorization by the District. No claims for additional work shall be accepted that have not received prior District approval.

Richard Harris, P.E., CFM
Project Manager

Timothy S. Phillips, P.E.
Chief Engineer and General Manager

EXHIBIT A

GENERAL SCOPE OF WORK

CONTRACT FCD 2012C005
Assignment # 1

The BFC/SAT FDS Data Incorporation for the Tres Rios Levee Zone AE Floodplain and Floodway Re-delineation Study, with EAP Updates

EXHIBIT A

GENERAL SCOPE OF WORK

CONTRACT FCD 2012C005 Work Assignment #1

The purpose of this work assignment is to define CONSULTANT (WEST) additional services for collecting, reviewing, and organizing data from the U.S. Army Corps of Engineers, Los Angeles District (LACOE) in context with developing a Technical Data Notebook (TDN) and Letter of Map Revision (LOMR) request package for submittal to the Federal Emergency Management Agency (FEMA), that will result in a re-delineation of the Salt River and Gila River Floodplain and Floodway from approximately 91st Avenue to 123rd Avenue. The floodplain is being modified as a result of the construction of the Tres Rios North Levee (TRNL). This work assignment extends the original work assignment from Contract FCD 2010C027 Work Assignment #6 to cover additional tasks not covered in the original scope of work.

The new tasks are a result of the Buckeye Feeder Canal (BFC) and Sunland Avenue Tributary (SAT) floodplains that were recently discovered underneath the Salt/Gila River floodplain. After removing the Salt/Gila River floodplain behind the TRNL, the BFC and SAT floodplains will remain. Modeling efforts are needed to tie in the effective BFC model to the Salt/Gila floodplain and to create new work maps showing the BFC and SAT floodplains after the removal of the Salt/Gila floodplain.

All work must meet the requirements of the DISTRICT's Consultant Guidelines most current edition. All work must also meet the latest versions of the Arizona Department of Water Resources (ADWR) Standards and FEMA) Guidelines and Specifications for floodplain delineations. Prior to the finalization of this assignment all items called for in this Scope of Work must be delivered, reviewed, and approved by the DISTRICT.

All work must be completed within seven hundred and nine (709) calendar days from the Notice to Proceed (NTP) which includes one hundred and twenty (120) days for DISTRICT reviews and three hundred forty-four (344) days for FEMA reviews. WEST shall have the final study results ready for submittal to FEMA within three hundred sixty-five (365) calendar days from the Notice to Proceed (NTP).

TASK 1 – COORDINATION

WEST will participate in regular coordination meetings with the DISTRICT (at least monthly) and attend teleconference call meetings with the LACOE every three weeks, or be granted any exception to skip a meeting and/or call from the DISTRICT. Monthly coordination meetings can be by phone if pre-authorized by the DISTRICT, and may double along with teleconference calls to the LACOE staff and other associated parties. WEST is responsible for the minutes of any meetings. Draft meeting minutes must be prepared and delivered to the DISTRICT within 7 calendar days of all meetings.

WEST will submit monthly progress reports at least five (5) days before submittal of monthly invoices. The report shall be brief and should be no longer than two (2) typed pages. Earned Value reporting is recommended to track progress throughout the project. At a minimum, the monthly report shall contain the following:

A description of the work accomplished by task during the reporting month.
Percent (%) completed for the period and percent (%) cumulative completed for each task.

A brief description of the work to be accomplished in the following month.
A description of any problems encountered.

WEST will review the technical data regarding the BFC and SAT provided by FEMA and the DISTRICT and make recommendation to the DISTRICT regarding the level of Public Information that will be required. Both the DISTRICT and WEST will work cooperatively drafting notification documents. The DISTRICT will be responsible for notification mailing and placing any legal advertising required for the study. The legal advertisement will be run once in a widely circulated newspaper. A display advertisement will also be run once in a local newspaper that serves the area being studied, if one is available. After the ads run in the newspapers, the DISTRICT will provide WEST with the original affidavits of publication for inclusion in the Technical Data Notebook (TDN). The DISTRICT also will be responsible for placing any legal advertisements for public open house meetings.

The DISTRICT has prepared a separate set of guidelines for consultants on conducting public involvement and public information activities for the DISTRICT. A copy of these guidelines is available from the DISTRICT Public Information Office and shall be used by WEST when preparing public information related materials.

WEST shall help to plan and conduct public involvement and prepare information as required for the public involvement activities and in accordance with the DISTRICT's Public Involvement and Information Guidelines.

The DISTRICT will create a critical path calendar for planning one (1) public open house meeting. The public meeting will be held at the end of the study, but prior to the submittal to FEMA, and will present the final results of the study. The meeting will be held at a location either within the study area or very near the study area based upon available accommodations. At least two (2) representatives from WEST will attend the public meeting. For the open house meeting, the DISTRICT will secure the public meeting venue and certificate(s) of insurance.

The DISTRICT will generate mailing lists of the residents and property owners that will be affected by the study results once the results become available.

WEST shall provide the preliminary language for inclusion in a brochure mailing that will be developed by the DISTRICT. A Notification of Study Results brochure mailing will notify affected property owners of the study results and to provide invitations to the public meeting.

The DISTRICT will prepare (design) the format of the mailing described in Task 1.10. The Notification of Study Results brochure will be mailed out after the DISTRICT has approved draft floodplains. The DISTRICT will be responsible for mailing out the brochure.

The DISTRICT may post the Notification of Study Results brochure and any other project documentation on the DISTRICT web site.

WEST shall also be responsible for providing PDF images of the study area to be used as downloadable documents on the project page within the Projects and Structures section of the DISTRICT Web site. The DISTRICT shall post the images and project information on the web site.

WEST shall be responsible for producing a minimum of two (2) study area display exhibit boards for the public open house meeting. The board size shall be 24" x 36" or 36" x 48". The display exhibit board format shall conform to the DISTRICT consultant guidelines (see Task 1.6). The DISTRICT shall be responsible for mounting the displays exhibits and providing sign-in sheets, comment sheets, name tags for staff, and any additional handouts regarding the study at the meeting. Additionally, Google Earth visualization could be provided by WEST to show residents very detailed views of their parcels with the effective and updated mapping products at the public open-house meeting.

Performance Evaluations will be performed by both the DISTRICT and WEST at the completion of the project.

TASK 2 - FLOODPLAIN RE-DELINEATION

Method Description

Floodplain re-delineations will be conducted using methodology outlined by FEMA. WEST will prepare the floodplain delineations using the guidelines established in FEMA's most current Guidelines and Specifications for Flood Hazard Mapping Partners, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993. Several hydraulic models for the BFC will be required for the TDN request package. These models may include the effective model, the duplicate effective model, the corrected effective model, the pre-project model, and the post-project model. No floodway was created in the effective BFC model, so none will be created for project.

Additional work on the Salt/Gila River models is also needed. With the inclusion of the BFC/SAT models, the right overbank model of the Salt/Gila River models need to be updated using the topography from the BFC/SAT models. In addition, the TRNL was raised at the downstream end. The model needs to be modified to reflect this new condition. Finally, the Emergency Action Plan will be updated based on the raised levee and additional comments from the LACOE.

Study Documentation

WEST will append the TRNL TDN with the appropriate information regarding the BFC model and floodplain using the guidelines established in FEMA's most current Guidelines and Specifications for Flood Hazard Mapping Partners, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993., and, if applicable, FEMA 265, *Managing Floodplain Development in Approximate Zone A Areas*, April 1995. The mapping scale shall be as approved by the DISTRICT.

WEST will create the work maps for the BFC/SAT floodplains for conformance to FEMA and DISTRICT standards.

The findings of the floodplain delineation study will be presented in Section 5 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT standards, following SSA 1-97 format.

WEST will prepare the draft FIS report data consisting of applicable tables, annotated FIRM panels, and RASPLOT used to generate flood profiles, and will continue providing updated materials until given approval from the DISTRICT. The profiles should be submitted in dxf format also.

TASK 3 - DIGITAL DATA

Digital data shall be delivered by WEST in accordance with the Data Delivery Modified Shape File Specifications Version 1.2. Preliminary floodplains must be delivered to the DISTRICT at the time the study TDN is ready to be mailed to FEMA for review. After review, this preliminary data will be included on the pending floodplain layer in the DISTRICT's database. The following files are required at the time of FEMA submittal for placement on the pending layer:

PRJ: Project Boundary
PRJDAT: Project Identification
DQ: Data Quality

FPZNFCD: Floodplain Zones

The following themes will be required from WEST before FEMA submittal:

NDXPRJ: Map Sheet Index
FPSRFFCD: Water Surface Elevation / Base Flood Elevation
FPXFCD: Cross Sections
FPBLN: Hydraulic Baseline

The HEC-RAS Report file, for which the flow distribution option has been turned on, must accompany the above files.

Files listed below could be developed by WEST for a Floodplain Delineation Study. Only those themes for which there is new data need to be delivered to the DISTRICT. If WEST has data that does not fit one of the themes listed, the DISTRICT's Project Manager shall be contacted to determine the appropriate theme for that data.

CARTO: (Cartographic Features) (separate submittals for Mapping and Flood Delineation)
CORNERS: (if any)
CTRL: (Miscellaneous Control Survey Points)
LNDUSECUR: (Current Land Use)
STRCT: (Structure)
FPCTLFCD: (FCD Reference Marks)
CNL: (Canal System, if any)
RR: (Railroad System, if any)
STRTDTL: (Street Detail)
ELV: (Elevation (Land))
CULVERTS: (if any)
LAKE: (if any)
RIVER: (if any)

TASK 4 - FINAL DELIVERABLES

The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued:

Any revised floodplain/floodway delineation data in conformance with the DISTRICT's CADD Data Delivery or modified Shape file Specifications.

Four (4) complete copies of the Technical Data Notebook including HEC-RAS input/output files, final study work sheets, and the report in pdf on disks. This submittal of the Technical Data Notebook shall include any correspondence and/or meeting minutes with the reviewing agencies and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, addressing FEMA's comments, modifications to the delineation maps, the HEC-RAS models, and/or the Final Report.

Appendix B: General Documentation and Correspondence

B.6 Public Notices

AFFIDAVIT OF PUBLICATION
SALT/GILA RIVER RE-DELINEATION

01

Arizona Business Gazette
The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7315 FAX (602) 444-7364

ANNOUNCEMENT OF INTENT TO PERFORM A FLOODPLAIN AND FLOODWAY RE-DELINEATION STUDY OF THE SALT AND GILA RIVERS

The Flood Control District of Maricopa County (FCDMC) has contracted with WEST Consultants, Inc., to prepare a study documentation package of detailed floodplain and floodway re-delineations for portions of the Salt River and Lower Gila River system, from above the confluence of the Gila and Salt rivers downstream to near the confluence of the Gila and the Agua Fria rivers. The study area is located in the central part of Maricopa County, extending roughly from 83rd Avenue to 133rd Avenue, between the alignments of Southern Avenue and Indian Springs Road. The study will re-evaluate flood hazard boundaries in relation to the newly constructed U.S. Army Corps of Engineers' Tres Rios North Levee that runs along the northern embankment of portions of the Salt River and Lower Gila River systems from 105th Avenue to 123rd Avenue. Updated flood hazard boundaries will then be used to determine the flood insurance rates used by the Federal Emergency Management Agency (FEMA).

This announcement is intended to inform all interested persons and communities of the commencement of this study so they may have an opportunity to bring any relevant technical information to the attention of the FCDMC/FEMA to be considered during the course of this study. Your comments should be addressed to Mr. Richard P. Harris, P.E., at the Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, AZ 85009; (602) 506-4526; e-mail: rph@mail.maricopa.gov; or for more general information, please visit: www.fcd.maricopa.gov.

In The Superior Court of the State of Arizona

Published: June 9, 2011

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

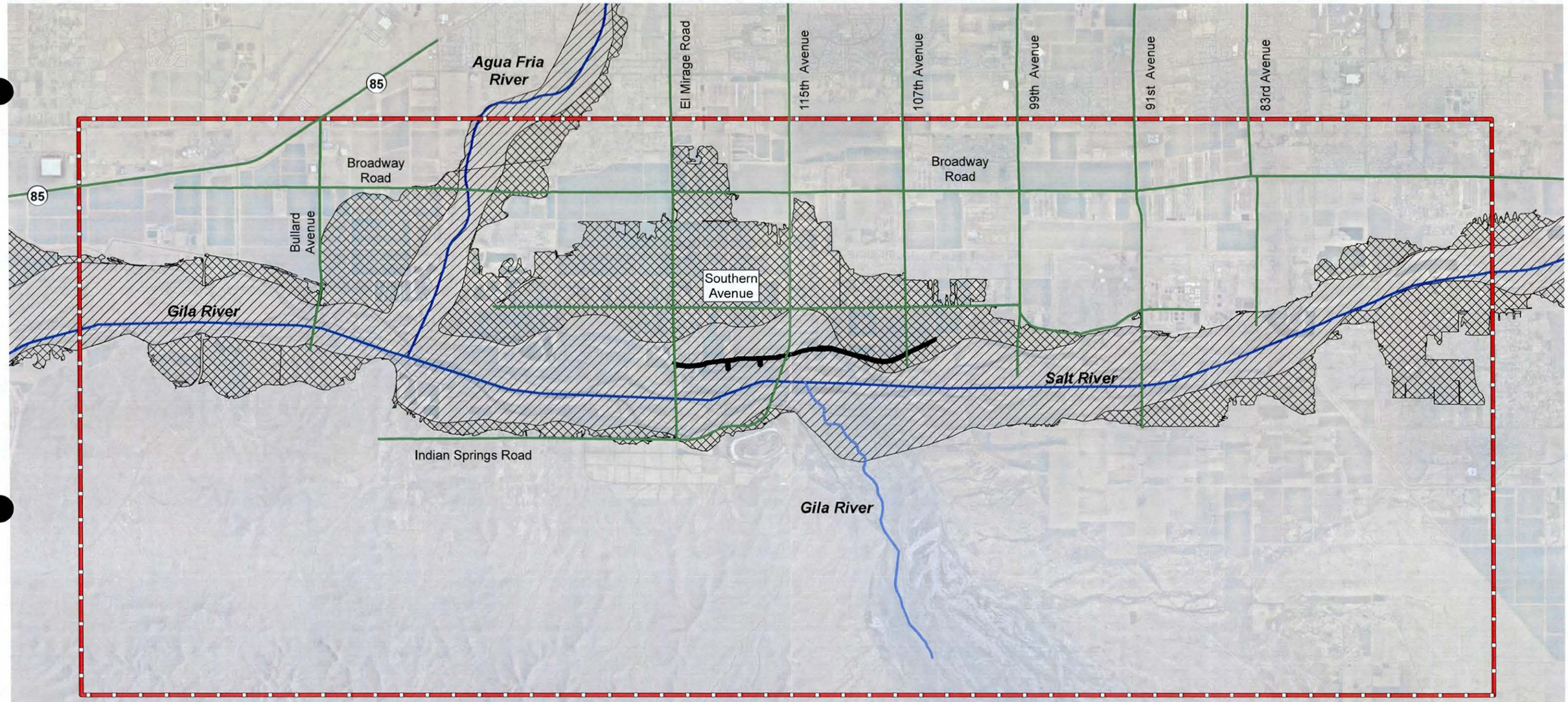
Mark Gilmore, being first duly sworn, upon oath deposes and says: That he is the Legal Ad Rep of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published weekly at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates indicated.

6/9/2011

Sworn to before me this
9TH day of
JUNE 2011

BRIAN BILLINGS
Notary Public - Arizona

Notary Public



Legend

- Major Cross Streets
- Tres Rios North Levee Alignment
- Right-of-Entry Boundaries
- FEMA River Centerlines
- FEMA Effective Floodplain
- FEMA Effective Floodway

Right-of-Entry for Surveying and Reconnaissance Purposes

The boundary shown on this graphic is intended to inform you that, if your property falls within this boundary, it may be necessary for the Flood Control District of Maricopa County to briefly enter or cross your property to perform surveying and reconnaissance activities in support of the floodplain and floodway re-delineation study of the Salt and Gila Rivers for the Tres Rios North Levee project. This activity should not result in any inconvenience to you or damage to your property.

0 0.5 1 2 3 4 Miles

N

Flood Control District of Maricopa County

Salt and Gila Rivers Floodplain and Floodway Re-Delineation Study Tres Rios North Levee

Appendix B: General Documentation and Correspondence

B.7 FEMA Correspondence

Appendix C: Survey Data and Field Notes

C.1 Aerial Mapping

Subject: Mapping of Tres Rios

In regards to the Tres Rios mapping of 2001 for the Corps of Engineers performed by our contractor Towill. This survey was performed for engineering design purposes. A review of the final product by the Corps of Engineer's Survey Section for the Los Angeles District determined that the mapping met National Map Accuracy Standards for one foot contour interval mapping.

Horizontal coordinates are referenced to the North American Datum of 1983 (NAD83), Arizona Central Zone, epoch 1992. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88).

National Geodetic Vertical Datum of 1929 elevations on NGS benchmarks with NAVD 88 elevations were determined by holding the datum shift of 2.19' at the project benchmark to each NGS benchmark.

Mapping was compiled in NGVD 29.

Harvey W. Beverly 1/5/2011

Harvey W. Beverly
Chief, Survey Section (Retired 2003)
Los Angeles District
Corps of Engineers

TRES RIOS DTM MAPPING CHECK REPORT

This report is to confirm the quality of existing aerial mapping in the vicinity of Southern Avenue and Avondale Road at or near Section 36 Township 1 North, Range 1 West and Section 31 of Township I North Range 1 East of the Salt River Meridian, Maricopa County, Arizona. The mapping checks were conducted on March 20, 2012 with a Trimble R8 and 5800 Rover with AZGPS virtual reference base station. Profiles were conducted along the major roads and various random points collected in the adjacent fields and streets. The total sampling involved 64 points with 36 being the road ways and 28 randomly selected on natural ground. All data was collected on Arizona State Plane Coordinate System Central Zone of 1983, 1992 epoch. Vertical values were collected in NAVD 1988 and converted to NGVD 1929 by Vertcon with a value of -2.18.

The computed RMSE of the points tested was 0.43.

John R. Stock, RLS, CFM
Chief Surveyor FCD

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
25087
JOHN R.
STOCK
Date Signed 3/22/12
ARIZONA U.S.A.

Expires 6/30/13

Report Created: 3/20/2012
Time: 3:42pm

Project Uni Imperial TOL1= 0.67
DTM Name Default TOL2= 0.1

POINT	X	Y	Field Z	DTM Z	Z Diff	-2.18	Diff squared
300	585431.1	870317.4	953.75	951	2.76	0.58	0.3364
301	585050.9	869707.9	950.85	949.4	1.45	-0.73	0.5329
302	585107.8	870024.3	951.89	948.98	2.91	0.73	0.5329
303	585040.7	870485.1	950.68	948.76	1.92	-0.26	0.0676
304	584942.9	870858.4	949.32	946.75	2.57	0.39	0.1521
305	585277.4	871301.7	950.56	947.71	2.86	0.68	0.4624
306	585827.6	870376.3	952.34	949.65	2.68	0.5	0.25
307	584390.9	870366.8	949.63	947.88	1.75	-0.43	0.1849
308	583888.8	870544.4	947.85	945.39	2.46	0.28	0.0784
309	583746.1	870279.3	952.23	948.48	3.75	1.57	2.4649
310	583756.4	869487.3	948.31	946.35	1.95	-0.23	0.0529
311	583133.5	870341	948.93	946.81	2.12	-0.06	0.0036
312	582428.3	869506.7	946.93	943.93	3	0.82	0.6724
313	582477.1	870020.9	946.79	944.6	2.19	0.01	1.00E-04
314	582449.8	870252.8	949.34	946.45	2.89	0.71	0.5041
315	582150.6	870331.6	947.03	944.69	2.34	0.16	0.0256
316	583607.1	871199.7	946.25	944.12	2.13	-0.05	0.0025
317	582884.4	871206.9	945.47	943.47	2.01	-0.17	0.0289
318	581980	871210.7	944.44	941.68	2.76	0.58	0.3364
319	581301.1	871196.8	943.53	940.79	2.74	0.56	0.3136
320	582063.5	870574.8	945.57	943.11	2.46	0.28	0.0784
321	581375.8	870456.1	944.71	943.22	1.49	-0.69	0.4761
322	581192.1	870344.2	945.99	943.67	2.32	0.14	0.0196
323	581041.8	871190.6	942.67	940.61	2.06	-0.12	0.0144
326	580759.3	870379.7	944.82	942.13	2.69	0.51	0.2601
327	580342.3	870272.3	945.24	943.54	1.7	-0.48	0.2304
328	581095.3	870087.4	946.58	944.64	1.94	-0.24	0.0576

329	581255.5	869631.3	944.63	942.18	2.44	0.26	0.0676
A202	581131.9	871220.5	943.76	941.35	2.41	0.23	0.0529
A203	581132.1	871026.4	944.05	941.69	2.35	0.17	0.0289
A204	581131.3	870834.3	944.32	941.7	2.62	0.44	0.1936
A205	581131	870641.7	944.75	942.01	2.74	0.56	0.3136
A206	581130.2	870464.7	945.23	942.77	2.46	0.28	0.0784
A207	581128.2	870299.3	946.02	944.07	1.95	-0.23	0.0529
A208	581129.6	870126.2	947.4	945.38	2.02	-0.16	0.0256
A209	581129.7	869924.8	946.5	944.98	1.52	-0.66	0.4356
A210	581129.5	869711	946.33	944.71	1.63	-0.55	0.3025
A211	581127.1	869444	945.95	944.09	1.85	-0.33	0.1089
S101	580278.3	870291.1	945.06	943.35	1.72	-0.46	0.2116
S102	580478.9	870290	945.35	943.76	1.59	-0.59	0.3481
S103	580691.9	870288.6	945.71	943.79	1.92	-0.26	0.0676
S104	580948.1	870288.4	945.95	944.15	1.79	-0.39	0.1521
S105	581282.7	870280.5	946.66	944.23	2.43	0.25	0.0625
S106	581471.4	870284.3	947.05	944.53	2.52	0.34	0.1156
S107	581696.6	870288.7	947.31	944.78	2.53	0.35	0.1225
S108	581907	870291.9	947.59	945.16	2.43	0.25	0.0625
S109	582087.2	870294.2	947.87	945.78	2.09	-0.09	0.0081
S110	582301.8	870296.3	948.2	945.93	2.27	0.09	0.0081
S111	582496.5	870299.5	948.56	946.49	2.07	-0.11	0.0121
S112	582725.7	870302.1	948.94	946.83	2.11	-0.07	0.0049
S113	582963.5	870305.2	949.34	947.29	2.05	-0.13	0.0169
S114	583155.1	870307.3	949.73	947.56	2.17	-0.01	0.0001
S115	583387.9	870309.9	950.13	947.86	2.27	0.09	0.0081
S116	583624.1	870313.4	950.54	948.28	2.26	0.08	0.0064
S117	583849.8	870316.5	950.99	948.66	2.33	0.15	0.0225
S118	584082.4	870319.2	951.43	949.02	2.41	0.23	0.0529
S119	584293.3	870321.7	951.72	949.36	2.36	0.18	0.0324
S120	584522	870324.2	952.11	949.74	2.37	0.19	0.0361
S121	584769.8	870327.2	952.62	950.26	2.36	0.18	0.0324
S122	585032.9	870331.7	953.04	950.79	2.25	0.07	0.0049
S123	585260.6	870334.1	953.3	950.83	2.47	0.29	0.0841

S124	585512.7	870337.1	953.72	951.1	2.62	0.44	0.1936
S125	585696.3	870340.2	953.94	951.46	2.47	0.29	0.0841
S126	585903.9	870346.5	954.25	951.69	2.56	0.38	0.1444
							11.6943

Points Outside of DTM RMSE 0.43430144

324 325 A200 A201 S100 S127

Total Points Outside 7

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
25087
JOHN R.
STOCK
Date Signed 3/22/12
ARIZONA U.S.A.
Expires 6/30/13

Appendix C: Survey Data and Field Notes

C.2 Survey Data and Field Notes for Hydrologic Modeling

(None for this TDN)

Appendix C: Survey Data and Field Notes

C.3 Survey Data and Field Notes for Hydraulic Modeling

(None for this TDN)

Appendix D: Hydrologic Analysis Supporting Documentation

D.1 Precipitation Data

(None for this TDN)

Appendix D: Hydrologic Analysis Supporting Documentation

D.2 Physical Parameter Calculations

(None for this TDN)

Appendix D: Hydrologic Analysis Supporting Documentation

D.3 Hydrograph Routing Data

(None for this TDN)

Appendix D: Hydrologic Analysis Supporting Documentation

D.4 Reservoir Routing Data

(None for this TDN)

Appendix D: Hydrologic Analysis Supporting Documentation

D.5 Flow Splits and Diversions Data

(None for this TDN)

Appendix D: Hydrologic Analysis Supporting Documentation

D.6 Hydrologic Calculations

GILA RIVER BASIN

ARIZONA

SECTION 7 STUDY FOR MODIFIED ROOSEVELT DAM, ARIZONA

(THEODORE ROOSEVELT DAM)

HYDROLOGIC EVALUATION OF WATER CONTROL PLANS

SALT RIVER PROJECT TO GILA RIVER AT GILLESPIE DAM

U.S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

MARCH 1996

TABLE 2-4. DISCHARGE FREQUENCY VALUES
SALT RIVER AND GILA RIVER
RECOMMENDED PLAN (P6OP2) VERSUS W/O PROJECT

LOCATION		RETURN PERIOD						
		500-YR	200-YR	100-YR	50-YR	20-YR	10-YR	5-YR
PEAK DISCHARGES (ft^3/s) IN SALT RIVER AT:								
CP-40	W/P	250,000	210,000	175,000	150,000	100,000	60,000	22,000
	WO/P	360,000	290,000	245,000	175,000	141,000	102,000	45,000
CP-109	W/P	246,000	207,000	172,000	145,000	95,000	58,000	21,000
	WO/P	345,000	285,000	230,000	170,000	139,000	100,000	44,000
CP-110	W/P	243,000	204,000	169,000	140,000	90,000	55,000	20,500
	WO/P	330,000	275,000	215,000	160,000	135,000	93,000	40,000
CP-111	W/P	240,000	202,000	166,000	135,000	87,000	53,000	20,200
	WO/P	325,000	265,000	200,000	155,000	130,000	91,000	39,000
CP-112	W/P	237,000	200,000	164,000	132,000	84,000	51,000	20,000
	WO/P	315,000	255,000	190,000	150,000	126,000	90,000	38,000
CP-113	W/P	235,000	198,000	162,000	130,000	82,000	49,000	19,500
	WO/P	310,000	250,000	185,000	145,000	125,000	85,000	36,000
PEAK DISCHARGES (ft^3/s) IN GILA RIVER AT:								
CP-1310	W/P	285,000	243,000	227,000	185,000	92,000	57,000	23,500
	WO/P	360,000	295,000	250,000	200,000	135,000	95,000	40,000
CP-1216	W/P	270,000	225,000	210,000	160,000	68,000	46,000	17,000
	WO/P	350,000	290,000	245,000	195,000	133,000	88,000	39,000
CP-1217	W/P	270,000	220,000	203,000	153,000	67,000	42,000	15,000
	WO/P	340,000	280,000	240,000	190,000	129,000	82,000	38,000
CP-1218	W/P	270,000	215,000	195,000	145,000	65,000	38,000	12,000
	WO/P	335,000	277,000	235,000	186,000	124,000	78,000	37,000

DEFINITIONS:
W/P = Recommended Plan, P6OP2. WO/P = without project/existing conditions per 1982 CAWCS Hydrology Report, Table 23.
CP-40, at Granite Reef Dam
CP-109, at Gilbert Road
CP-110, at Tempe Bridge
CP-111, at Central Avenue
CP-112, at 67th Avenue
CP-113, above confluence with Gila River
CP-1310, below confluence with Salt River
CP-1216, below confluence with Waterman Wash
CP-1217, below confluence with Hassayampa River
CP-1218, at Gillespie Dam

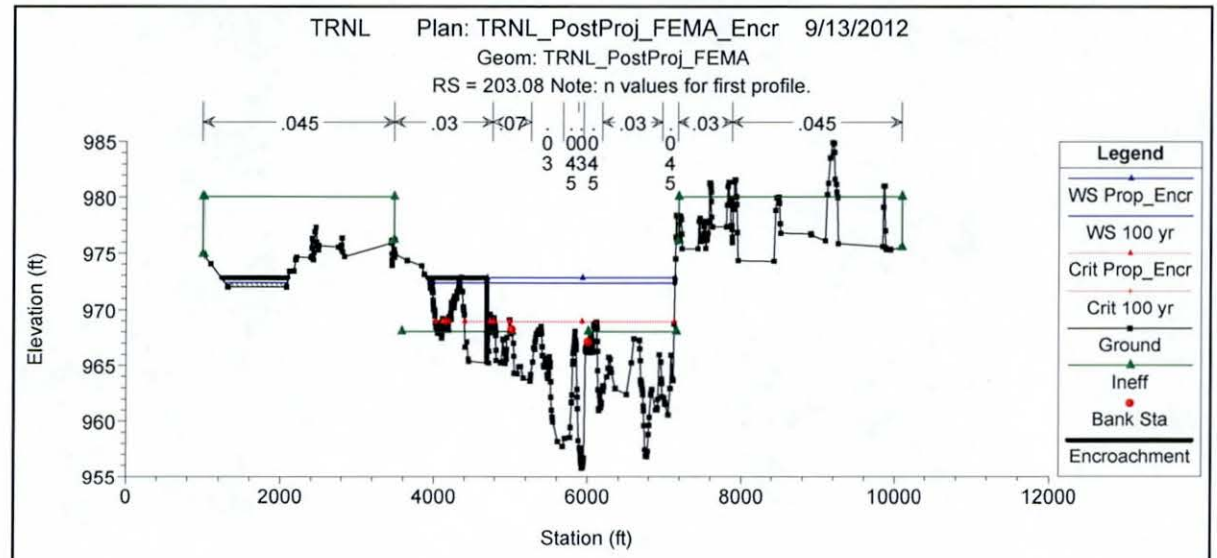
Appendix E: Hydraulic Analysis Supporting Documentation

E.1 Roughness Coefficient Estimation

(None for this TDN, Refer to the reports in Appendix E.5)

Appendix E: Hydraulic Analysis Supporting Documentation

E.2 Cross Section Plots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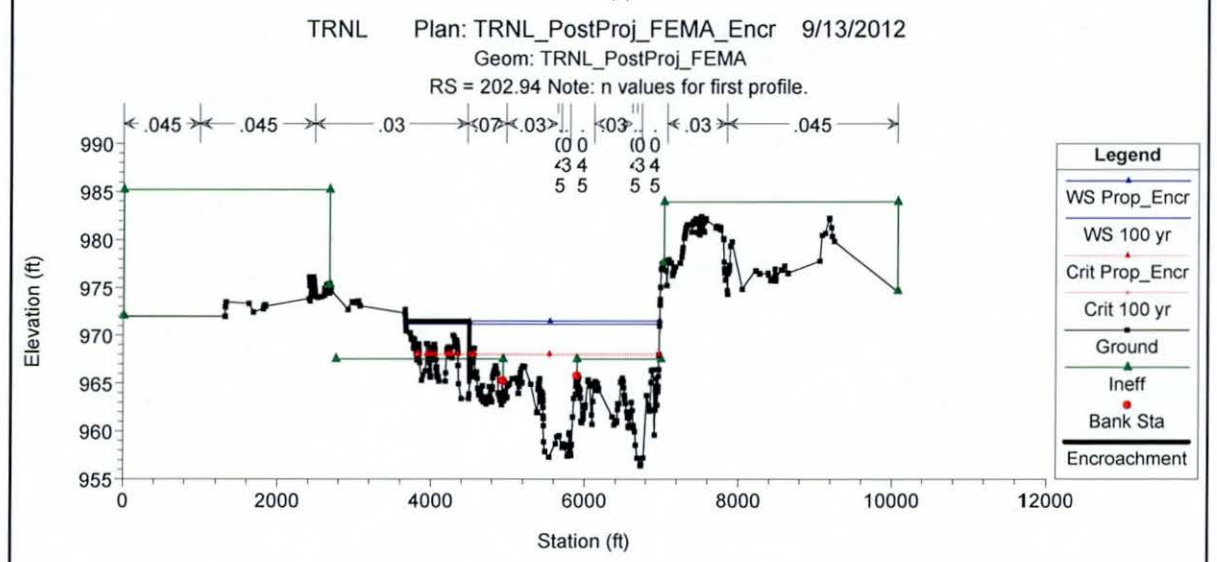
Crit Prop_Encr
Crit 100 yr
Ground
Ineff
Bank Sta
Encroachment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Crit 100 yr
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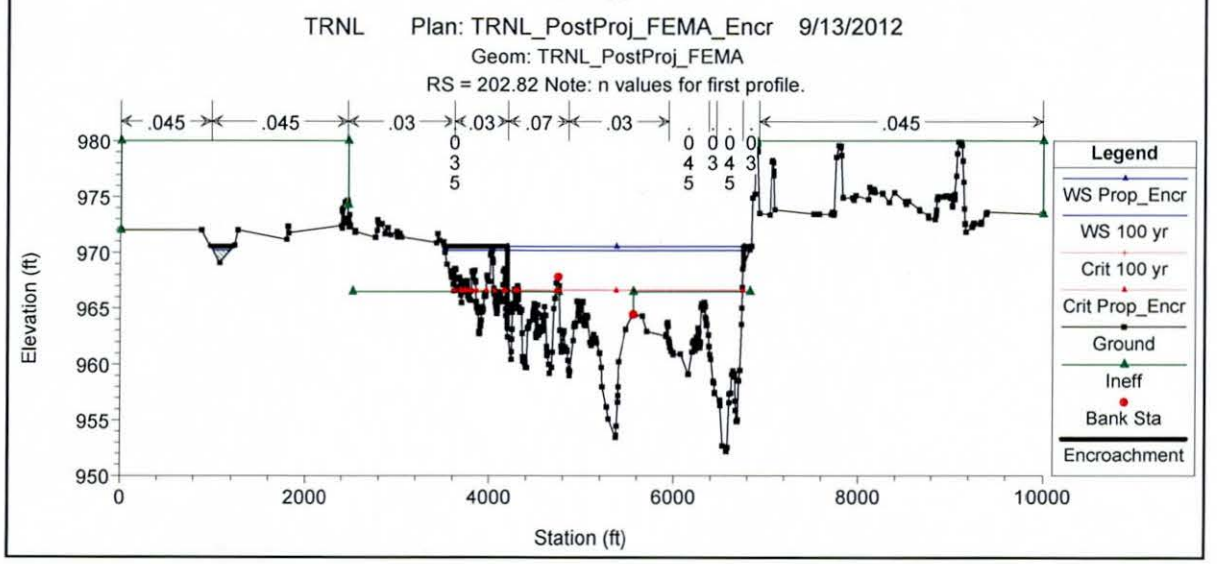
Bank Sta
Encroachment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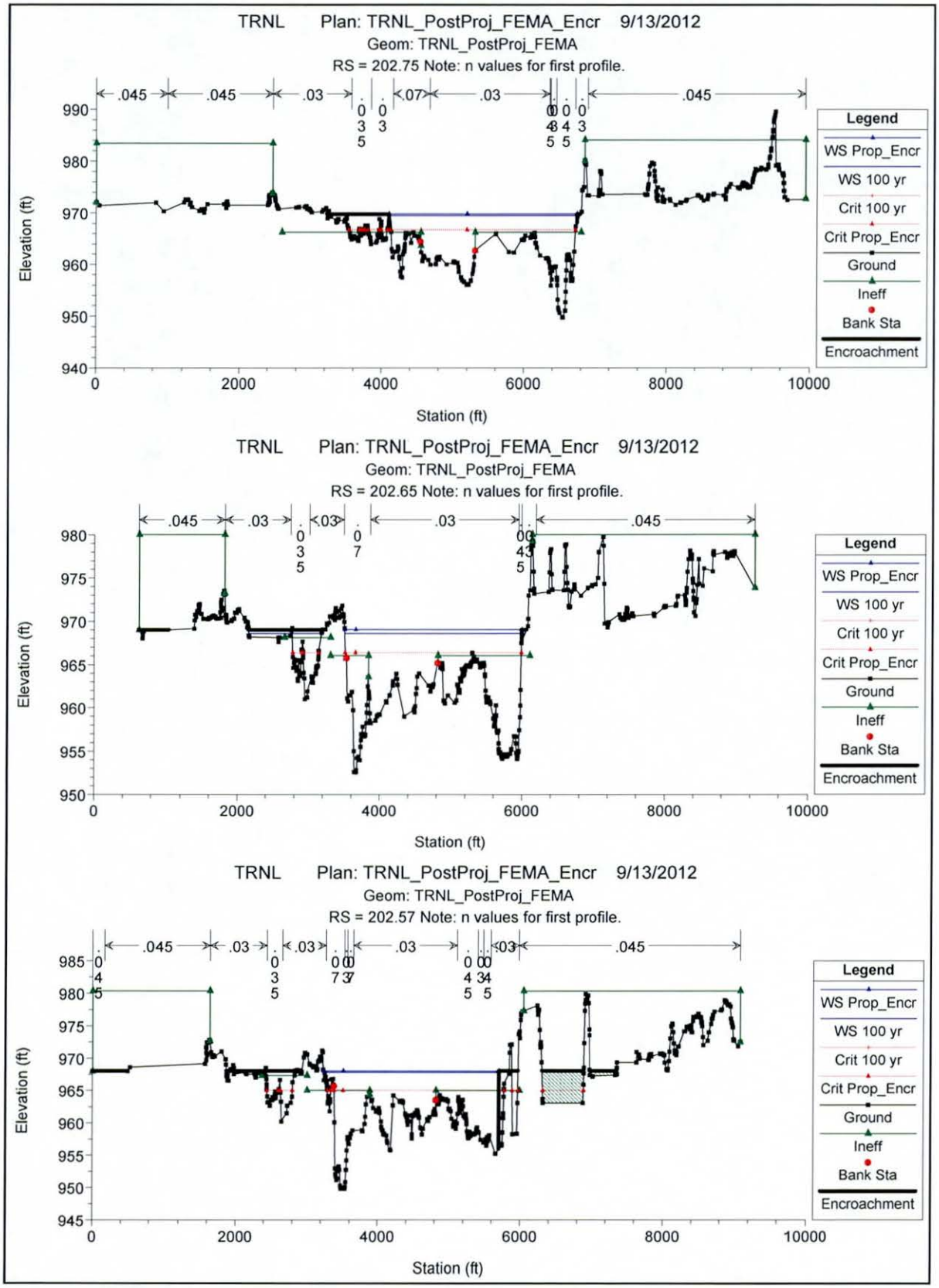
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment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Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
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Elevation (ft)
Station (ft)
Legend
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Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
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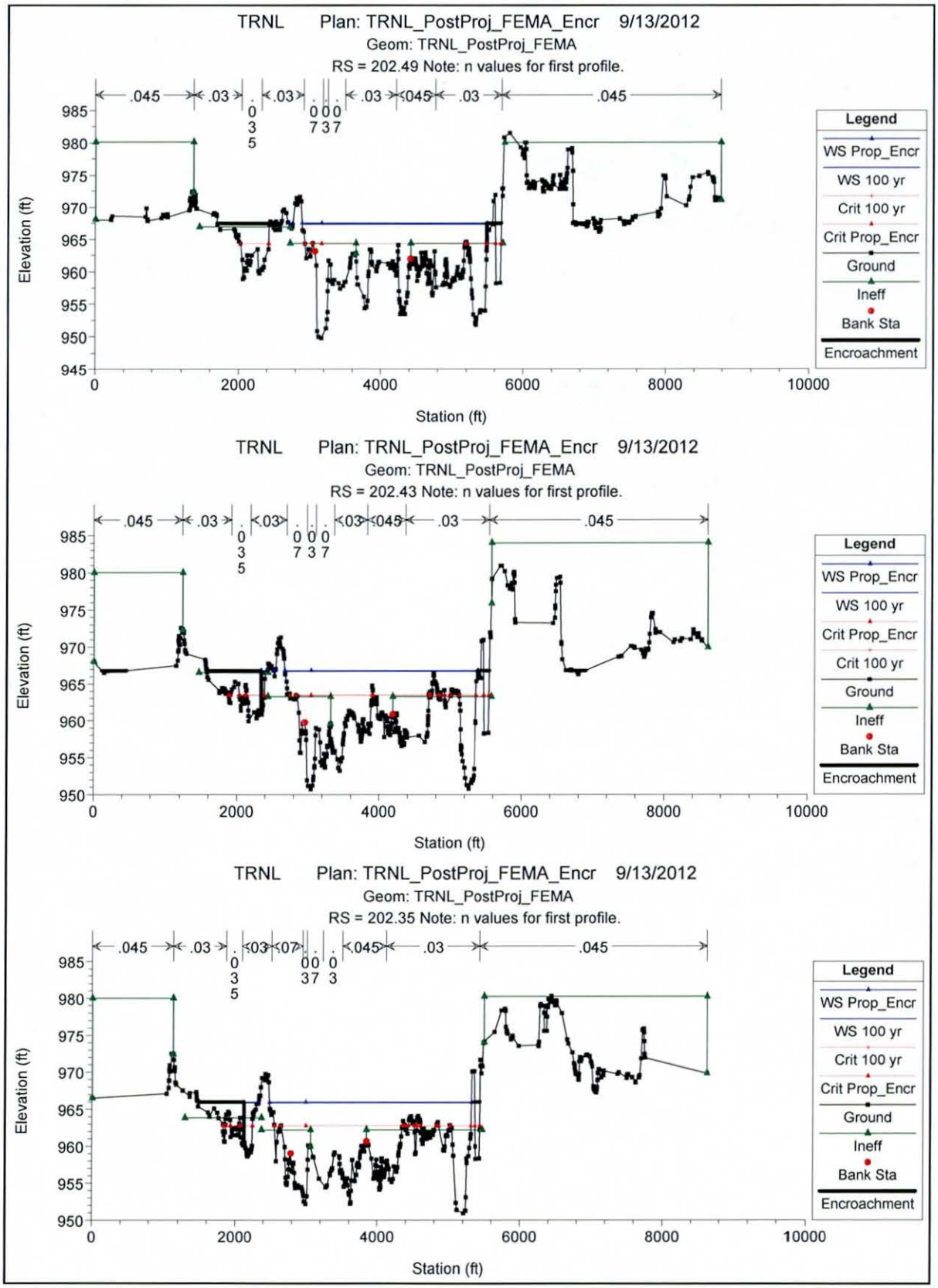
Bank Sta
Encroachment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Station (ft)
Legend
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WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
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Station (ft)
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WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Ineff
Bank Sta
Encroachment
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Crit 100 yr
Crit Prop_Encr
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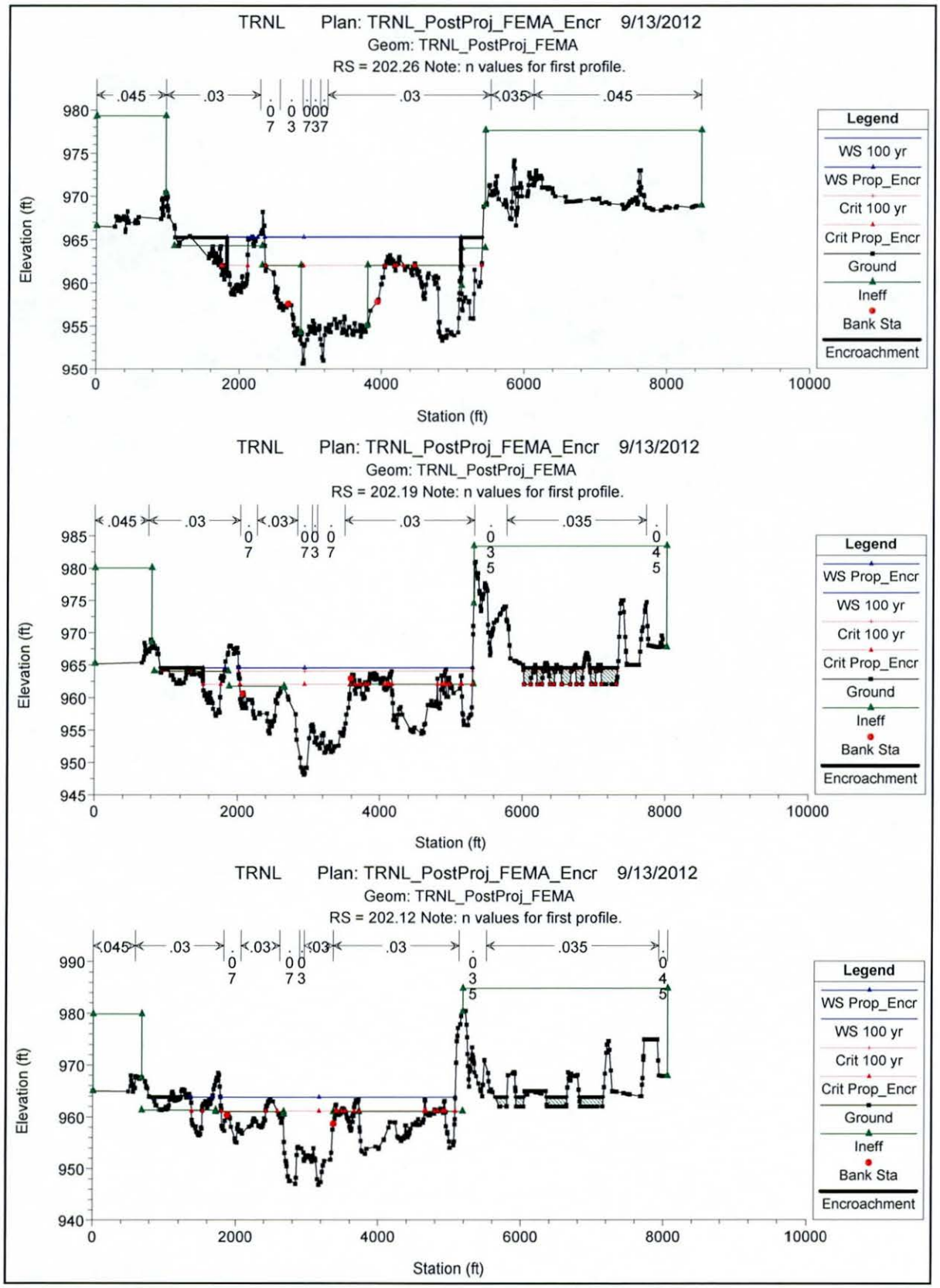
Bank Sta
Encroachment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Station (ft)
Legend
WS 100 yr
WS Prop_Encr
Crit 100 yr
Crit Prop_Encr
Ground
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Bank Sta
Encroachment
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Geom: TRNL_PostProj_FEMA
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Elevation (ft)
Station (ft)
Legend
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WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
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Crit 100 yr
Crit Prop_Encr
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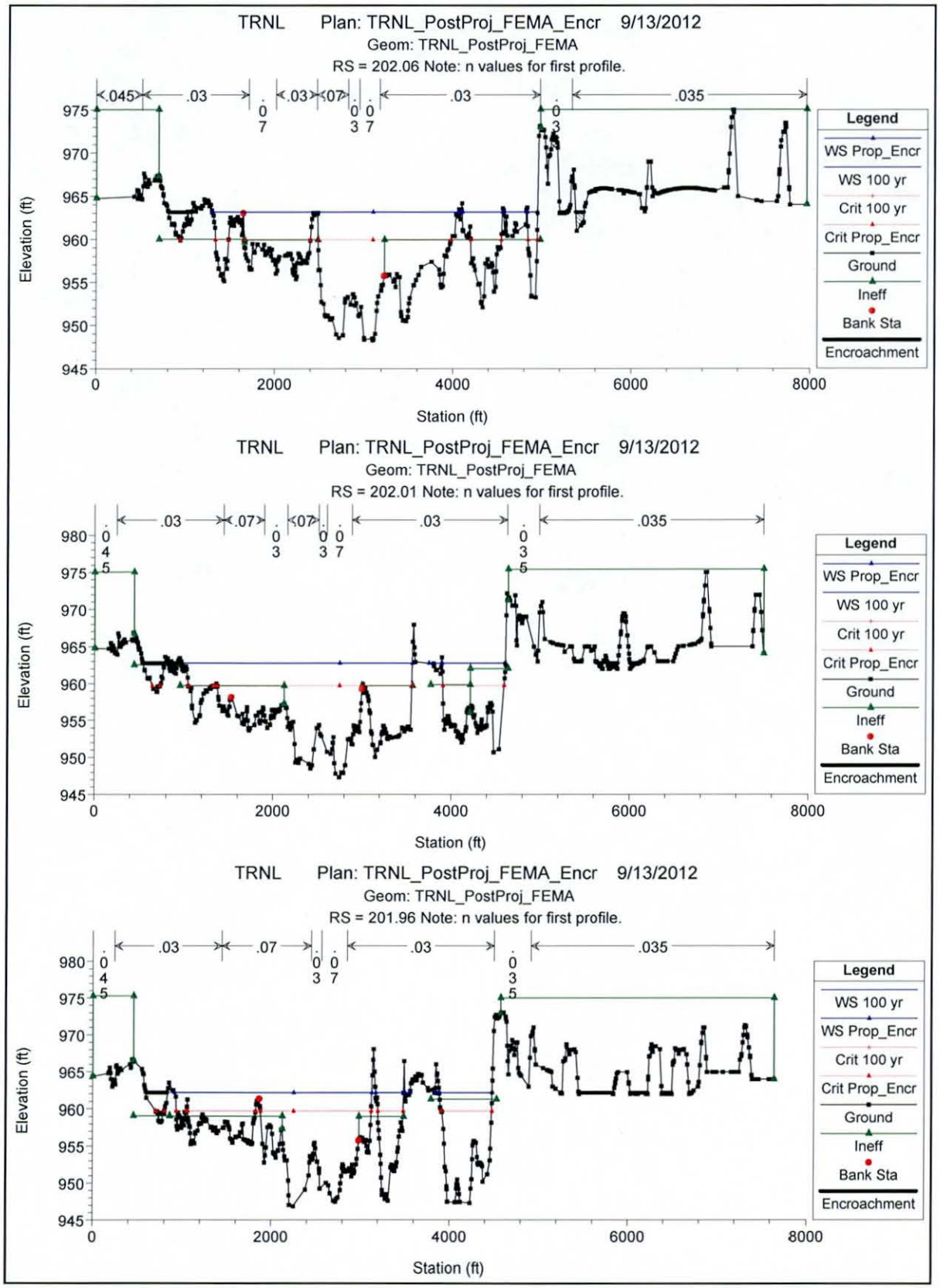
Bank Sta
Encroachment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Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
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Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
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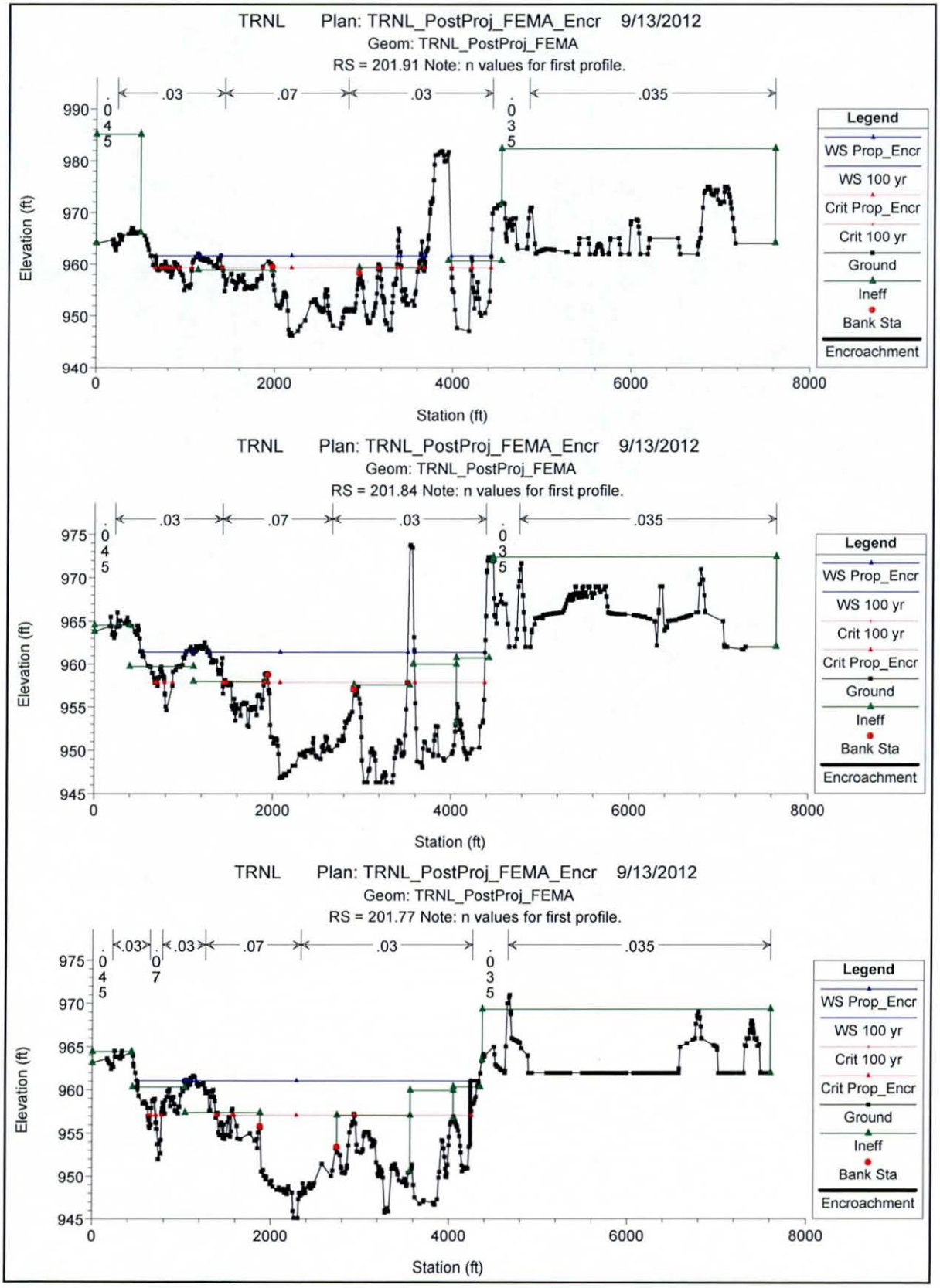
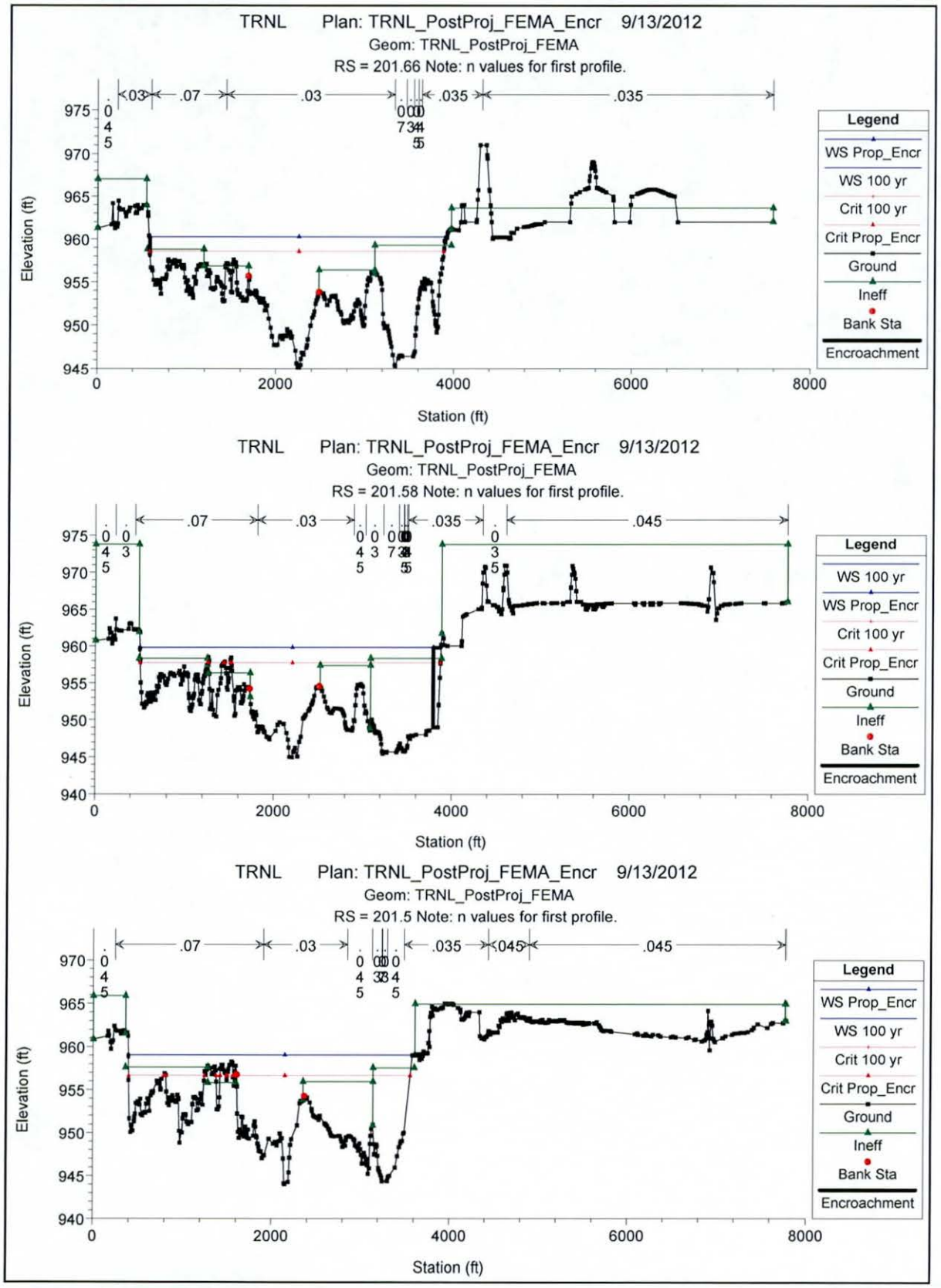
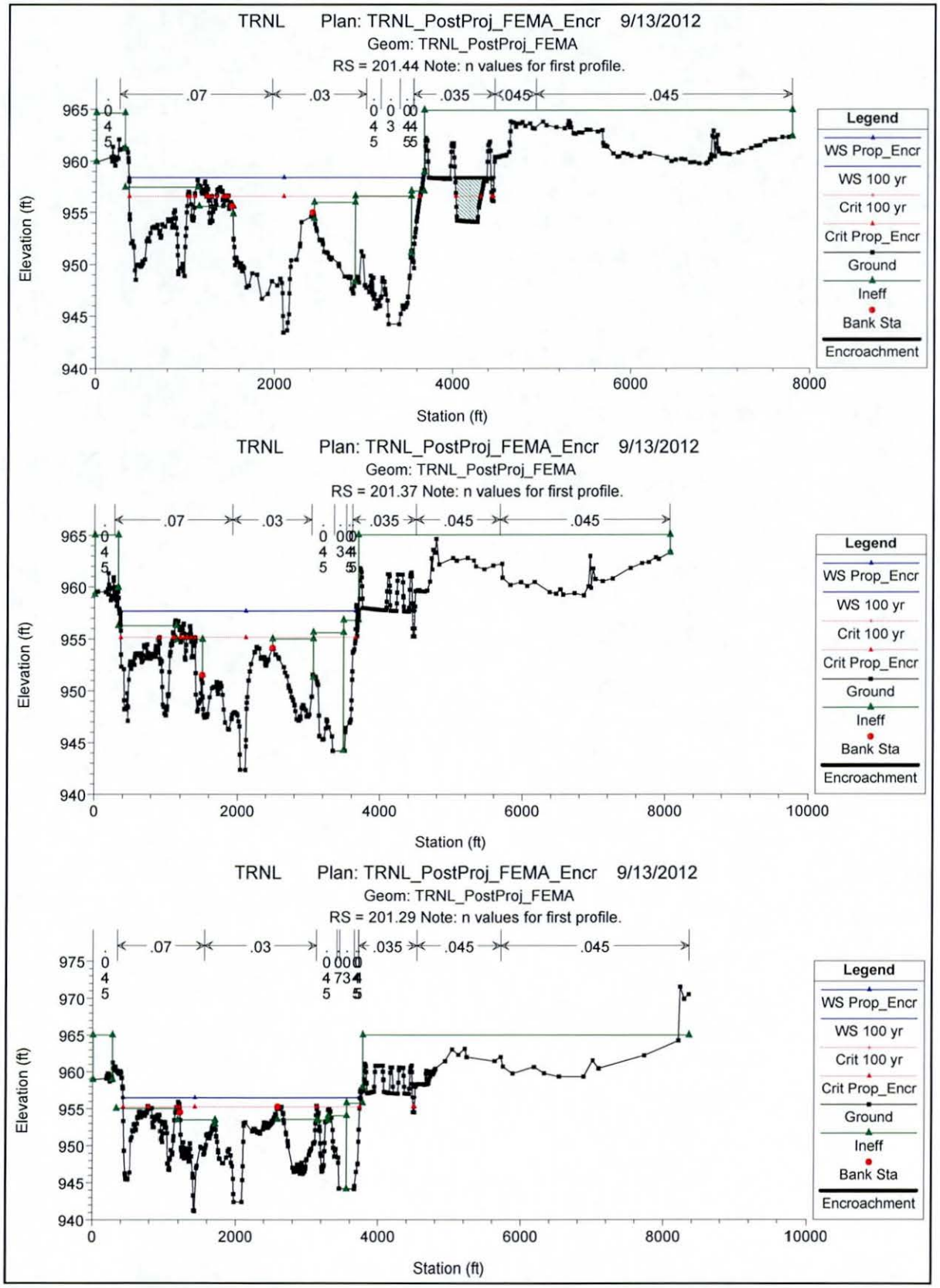
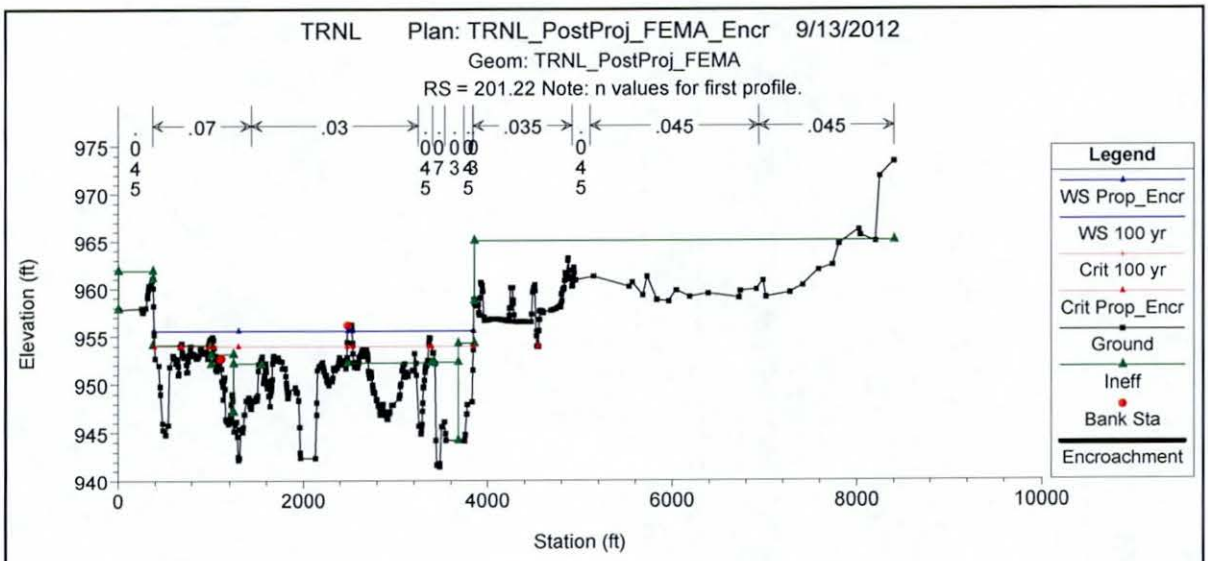
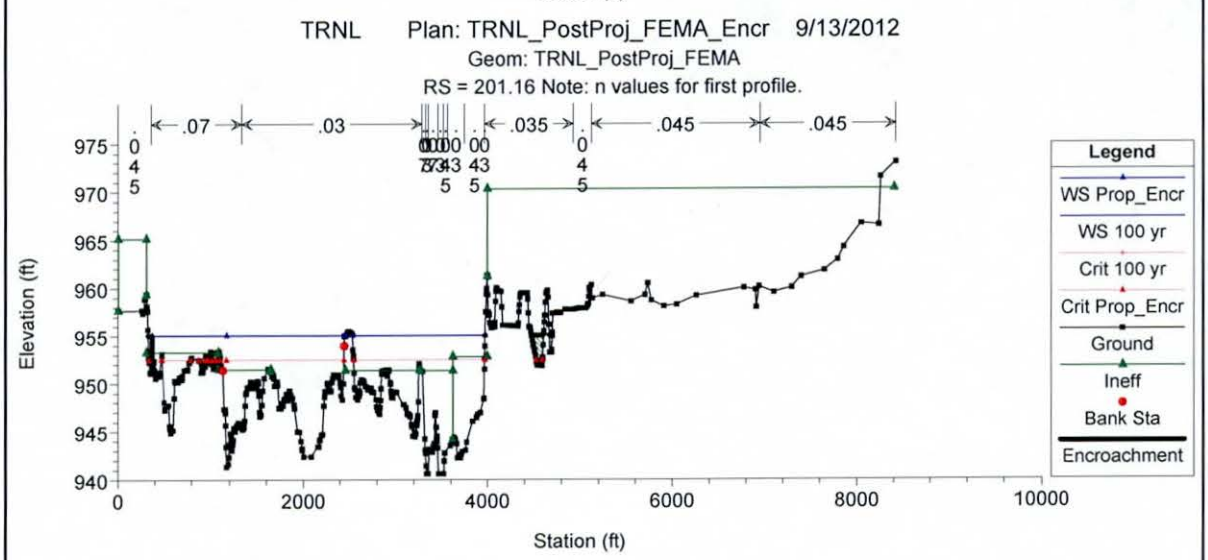
Geom: TRNL_PostProj_FEMA
RS = 201.96 Note: n values for first profile.
.045
.03
.07
.03
.07
.03
.035
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS Prop_Encr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

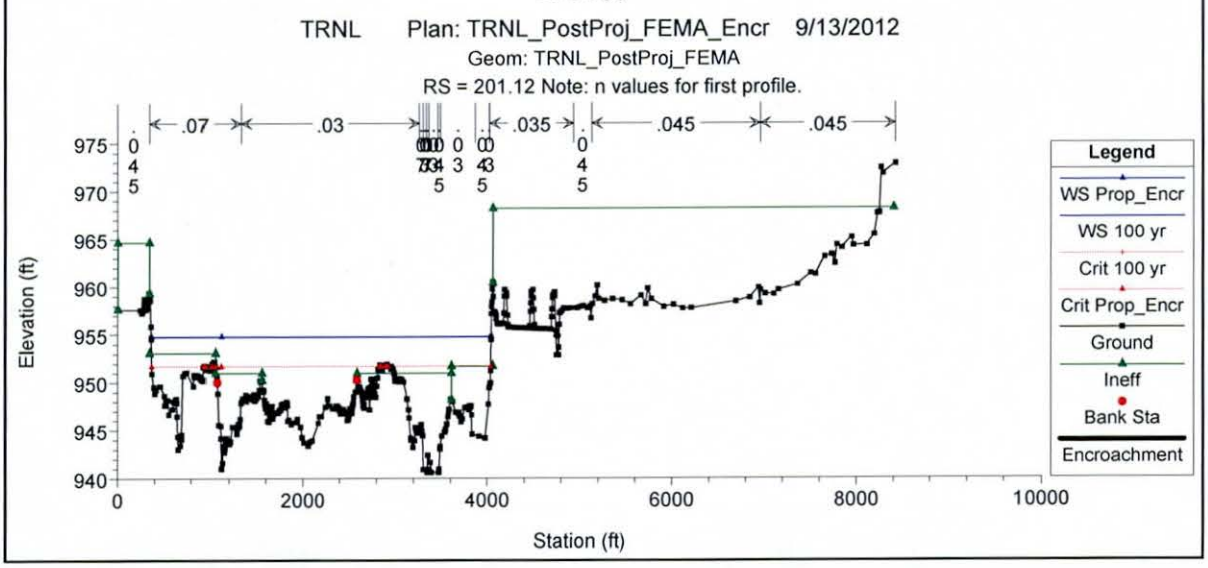

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.91 Note: n values for first profile.
.045
.03
.07
.03
.035
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.84 Note: n values for first profile.
.045
.03
.07
.03
.035
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.77 Note: n values for first profile.
.045
.03
.07
.03
.07
.03
.035
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

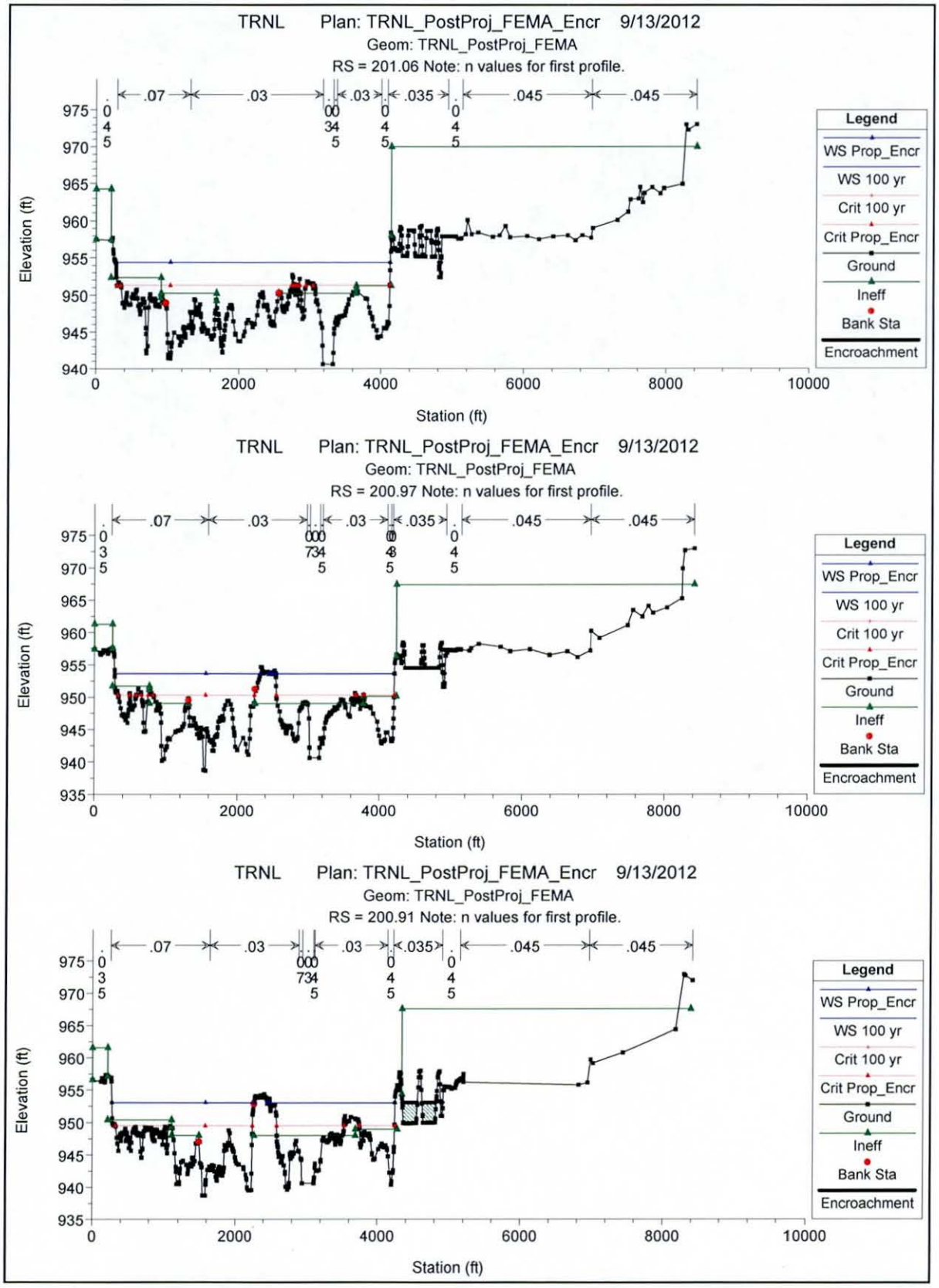

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.66 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.58 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS Prop_Encr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.5 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.44 Note: n values for first profile.
.07
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.37 Note: n values for first profile.
.07
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.29 Note: n values for first profile.
.07
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.22 Note: n values for first profile.
.07
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.16 Note: n values for first profile.
.07
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.12 Note: n values for first profile.
.07
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 201.06 Note: n values for first profile.
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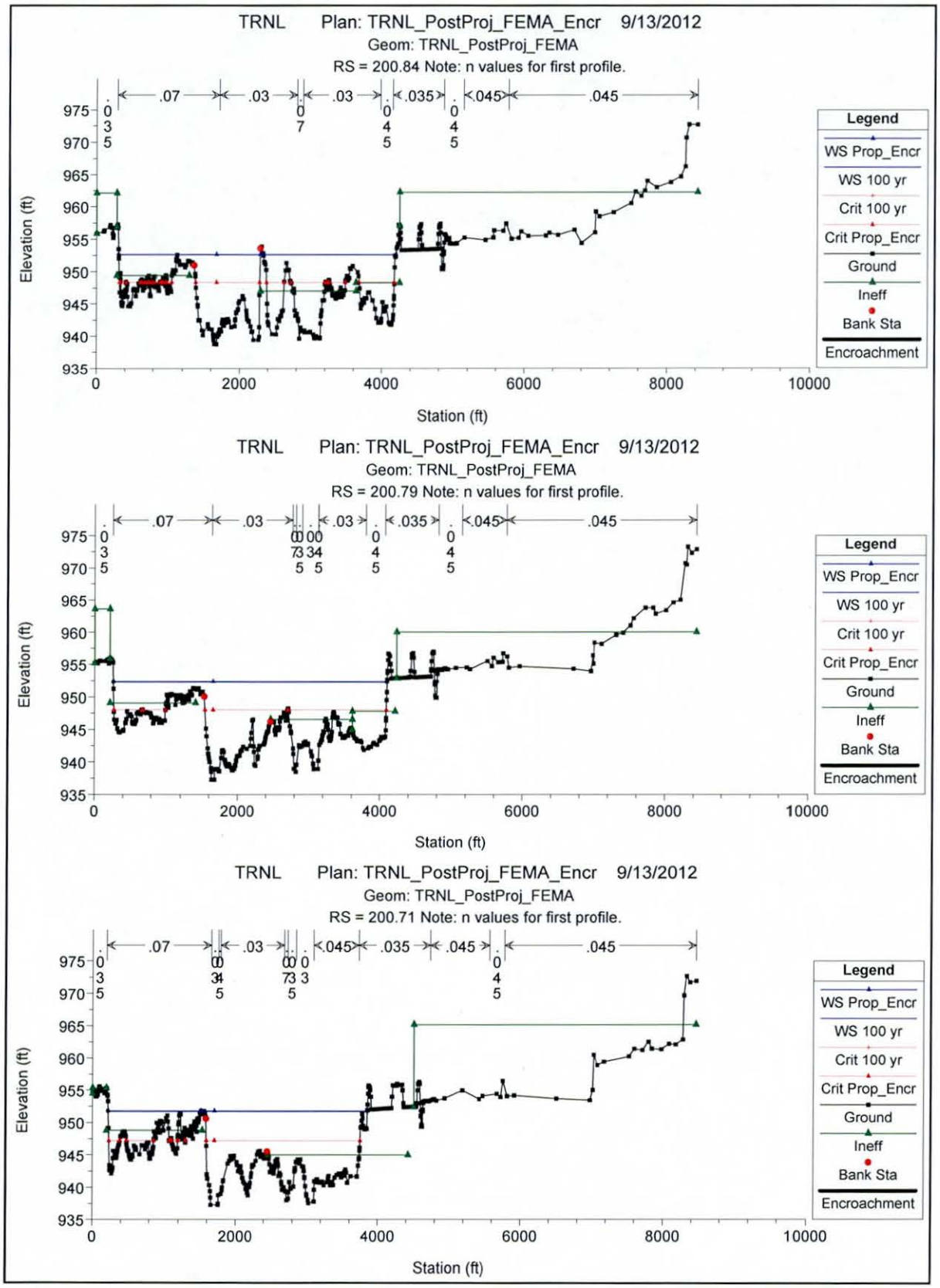
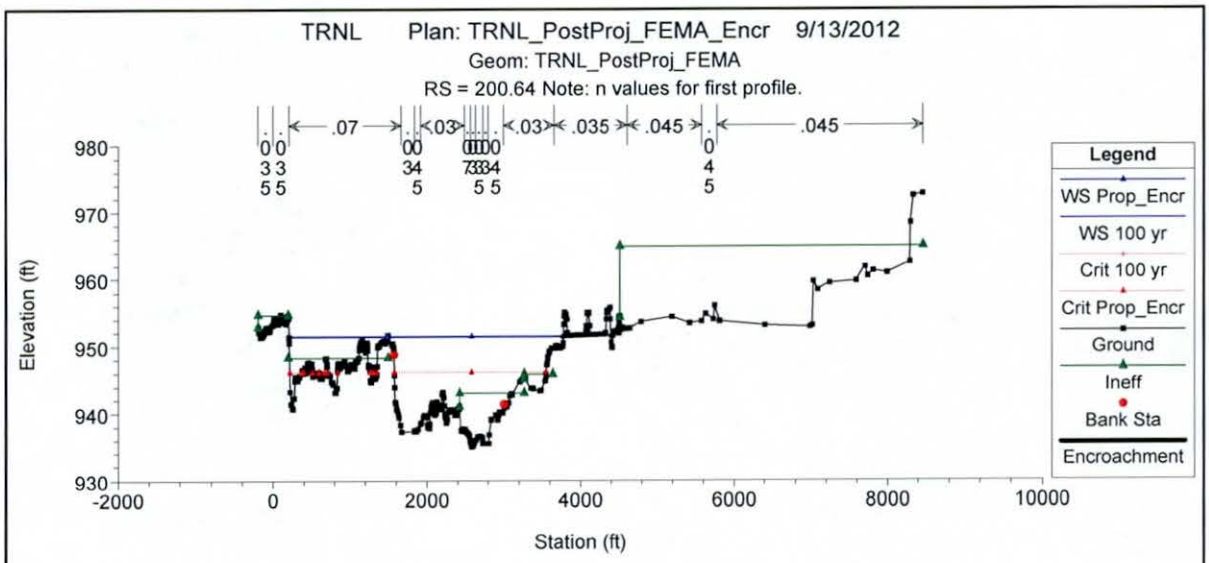
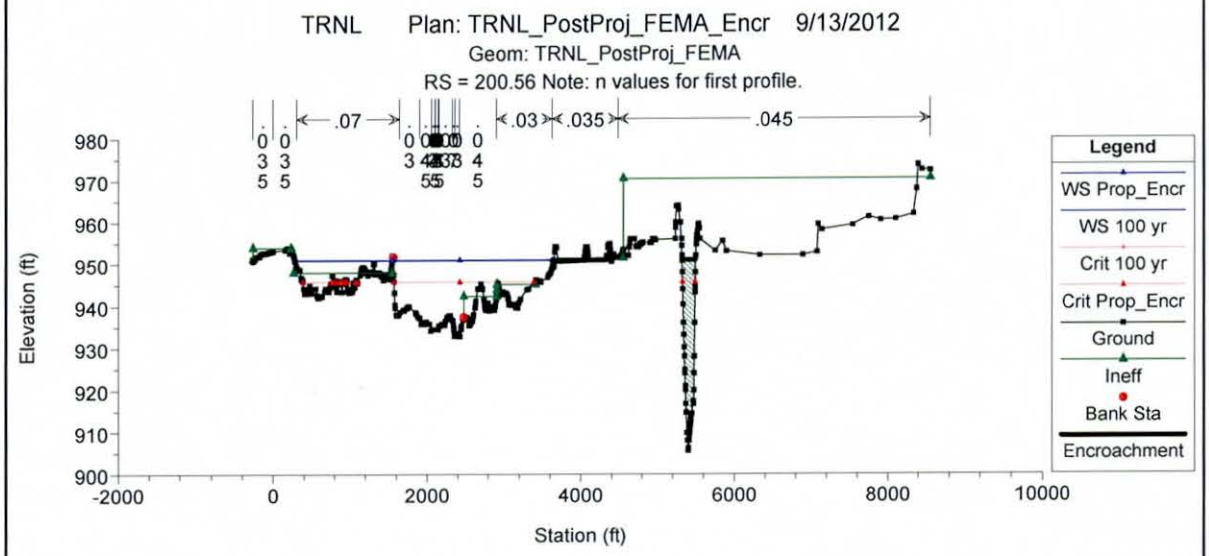
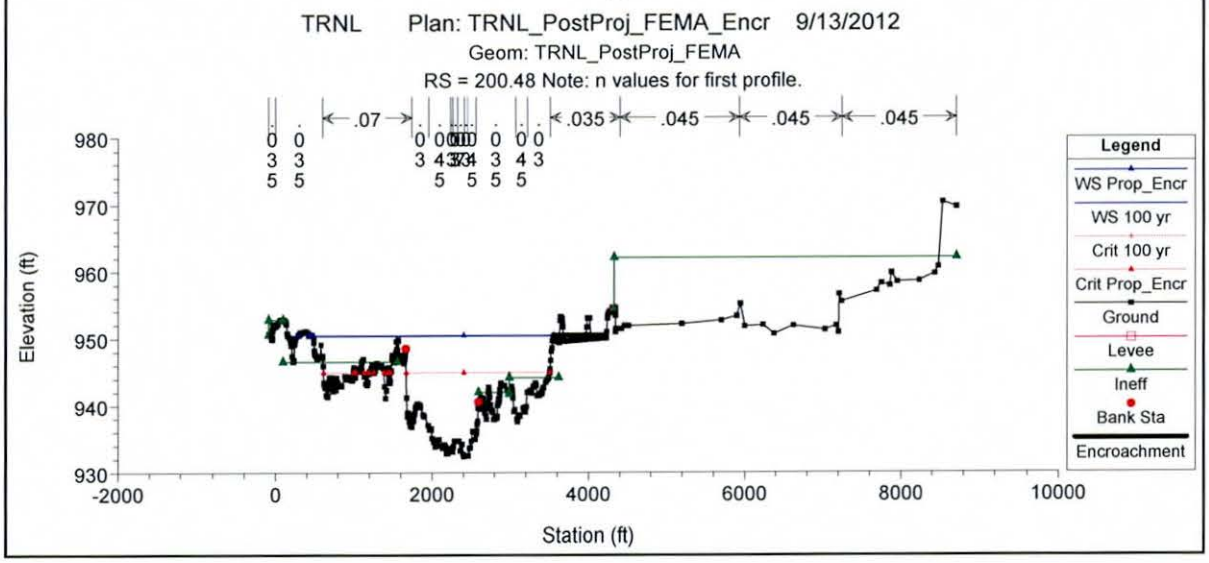
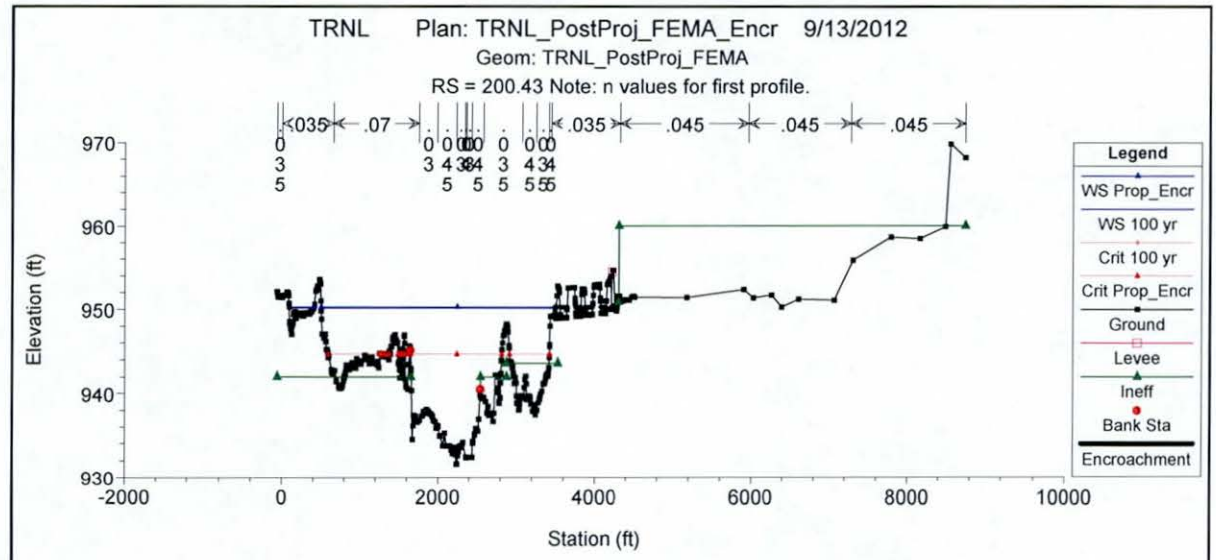
.03
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.97 Note: n values for first profile.
.07
.03
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.91 Note: n values for first profile.
.07
.03
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

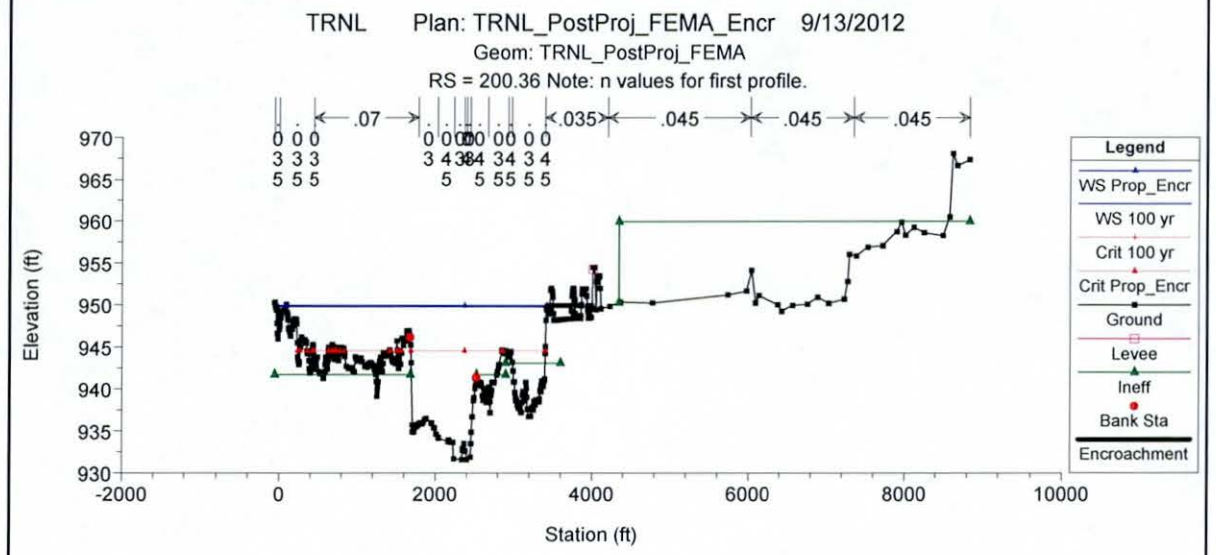

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.84 Note: n values for first profile.
.07
.03
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.79 Note: n values for first profile.
.07
.03
.03
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.71 Note: n values for first profile.
.07
.03
.045
.035
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

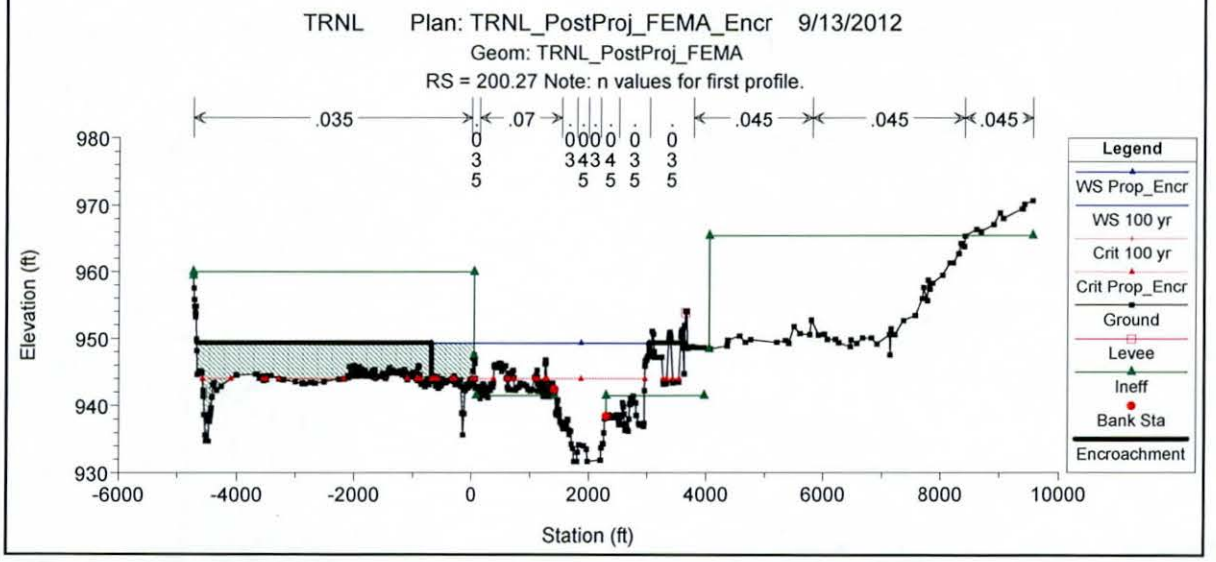

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.64 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

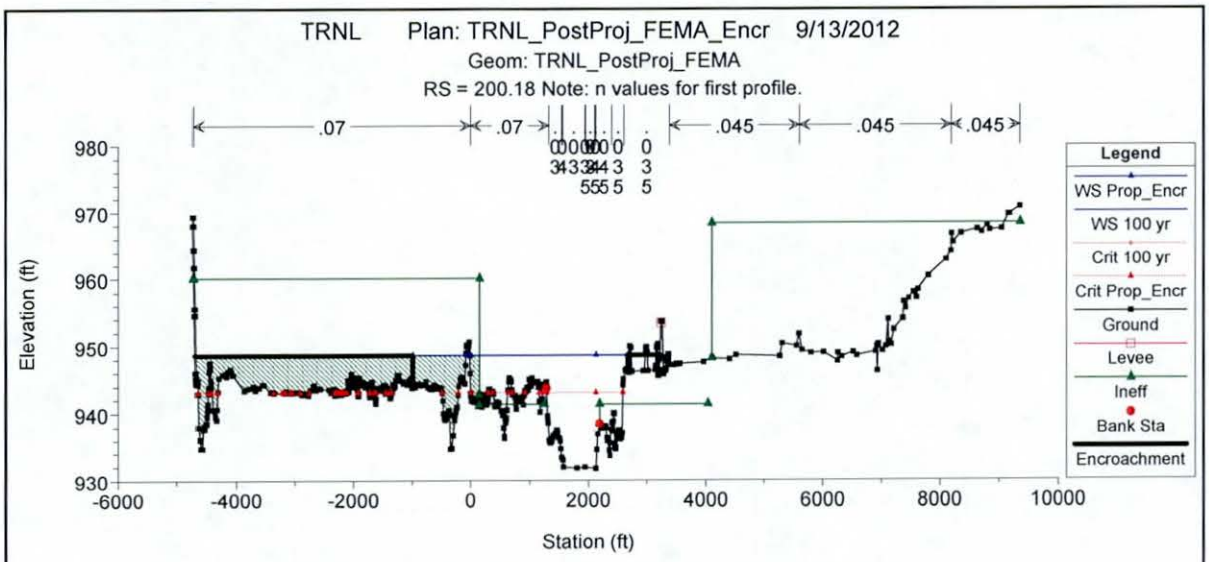

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.56 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

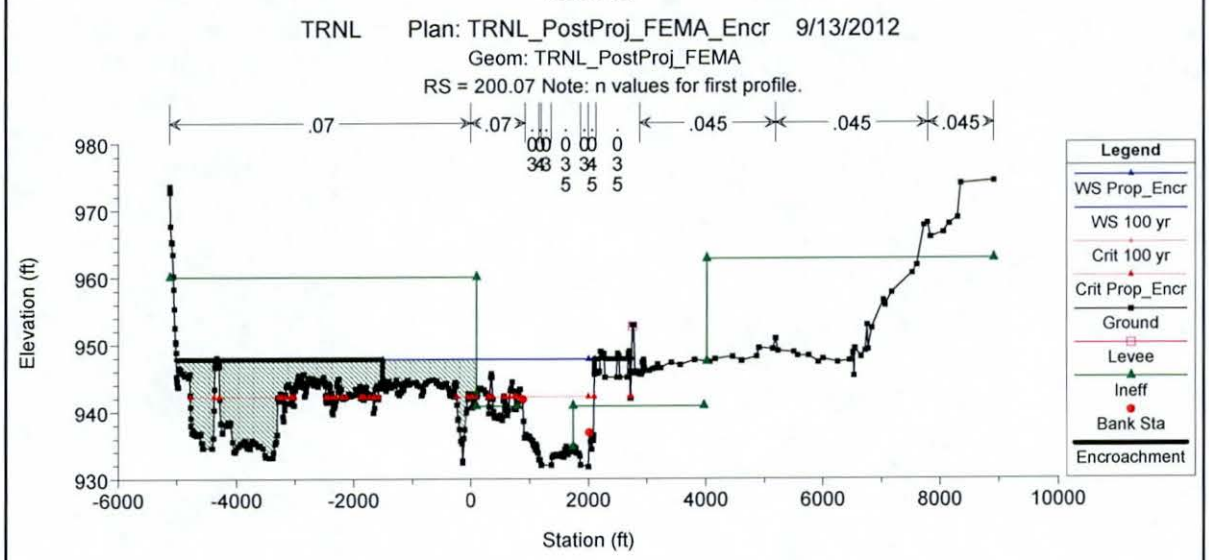

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.48 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

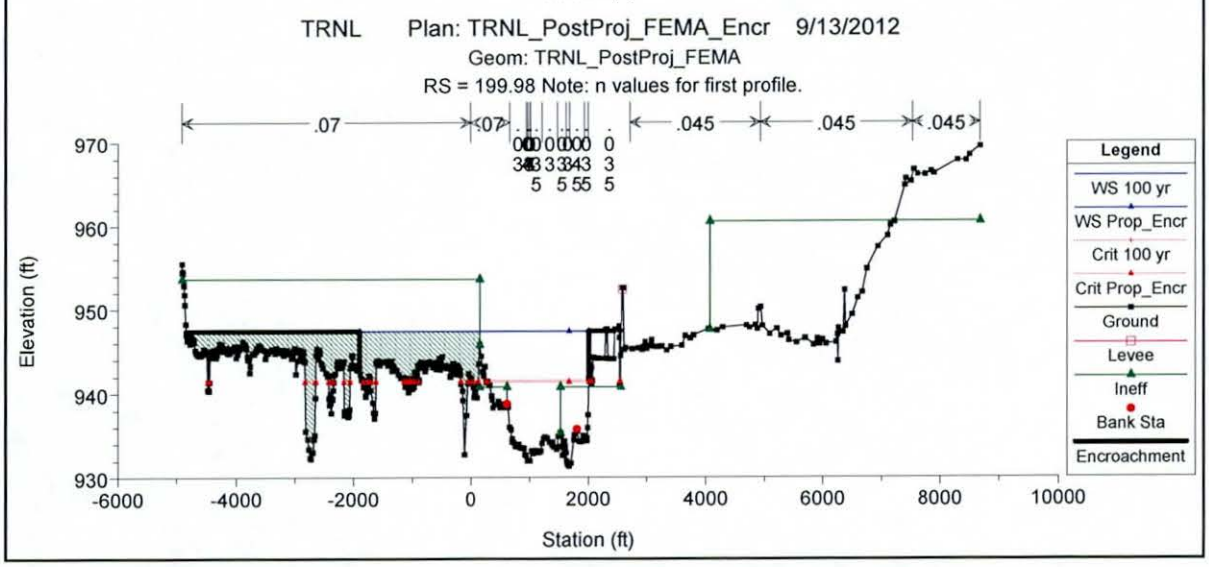

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.43 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

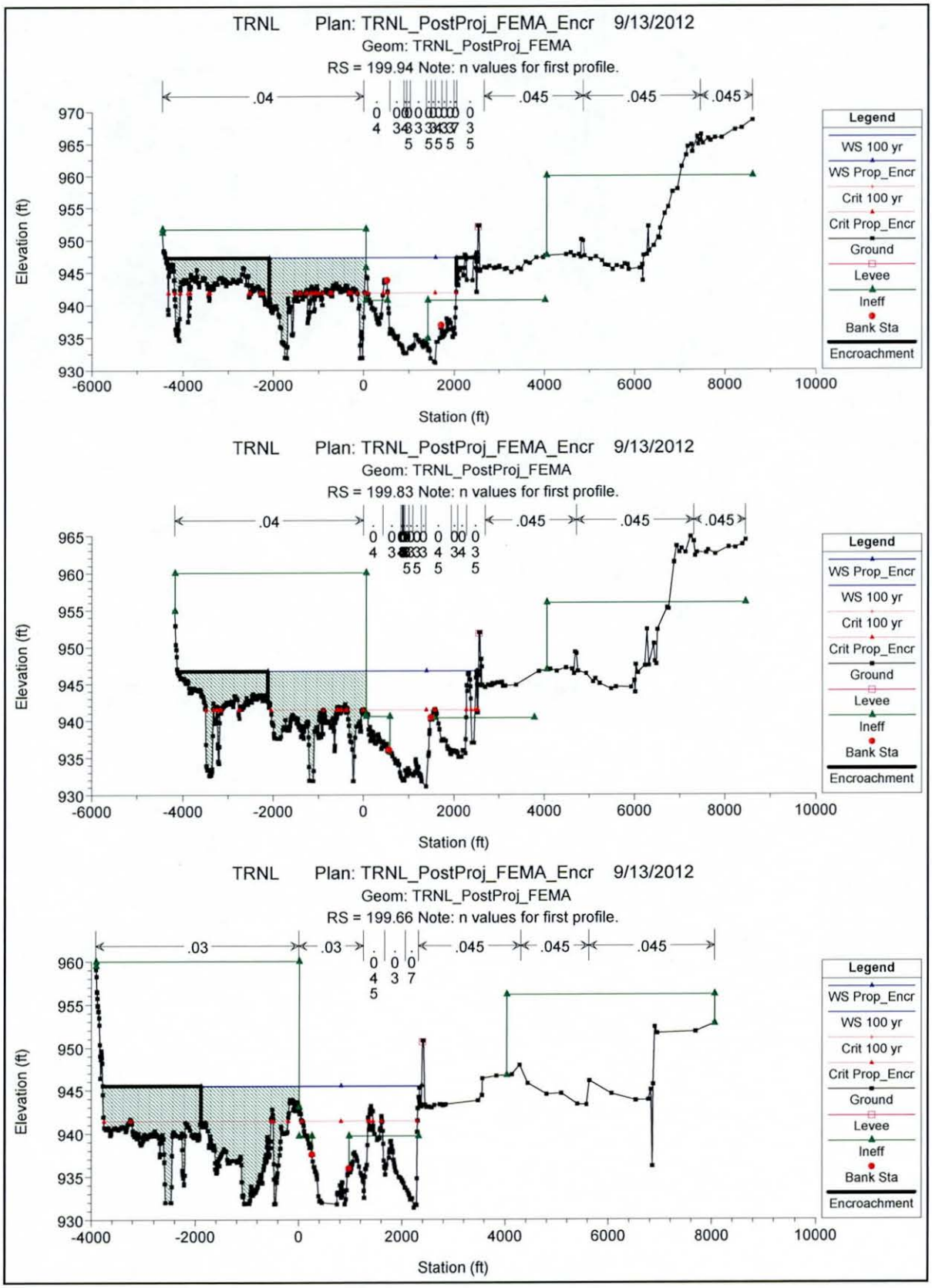

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.36 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

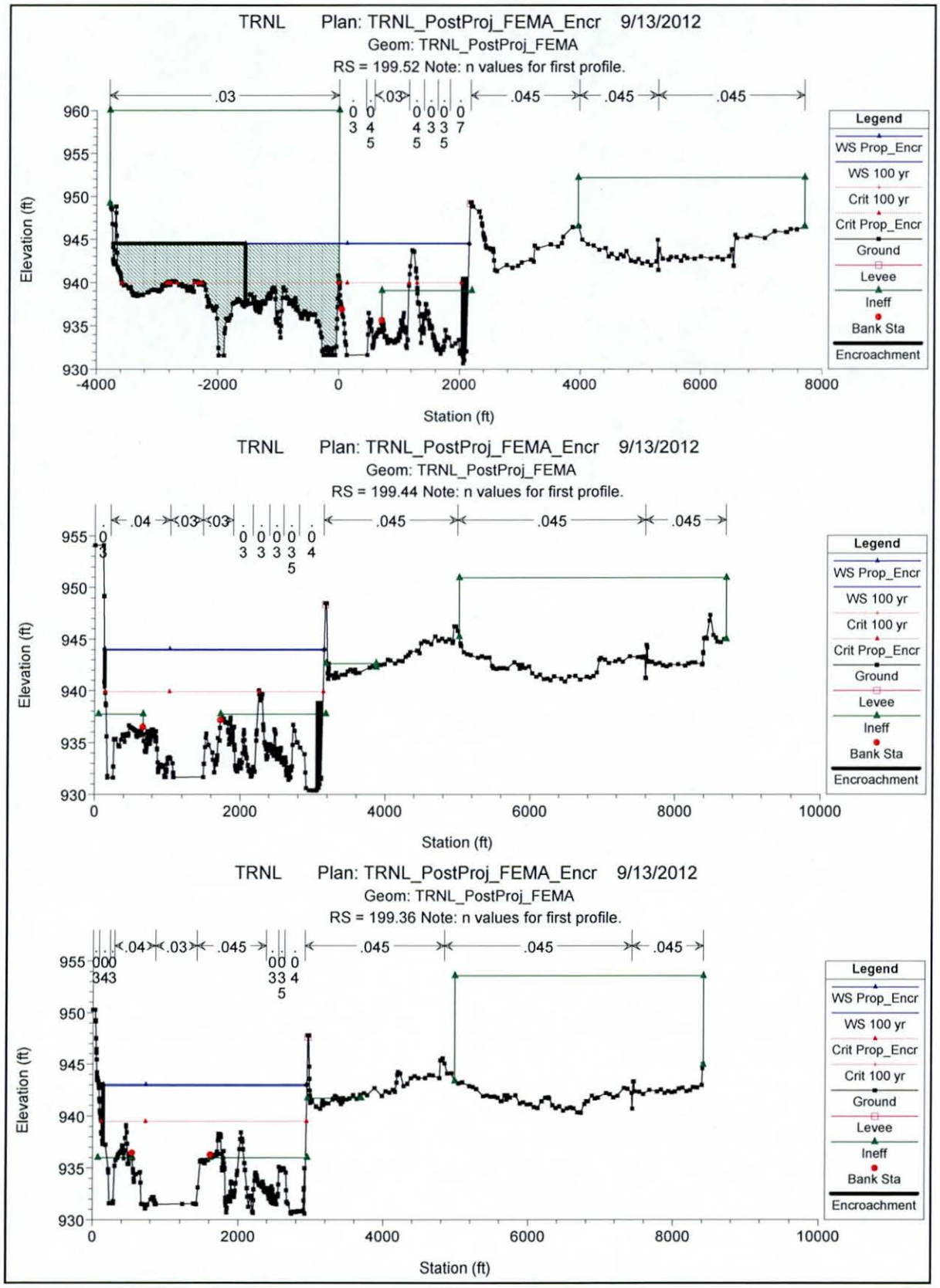

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.27 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

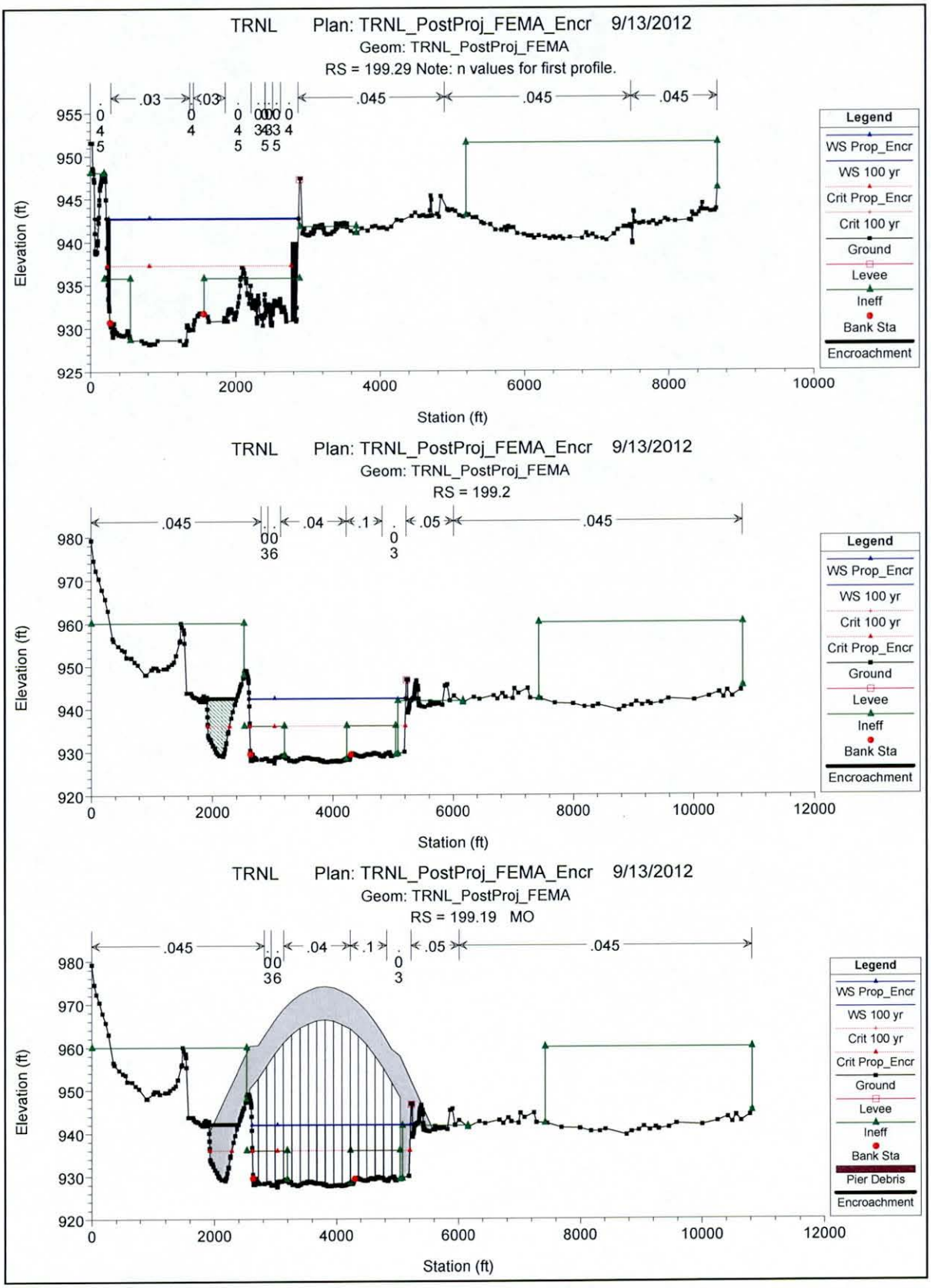

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.18 Note: n values for first profile.
.07
.07
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

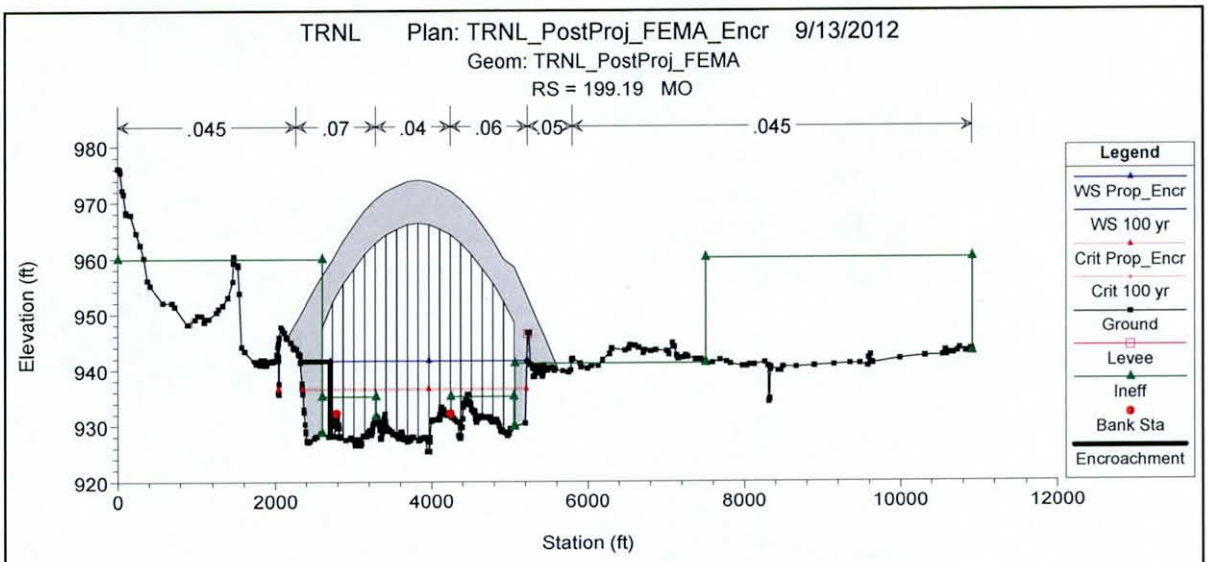

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 200.07 Note: n values for first profile.
.07
.07
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

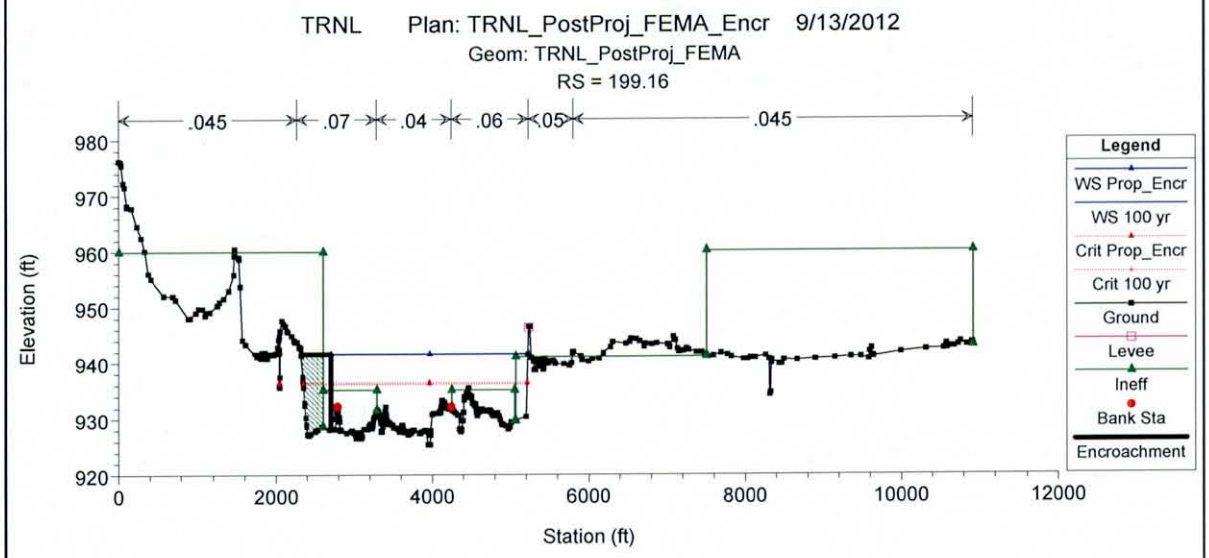

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.98 Note: n values for first profile.
.07
.07
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS Prop_Encr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

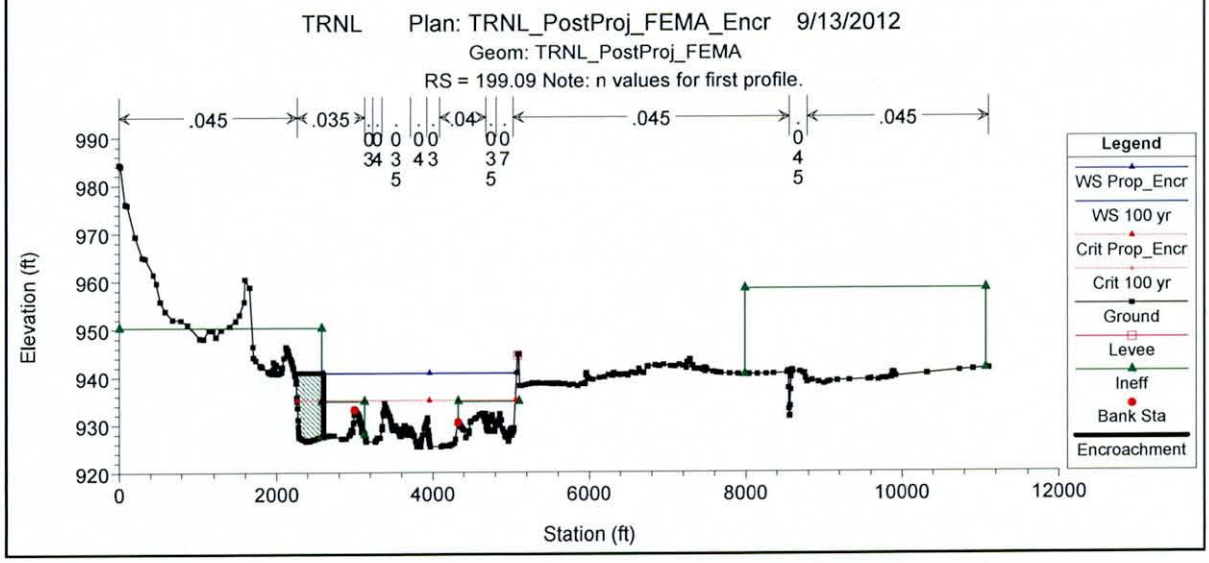

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.94 Note: n values for first profile.
.04
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS Prop_Encr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.83 Note: n values for first profile.
.04
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.66 Note: n values for first profile.
.03
.03
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment

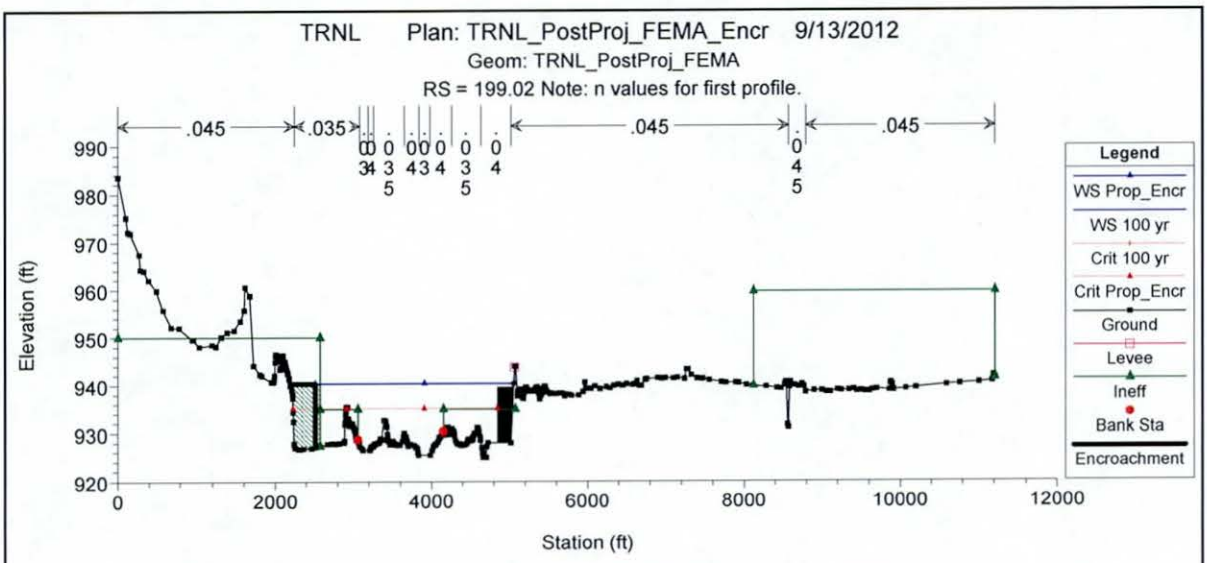

TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.52 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.44 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.36 Note: n values for first profile.
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Levee
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.29 Note: n values for first profile.
.03
.03
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Levee
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.2
.045
.04
.1
.05
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Encroachment
TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.19 MO
.045
.04
.1
.05
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit 100 yr
Crit Prop_Encr
Ground
Levee
Ineff
Bank Sta
Pier Debris
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.19 MO
.045
.07
.04
.06
.05
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Levee
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.16
.045
.07
.04
.06
.05
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Levee
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
Geom: TRNL_PostProj_FEMA
RS = 199.09 Note: n values for first profile.
.045
.035
.04
.045
.045
Elevation (ft)
Station (ft)
Legend
WS Prop_Encr
WS 100 yr
Crit Prop_Encr
Crit 100 yr
Ground
Levee
Ineff
Bank Sta
Encroachment


TRNL Plan: TRNL_PostProj_FEMA_Encr 9/13/2012
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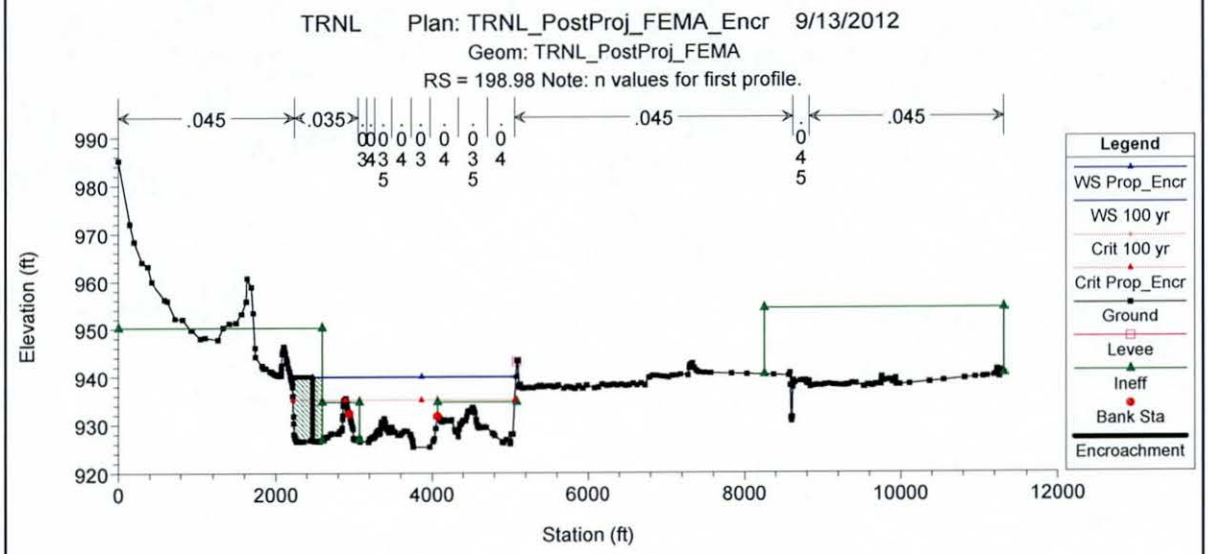
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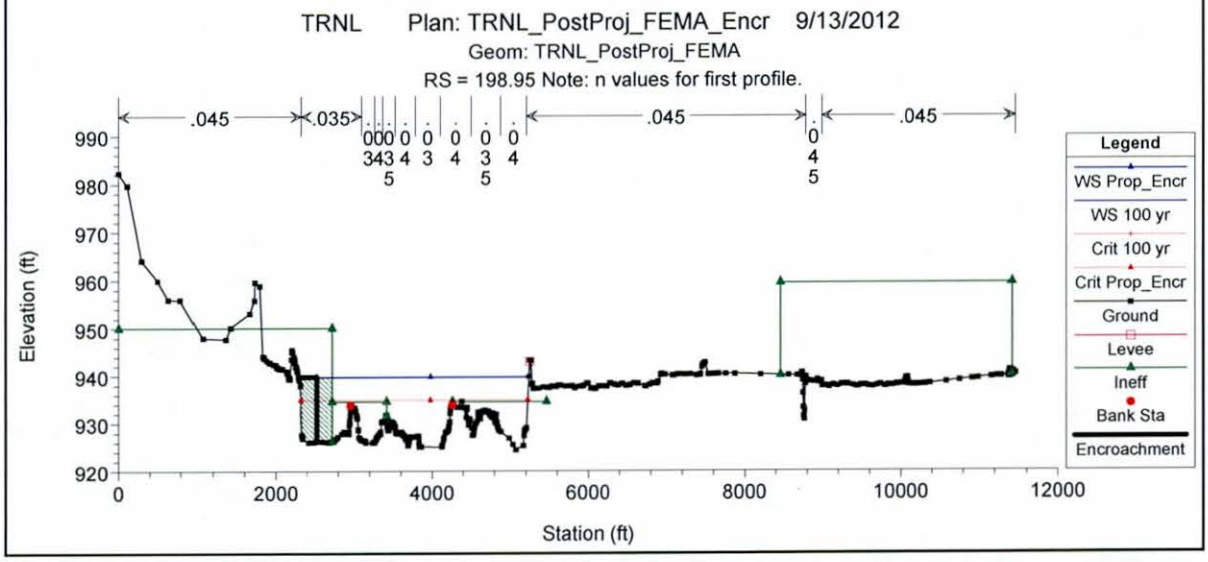
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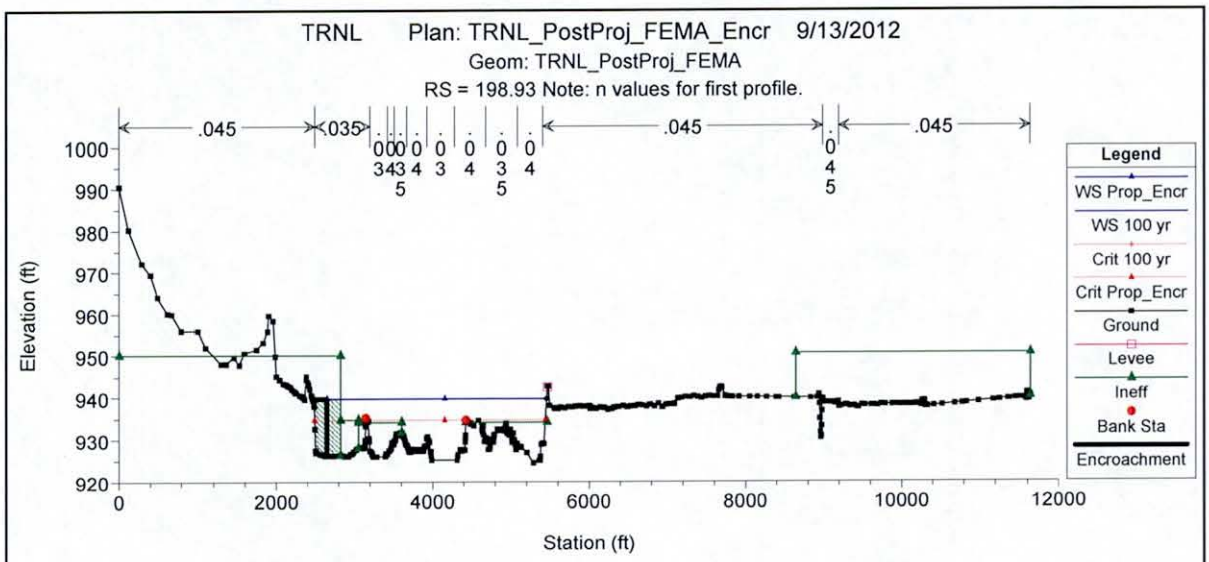
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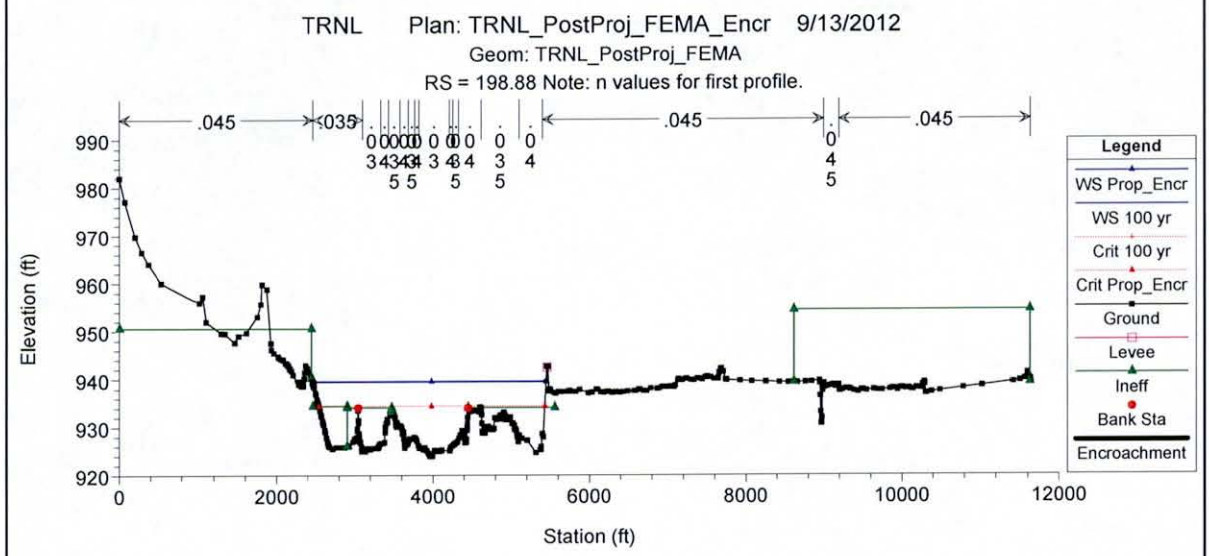
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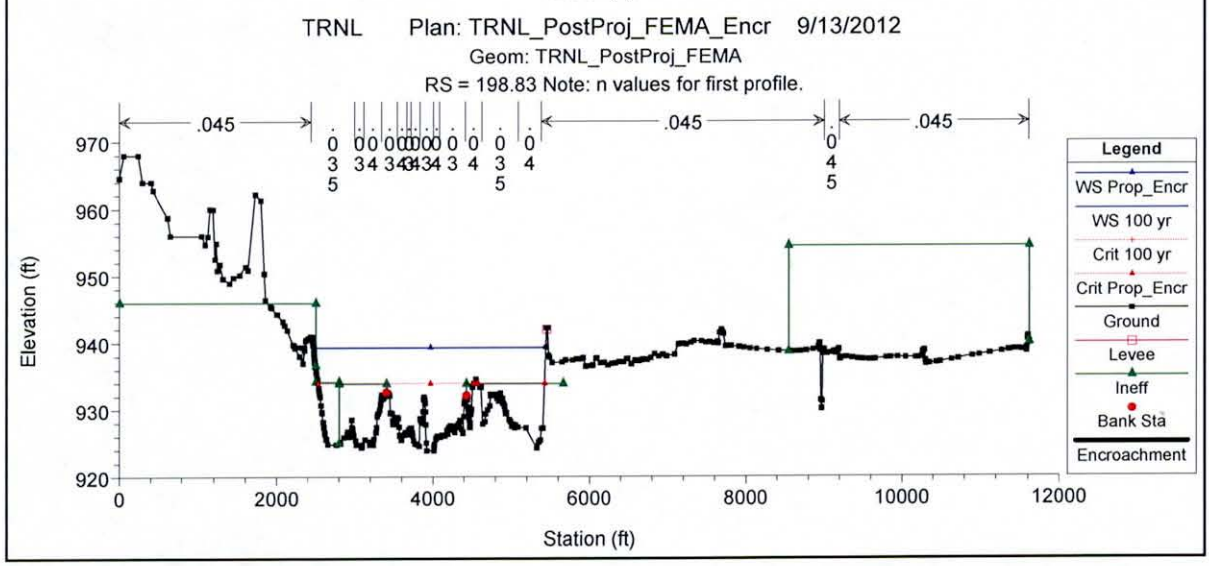
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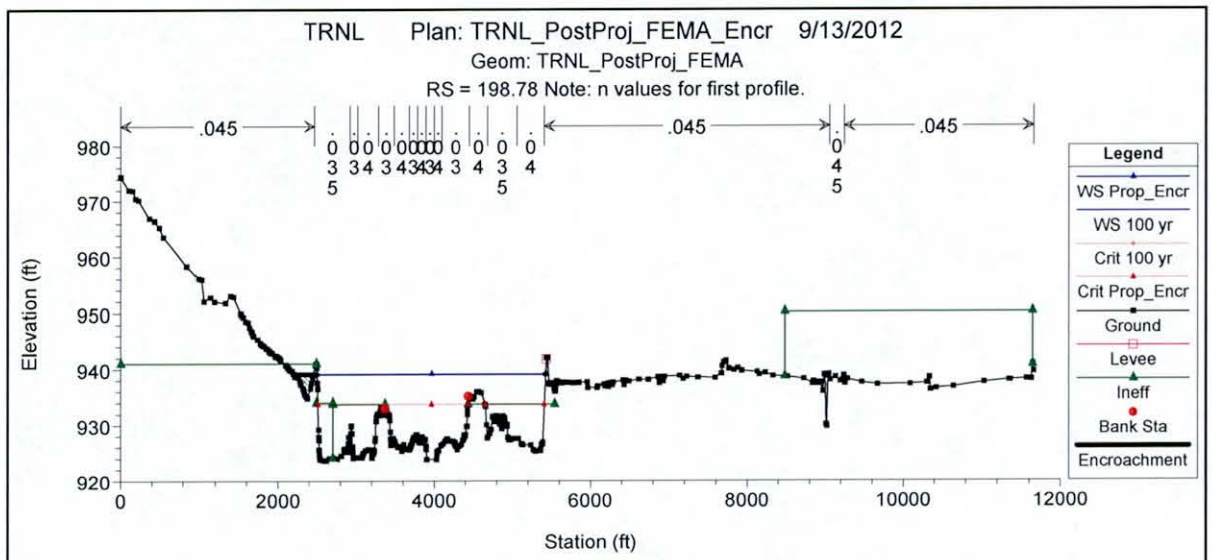
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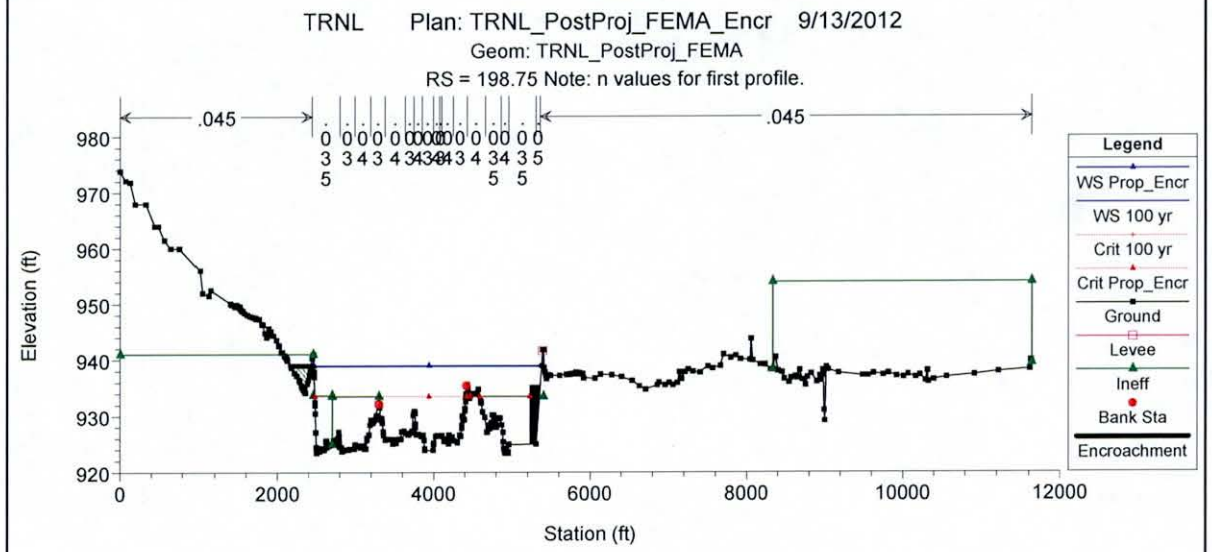
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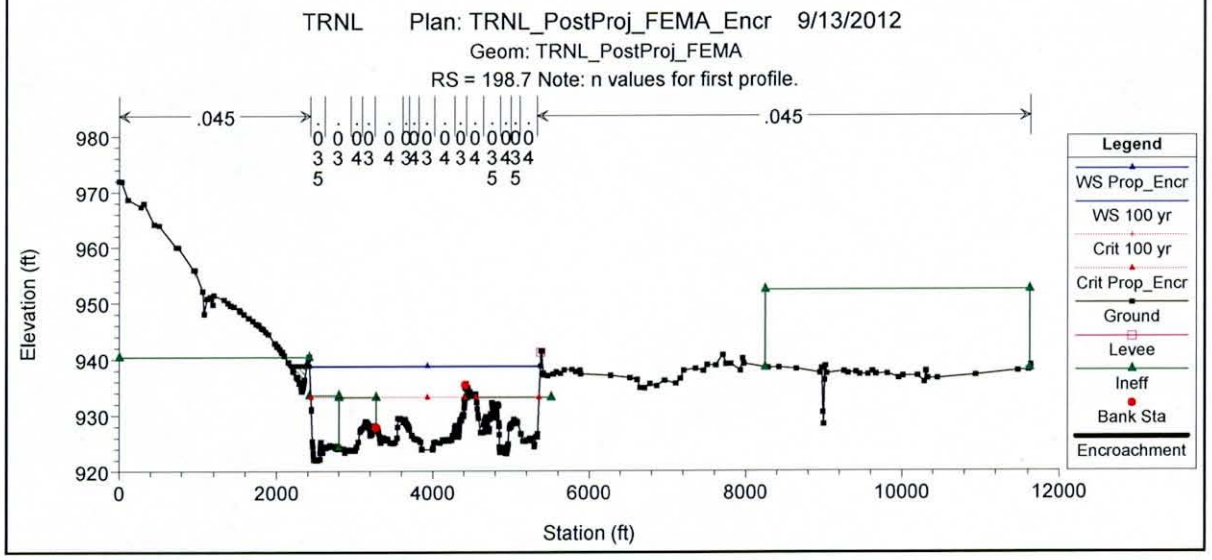
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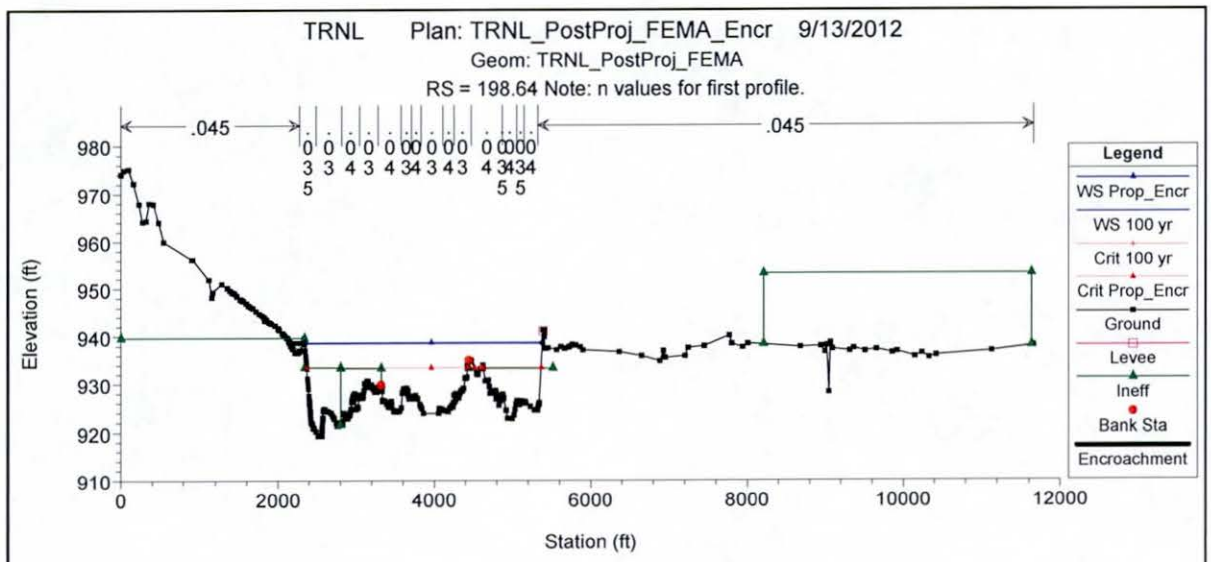
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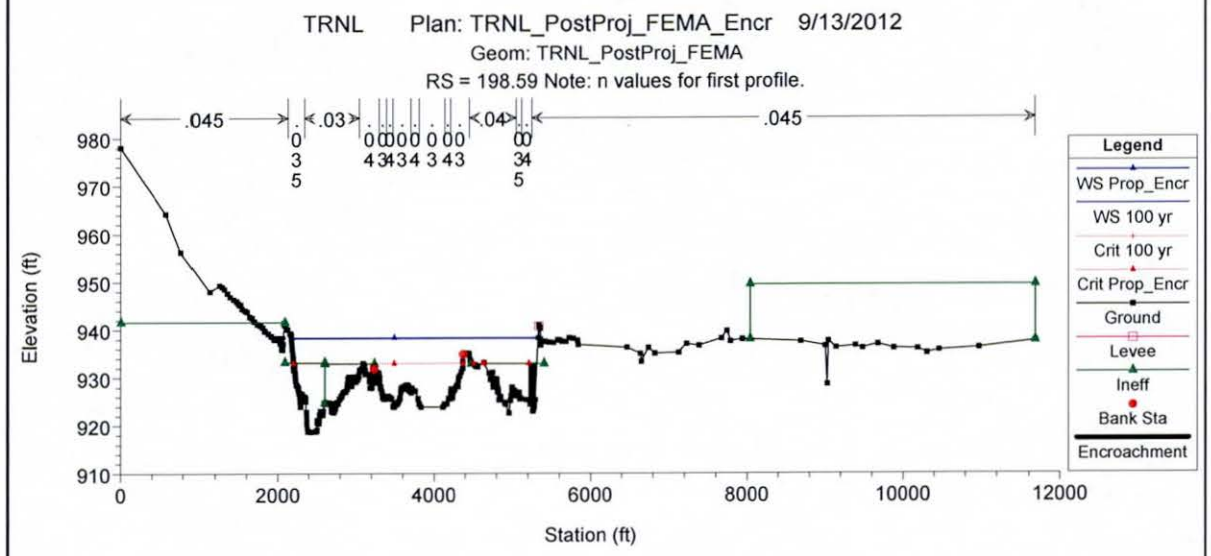
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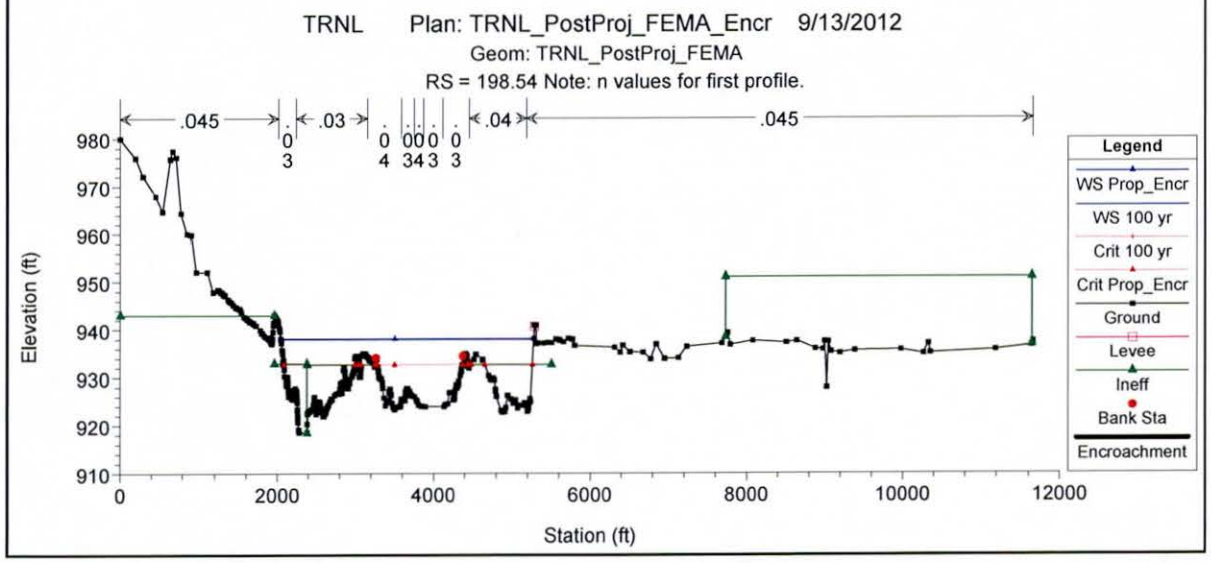
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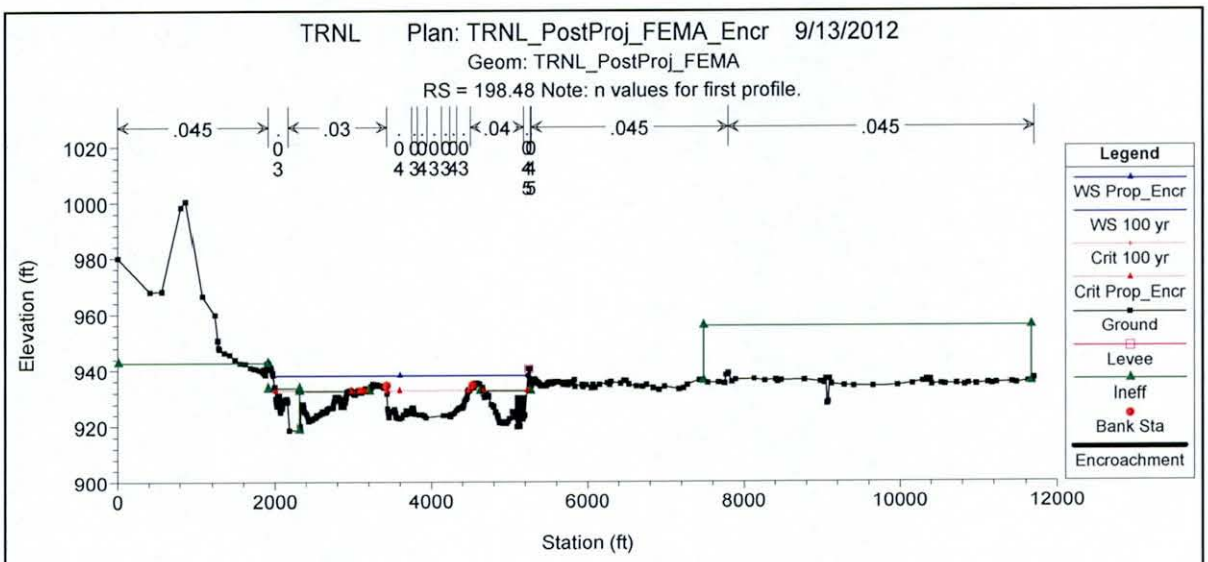
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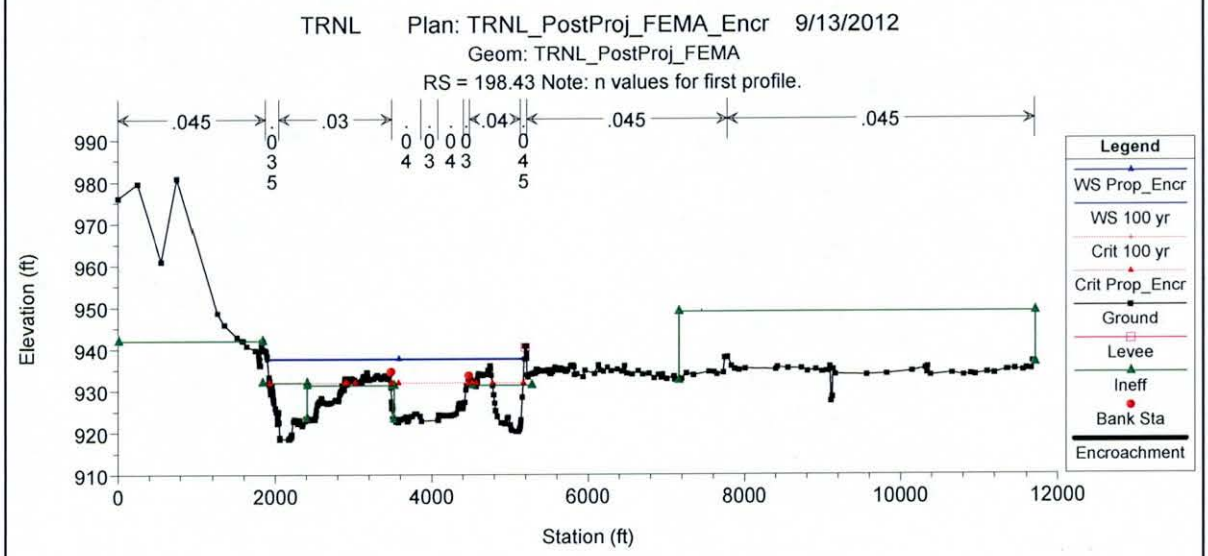
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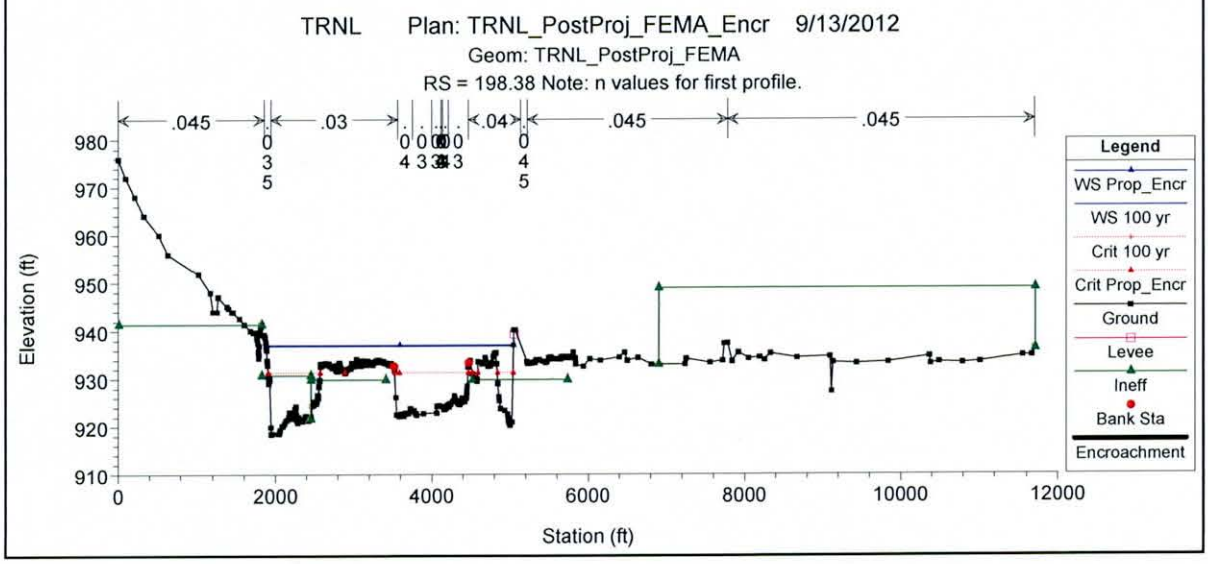
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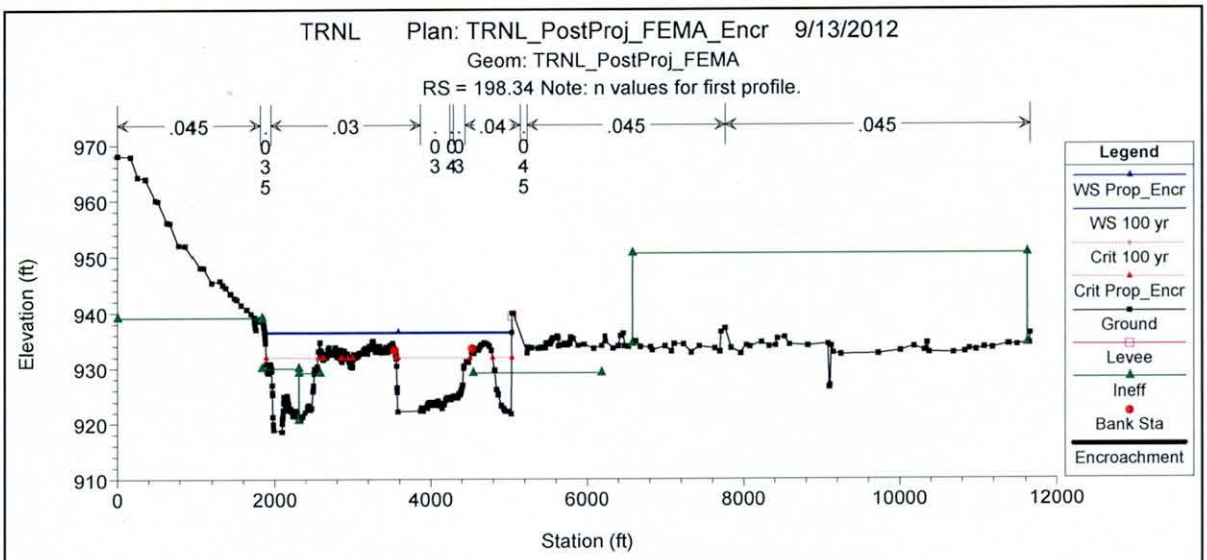
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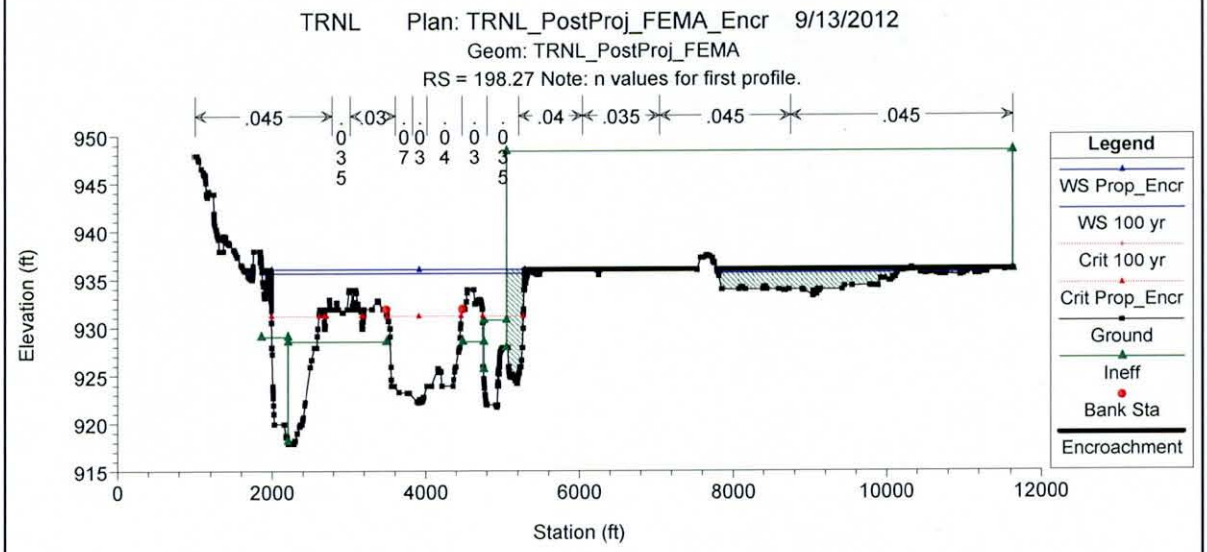
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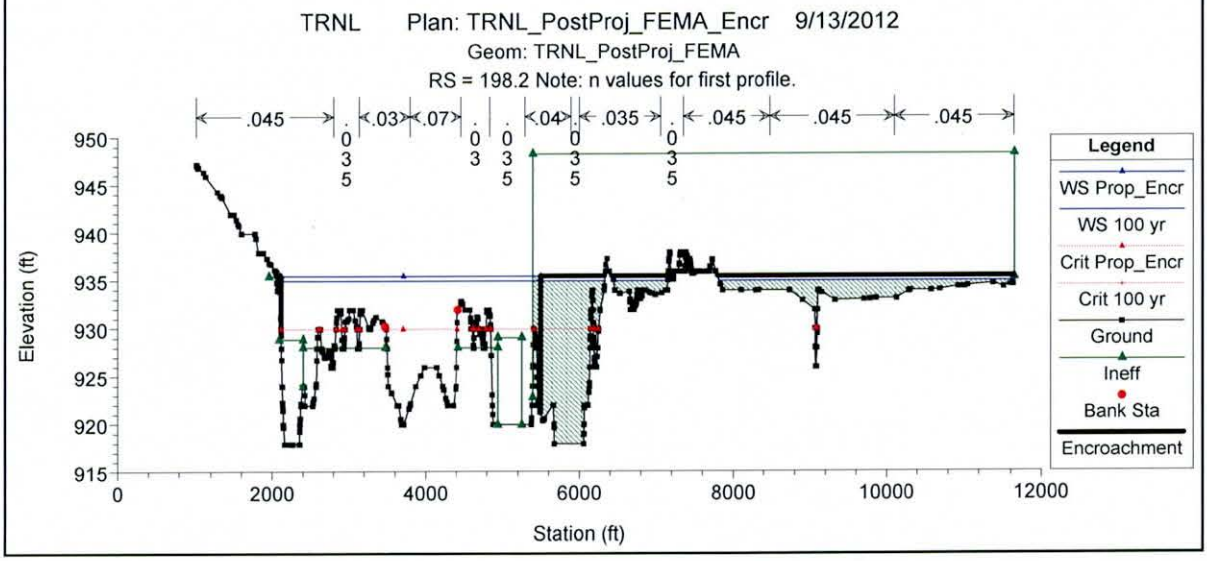
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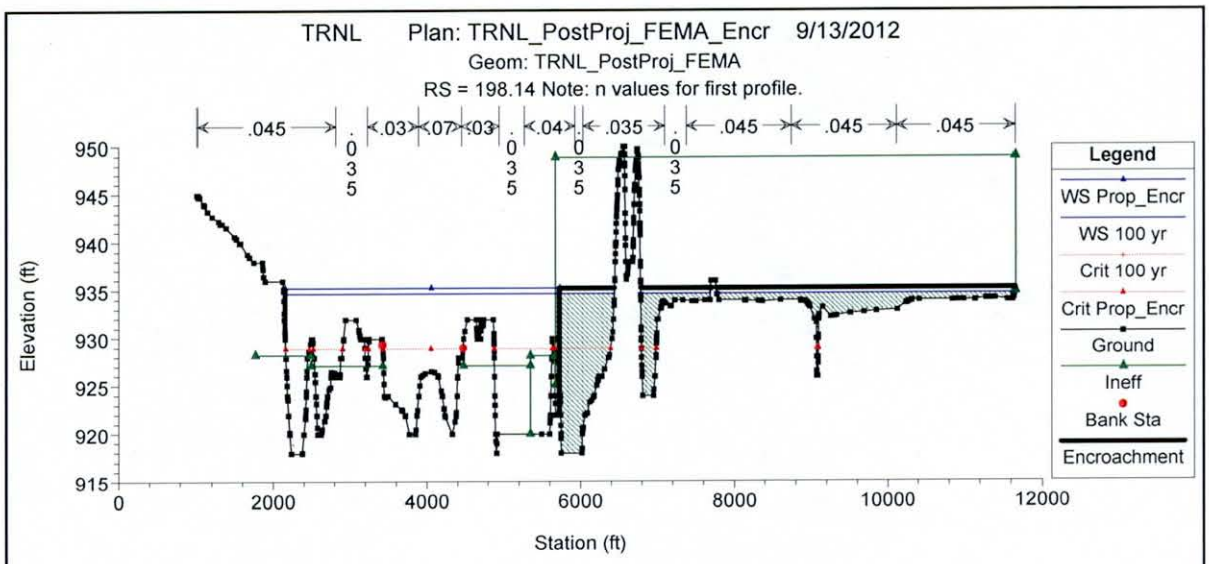
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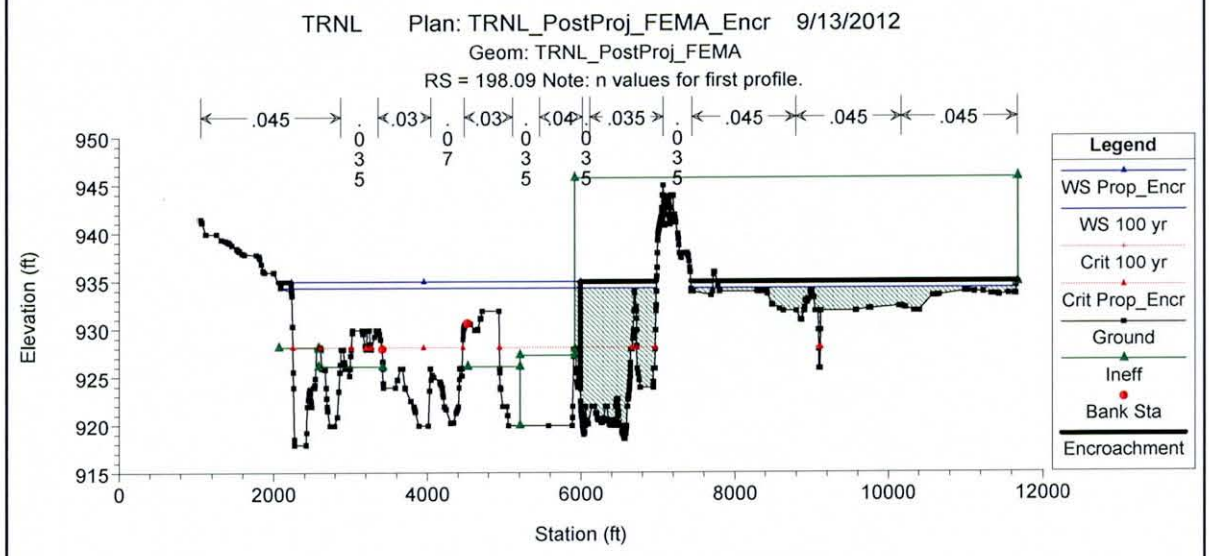
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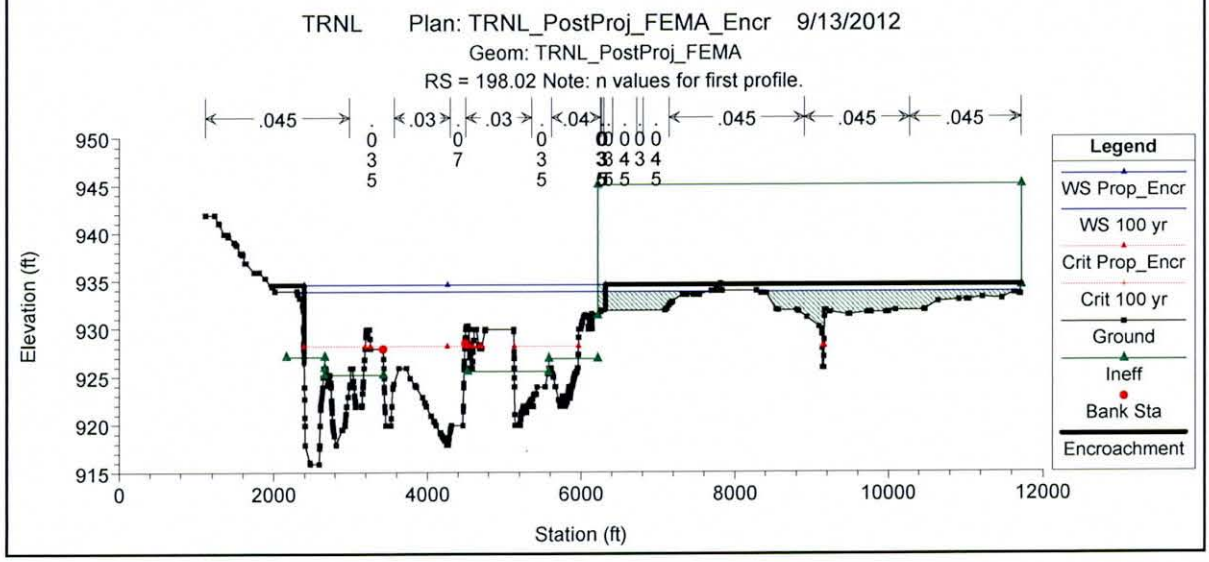
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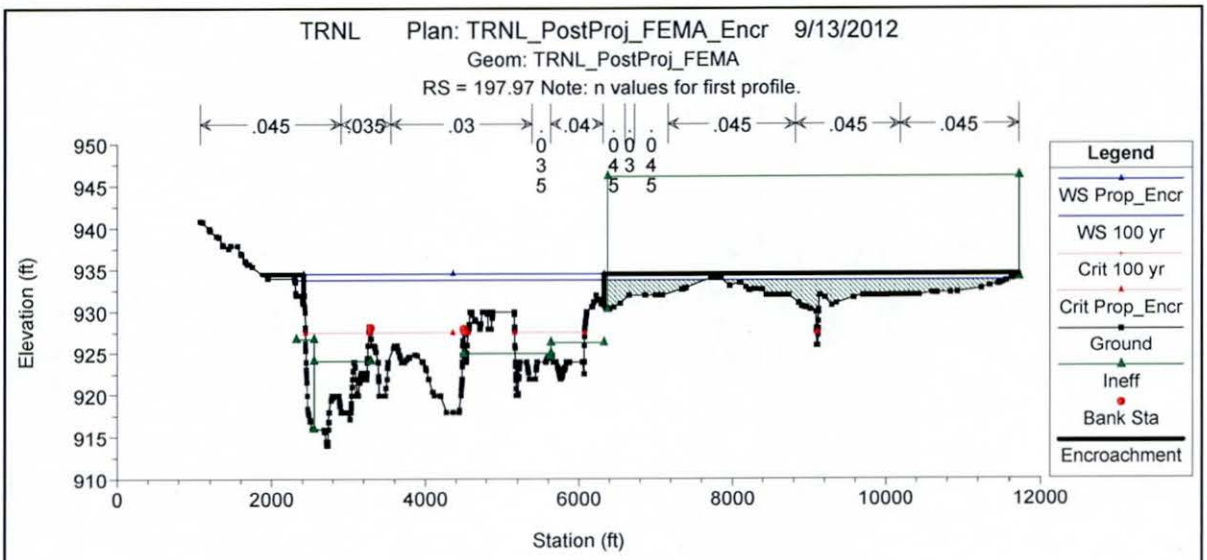
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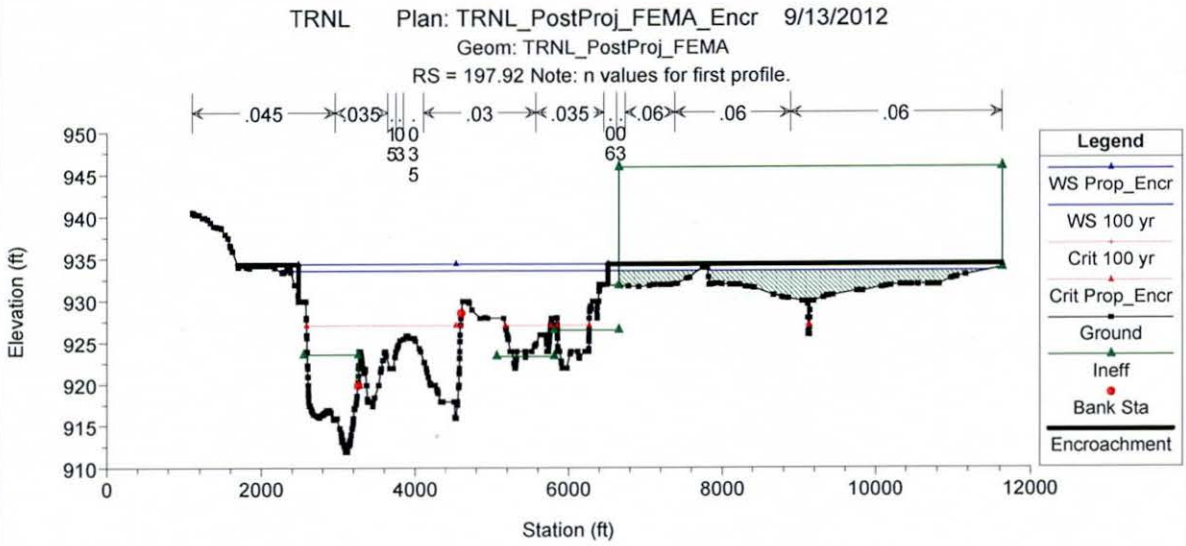
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Crit Prop_Encr
Ground
Ineff
Bank Sta
Encroachment

Appendix E: Hydraulic Analysis Supporting Documentation

E.3 Expansion and Contraction Coefficients

(None for this TDN, Refer to the DDR in Appendix G.2)

Appendix E: Hydraulic Analysis Supporting Documentation

E.4 Analysis of Structures

(None for this TDN, Refer to the DDR in Appendix G.2)

Appendix E: Hydraulic Analysis Supporting Documentation

E.5 Hydraulic Calculations

HNTB Companies
The HNTB Companies
Engineers Architects Planners

49856 Tres Rios
715 Kirk Drive
Kansas City, MO 64105

Telephone (816) 472-1201
Facsimile (816) 472-4075
www.hntb.com

HNTB

Transmittal No. 3636
Date: December 30, 2010

Client Job No. Tres Rios Environmental Restoration Project
RE: HEC-RAS Model (additional files)

To: Richard Harris
Don Rerick
Flood Control District
2801 West Durango Street
Phoenix, AZ 85009

Transmitting:

- ☐ Estimates/Proposals
- ☐ Change Order
- ☐ Minutes
- ☐ Plans/Specifications
- ☐ Shop Drawings
- ☐ Other
- ☐ Correspondence
- ☒ Submittal
- ☐ Shop Drawings
- ☐ Technical Data

By Way Of: FTP Site

No. of Copies and Size	Drawing Number	Latest Date/Rev	Description
Electronic	TR_P3a_101214.f02	n/a	HEC-RAS model
Electronic	TR_P3a_101214.g18	n/a	HEC-RAS model
Electronic	TR_P3a_101214.O19	n/a	HEC-RAS model
Electronic	TR_P3a_101214.p19	n/a	HEC-RAS model
Electronic	TR_P3a_101214.p19.comp_msgs.txt	n/a	HEC-RAS model
Electronic	TR_P3a_101214.prj	n/a	HEC-RAS model
Electronic	TR_P3a_101214.r19	n/a	HEC-RAS model

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- ☒ Review and Comment

Copied To: File, Gary Sanders, John Armstrong, Michael Schwar, Robert Rastorfer

Sent By: pbx 2. mt 1.

Received By:

Date: 12/30/10

Date:

PW Location: 2010-12-30_HEC-RAS model (additional)

HNTB Companies
The HNTB Companies
Engineers Architects Planners

49856 Tres Rios
715 Kirk Drive
Kansas City, MO 64105

Telephone (816) 472-1201
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www.hntb.com

HNTB

Transmittal No. 3617
Date: December 23, 2010

Client Job No. Tres Rios Environmental Restoration Project
RE: HEC-RAS model

To: Richard Harris
Flood Control District
2801 W. Durango Street
Phoenix, AZ 85009

Phone: (602) 506-1501
Fax: (602) 506-4601

Transmitting:

- ☐ Estimates/Proposals
- ☐ Change Order
- ☐ Minutes
- ☐ Plans/Specifications
- ☐ Shop Drawings
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- ☐ Correspondence
- ☒ Submittal
- ☐ Shop Drawings
- ☐ Technical Data

By Way Of: FTP Site

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- ☐ Return
- ☐ Amend/Resubmit
- ☒ Review and Comment

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Sent By: pbr 2. mt 1.

Received By: _____

Date: December 23, 2010

Date: _____

PW Location: 2010-12-23_HEC-RAS model

To

Van Cristosomo

From

Michael Hrzic, PE
Michael Schwar, PE

Date

December 15, 2010

Subject

Revised Draft Tres Rios Phase 3
Pre-Project Hydraulic Analysis Review

HNTB

Technical Memorandum

This memorandum summarizes a review of the HEC-RAS hydraulic modeling documented in the "Tres Rios Phase 3 Environmental Restoration Project Design Documentation Report - Hydraulic Analysis Appendix" completed by JE Fuller May 2010. The 100-year water surface profiles generated by the Fuller models were determined to differ from those generated by the 2004 USACE analysis used to design the Phase 1 and Phase 2 Tres Rios project features. The intent of this review is to evaluate the source of discrepancies between the two models and to determine whether model assumptions might reasonably be adjusted to develop a design model for the Tres Rios Phase 3 project that is consistent with the previous USACE modeling.

Review

The model of interest represents the condition that includes the features from both Phase 1 and Phase 2; this is referred to as the Pre-Project condition for the Tres Rios Phase 3 project. The portion of the model reviewed extends from the Salt River Station 203.48 to the Lower Gila River Station 195.16. The Upper Gila River was not included in this review.

The 2004 USACE Pre-Project condition HEC-RAS model was provided to JE Fuller to use as a basis for their Phase 3 hydraulic analysis. For their analysis, Fuller made several modifications to this model, including changes to vegetation and levee locations. The Fuller Pre-Project condition model showed generally lower water surface profiles than did the USACE model. However, some reaches showed increased water surface profiles relative to the USACE profiles. Figure 1 displays the Pre-Project profiles provided by USACE (USACE Pre-Project) and Fuller (Fuller Pre-Project) models. The portions of the profiles that increased extend along the Lower Gila River from Station 198.49 to 199.31, and Stations 199.55 and 202.94 on the Salt River. The changes that contributed to higher modeled water surface profiles in these segments include:

1. The modeled north bank levee location was shifted riverward from Station 198.4 to 198.49 and to lesser degree from Station 198.54 to 199.11.

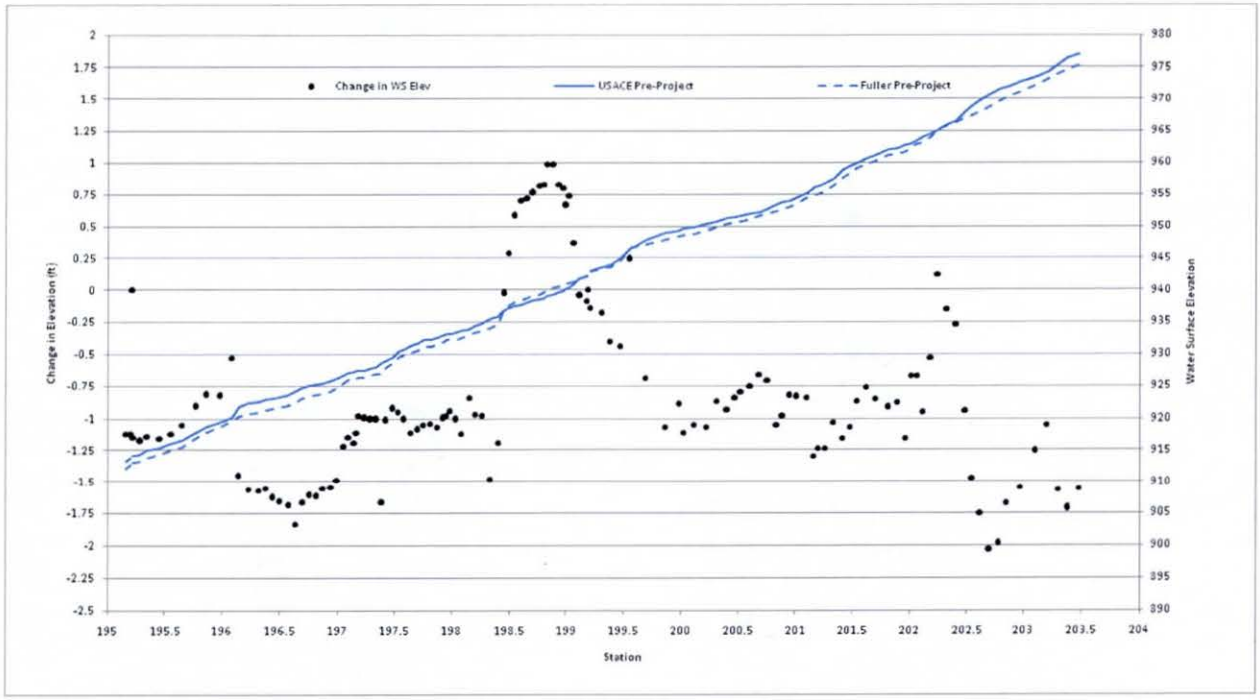


Figure 1. USACE Pre-Project and Fuller Pre-Project Water Surface Profile Comparison for 100-Year Recurrence Interval Flow Event. Positive values for "Change in Elevation" signifies Fuller Pre-Project elevations greater than USACE Pre-Project Elevations..

2. Roughness values were increased and reassigned to have vertical variation as a function to discharge.
3. Horizontal roughness variation was revised based on updated land cover information.

Attachment 1 provides example cross section depicting the changes made to the levee location and roughness values.

With respect to the shift in the levee alignment, the Fuller (2010) report provided a discussion on levees and establishing the levee alignment based on information provided by the USACE and recent aerial photography. A comparison of the flow boundaries for the USACE and Fuller models indicates that the levee footprint in the Fuller model is somewhat riverward of the location represented in the 2004 USACE model (Attachment 2).

The Pre Project Phase 3 geometry was updated by JE Fuller using land cover information to provide more detail in designating roughness variation within the channel. The updated model also was assigned with flow varying roughness values for the various land cover types that were accounted for. In areas where cottonwood vegetated stands existed, higher roughness values were designated with a roughness value decreasing from 0.15 to 0.07 for the 5-year to 100-year discharges. The USACE Pre-Project model had assumed 0.03 for much of the main channel area. A discussion of this approach is provided in the Fuller (2010) report.

Analysis

Because of the design discrepancies that would arise from the higher modeled water surface profiles, HNTB conducted an evaluation of the Fuller assumptions to determine whether reasonable changes to the model might bring the Pre-Project water surface profile into better agreement with the USACE design Pre-Project water surface profile.

Roughness. The first evaluated assumption was the roughness values Fuller used for the main channel from Station 198.4 to 199.06, 199.47, and 202.18. Evaluation of the representation of the cottonwood areas along the edge of the channel suggests that the values used in the Fuller models may be somewhat conservative. The Fuller model uses a vertical distribution of 0.15 for the 5-year magnitude flow event (approximately 6-7 feet above low flow depth), 0.10 for the 20-year event (approximately 7-8 feet above low flow depth), and 0.07 for events greater than or equal to the 100-year event (approximately 12-13 feet above low flow depth). These values are subject to engineering judgment and it appears that somewhat lower values may be appropriate.

Levee Alignment. USACE-SPL provided HNTB with a HEC-RAS geometry file (*TresRiosCLOMR.g04*) which updates the representation of the north levee using as-built information and actual ground points. This information indicates that the actual constructed levee alignment lies between the initial USACE modeled location and the Fuller levee location (Attachment 2).

Dikes. It was observed that the model does not represent several dikes which have been constructed along the northern bank. The Fuller Pre-Project geometry file represents two of the existing dikes with ground elevations capturing the shape of the dike, but the other five dikes are not represented in any way.

Revised Pre-Project Design Model

To evaluate the implications of revising the Fuller assumptions, HNTB developed a Revised Pre-Project Design Model. This model incorporates the as-built north levee information into the Fuller model, adds obstruction areas to cross sections that are influenced by dikes (Attachment 3), and adjusts the vertical roughness distribution for the cross sections at Station 198.4 to 199.06, 199.47, and 202.18 by reducing the 100-year Manning's "n" representation of the cottonwood areas to 0.04. With these changes the Revised Pre-Project Design model 100-yr water surface profile does not exceed the USACE Pre Project profile (Figure 2). Attachment 4 provides the table of results for comparing model results for the USACE and Revised Pre-Project conditions to demonstrate the impacts of these changes.

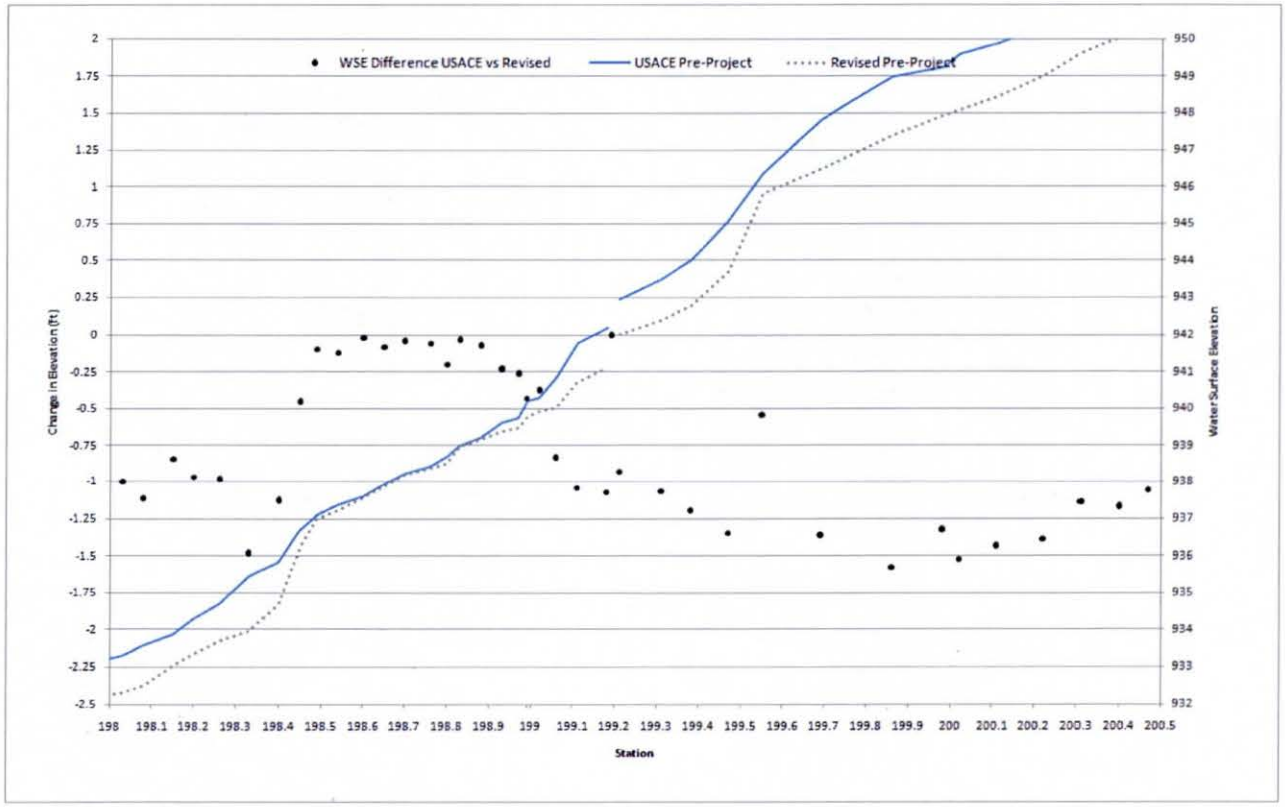


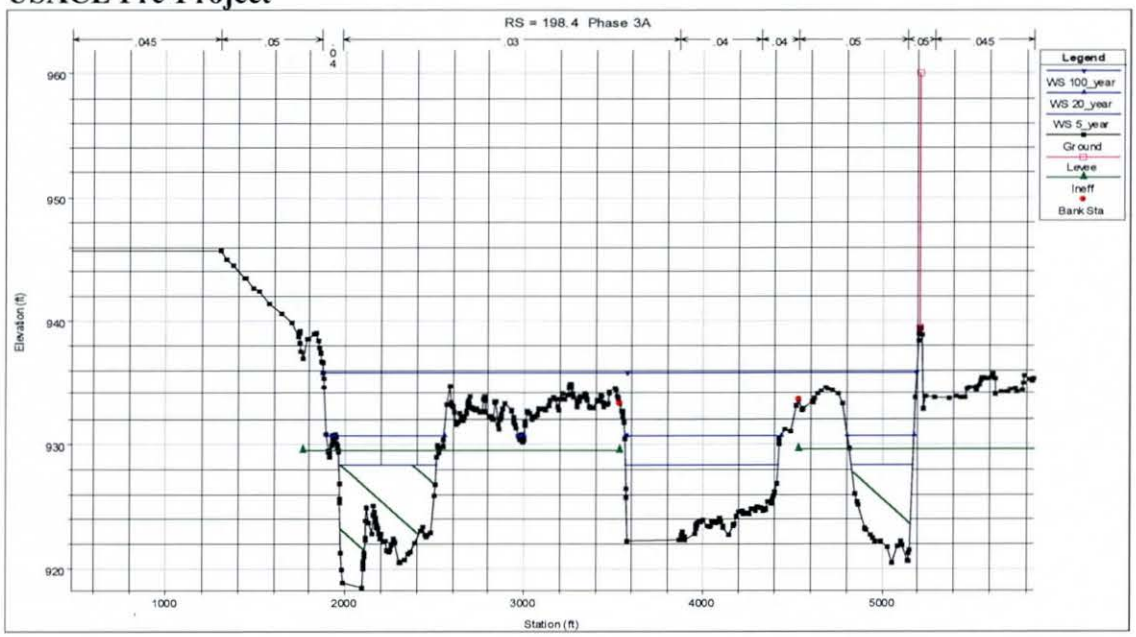
Figure 2. USACE Pre-Project and Revised Pre-Project Design Model Water Surface Profile Comparison for 100-Year Recurrence Interval Event.

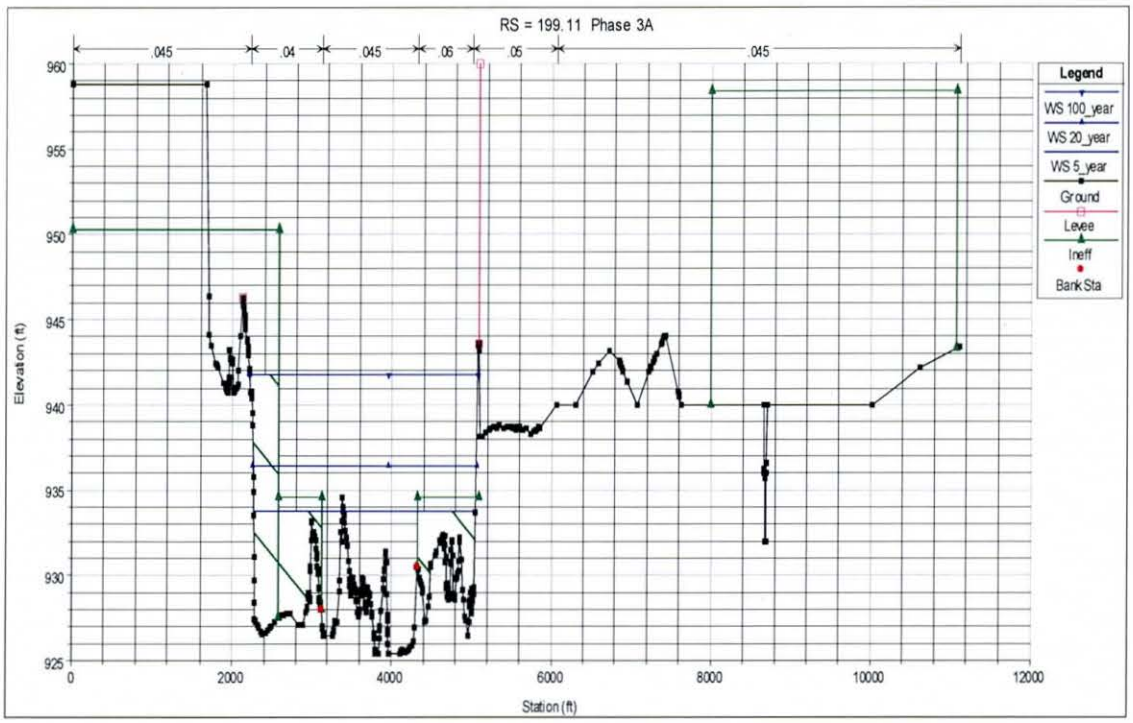
Conclusions

Based on this analysis, modifying the Fuller model to represent as-built levee conditions as provided by the USACE in file *TresRiosCLOMR.g04*, including the influence of dikes along the north bank and to reduce the assumed resistance caused by cottonwoods on the floodplain at Station 198.4 to 199.06, 199.47, and 202.18 would create a design model that reasonably represents conditions within the Tres Rios project area and maintains consistency with the design model developed by the USACE. We recommend that the USACE consider incorporating these changes into the Fuller model to establish the design model for the Tres Rios Phase 3 projects.

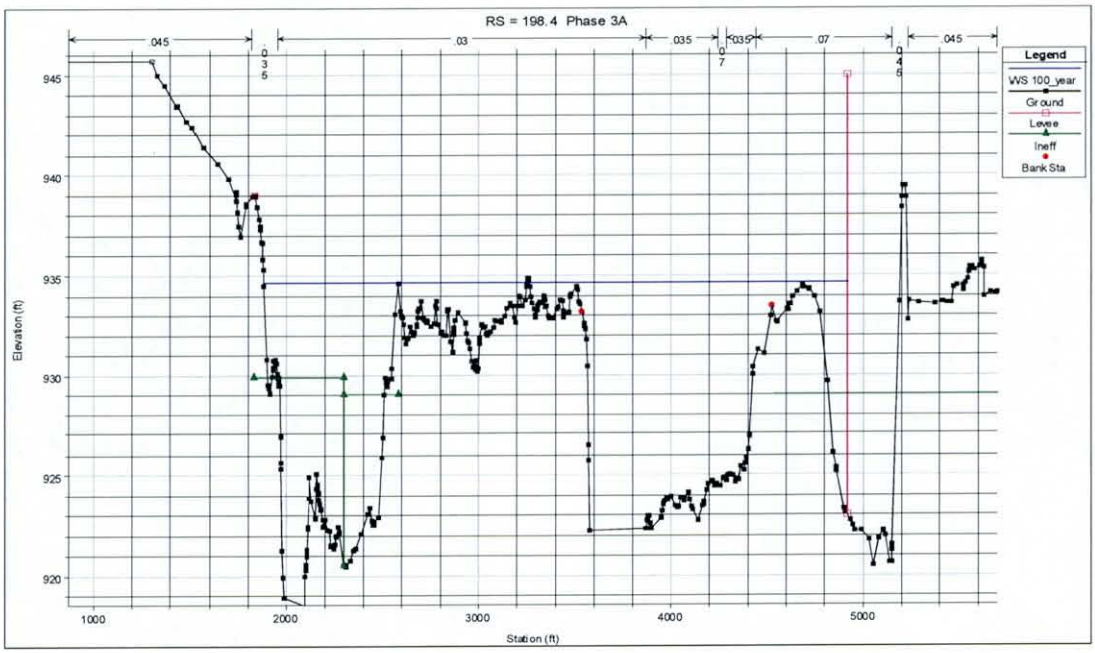
Attachment 1 Cross Section Information

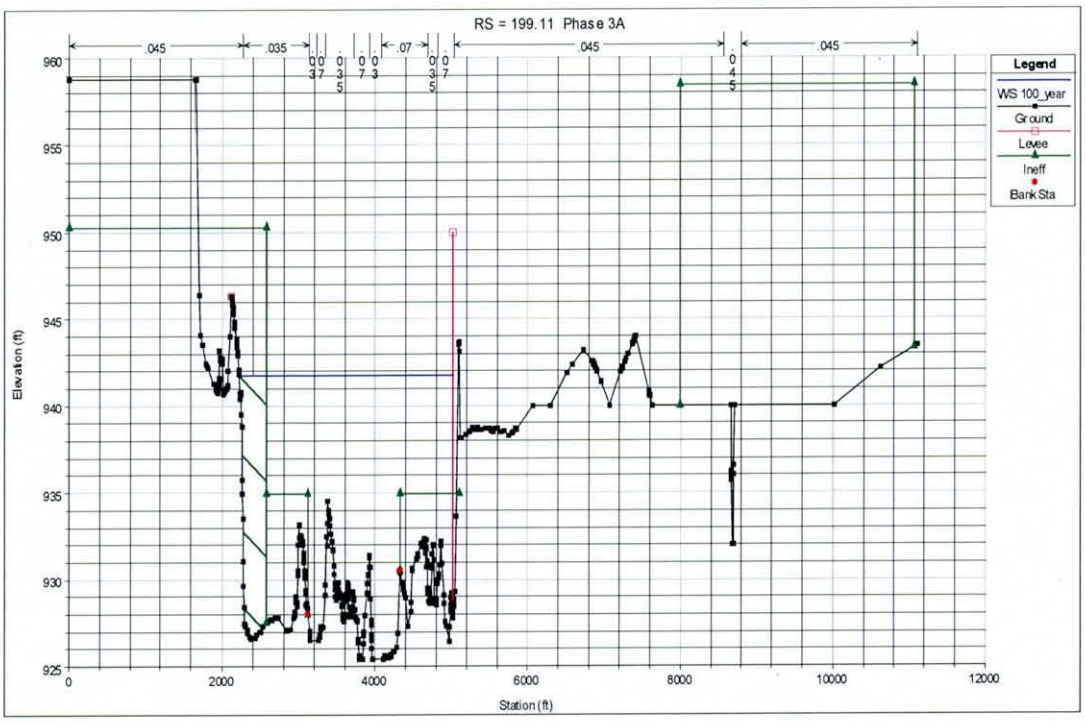
USACE Pre-Project



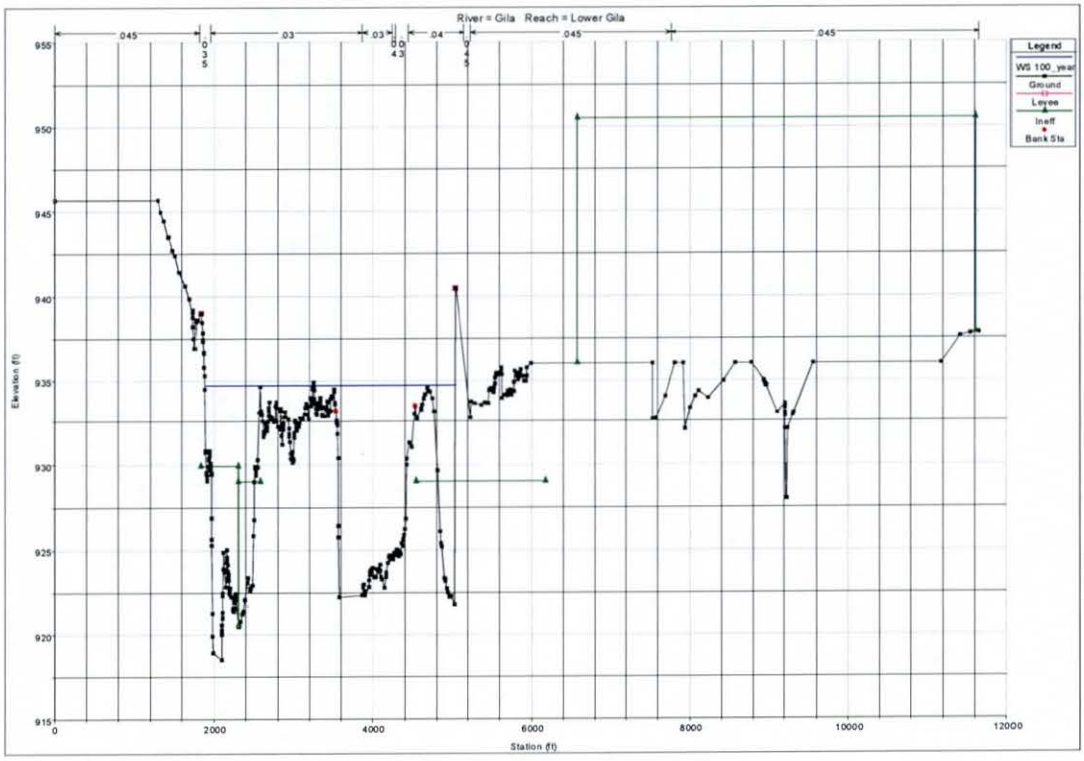


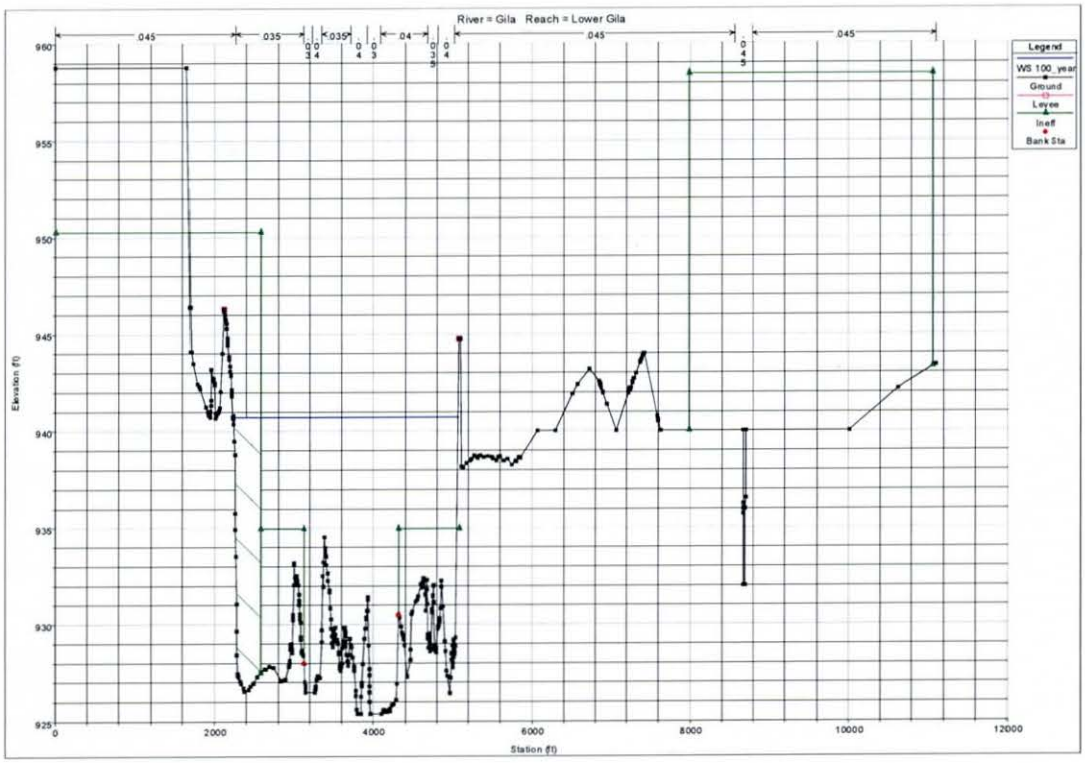
Fuller Pre-Project

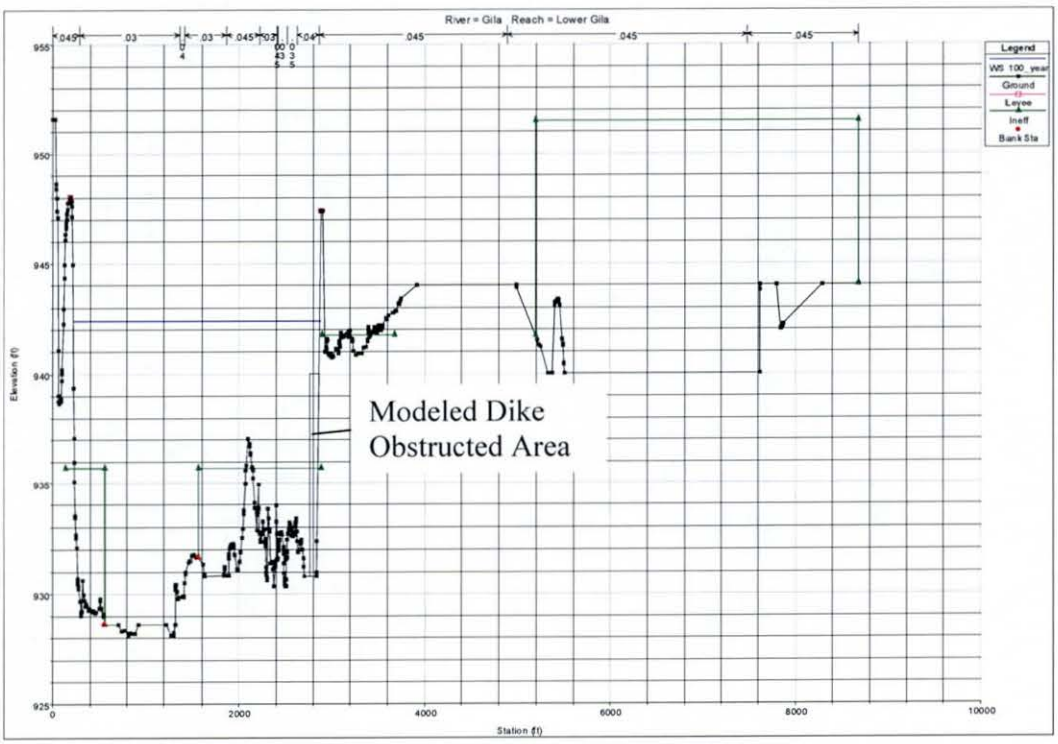




Revised Pre-Project Design Model

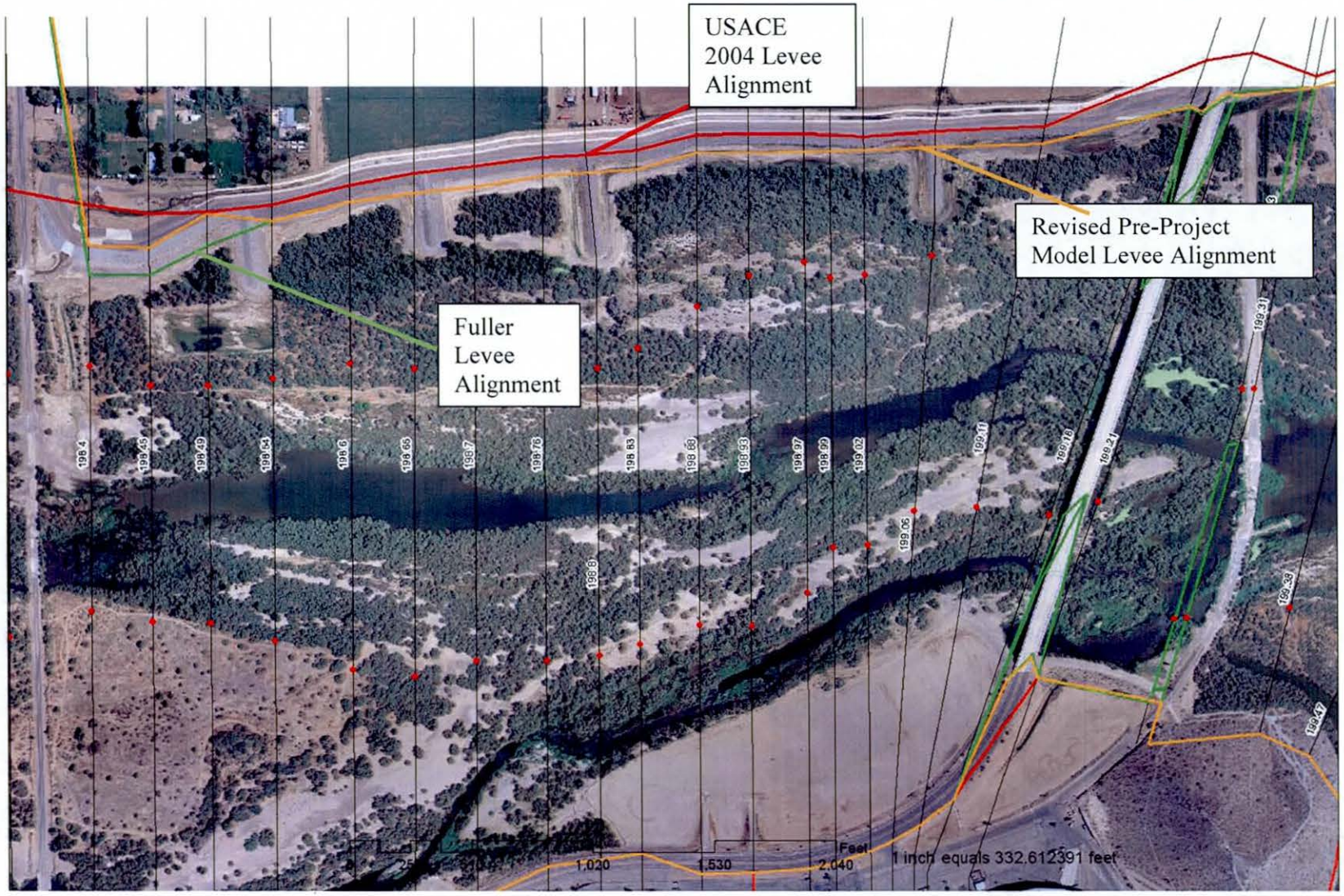




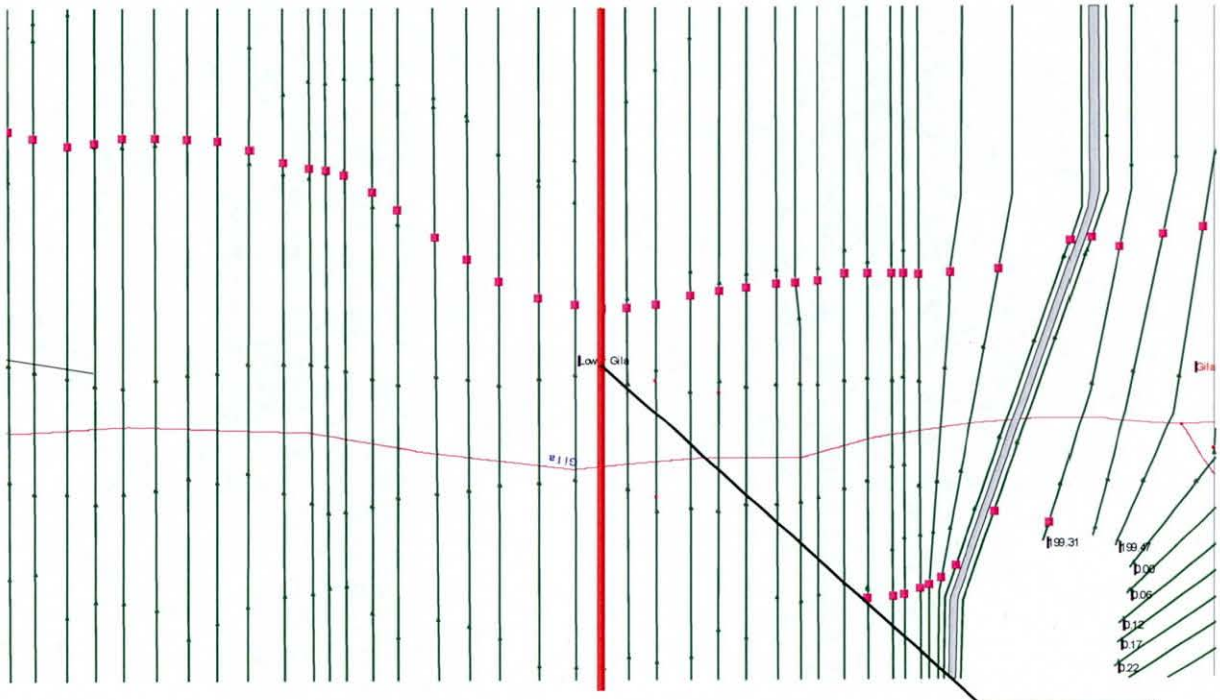

River = Gila Reach = Lower Gila
Legend
WS 100_year
Ground
Levee
Ineff
Bank Sta
Modeled Dike
Obstructed Area
Elevation (ft)
Station (ft)
955
950
945
940
935
930
925
0
2000
4000
6000
8000
10000

Attachment 2

Levee Alignment Comparison Map.



HEC-RAS Levee Alignment USACE Pre-Project

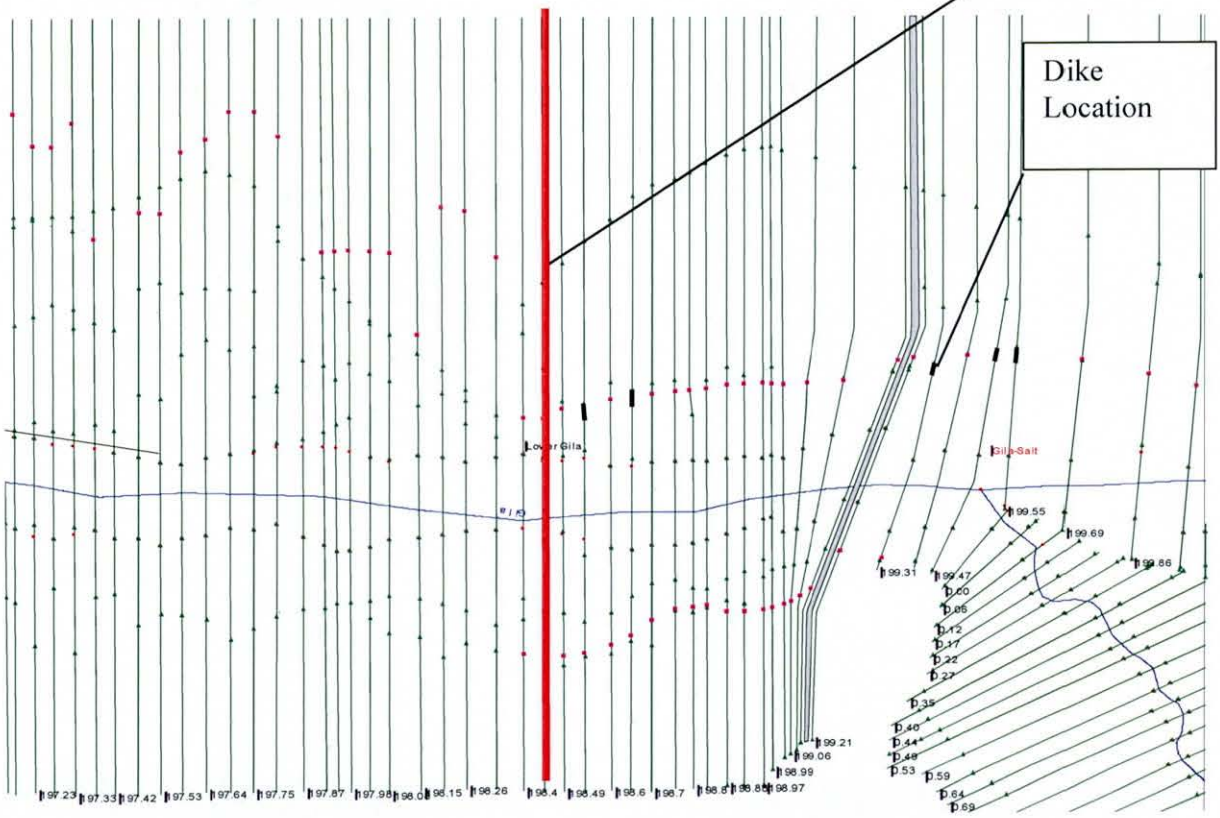


Station 198.45

Levee Alignment

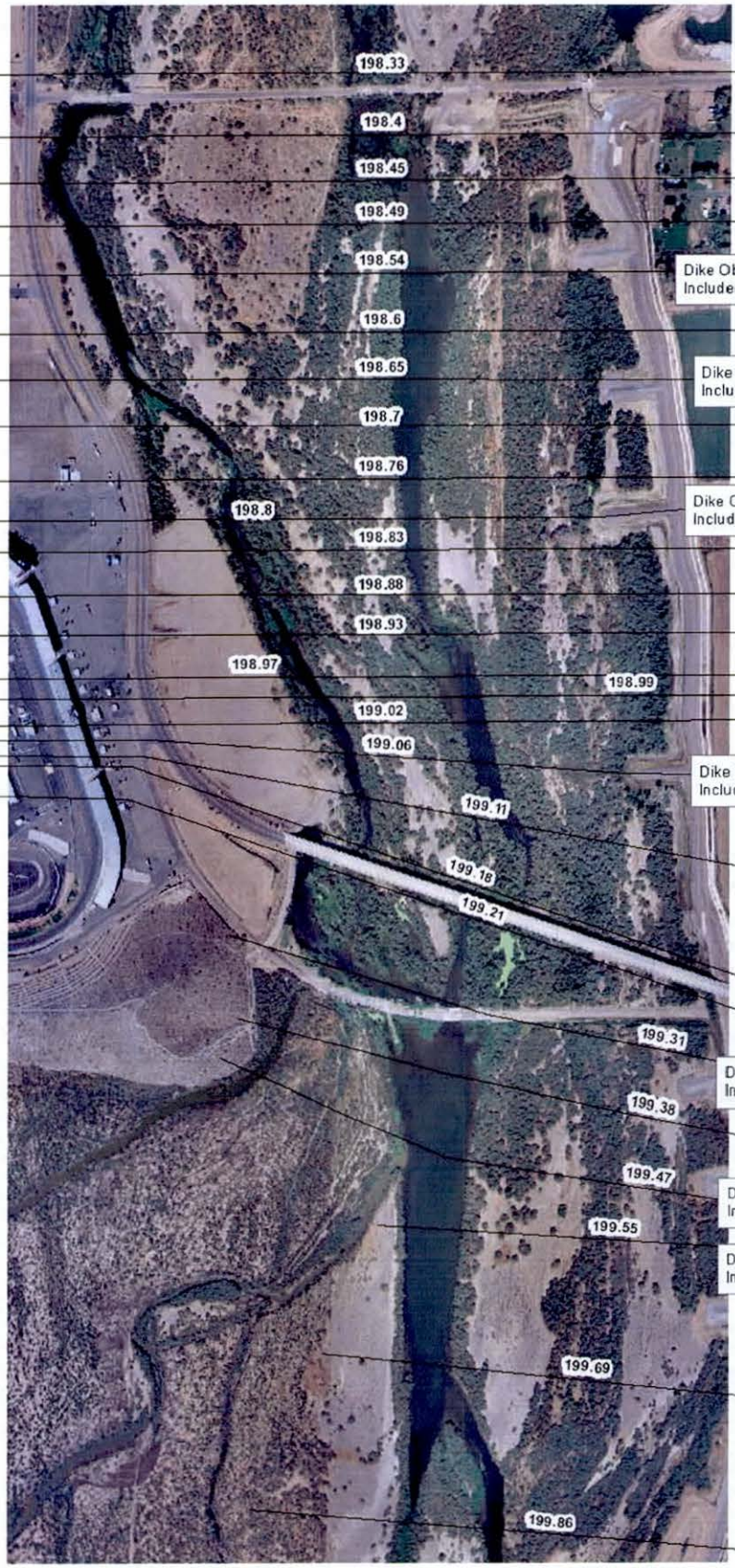
HEC-RAS Levee Alignment Fuller Pre-Project

Dike Location



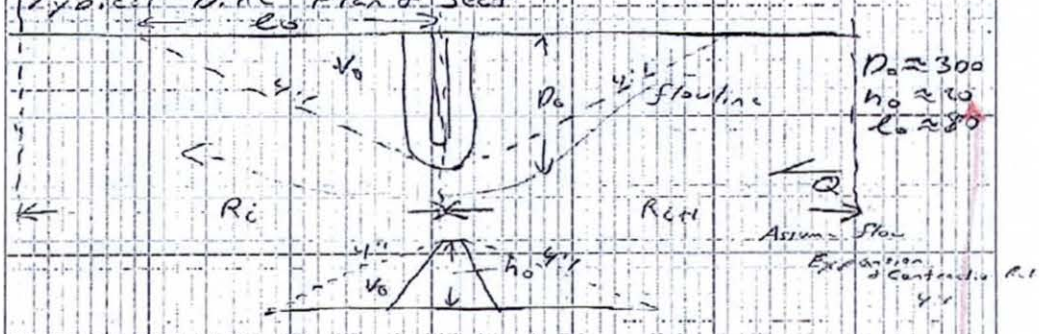
Attachment 3

Obstruction Support Documentation



Calculations for Dike Calculation	Job No. 49856	Sheet No. 1 of 2	HNTB
Made by MH	Date 12/08/10		
Checked by MTJ	Date 12/15/10		
Backchecked by	Date		

Typical Dike Plan & Sect



Hec-RAS Approach for Dike Obstruction and effective Area accounted for in model

A_o = ~~Obstr~~ Physical Obstruction Area = $D_o h_o$

V_o = Obstructed Volume of flow due to dike area

$V_o = \frac{A_o l_o}{2}$ where l_o is obstructed flow reach U.S. & D.S. St. $l_o = 4 h_o$

or

$V_o = 2 A_o h_o$

Since that,

V_n is the corresponding obstructed volume in Hec-RAS model & should be equal to V_o

$V_n = \frac{A_n R_i}{2}$ where A_n is dike obstruction Area in Hec-RAS & $A_n = d_n b_n$

If $V_n = V_o$ — R_i is Downstream Reach length

then

$V_n = \frac{A_n R_i}{2} = 2 A_o h_o$ or $\frac{A_n R_i}{2} = \frac{A_o l_o}{2}$

$A_n = A_o \frac{l_o}{R_i}$ & $A_n = l_n h_n = n^2 l_o h_o$

$n \approx \left(\frac{A_n}{A_o}\right)^{1/2}$

RS	R_i	A_n	n	d_n	h_n
198.65	330	1455	0.49	147	10
198.54	240	2000	0.58	173	11.5
197.31	500	260	0.4	120	2.0
199.47	430	1116	0.43	125	8.6
197.55	518	1322	0.50	130	10.0

$A_o \approx 6000$ SF

ME111-1204 1

Calculations for Dike Calculation	Job No. 49856	Sheet No. 2 of 2	HNTB
Made by MJH	Date 12/13/10		
Checked by MTS	Date 12/15/10		
Backchecked by	Date		

Note: RAS Cross sectional area for dike obstruction was based on downstream channel reach length. Length downstream is similar to upstream, it was assumed that using obstructed area using downstream reach length is appropriate because the backwater calculation and average conveyance area for the reaches upstream & downstream of dike section will be at an appropriate accuracy.

ME111-1204

Attachment 4

Tabular Results for Revised Pre-Project Design Model

		Difference Between Proposed Pre-Project Design Model Results and USACE Model (2004)			
Reach	Station	Change in W.S.E . (ft)	Change in Vel. (ft/s)	Change in Area (ft^2)	Change in Channel Avg. Manning's "n"
Lower Gila	195.16	-1.12	0.79	-2021	-0.005
Lower Gila	195.2	-1.12	0.72	-1984	-0.005
Lower Gila	195.21	0.00	0.00	0	0
Lower Gila	195.22	-1.15	0.72	-2041	-0.005
Lower Gila	195.28	-1.17	0.83	-2233	-0.005
Lower Gila	195.34	-1.14	0.88	-2580	-0.005
Lower Gila	195.45	-1.16	1.05	-2965	-0.005
Lower Gila	195.55	-1.12	1.06	-2762	-0.005
Lower Gila	195.65	-1.05	0.72	-2665	-0.001
Lower Gila	195.77	-0.90	0.58	-2450	-0.002
Lower Gila	195.86	-0.81	0.40	-2559	-0.003
Lower Gila	195.98	-0.82	0.70	-2946	-0.008
Lower Gila	196.08	-0.53	-5.74	-1689	0.006
Lower Gila	196.14	-1.45	-1.48	-5989	0.004
Lower Gila	196.23	-1.57	0.21	-3886	-0.001
Lower Gila	196.32	-1.58	0.78	125	-0.008
Lower Gila	196.38	-1.56	0.20	839	-0.002
Lower Gila	196.44	-1.63	1.07	113	-0.009
Lower Gila	196.5	-1.66	0.98	-947	-0.009
Lower Gila	196.57	-1.69	0.75	-1669	-0.010
Lower Gila	196.63	-1.83	1.52	-6101	-0.008
Lower Gila	196.69	-1.67	1.02	-6027	-0.010
Lower Gila	196.75	-1.61	-0.01	-5904	-0.007
Lower Gila	196.81	-1.62	-0.18	-6255	0
Lower Gila	196.87	-1.56	-0.30	-6313	0.003
Lower Gila	196.94	-1.55	0.59	-7246	0
Lower Gila	196.99	-1.49	1.33	-7773	-0.004
Lower Gila	197.05	-1.22	0.14	-6508	-0.002
Lower Gila	197.09	-1.15	0.26	-5606	0
Lower Gila	197.14	-1.19	0.96	-4948	-0.005
Lower Gila	197.16	-1.11	0.29	-4355	-0.003
Lower Gila	197.18	-0.98	-0.77	-3264	-0.002
Lower Gila	197.23	-0.99	-0.62	-3319	-0.001
Lower Gila	197.28	-1.00	-0.65	-2875	-0.001
Lower Gila	197.33	-1.00	-0.77	-3833	-0.001
Lower Gila	197.38	-1.67	2.39	-6170	-0.007
Lower Gila	197.42	-1.01	0.25	-2614	-0.002
Lower Gila	197.48	-0.92	-0.06	-2090	-0.003
Lower Gila	197.53	-0.95	-0.30	-1130	-0.003

		Difference Between Proposed Pre-Project Design Model Results and USACE Model (2004)			
Reach	Station	Change in W.S.E . (ft)	Change in Vel. (ft/s)	Change in Area (ft^2)	Change in Channel Avg. Manning's "n"
Lower Gila	197.58	-1.00	-0.10	-1645	-0.001
Lower Gila	197.64	-1.11	0.50	-1446	-0.001
Lower Gila	197.7	-1.08	0.34	-1221	-0.002
Lower Gila	197.75	-1.05	0.29	-1104	-0.001
Lower Gila	197.81	-1.04	0.17	-2727	0
Lower Gila	197.87	-1.07	0.41	-3690	-0.001
Lower Gila	197.92	-0.99	0.05	-3487	0
Lower Gila	197.95	-0.98	0.17	-3547	-0.001
Lower Gila	197.98	-0.94	-1.56	-3636	0
Lower Gila	198.03	-1.00	-1.61	-3802	0
Lower Gila	198.08	-1.12	-1.02	-4125	-0.001
Lower Gila	198.15	-0.84	-3.5	-2273	0.007
Lower Gila	198.2	-0.97	-3.25	-2798	0.012
Lower Gila	198.26	-0.98	-1.79	-3413	0.005
Lower Gila	198.33	-1.48	0.80	-6941	0.007
Lower Gila	198.4	-1.13	2.75	-5576	-0.005
Lower Gila	198.45	-0.45	0.93	-3450	-0.002
Lower Gila	198.49	-0.10	-1.08	-326	0.007
Lower Gila	198.54	-0.12	-0.48	-1691	0.005
Lower Gila	198.6	-0.02	-0.82	-24	0.003
Lower Gila	198.65	-0.08	-0.45	-1166	0.002
Lower Gila	198.7	-0.04	-1.23	-301	0.004
Lower Gila	198.76	-0.06	-1.34	-517	0.006
Lower Gila	198.8	-0.20	0.33	-1122	-0.005
Lower Gila	198.83	-0.03	-1.27	-575	0.003
Lower Gila	198.88	-0.07	-1.07	-196	-0.002
Lower Gila	198.93	-0.23	-0.45	-715	-0.002
Lower Gila	198.97	-0.26	-1.02	-541	-0.006
Lower Gila	198.99	-0.43	-0.33	-1075	-0.006
Lower Gila	199.02	-0.37	-0.13	-961	-0.011
Lower Gila	199.06	-0.83	0.76	-1966	-0.015
Lower Gila	199.11	-1.05	0.55	-2641	-0.009
Lower Gila	199.18	-1.08	0.32	-835	0
Lower Gila	199.19	0.00	0.00	0	0
Lower Gila	199.21	-0.93	-0.25	-58	0
Lower Gila	199.31	-1.07	0.10	-3636	-0.005
Lower Gila	199.38	-1.2	0.05	-3368	-0.006
Lower Gila	199.47	-1.35	-1.00	-4845	-0.003
Salt	199.55	-0.54	-3.97	-2269	0.002
Salt	199.69	-1.36	-0.96	-3782	0
Salt	199.86	-1.58	1.15	-4195	-0.001
Salt	199.98	-1.32	-0.55	-4218	0.003
Salt	200.02	-1.52	0.79	-6118	0

		Difference Between Proposed Pre-Project Design Model Results and USACE Model (2004)			
Reach	Station	Change in W.S.E . (ft)	Change in Vel. (ft/s)	Change in Area (ft^2)	Change in Channel Avg. Manning's "n"
Salt	200.11	-1.43	0.80	-4121	-0.001
Salt	200.22	-1.39	1.39	-4680	-0.008
Salt	200.31	-1.14	0.09	-3166	0.001
Salt	200.4	-1.17	0.53	-4744	0.002
Salt	200.47	-1.06	0.56	-4491	0.003
Salt	200.52	-0.99	0.47	-4539	0.005
Salt	200.6	-0.92	0.95	-4276	-0.005
Salt	200.68	-0.81	-1.12	-3494	-0.002
Salt	200.75	-0.84	-2.23	-3645	0.002
Salt	200.83	-1.16	-0.23	-4448	0.002
Salt	200.88	-1.07	-0.79	-4162	0.009
Salt	200.95	-0.89	-1.41	-3391	0.005
Salt	201.01	-0.89	-1.89	-3405	0.007
Salt	201.1	-0.88	-2.24	-3412	-0.002
Salt	201.16	-1.33	0.27	-4919	0
Salt	201.2	-1.27	-0.48	-4642	0
Salt	201.26	-1.27	0.26	-4350	0
Salt	201.33	-1.04	-1.63	-3485	0
Salt	201.41	-1.17	-0.97	-3866	0.007
Salt	201.48	-1.07	-1.22	-3533	0.004
Salt	201.54	-0.87	-1.56	-2281	0.008
Salt	201.62	-0.76	-0.95	-1899	0.001
Salt	201.7	-0.85	-0.99	-2857	-0.006
Salt	201.81	-0.92	-2.88	562	0.015
Salt	201.89	-0.88	-4.23	4690	0.026
Salt	201.96	-1.16	-2.36	-374	0.022
Salt	202.01	-0.67	-3.65	4258	0.015
Salt	202.06	-0.67	-4.53	3993	0.021
Salt	202.11	-0.95	-2.69	-5180	0.026
Salt	202.18	-0.90	1.00	-6920	0.003
Salt	202.24	-0.16	-2.16	-645	0.018
Salt	202.32	-0.34	-1.07	-1441	-0.003
Salt	202.4	-0.49	-3.77	-4406	0.006
Salt	202.48	-0.86	-4.47	-3265	0.005
Salt	202.54	-1.41	-3.32	-5333	0.004
Salt	202.61	-1.70	-2.11	-6563	0
Salt	202.69	-2.00	-0.50	-7448	0.001
Salt	202.78	-1.97	1.07	-7551	-0.006
Salt	202.85	-1.67	-0.65	-6052	0.002
Salt	202.97	-1.55	-0.11	-5204	0.003
Salt	203.1	-1.24	-1.15	-4013	0.007
Salt	203.2	-1.05	-2.76	-3577	0.002
Salt	203.3	-1.57	-0.17	-5678	-0.005

		Difference Between Proposed Pre-Project Design Model Results and USACE Model (2004)			
Reach	Station	Change in W.S.E . (ft)	Change in Vel. (ft/s)	Change in Area (ft^2)	Change in Channel Avg. Manning's "n"
Salt	203.38	-1.71	0.79	-61780	-0.008
Salt	203.48	-1.56	0.16	-5504	0

Appendix F: Erosion and Sediment Transport Analysis Supporting Documentation

F.1 Excerpt from the PED Study

5. Sediment Transport Analysis

5.1. General

The objective of the sediment transport analyses was to evaluate baseline and future sediment conditions to identify the impacts of the preferred project alternative. A base conditions sediment transport model was developed and adjusted to insure hydraulic similarity between the sediment transport model and the HEC-RAS model. The HEC-6T model used the geometry from the existing conditions hydraulic model described in the previous sections as well as Manning's *n* values and other features. The sedimentation model was then adjusted as necessary to reproduce water surface elevations in the RAS model. This procedure was performed for each existing and plan condition modeled.

The bed material in the study reach is composed primarily of sand and gravel. Sand is the main transport size, but there is also a high percentage of gravel in the bed. Based on the analysis of the material the Toffaleti – Meyer-Peter Muller (TMPM) combination transport method was used in the sediment transport simulations. This method transports gravel as well as sand and is well suited for this type of a river system.

The computer program HEC-6T: "Sedimentation in Stream Networks", version 5.13 (2002), was used to conduct the numerical sediment transport modeling. Copeland's solution of the Exner equation (EXNER 7 HEC-6T option) is used in the sediment transport simulations to enable armoring to occur.

5.2. HEC-RAS Model Conversion

5.2.1 Model Geometry

The geometry of the HEC-RAS hydraulic model was converted into a text file with the format required by the HEC-6T program. Roughness coefficients (Manning's *n*) in the cross sections of the river models were varied with depth. After running the 5-, 20- and 100-year flood events in HEC-RAS, the profile output tables were used to extract conveyance weighted Manning's n values for the channel, the left and the right overbanks for the different discharges. The modified data was then entered into the HEC-6T input file using NV records. A default value of 0.04 was used to fill blanks when the conveyance in an overbank area was zero. The result was a configuration of roughness coefficients changing vertically by discharge rather than horizontally by distance as in the HEC-RAS models.

Conveyance limits defined in HEC-RAS using 5-year-discharge ineffective flow boundaries were coded in HEC-6T using XL records. The advantage of using XL record is that it allows deposition to occur in the ineffective flow areas. X3 records were used to set the encroachment limits or prevent flow into areas protected by natural or man-made levees. The upstream and downstream bridge cross sections from the HEC-RAS model were retained.

Using normal flow considerations, an elevation-discharge Rating Curve was developed at the downstream boundary of the Lower Gila River (cross section 195.16) for starting water surface elevations. The rating curve at this point was generated for discharges ranging from 0-225,000 cfs, at 7500 cfs increments for a bed slope of 0.002 ft/ft (Figure 5-1).

5.2.2. Fixed Bed Model Calibration

Initially, the HEC-6T model was calibrated with a fixed bed using the 5-, 20- and 100-year flows, and the resulting water surface profiles were compared to the HEC-RAS Existing Conditions (Condition 1) results. For the purpose of north levee design, an effort was made to keep the difference in water surface elevations within 0.1 ft. This was accomplished by setting the Manning's *n* equal to 5 in the overbank areas for the 5-year and 20-year flows (i.e. ineffective flow areas for low flows) and calculating the corresponding effective depth across the channels. Adjustments of Manning's *n* were performed for calibration purposes for all cross sections beginning with the downstream section in the Lower Gila reach. These adjustments were performed to reach agreement between the HEC-RAS and HEC-6T water surface elevations and channel velocities.

The hydraulic comparison results from this analysis are given in Appendix H.

5.3. Sediment Data

The decisive factor in selecting the proper sediment transport function was based on available bed gradation and maximum grain size. Initial data received from the U.S. Army Corps of Engineers Los Angeles District supported a maximum grain size diameter of 76mm. Bed material in the project location is comprised of sand and gravel, making it necessary to use an appropriate transport function. A combination of the Toffaleti and Meyer-Peter and Muller (TMPM) transport functions was used in the study. This combination accounts for sand and gravel, giving a higher, realistic measure of total sediment concentration (and thus total sediment load) and was compared with Yang's method for the study area. Based on field observations, to facilitate modeling and to

represent larger diameter cobbles noted in the bed, a maximum grain size of 300mm was used in the final sediment transport runs in HEC-6T.

5.3.1. Bed Sediment Characteristics

Data for the particle size distribution of the bed sediment is required to drive the sediment transport model. The Corps of Engineers and WEST personnel collected 22 surface samples (on September 4 and 16, 2002) along the Salt and Lower Gila reaches of the project area. Surface sample ID's are SS1, SS2, etc. September 4th sampling locations ranged from densely vegetated areas within the banks (i.e. SS1, SS5, SS6, and SS7), to channels completely denuded of vegetation and with an armored surface layer (i.e. SS2, SS3, SS4, SS8, SS9, and SS10). Out of the above mentioned samples, SS1, SS4, SS6, and SS7 were discarded for poor data (mostly sand). Sample SS10, was beyond the project boundary and was disregarded. Observations indicate areas of dense vegetation contain finer sediment beds, providing evidence of the ability of vegetation to prevent erosion and promote deposition by trapping fine particles.

Samplings of September 16th cover the entire Salt-Lower Gila reach and were identified as SS12, SS12A, SS13 through SS19, and SS21 through SS23; with SS19 missing. Due to reasons discussed above, samples SS12, SS16, and SS19 were also eliminated from the analyses.

Sediment samples were also collected from the upstream portion of Upper Gila at the Santa Cruz Road crossings of the Santa Cruz River and Gila River. This location is approximately 10 miles upstream of the Salt-Gila confluence. Ricker Atkinson McBee & Associates performed sieve analysis on these sediment samples and provided the sediment gradations. The data indicates that the sediment contains mostly fines. The

locations where samples were obtained are very densely vegetated with salt cedar and deposition of fines can be expected due to slowing of the flow as it moves through the vegetation. If the salt cedar vegetation is removed in the future, the fines will be carried by the flow resulting in a coarser sediment gradation in the Upper Gila. The samples were collected from areas where the bed surface had been removed to a depth of five feet or more and the material evidenced along the edges of the excavations indicated that the fines extended at least that far into the bed. Along the Santa Cruz River, however, cobbles up to 14 inches in diameter were noted in areas where sediment had been removed to depths of 8 to 10 feet. It is expected that the original bed material is similar to that found in the confluence area and downstream from the confluence. The fine material is estimated to be from 5 to 10 feet deep over the original bed material, however. Based on these observations the sediment gradation from the confluence was used for the Upper Gila and data from the samples obtained at the Santa Cruz Road crossings were disregarded in the modeling effort.

The size class of the material sampled on the Gila does, however, have major implications for maintenance of the ponds in the confluence area. Since the material is extremely fine it will likely have little commercial value and the removal of the material from the pond at the confluence will be expensive. Based on this and the fact that the pond will act as a sediment trap, it is recommended that the pond at the confluence be eliminated from the construction plans.

Available sediment gradation data is shown in Appendix J and sample locations are shown on the existing condition maps in Appendix P. At locations with high spatial variability of sediment characteristics, more than one sample was taken representing

different types of bed material along a cross section. In these cases, the resulting gradation from the samples was combined into a single averaged gradation curve for use in the HEC-6T model.

5.3.2. Inflowing Sediment Load

The sediment transport model cannot be directly calibrated to historical conditions because detailed historical bed elevation data are not readily available, and the bed elevation changes have been influenced by man-made changes to the Salt River. The HEC-6T model requires input of the bed material load at the upstream limit of the project reach for the entire range of discharges. For this purpose, the following estimates of inflowing sediment load were considered: 1) equilibrium sediment load from representative cross-sections near the upstream end of the Salt and Upper Gila model limits; 2) outgoing sediment load from the Rio Salado Oeste HEC-6T Model (WEST Consultants, 2002) as inflowing load at the upstream end of Salt River (Rio Salado Oeste is immediately upstream from Tres Rios); and 3) sediment inflow used in the Rio Salado Study as inflowing load at the upstream end of Salt River (WEST Consultants, 1999). The sediment loads were estimated for a range of discharges up to 200,000 cfs for the Salt and 100,000 cfs for the Upper Gila.

Although the upstream project limit in the Salt River is at River Station 203.48, the equilibrium load run was performed between River Stations 201.41– 202.11 to avoid influences from a gravel pit immediately upstream of 83rd Avenue. This process was repeated for a longer reach of the upstream cross sections of the Salt River to verify the stability in the corresponding bed-change elevation.

Initially, HEC-6T was run for three years using clear water inflow as the initial condition and the recirculation option ($RE record). The recirculation option instructs the program to use the sediment discharge at the downstream end of the reach as the sediment inflow at the upstream end for the following time step. When equilibrium is attained, sediment load entering the reach is about equal to the load leaving the reach. The estimated load from the initial run was input to a model with the recirculation option turned off, and simulation was performed over a period of two years. The initial estimates of sediment load and the gradation were adjusted until the changes in the bed elevations between the River Stations 201.41 and 202.11 were minimized.

The procedure described above was repeated for the Upper Gila River between River Stations 1.48 and 1.67.

The inflowing sediment loads generated using the Toffaleti – Meyer-Peter and Muller (TMPM) sediment transport function are shown in Figures 5-2. The gradation of the inflowing load from the equilibrium analysis is shown in Figures 5-3 and 5-4. In Figure 5-2, the largest inflow load representing the conservative scenario from the levee design point of view is provided by the outgoing sediment load from the Rio Oeste Model. Therefore, this sediment load was selected as the inflowing load at the upstream end of the Salt River which was entered into the HEC-6T input files using LQ, LT and LF records for long term sediment transport analyses. A sensitivity analysis to the inflowing sediment loads was performed and is presented in Section 5.5.

5.3.3. Movable Bed and Erosion Limits

In general, sediment dynamics tend to be more significant within the active channel, where the bed can either degrade or aggrade in response to erosion or

deposition. The overbank areas tend to be more stable and normally are free of erosion, but can experience deposition. HD records were used to specify a bed sediment depth of 25 feet for all cross sections. Movable bed limits were identified at the boundary of the main channel in HD records. The movable bed limits extend beyond the 5-year low flow channel (regime channel) and the defined bank stations. During high flows, significant deposition and scour was expected to occur within the movable bed limits but not expected to extend to the overbank areas.

Average bed elevations were generated using 50-year period-of-record flow within the movable bed limit bank limits. This allowed wetting of the movable bed cross sections and provide average elevation across the cross section.

5.4. Hydrologic Data

A 105-year (1889-1993) series of hydrographs at the Salt-Gila confluence consisting of historical flows was developed by WEST. These hydrographs were based on a series of hydrographs obtained from the U.S. Army Corps of Engineers. A 50 year series was available from the earlier WEST Tres Rios study and hydrographs for an additional 55 years were adapted for use in this study. The outstanding balance of fifty-five years of partial hydrographs was fully reconstituted by reconstructing each of the respective hydrograph's rising limbs and tails. The complete record was developed by inserting the historical Gila River period-of-record hydrographs at the appropriate time line locations for the Salt-Lower Gila River record.

The Salt inflow was obtained by routing the available hydrograph downstream of Granite Reef diversion dam. Modifications were made to the hydrographs by WEST as

described above in order to extend the data. Hydrograph ordinates were obtained at 6-hour intervals from the U.S. Army Corps of Engineers' DSS software.

Hourly hydrologic data for portions of the record for the Upper Gila were obtained from U.S. Army Corps of Engineers, Los Angeles District. Hydrographs for the available data were plotted at six hour intervals over the 105 year period and are shown in Appendix J.

The USGS historical record for the Gila River near the confluence extends only to 1940 and was estimated by various means for the period prior to 1940. The influence of the hydrograph is not, however, extremely significant in the comparisons between ending bed elevations. The flows were estimated by various means including using a percentage of flow on the Salt as was used on the feasibility study performed in 1999, repeating the 1940-1992 hydrograph, using a combination of the percentage of flow on the Salt with historical events on the Gila being estimated and patterned after the 1983 Gila River flood hydrograph.

5.5. Sensitivity Analysis

A sensitivity analysis was performed with the objective of exploring the sensitivity of the sediment transport model to variations in the parameters, in an attempt to determine the appropriateness of the selected values. Sensitivity runs were performed on the base conditions HEC-6T input file to determine the relative effect of inflowing sediment load, Gila River hydrograph, and Manning's *n* values. Results are given in Appendix K.

The Manning's *n* values were varied between 80 % and 120 % of the values used in the base conditions model. The results show that there is not a significant change in

the average bed elevations due to changes in the Manning's *n* values except at the upstream end of the Salt River and Upper Gila. At these locations, the higher values of Manning's *n* resulted in more deposition since higher values of Manning's *n* causes the flow to slow down.

The model sensitivity to changes in the inflowing load was investigated by considering 50 % and 150 % of the selected sediment load. Sediment simulations were performed for the different sediment inflow loads for 105 years and a comparison of the average bed elevations is presented in Appendix K. As anticipated, the results indicate that the erosion decreases with increasing sediment loads. The differences between the results obtained by using the different load curves are more significant near the upstream end of the Salt River with deposition in the first few cross sections. The model likely deposits in this reach due to the influence of the upstream gravel pit on the bed geometry under existing conditions. The deposition at the upstream portion of Upper Gila can be attributed to the fact that this area is densely vegetated with salt cedar resulting in the use of high Manning's *n* values. As a result, the flow is slowed down resulting in significant deposition. The differences in the average bed elevations tend to reduce significantly towards the downstream end of the Lower Gila. This indicates that the effect of the inflowing load does not influence the sedimentation near this region.

When the various estimates of the historical Gila hydrology were compared (see discussion in Section 5.4), the largest differences in bed elevation were noted when flows on the Gila were set to a percentage of the flow on the Salt for the period from 1889 to 1940. Even this impact accounted for only small changes – usually less than one foot - in the final bed elevations along the Salt and Gila Rivers. When the 1940 to 1992

hydrograph was used in place of flows from 1889 to 1939 (i.e. the 1940 to 1992 hydrograph was run twice end to end to simulate 105 years) there was no significant change in final bed elevations between the single record and the repeated record ending bed elevations. This indicates that the sediment model and river are fairly stable and changes in the inflowing hydrograph do not have major impacts on the sediment transport results.

5.6. Computation Options in HEC-6T

The supercritical option ($SCRT card) was turned off in the HEC-6T model to prevent supercritical velocities, which could produce unrealistic scour depths, from being used in the sediment transport calculations.

The $SMOOTH command was also used to prevent the cross section geometry from becoming irregular (i.e., having spurious spikes) during the simulation. The command instructs HEC-6T to test the slope across the movable bed versus the angle of repose for sand. An angle of repose is calculated between each set of coordinates using the initial cross section stations and elevations. The HEC-6T program assumes the bed material to be sand and assigns a value of 0.3 as the angle of repose. When the calculated values are larger than 0.3, the computed angle of repose is used to calculate the slope between cross section stations. This results in more uniform cross sections while not impacting the average bed elevations.

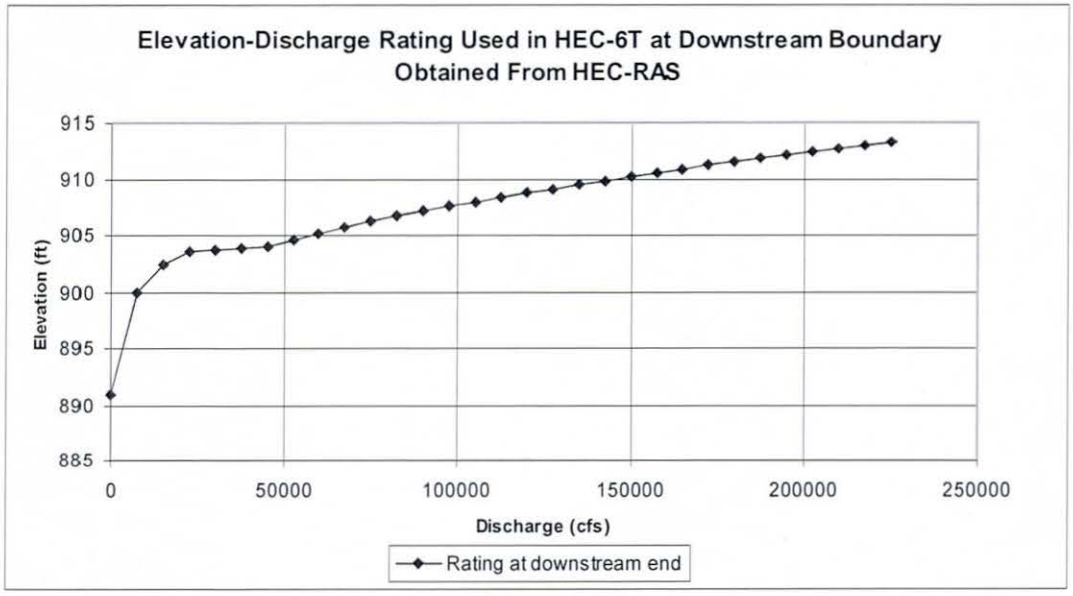


Figure 5-1. Downstream Boundary Condition

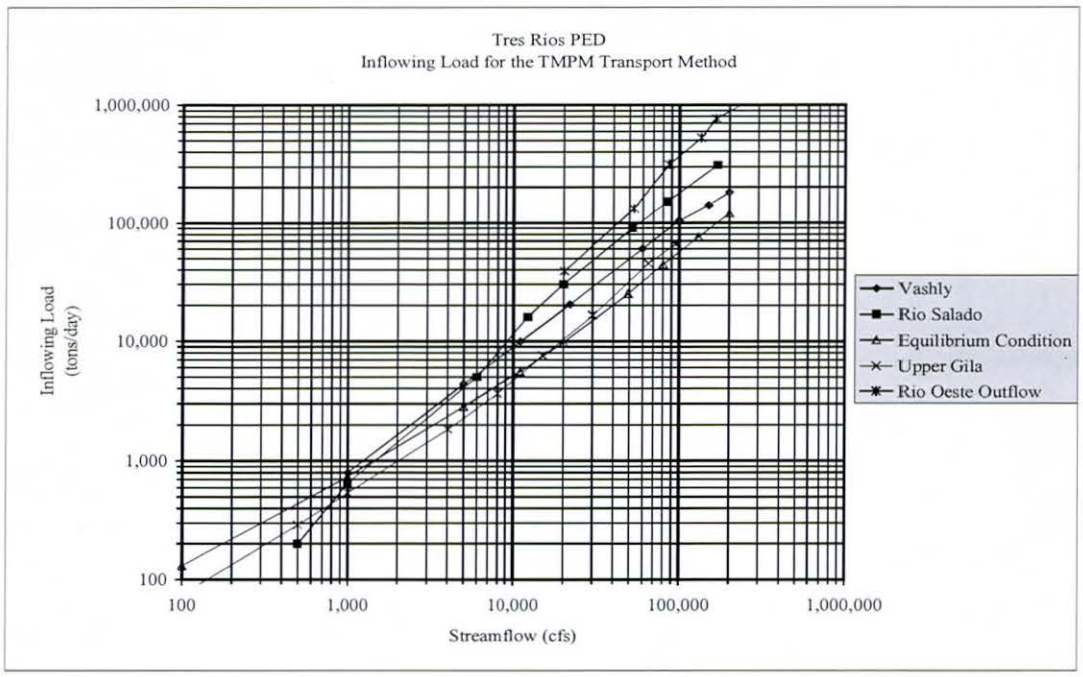


Figure 5-2. Salt River Equilibrium Sediment Loads

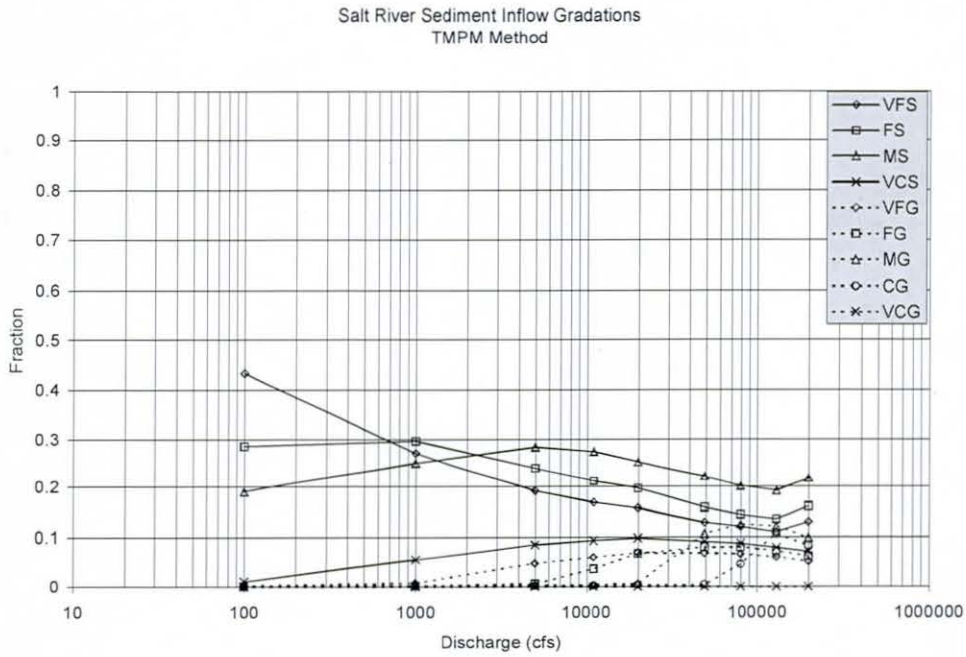


Figure 5-3. Salt River Sediment Inflow Gradations

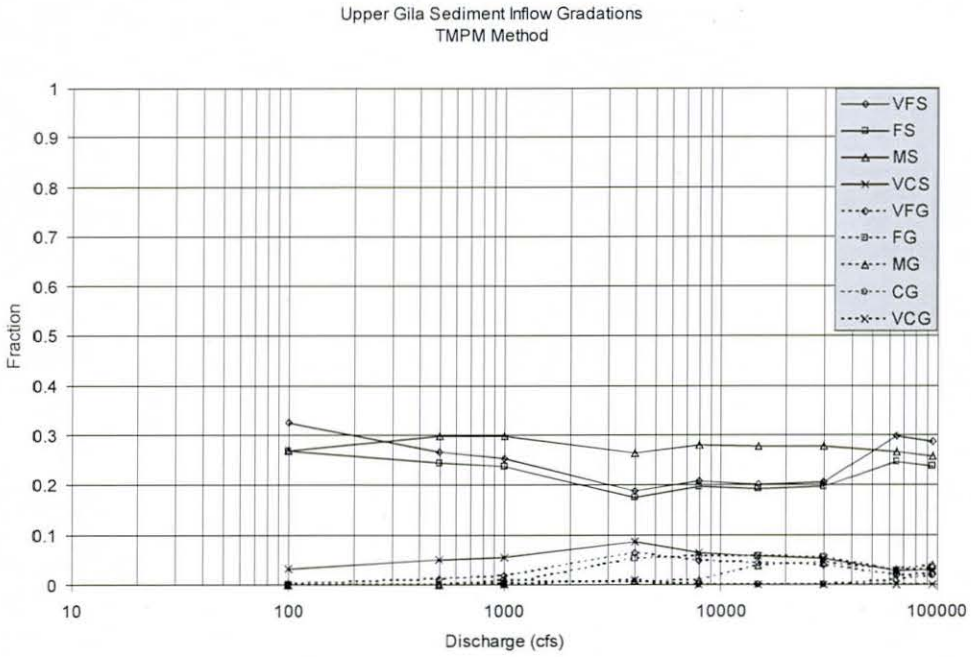


Figure 5-4. Upper Gila Sediment Inflow Gradation

5.7. Existing Conditions Sediment Results

The HEC-6T model simulation was performed for 105 years with two major events of 1891 and 1993. The results show an overall lowering of the average bed elevations indicating potential for erosion in most areas. The model responded to the 1891 event with deposition along the study reach during the first part of the flood hydrograph followed by erosion during the latter part. However, no significant change was noted for the 1993 major event, indicating a general stability of the reach in response to recent floods.

A notable sediment accumulation was seen on the high ground in the center of cross section 197.09 during the 1891 event. Since the high ground was approximately in the middle of the channel, the sediment brought in by the large event was deposited on top, and the model did not show any degradation of the deposited sediment for the subsequent runs through 1993. The final results showing accumulation at 197.09 may also be due to the way HEC-6T calculates average bed elevation using the cross-section data between the bank stations only and not considering any changes in the cross-section outside the bank stations. The effect of this was an average bed elevation for the noted cross section that does not show any temporal change. Other parts of the Salt-Lower Gila reaches did not show significant deviation from the expected results presented in this report, given the nature of the reaches, existing ponding conditions, and braiding. The Upper Gila being heavily vegetated, the long-term average bed elevation did not show significant variation.

5.8. Levee Only Sediment Results

The analysis of the Levee Only condition indicates that changes in bed elevations due to changes in flow conditions as the result of the levee are minimal. The comparison is shown in Figures 5-5 through 5-7. The only difference is noted at river mile 198.3 where two cross sections show a significant difference of 1.5 to 3.0 feet. This difference appears to be a model problem rather than a difference between the conditions modeled. Another model anomaly appears at cross section 197.09 as described above for the existing conditions.

5.9. Levee with Ponds Sediment Results

The sediment transport modeling for the future conditions with ponds was performed and the resulting changes in the average bed elevations are shown in Figures 5-8 through 5-10. In the Salt reach, the addition of ponds provides additional conveyance on the overbanks resulting in lower velocities within the channel. This results in an increase in the average bed elevations following deposition of sediments in this portion of the river. This deposition results in the depletion of the sediment load as the flow moves into the downstream portion. As a result of the upstream deposition, there is erosion in the Lower Gila as the flows tend to regain equilibrium by scouring to increase the sediment load that was lost due to deposition in Salt River portion of the model.

The location of the pond in the main channel of the Gila River immediately upstream of the 116th Avenue Bridge appears problematic from a sediment transport point of view. According to the sediment results, this pond will act as a sediment trap and retain nearly all sediment inflows from the Gila River during low flows. This could

lead to increased degradation downstream of the confluence. Additional modeling is needed, however, to evaluate the impacts of the ponds on channel stability. It is recommended that this pond be removed from the design for this reason as stated earlier in this report.

5.10. Post HEC-6T Inundation Mapping

Following sediment transport analysis, the resulting bed elevations were brought back into the HEC-RAS model and the HEC-RAS model rerun. The output from these runs can be seen in Appendix L. The inundation limits were then re-mapped using the same hydrology as the pre-sediment transport hydraulic modeling. The HEC-6T results were used to generate HEC-RAS models with geometry reflecting post-sediment transport conditions. These HEC-RAS models were then used to generate inundation mapping in the same manner as the pre-sediment transport results. Comparison plots showing inundation limits for both pre- and post-sediment transport conditions are shown in Appendix P.

Post-sediment transport inundation limits indicate that the lateral extent of inundation decreased in most locations throughout the study reach. These results are consistent with the overall trend of erosion and slight channel deepening indicated in the sediment transport analysis.

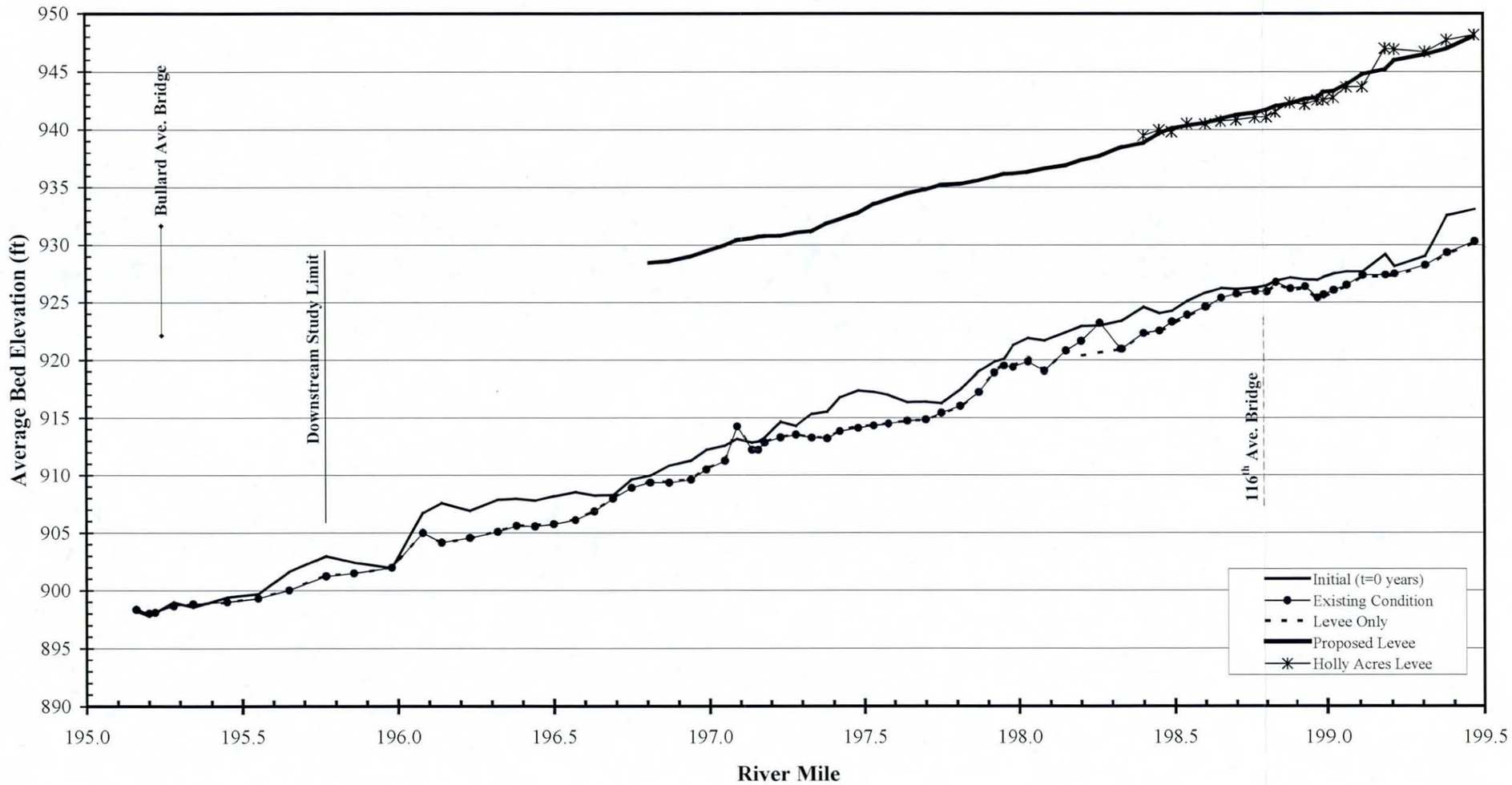


Figure 5-5. Average Bed Elevation Comparison After 105 Years – Existing vs. Levee Only – Lower Gila River

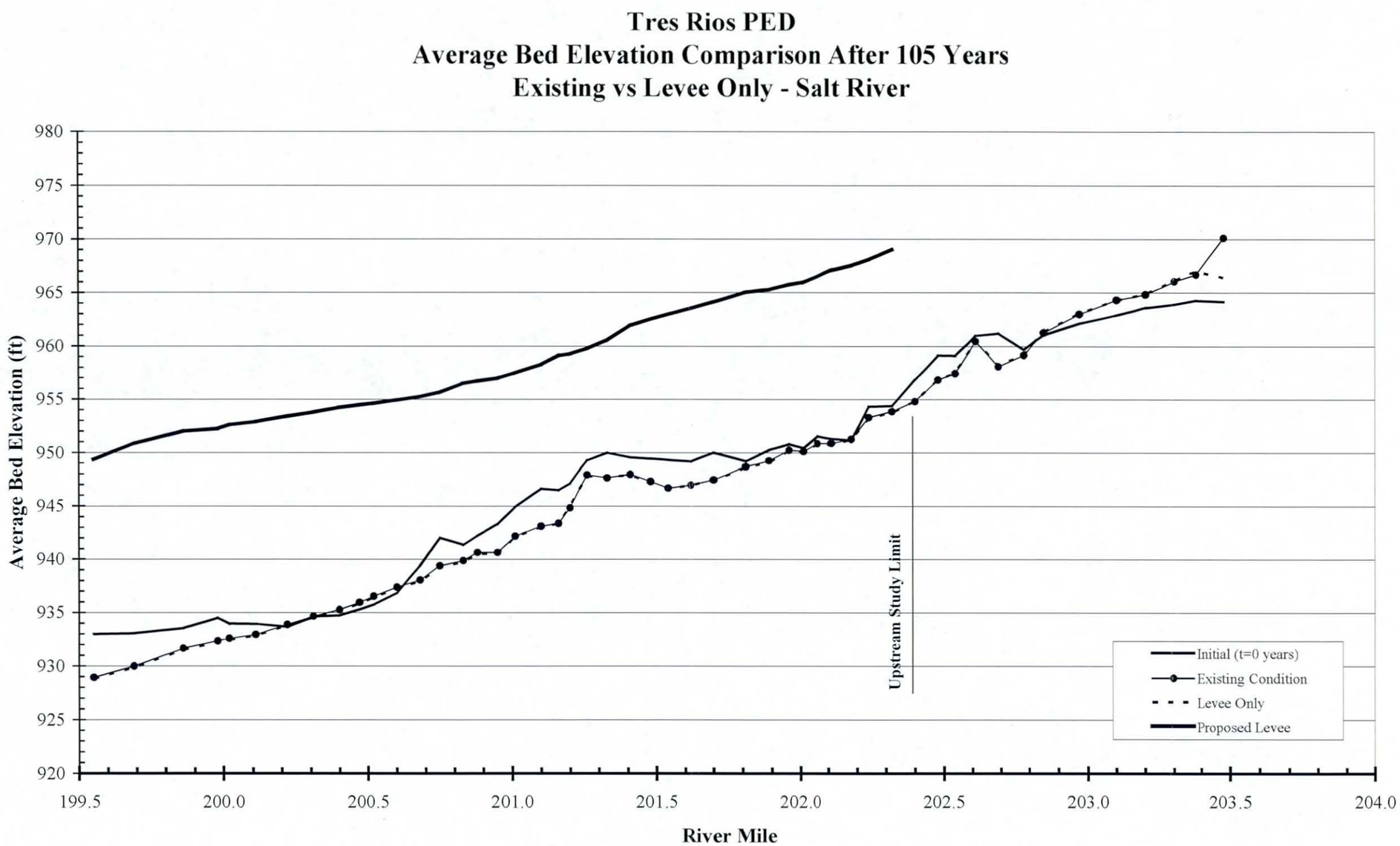


Figure 5-6. Average Bed Elevation Comparison After 105 Years – Existing vs. Levee Only – Salt River

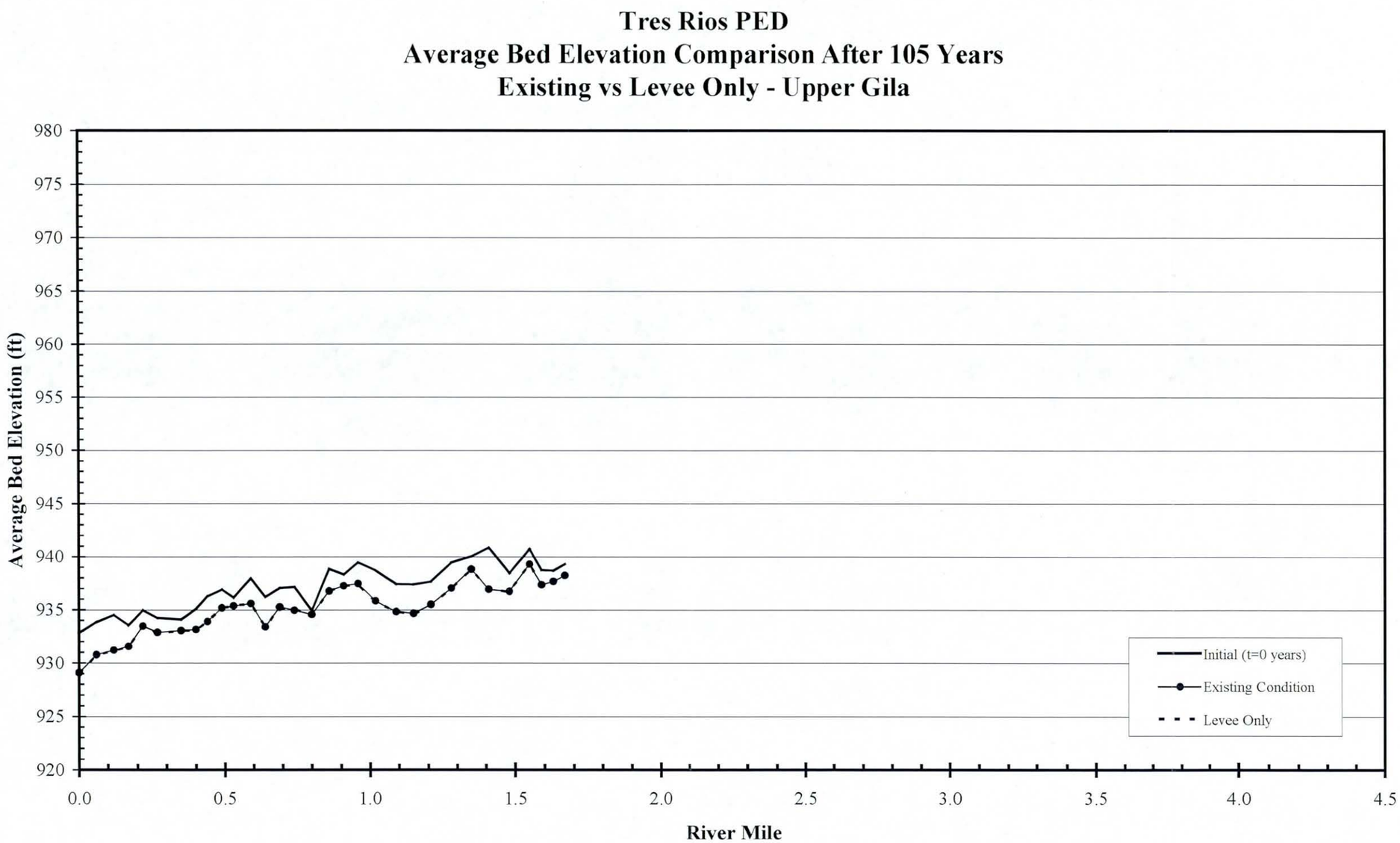


Figure 5-7. Average Bed Elevation Comparison After 105 Years – Existing vs. Levee Only – Upper Gila River

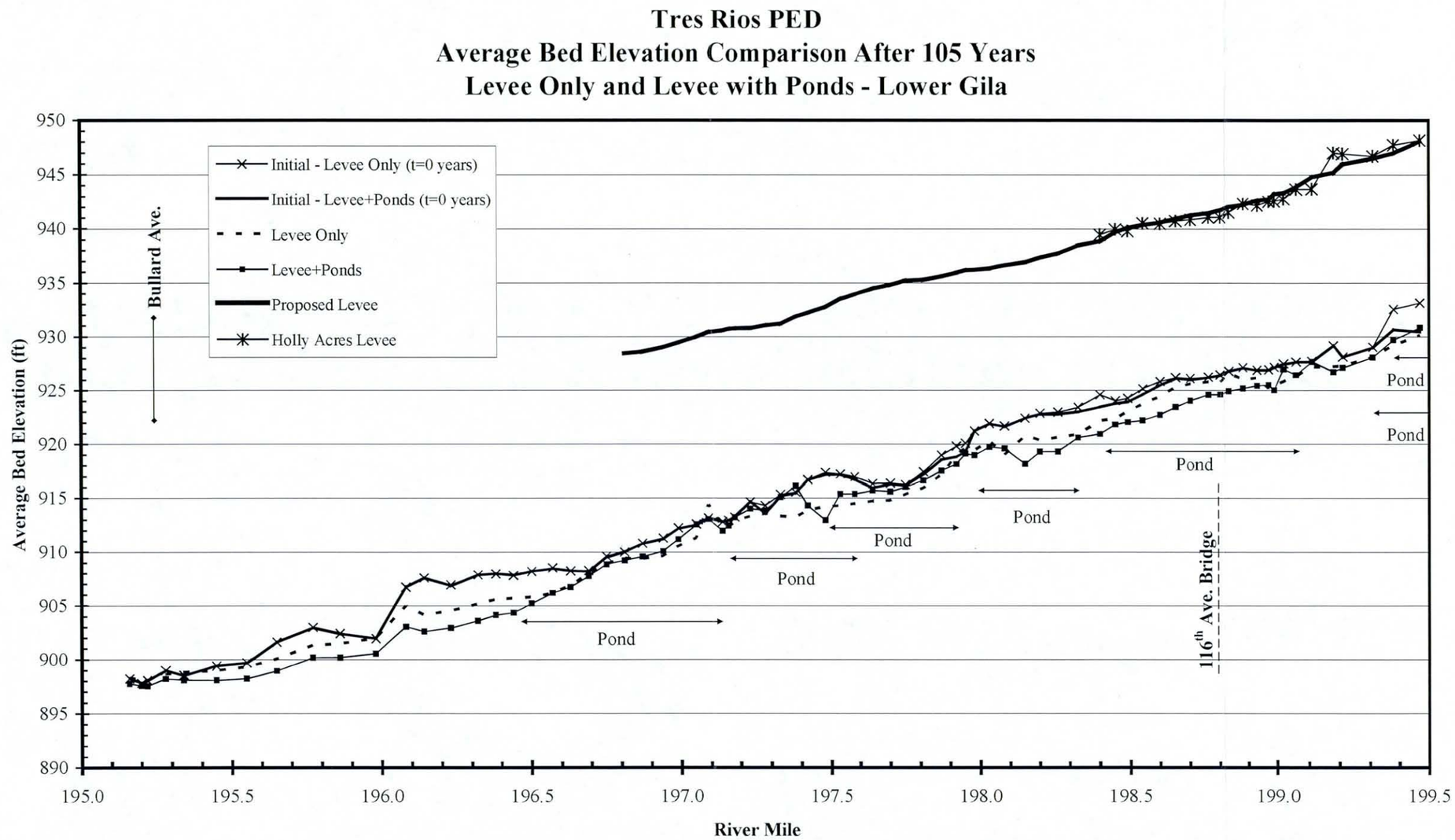


Figure 5-8. Average Bed Elevation Comparison After 105 Years – Levee Only vs. Levee with Ponds – Lower Gila River

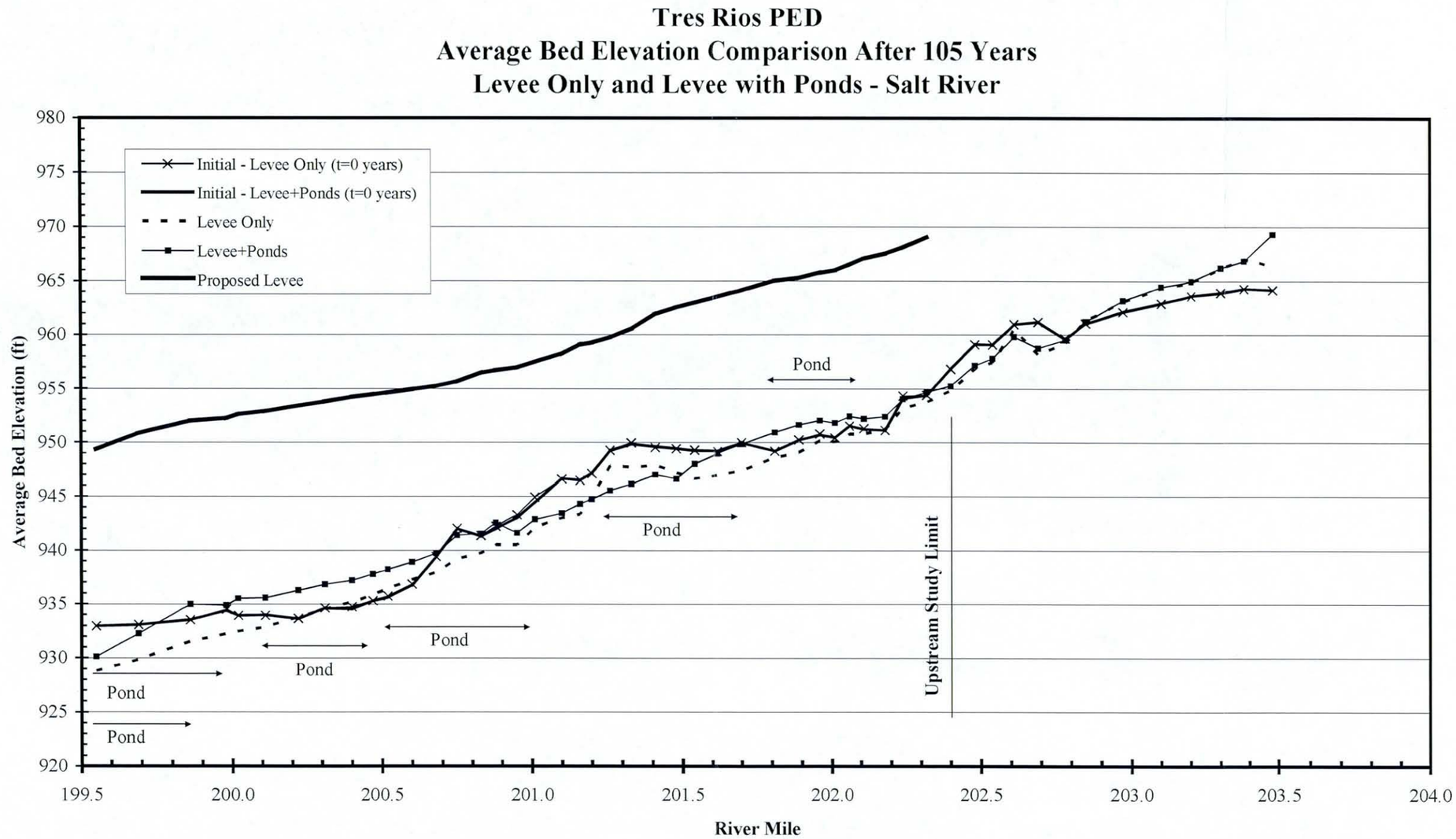


Figure 5-9. Average Bed Elevation Comparison After 105 Years – Levee Only vs. Levee with Ponds – Salt River

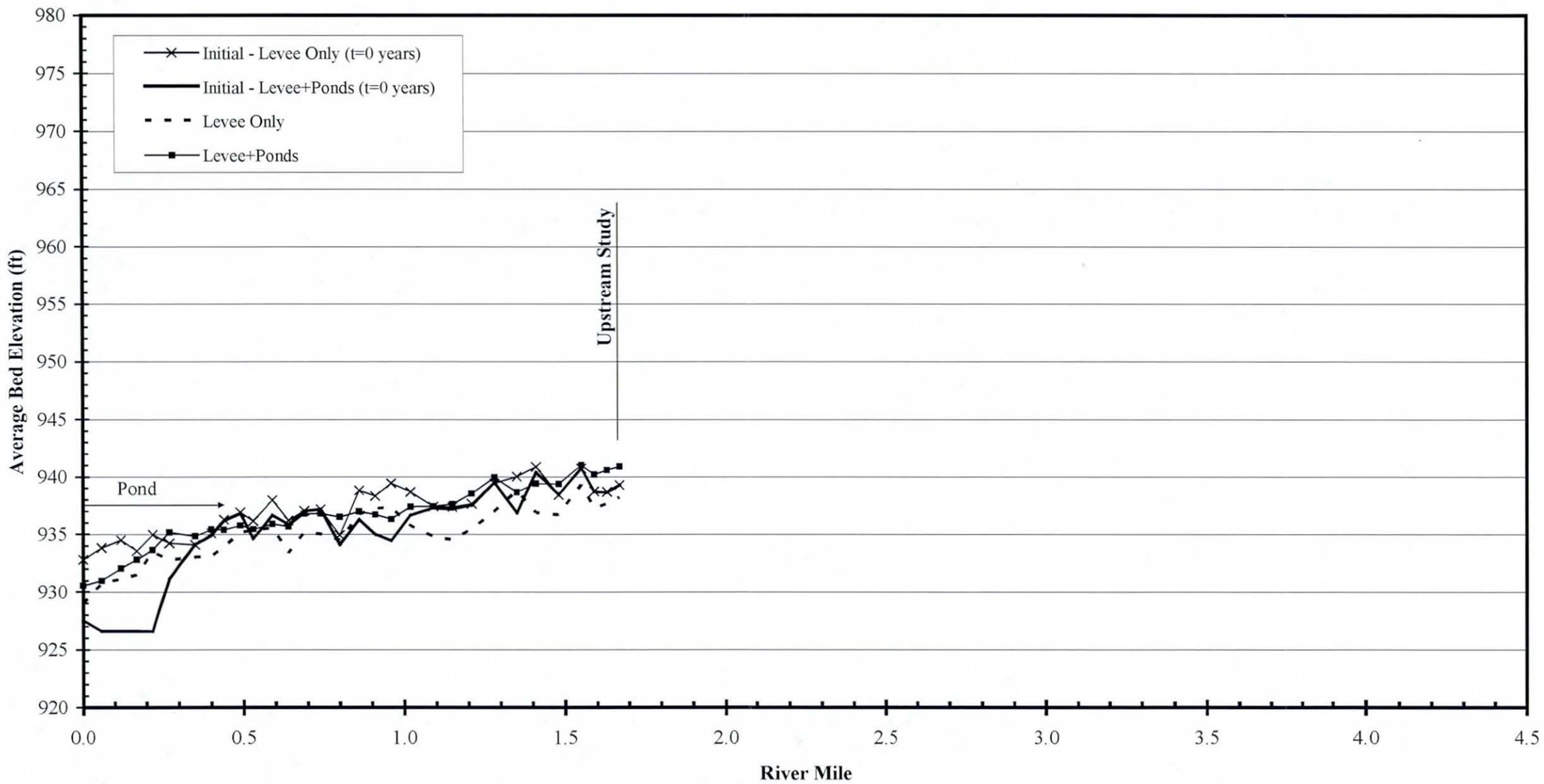


Figure 5-10. Average Bed Elevation Comparison After 105 Years – Levee Only vs. Levee with Ponds – Upper Gila River

Appendix G: Supporting Documentation from the LACOE

G.1 National Levee Safety Evaluation Report (NLSER)

Appendix G: Supporting Documentation from the LACOE

G.2 Design Documentation Report (DDR)

Appendix G: Supporting Documentation from the LACOE

G.3 Operations and Maintenance Manuals for Tres Rios North Levee Phases 1A and 1B

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INTERGOVERNMENTAL AGREEMENT

for the

Design, Rights-of-Way Acquisition, Construction, and Operation and Maintenance

of the

TRES RIOS PROJECT FLOOD CONTROL FEATURES

between the

Flood Control District of Maricopa County

and the

City of Phoenix

IGA FCD 2004A017

Agenda Item: C-69-05-101-2-00

This Agreement is entered into by and between the Flood Control District of Maricopa County, a municipal corporation and political subdivision of the State of Arizona, acting by and through its Board of Directors hereinafter called DISTRICT; and the City of Phoenix, a municipal corporation, acting by and through its City Manager, hereinafter called CITY.

This Agreement shall become effective as of the date it has been executed by all parties.

DATE FILED WITH MARICOPA COUNTY RECORDER May 10, 2005

STATUTORY AUTHORIZATION

1. The DISTRICT is empowered by Arizona Revised Statutes §48-3603, as revised, to enter into this Agreement and has authorized the undersigned to execute this Agreement on behalf of the DISTRICT.

2. The CITY is empowered by Arizona Revised Statutes §11-951 and Article II, Chapter II, and Section 2 of the Phoenix City Charter to enter into this Agreement, and has authorized the undersigned to execute this Agreement on behalf of the CITY.

BACKGROUND

3. The Tres Rios Project is a joint project between the U. S. Army Corps of Engineers (CORPS) and the City of Phoenix (CITY), with the CITY acting as the local sponsor. The CORPS has completed a feasibility study for the Tres Rios Project with the CITY, and is presently underway with the design for the Tres Rios Project.

4. The Tres Rios Project is located along the Salt and Gila Rivers from approximately 83rd Avenue downstream to the Agua Fria River, and will provide flood control as well as river and habitat restoration. The DISTRICT and the CITY desire to implement cooperatively the flood control and drainage features of the Tres Rios Project consisting primarily of a flood control levee along the north bank of the Salt and Gila Rivers, beginning west of 91st Avenue and extending downstream to near the confluence with the Agua Fria River, and related interior drainage features near the levee, hereinafter referred to as the PROJECT, as shown in Exhibit "A".

5. The DISTRICT and the CITY wish to formally establish the DISTRICT's role in the PROJECT, including but not limited to cooperation with the CITY in identifying and providing usage of necessary rights-of-way for the PROJECT, at no cost to the PROJECT, DISTRICT owned rights of way along the Holly Acres Levee and in the rivers, and DISTRICT operation and maintenance of the completed PROJECT features that function solely for flood control purposes. The DISTRICT will also cost-share in the flood control features of the PROJECT.

6. The CORPS is the lead agency for design and construction and is funding approximately 65% of the PROJECT costs. Under an agreement between the CORPS and CITY, the CITY is tasked with, among other things, rights-of-way acquisition, utility conflict resolution, operations and maintenance of the completed PROJECT and funding 35% of the PROJECT costs. The DISTRICT's cost sharing and rights of way would be credited as part of the CITY's obligations.

PURPOSE OF THE AGREEMENT

7. The purpose of this Agreement is to identify and define the responsibilities of the DISTRICT and the CITY (collectively identified as PROJECT PARTNERS) for rights-of-way acquisition, construction, and operation and maintenance for the PROJECT.

TERMS OF AGREEMENT

8. The DISTRICT shall:

   8.1 Recommend, review and, if accepted by the DISTRICT reviewers, approve levee and other flood control features design criteria, and provide technical support to the CORPS as they proceed with the hydraulic design

   8.2 Review draft Design Documentation Reports (DDR) and provide comments.

   8.3 Review and provide comments on draft technical documents and reports prepared by the CORPS and others in support of the PROJECT.

   8.4 Review and provide comments on all construction plans and specifications at 30%, 60%, 90% and 100% completion.

8.5 Maintain the "River" computer based model after it is updated by the CORPS at the end of the five-year monitoring period. Model hydraulics may be adjusted for future changed conditions as determined by the DISTRICT.

8.6 Perform Local Sponsor Federal Emergency Management Agency (FEMA) Letter of Map Revision (LOMR) – Conditional Letter of Map Revision (CLOMR) responsibilities. The CITY will request that the CORPS provide all supporting technical information and documentation, including FEMA forms sealed by a registered engineer, needed for the DISTRICT to apply for the CLOMR and LOMR. If the CORPS does not provide all supporting information and documentation, the DISTRICT has no obligation under this Agreement to perform these responsibilities.

8.7 Upon completion and written acceptance of the PROJECT by the CITY and the DISTRICT, and upon release of the PROJECT from the CORPS to the CITY, the DISTRICT will operate and maintain the PROJECT features that function solely for flood control purposes including the levee and the interior drainage facilities, including but not limited to (a) collector channel(s) and basins during and after the five-year monitoring period. If the PROJECT flood control features are incorporated into Tres Rios Recreational and Outreach Facilities, the DISTRICT will not maintain those features. The initial period of the DISTRICT's operation and maintenance shall be for fifty years, which may be extended if agreed to in writing by the Chief Engineer and General Manager of the DISTRICT and the City manager of the CITY.

8.8 For the Tres Rios Recreational and Outreach Features and Facilities, the DISTRICT will provide the following:

- 8.8.1 Review and provide comments on draft DDR's
- 8.8.2 Review and provide comments on plans and specifications

8.9 For Tres Rios Habitat and Species Restoration Features, the DISTRICT will provide the following:

- 8.9.1 Participate in special habitat workshops and technical committee meetings.
- 8.9.2 Review and comment on draft DDR's.
- 8.9.3 Review and comment on in-stream vegetation affecting river hydraulics.
- 8.9.4 Review and provide comments on plans and specifications at the intervals provided by the CORPS, but no less than at the 30%, 60%, 90% and 100% levels of completion.
- 8.9.5 Review and provide comments on adaptive management studies and reports as needed.
- 8.9.6 Review and provide comments on Operations and Maintenance plans prepared by the CORPS.

8.10 The DISTRICT will be responsible for the following for Tres Rios Project rights-of-way:

- 8.10.1 Provide easements to the CITY for DISTRICT owned rights-of-way for the Holly Acres Levee necessary for the CORPS' reconstruction and modification of the existing structure.
- 8.10.2 Convey easements to the CITY, for other DISTRICT owned rights-of-way in the rivers necessary for construction of the Habitat and Species Restoration Features, prior to the CITY issuing authorization of entry to the CORPS for construction of those features.
- 8.10.3 The DISTRICT will provide to the CITY a construction easement for DISTRICT rights-of-way in the rivers, as requested and required by the CITY for the PROJECT. This easement right will not include warranting or defending this right should it be determined that any of these rights-of-way are within Gila River Indian Community (GRIC) jurisdiction.

8.10.4 The DISTRICT will provide review comments and have the opportunity to approve any rights-of-way easements or fee acquisition in the PROJECT area upon which the DISTRICT will assume operation and maintenance responsibility. The DISTRICT will not assume operation and maintenance responsibility on any property on which the DISTRICT does not believe the CITY has appropriate land rights or federal permits nor shall the DISTRICT have the obligation to acquire additional land rights or federal permits.

8.10.5 The DISTRICT will cooperate with the CITY for the use of DISTRICT owned rights-of-way for a potential vegetation nursery to be managed by others.

8.10.6 In accordance with property rights granted or held by the DISTRICT, the DISTRICT will have rights-of-way use permitting authority over any features that it maintains. If the rights-of-way are on GRIC property, the CITY and DISTRICT will request that the DISTRICT be given special review authority.

8.10.7 The DISTRICT will be provided by the CITY at no cost, fee ownership over all rights-of-way for the PROJECT features that it maintains, with exception of any features on DISTRICT owned or GRIC property.

8.10.8 The DISTRICT will provide rights-of-way owned or controlled by the DISTRICT needed by the CITY for the PROJECT, at no cost, to the Tres Rios Project by issuing easements as requested by the CITY for the PROJECT. The DISTRICT can mine mineral resources on its property prior to the start of CORPS construction in the lines and grades of the Tres Rios Project and any revenues generated from this activity shall be the DISTRICT's.

8.10.9 In accordance with the property rights granted to or held by the DISTRICT, upon completion and written acceptance of the PROJECT by the CITY and the DISTRICT, and upon release of the PROJECT from the CORPS to the CITY, the DISTRICT will be the licensing/permitting authority for any future modifications, construction, or uses within the PROJECT rights-of-way that the DISTRICT operates and maintains. The CITY will be given the opportunity to review and approve the modifications prior to construction of such future modifications within the limits of the PROJECT.

8.11 The DISTRICT will contribute $2,000,000 cash to the local 35% cost-share of the PROJECT. The DISTRICT may participate in cost-sharing of a south bank levee, if required because of a raised 100-year water surface elevation due to the north bank levee.

8.11.1 The DISTRICT will contribute $1,000,000 to the CITY upon approval and recordation of this Agreement, and within thirty (30) days of receipt of an invoice from the CITY.

8.11.2 The DISTRICT will contribute $1,000,000 to the CITY upon the Notice to Proceed by the CORPS of Phase 1B construction of the PROJECT flood control features, and within thirty (30) days of receipt of an invoice from the CITY.

8.12 The DISTRICT shall monitor construction and provide comments and concerns to the CORPS through the CITY, for resolution and/or incorporation into the PROJECT.

8.13 The DISTRICT will acquire and periodically renew the 404 Permit required for the DISTRICT to operate and maintain the PROJECT flood control features.

9. The CITY shall:

9.1 Review the draft DDR's and provide comments to the CORPS and DISTRICT.

9.2 Review and provide comments on draft technical documents and reports prepared by the CORPS in support of the PROJECT.

9.3 Review and provide comments on all construction plans and specifications at 30%, 60%, 90% and 100% completion.

9.4 Provide the DISTRICT's review comments as described in subparagraphs 8.3 and 8.4 to the CORPS for resolution and/or incorporation into the design of the PROJECT.

9.5 Assist the DISTRICT in acquiring and periodically renewing the 404 Permit required for the DISTRICT to operate and maintain the PROJECT flood control features.

9.6 For Tres Rios Recreational and Outreach Features and Facilities, the CITY will provide the following:

- 9.6.1 Review and provide comments on draft DDR's.
- 9.6.2 Review and provide comments on plans and specifications.
- 9.6.3 Assist the CORPS in developing an Operation and Maintenance plan for recreation and education features.
- 9.6.4 Operate and Maintain recreation and education features.

9.7 For the Tres Rios Habitat and Species Restoration Features, the CITY will provide the following:

- 9.7.1 Provide design oversight to the CORPS during design of habitat restoration features.
- 9.7.2 Review and provide comments on draft DDR's.
- 9.7.3 Review and provide comments on plans and specifications at intervals provided by CORPS, but no less than at the 30%, 60%, 90% and 100% levels of completion.
- 9.7.4 Assist the CORPS in reviewing the monitoring data collected and preparation of annual reports.
- 9.7.5 Provide for continued operation and maintenance of habitat and restoration features for the Tres Rios Project, during and after the 5-year Adaptive Management period.

9.8 The CITY will be responsible for PROJECT rights-of-way acquisition as provided in the PROJECT Cooperation Agreement between CORPS and CITY, except as indicated in paragraph 8.10. The CITY will convey to the DISTRICT at no cost, fee ownership of lands needed for the operation and maintenance of the PROJECT flood control features, and not owned by the DISTRICT, at the completion of the PROJECT construction.

9.9 The CITY will take the lead for PROJECT public involvement activities, with assistance from the DISTRICT.

9.10 The CITY will provide to the CORPS DISTRICT comments and concerns regarding construction of the PROJECT, for resolution and/or incorporation into the PROJECT.

9.11 In accordance with the property rights granted or held by the CITY, the CITY will be the licensing/permitting authority for any future modifications, construction, or uses within the PROJECT rights-of-way with the exception of the portion(s) of the PROJECT operated and maintained by the DISTRICT. The DISTRICT will be given the opportunity to review and approve the modifications prior to construction of such future modifications.

9.12 As provided in the Agreements between the CORPS and the CITY, and notwithstanding other sources of funding obtained by the CITY, the CITY will fund all of the 35% local sponsor cost-

share for PROJECT costs, with the exception of the DISTRICT's contribution of $2,000,000 cash and the market value of lands, easements, and rights-of-way provided by the DISTRICT toward the CITY's local 35% cost-share of the PROJECT. The value of DISTRICT provided rights-of-way may also be credited to the CITY's local 35% project cost-share.

9.12.1 The CITY will invoice the DISTRICT for $1,000,000 upon approval and recordation of this Agreement.

9.12.2 The CITY will invoice the DISTRICT for $1,000,000 upon the Notice to Proceed by the CORPS of Phase 1B construction of the PROJECT flood control features.

10. The PROJECT PARTNERS shall provide any and all permits and/or licenses within their authority required for the PROJECT at no cost to the PROJECT.

11. The PROJECT PARTNERS may, with mutual written agreement of all parties, delegate responsibilities to another party. Any delegation, however, shall not relieve the delegating party of its original responsibilities as defined herein.

12. Each of the PROJECT PARTNERS to this Agreement shall take appropriate actions within their authority to ensure that only agricultural drainage, irrigation delivery, storm water, or waste water is discharged into the PROJECT, and that such discharges into the PROJECT comply at the point of discharge with any applicable requirements of the Clean Water Act, and the Arizona Pollutant Discharge Elimination System (AZPDES), or any other applicable discharge requirements, including any permit requirements.

13. Each of the PROJECT PARTNERS to this Agreement (indemnitor) shall, to the extent permissible by law, indemnify, defend, and save harmless the other (indemnitees) including agents, officers, directors, governors, and employees thereof, from and against any loss or expense incurred as a result of any claim or suit of any nature whatsoever, which arises out of indemnitor's negligent or wrongful acts or omissions pursuant to this Agreement. Such indemnification obligation shall encompass any personal injury, death or property damages resulting from the indemnitor's negligent or wrongful acts or omissions, as well as reasonable attorney's fees, court costs, and other expenses relating to the defense against claims or litigation incurred by the indemnitee.

14. Each PROJECT PARTNER to this Agreement will pay for, and not seek reimbursement from each other for, its own personnel and administrative costs associated with this PROJECT including, but not limited to, the following unless specifically identified otherwise in this Agreement: design, rights-of-way acquisition, inspection, public involvement, permitting, management and administration, and operation and maintenance. The CITY will submit the market value of lands addressed in this agreement to the CORPS as part of the local cost share for the PROJECT, and provide a copy of the market valuation and request for credit to the DISTRICT.

15. This Agreement shall expire fifty (50) years from the date of recording with the Maricopa County Recorder or upon exceeding the life of the PROJECT, whichever is the first to occur, and after all funding obligations and reimbursements have been satisfied in accordance with this Agreement. However, by mutual written agreement of all parties, this Agreement may be amended or terminated.

16. This Agreement is subject to cancellation by any party pursuant to the provisions of Arizona Revised Statutes §38-511.

17. Attached to this Agreement or contained herein are the written determinations by the appropriate attorneys for the parties to this Agreement that these agencies are authorized under the laws of the State of Arizona to enter into this Agreement and that it is in proper form.

18. If legislation is enacted after the effective date of this Agreement, which changes the relationship, or structure of one or more parties to this Agreement, the parties agree that this Agreement shall be renegotiated at the written request of either party.

19. All notices or demands upon any of the PROJECT PARTNERS to this Agreement shall be in writing and shall be delivered in person or sent by mail addressed as follows:

Flood Control District of Maricopa County
Attn: Chief Engineer and General Manager
2801 West Durango Street
Phoenix, Arizona 85009-6399

City of Phoenix
Attn: Water Services Director
200 West Washington Street, 12th Floor
Phoenix, Arizona 85003-1611

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
A Municipal Corporation

Recommended by:

4/25/05

Timothy S. Phillips, P.E. Date
Acting Chief Engineer and General Manager

Approved and Accepted:

By: _____
Chairman, Board of Directors Date

Attest:

By: _____ 5/4/05
Clerk of the Board Date

The foregoing Intergovernmental Agreement IGA FCD 2004A017 has been reviewed pursuant to Arizona Revised Statutes §11-952, as amended, by the undersigned General Counsel, who has determined that it is in proper form and within the powers and authority granted to the Flood Control District of Maricopa County under the laws of the State of Arizona.

3/10/05

General Counsel Date

CITY OF PHOENIX

CITY OF PHOENIX
A Municipal Corporation
Frank Fairbanks, City Manager

By: Andrea Tevlin 4/18/05
Andrea Tevlin Date
Deputy City Manager

Attest:

By: Vicky Miel 4-21-05
City Clerk Date

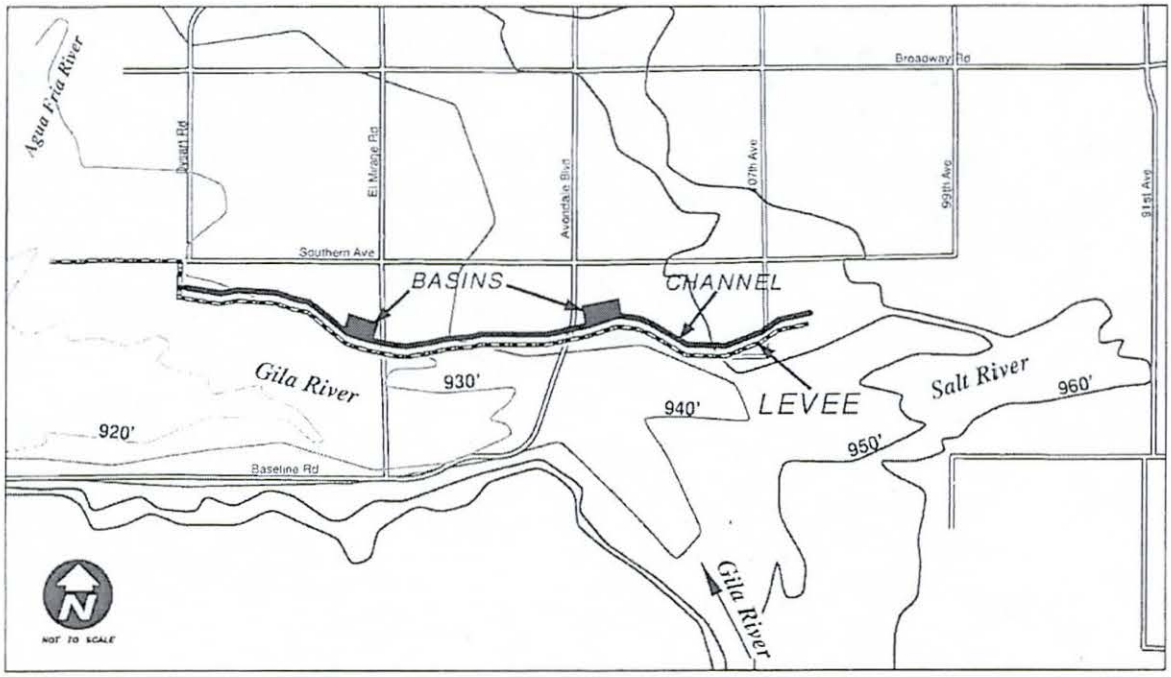
The foregoing Intergovernmental Agreement IGA FCD 2004A017 has been reviewed pursuant to Arizona Revised Statues §11-952, as amended, by the undersigned attorney who has determined that it is in proper form and within the power and authority granted to the City of Phoenix under the laws of the State of Arizona.

Jesse W Sears 4/21/05
ACTING City Attorney Date

APPROVED BY CITY COUNCIL:

DATE: March 30, 2005 – Item No. 79

IGA FCD 2004A017
TRES RIOS PROJECT FLOOD CONTROL FEATURES
EXHIBIT "A"



Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: December 22, 2011

To: Timothy S. Phillips, P.E., Chief Engineer and General Manager

From: Richard Harris, P.E., CFM, Project Manager

Subject: Tres Rios North Levee Floodplain and Floodway Re-delineation project, Phase II – Technical Data Notebook and PMR Package Preparation, Contract FCD 2010C027, **Memo from Charlie Klenner to indicate District acceptance of Operations and Maintenance for the Levee.**

This memo provides additional information for a request for you to sign a memo from Charlie Klenner to indicate the District's has formally accepted maintenance of the USACOE-constructed Tres Rios North Levee along the Salt/Gila River.

As I am sure you are aware, the District has been positioned to provide packaging to FEMA for a Letter of Map Revision (LOMR)/Physical Map Revision (PMR) request for map changes to the Salt/Gila River in context with the recently completed Tres Rios North Levee constructed by the USACOE. This feature has been constructed in large part to eliminate the flood insurance needs of the residents in the adjacent Holly Acres Subdivision (which will ultimately only be possible once map changes become effective). In order for us to complete the packaging effort, we apparently need to provide evidence of formal acceptance of maintenance for the structure (please see attached FEMA Procedural Memorandum 63, Step 4 on page 5). To meet this requirement Don Rerick and myself have helped Charlie Klenner draft a memo that describes our O & M approach in context with already accepted Manuals provided by the USACOE. Your signature on the memo will formalize our acceptance and we are hopeful that combined with the supporting attached documentation, we will not be required to provide additional evidence of such during FEMA's flood study review process.

Activities such as these are a continuation of the District's goal to identify and update flooding hazard information for the residents of Maricopa County in context with providing them with floodplain management services.

If you have any questions, please contact me at 64528.

Thanks,

RPH

Richard

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Enclosures:

Maintenance Memo
2011 Maintenance Inspection Report for Tres Rios
2011 Annual Inspection Report for Tres Rios
FEMA Procedural Memo 63

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: 12/21/2011

To: Timothy S. Phillips, P.E. Chief Engineer and General Manager

From: Charles F. Klenner, Operations and Maintenance Division Manager

Subject: Tres Rios Levee O & M documentation and Maintenance Acceptance

The US Army Corps of Engineers rebuilt the Holly Acres Levee and the interior drainage as part of the Tres Rios Project. The District, previous to the Tres Rios Project, maintained the Holly Acres Levee. Upon completion of the USACE construction of the Tres Rios Levee, the Districts O&M Division began maintenance of the improved project in March of 2009.

The operations and maintenance procedures followed by the O&M Division are included in the USACE Phase 1A and 1B O&M Manuals. The Districts O&M Division maintains all project features solely for flood control purposes.

It has been brought to my attention that there is a request to update the mapped flood hazard boundaries in the vicinity of the levee. In order to complete processing of the flood hazard boundary update/map change request, FEMA requires written acceptance of maintenance plans (in this case the O & M Manuals). FEMA Procedural Memorandum 63 states: "Officially adopted plans must be signed by the CEO of the community or the appropriate head of the agency that is accepting the ultimate responsibility of all the tasks and actions listed in those plans"(September 2, 2010). This memo seeks to satisfy that requirement. Please provide your signature after mine, below.

Charles F. Klenner — Date: 12/22/11

Charles F. Klenner,
Operations and Maintenance Division Manager

Date: 12/22/11

Timothy S. Phillips, P.E.,
Chief Engineer and General Manager

Enclosure 2011 Maintenance Inspection, 2011Annual Inspection, FEMA Procedural Memorandum 63.

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Flood Control District of Maricopa County
Maintenance Inspection Report

Holly Acres-Tres Rios 2011

Holly Acres-Tres Rios		Inspectors Name	Albert Buruato FCDMC
Date of Inspection	03/02/11	Inspectors Name	Erik Arntz FCDMC
&M Division Manager Name		Date Reviewed	

Existing Weather Conditions	Clear & Cool	Recent Rain Fall	Yes ☑ No ☐

Yes	No	
		1. Crest of Levee
☐	☑	a. Crest shows evidence of erosion, rilling, deep rooted vegetation, and/or rodent/animal activity
☐	☑	b. Evidence of holes, cracks or suspicious areas
☐	☑	c. Additional slope protectoin needed
☐	☑	d. Survey monuments in need of maintenance or missing
☐	☑	e. Other (vandalism, liability concerns, etc.)
		See Comments: 3,5,6
		2. Upstream Slope
☑	☐	a. Slope shows evidence of erosion, rilling, deep rooted vegetation and/or rodent/animal activity.
☐	☑	b. Evidence of holes, cracks or suspicious areas
☐	☑	c. Additional slope protection needed
☐	☑	f. Other (vandalism, liability concerns, etc.)
		See Comments: 1,2,3,4,5,6,7
		3. Downstream Slope
☑	☐	a. Shows evidence of erosion, rilling, deep rooted vegetation, and/or rodent/animal activity
☐	☑	b. Evidence of holes, cracks or suspicious areas
☐	☑	c. Additional slope protection needed
☐	☑	d. Flap gate concerns
☐	☑	e. Other (Vandalism, liability concerns, etc.
		See Comments: 5,6

Flood Control District of Maricopa County
Maintenance Inspection Report

03/02/11

Holly Acres-Tres Rios 2011

Yes	No	
		4. Abutment
☐	☑	a. Shows evidence of erosion, rilling, deep rooted vegetation, and/or rodent/animal activity
☐	☑	b. Evidence of holes, cracks or suspicious areas
☐	☑	c. Additional slope protection needed
☐	☑	d. Differential movement
☐	☑	e. Other (vandalism, liability concerns, etc.)
		See Comments: 5,6
		5. Maintenance Access roads and ramps
☐	☑	a. Road shows evidence of erosion, rilling, deep rooted vegetation, and/or rodent/animal activity
☐	☑	b. Additional slope protection needed
☐	☑	c. Roads need regrading
☐	☑	d. Other (vandalism, liability concerns, etc.)
		See Comments: 3,5
		6. Perimeter fencing and gates
☐	☑	a. Fence cut or damaged
☐	☑	b. Damaged gates
☐	☑	c. Additional fencing or gates needed
☐	☑	d. Other (vandalism, liability concerns, etc.)
		See Comments: 7,8
		7. Stationing & Signs
☐	☑	a. Additional signs needed
☑	☐	b. Stationing needs to be refurbished
☐	☑	c. Signs damaged or missing
☐	☑	d. Subsidence survey markers are missing
☐	☑	e. Other (vandalism, liability concerns, etc.)
		See Comments: 3

Flood Control District of Maricopa County
Maintenance Inspection Report

03/02/11

Holly Acres-Tres Rios 2011

Yes	No	8. Diversion Dikes
	✓	a. Deterioration
	✓	b. Sediment buildup
	✓	c. Riprap displacement
	✓	d. Trash or debris concerns
	✓	e. Other (vandalism, liability concerns, etc.)

See Comments: 2

Flood Control District of Maricopa County
Maintenance Inspection Report

03/02/11

Holly Acres-Tres Rios 2011

Comments Page 1

Comments 1:

113th Ave end cable fence I-beam leaning next to irrigation ditch. Will monitor.

Comments 2:

Sediment and debris needs to be removed from concrete channel.

Comments 3:

There are no station markers along the project. Install stationing as needed to include stationing on all inlet structures along concrete lined channel and all appurtenant structures.

Comments 4:

Erosion observed on north side of concrete lined channel just east of Avondale Blvd.

Comments 5:

Rilling throughout project.

Comments 6:

Rodent activity throughout project.

Comments 7:

Sta #960+00 fence cut.

Comments 8:

The box culvert at station# 1007+50 and pilot channel of invert will need the sediment removed and invert restored.

Comments 9:

Comments 10:

ANNUAL INSPECTION REPORT

Inspection Date: 5/2/2011	Structure: Tres Rios	N/A	NO	YES	MONITOR	REPAIR
Inspector(s): C.F. Rivera-FCDMC, Erik Arntz-FCDMC	Location: #106					

INSPECTION OBSERVATIONS: Through the use of a levee, groins, riprap and gabions it is hoped it will prevent further erosion of the river bank and the resultant loss of land and improvements. The immediate benefit in this case, will be to protect the Holly Acres sub-division. Authorization: Board of Directors, Flood Control District of Maricopa County, State of Arizona, HB 2457 34th Legislature Appropriate SB 1163. Local sponsors are the Flood Control District of Maricopa County and Arizona Department of Water Resources. Salt-Gila Watershed for all areas upstream of the project.

1. Crest of Structure: 6,600' lf x 12' ft. width.	NA	No	Yes	Mon.	Rep.
a. Settlement, slides, depressions?		✓			
b. Misalignment?		✓			
c. Longitudinal or transverse cracks? **None observed.**		✓			
d. Animal/rodent holes? **Scattered rodent activity along the shoulders of the crest of the levees.**			✓		✓
e. Adverse vegetation? **New tumbleweed growth noted.**			✓		✓
f. Erosion concerns?		✓			
g. Plating material displacement? **Minor scattered displacement noted.**			✓	✓	
h. Other? **Stationing is missing along the east end of the project. Several pertinent structures also need stationing.**			✓		✓
i. Fencing or gate concerns? **All gates and fencing were operational and secured at time of inspection.**		✓			

2. Upstream Slope: Natural compacted backfill material with riprap slope protection	NA	No	Yes	Mon.	Rep.
a. Erosion concerns?		✓			
b. Flap gate or side inlet concerns?		✓			
c. Fencing or gate concerns?		✓			
d. Longitudinal or transverse cracks? **None observed.**		✓			
e. CSA deterioration?		✓			
f. Settlement, slides, depressions, bulges?		✓			
g. Animal/rodent holes? **Scattered rodent activity throughout the project.**			✓		✓
h. Gabion protection concerns? **Damaged gabion basket at sta. #952+51. *See attached photo at the end of report.**					
i. Riprap concerns?		✓			
j. Other?		✓			

ANNUAL INSPECTION REPORT

Inspection Date: 5/2/2011	Structure: Tres Rios	N/A	NO	YES	MONITOR	REPAIR
Inspector(s): C.F. Rivera-FCDMC, Erik Arntz-FCDMC	Location: #106					

3. Downstream Slope: Natural compacted backfill material with newly installed gravel mulch.	NA	No	Yes	Mon.	Rep.
a. Erosion/rilling concerns?		✓			
b. Inadequate slope protection?		✓			
c. Adverse vegetation? **New tumbleweed growth.**			✓		✓
d. Longitudinal or transverse cracks? **None observed.**		✓			
e. Inadequate riprap?		✓			
f. Fencing, signs and or gate concerns?		✓			
g. Settlement, slides, depressions, bulges?		✓			
h. Animal/rodent holes? **Scattered rodent activity.**			✓		✓

4. Instrumentation: Staff gages	NA	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff gages**					
b. Any repair or replacement required?		✓			

5. Concrete low flow channel, basin and culverts	N/A	No	Yes	Mon.	Rep.
a. Erosion concerns from sheet flows or irrigation damage?			✓		✓
b. Low flow channel stable? **Temperature &heat cracking noted. Non- structural.**			✓	✓	
c. Adverse vegetation? **New tumbleweed growth between low flow and toe of levee.**			✓		✓
d. Drainage issues?		✓			
e. Project stationing issues? **Concrete low flow channel needs stationing.**			✓		✓
f. Side inlet chutes or spillway drainage concerns?		✓			
g. Culvert structures stable? **Temperature & shrinkage cracks noted. Non-structural.**			✓	✓	
h. Vandalism?		✓			
i. Illegal discharge noted into the channel?		✓			
j. Flow restrictions or possible blockage noted? **Sediment plugs and vegetation noted.**			✓		✓
k. Exposed reinforcement?		✓			
l. Loss of joint material?		✓			
m. Leakage evident?		✓			
n. Basin area stable? **High vegetation needs to be mowed. Some scattered deep-rooted vegetation noted.**			✓		✓
o. Other		✓			

Flood Control District of Maricopa County O&M Division Manager-Charles F. Klenner

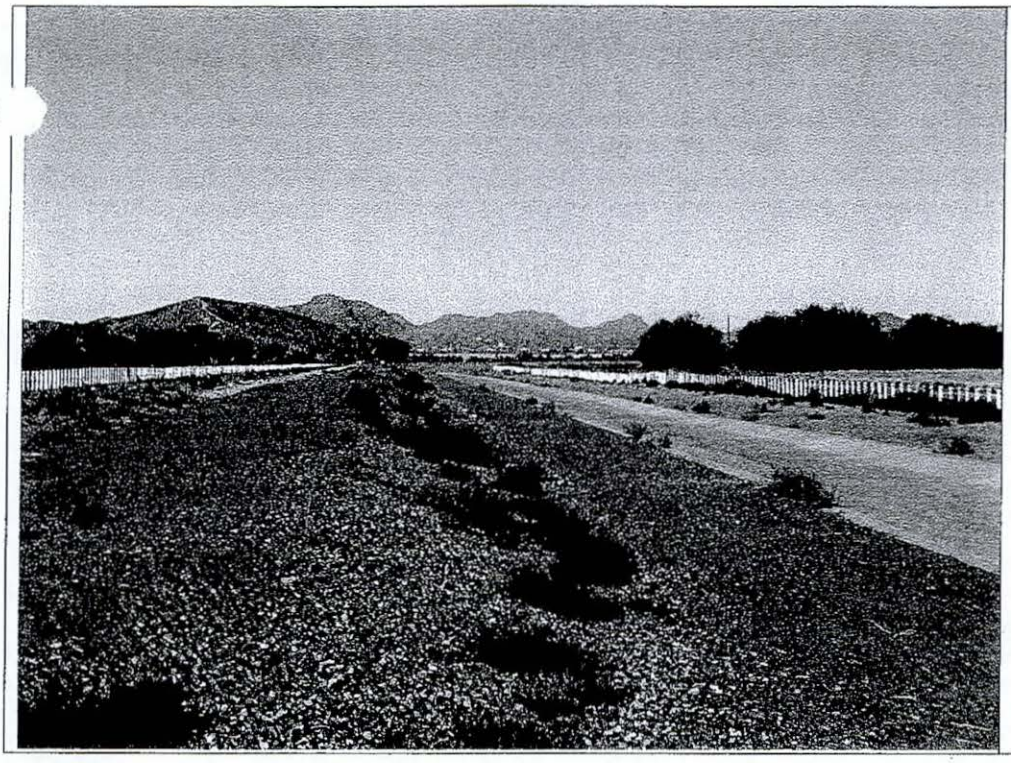


Photo No.: 1
Date: 5/2/2011
Description: View is looking west from the far end of the Tres Rios levee system.

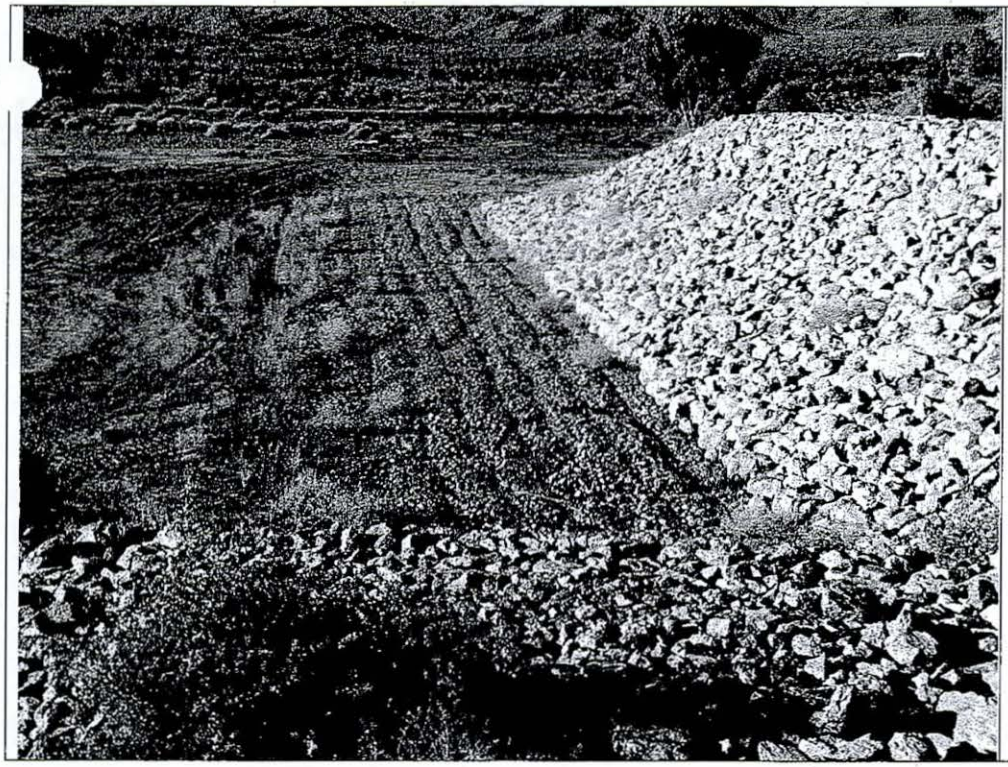


Photo No.: 2
Date: 5/2/2011
Description: Damaged gabions near Finger Dike sta. #952+51.

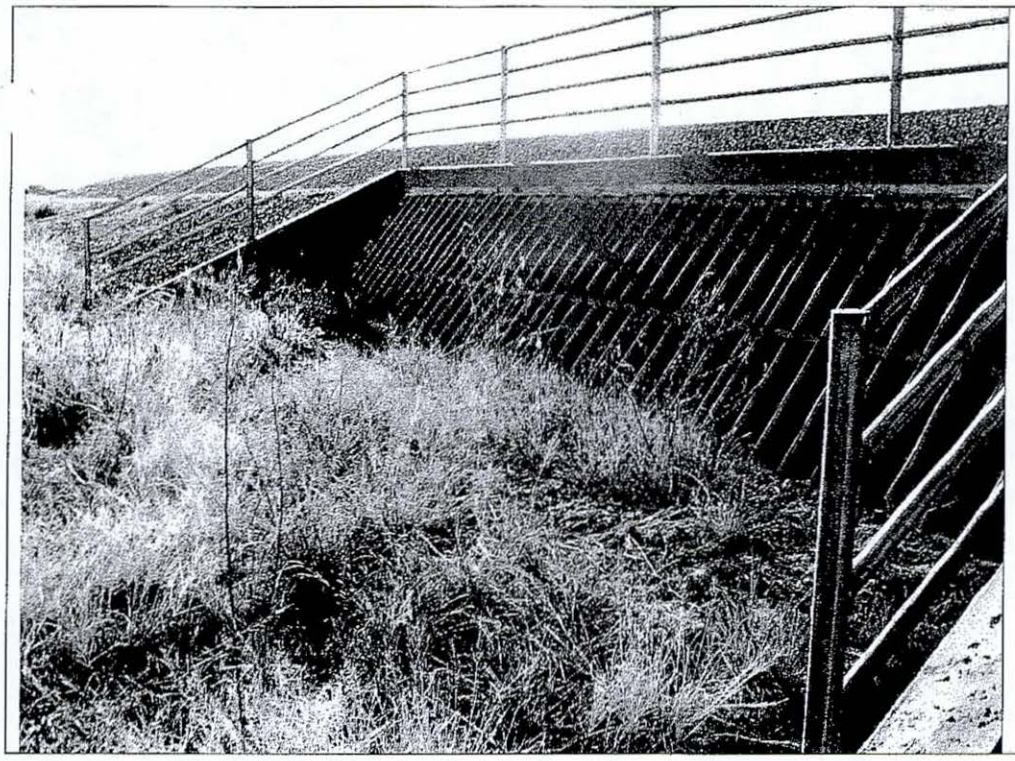


Photo No.: 3
Date: 5/2/2011
Description:
Sediment and vegetation buildup at inlet trash rack.

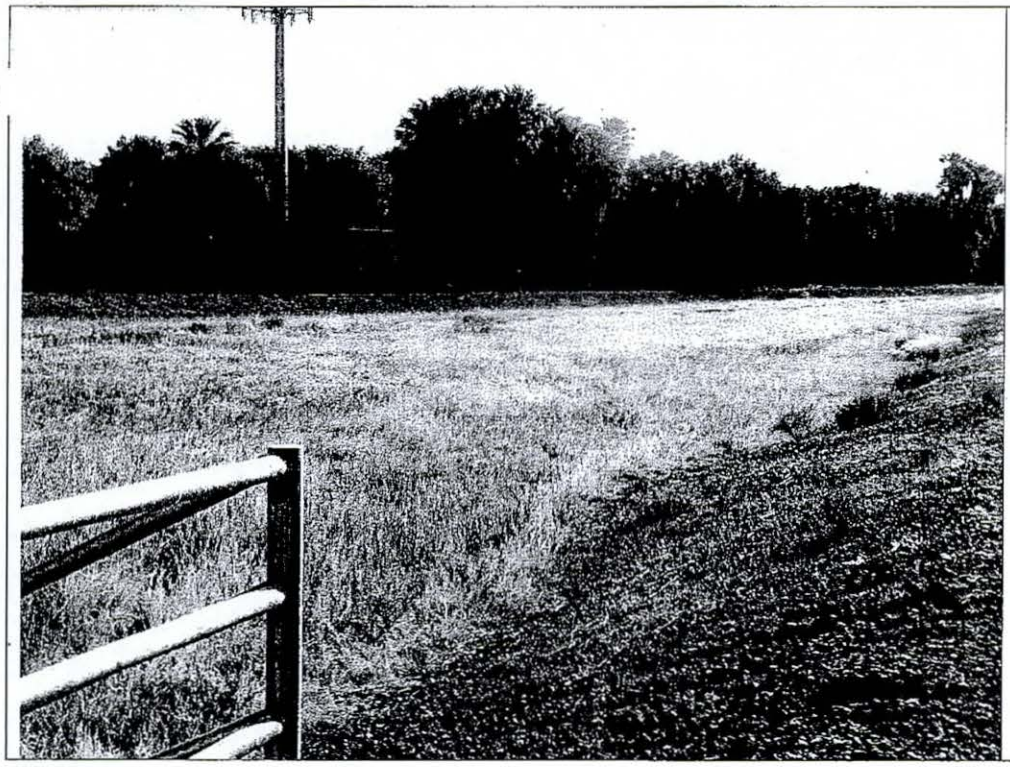


Photo No.: 4
Date: 5/2/2011
Description: Vegetation in basin area needs mowed.

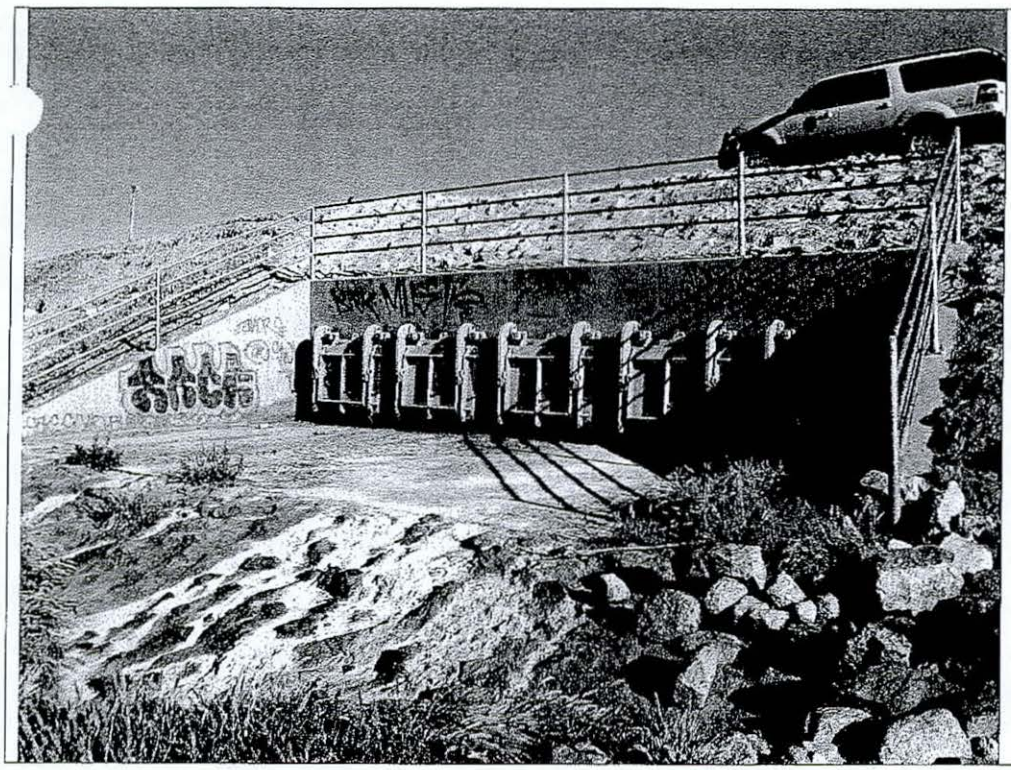


Photo No.: 5
Date: 5/2/2011
Description: Outlet flap gates.

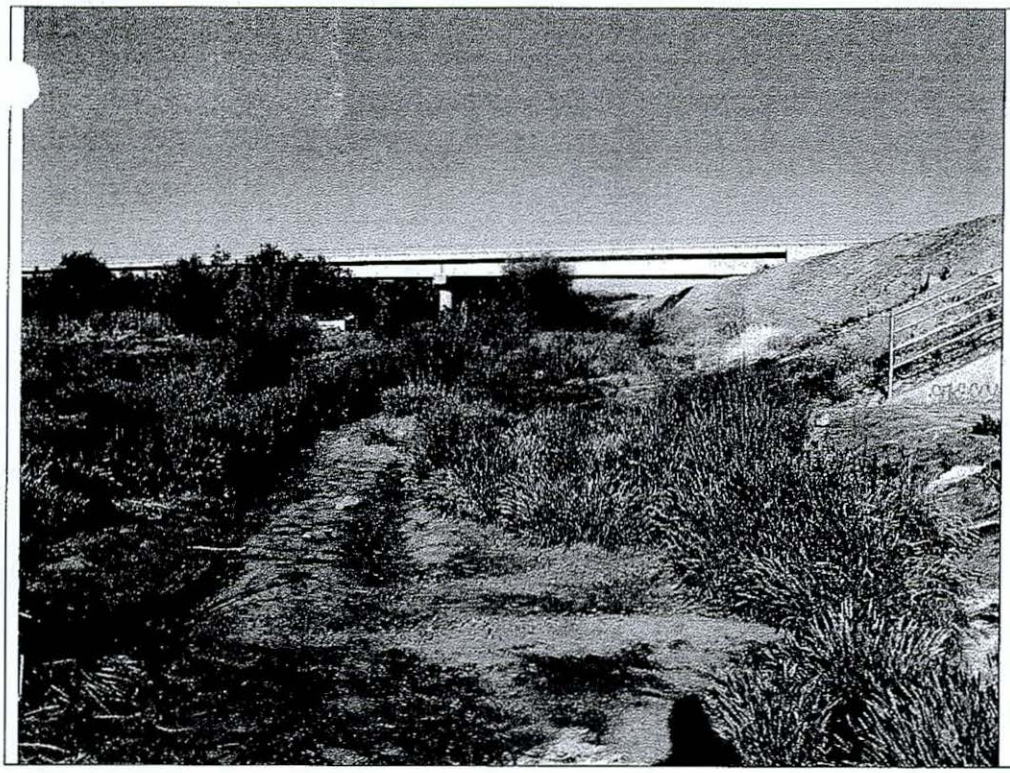


Photo No.: 6
Date: 5/2/2011
Description: Salt cedar and dense vegetation are choking the outlet channel from the five flap gate outlet.

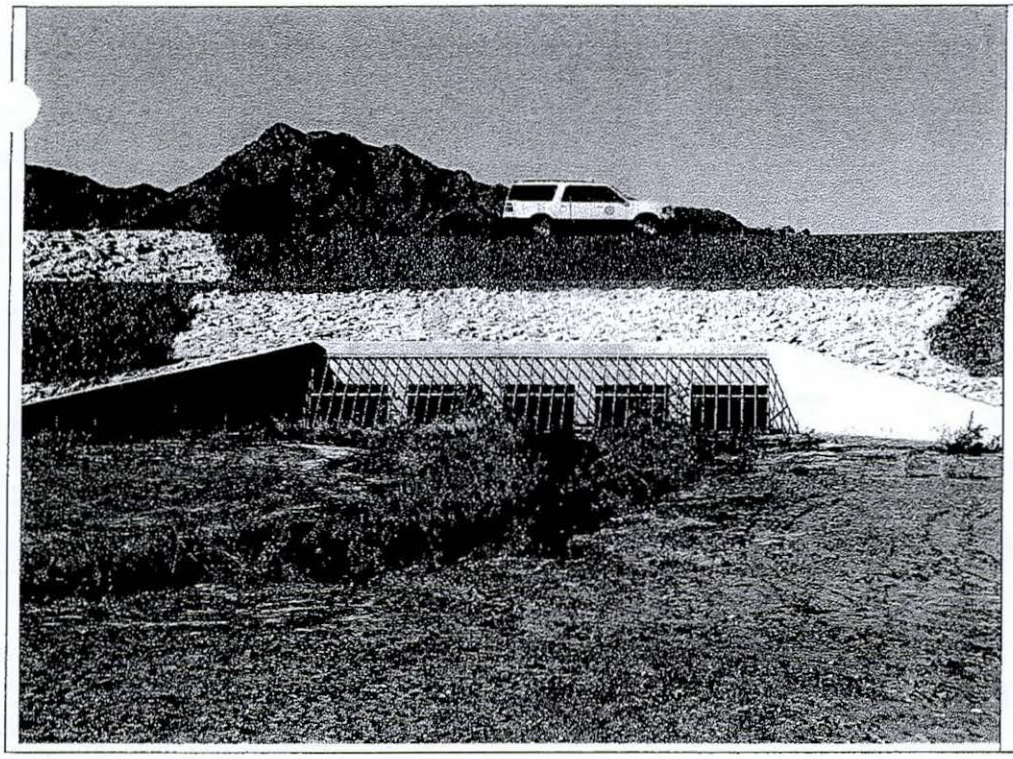


Photo No.: 7
Date: 5/2/2011
Description: 5 box culvert inlet structure.

Photo No.: 8
Date: 5/2/2011
Description: North levee inlet structure located just east of Avondale Blvd., needs a cutoff wall installed to prevent structural damage to the grouted riprap apron.

TRL

US. Department of Homeland Security
500 C Street, SW
Washington, DC 20472

FEMA

September 2, 2010

MEMORANDUM FOR: Mitigation Division Directors
Regions I - X

FROM: Doug Bellomo, Director
Risk Analysis Division

SUBJECT: Procedure Memorandum No. 63
Guidance for Reviewing Levee Accreditation Submittals

EFFECTIVE DATE: **Encouraged for all levee accreditation requests submitted prior to October 1st, 2010; required after October 1st, 2010**

Background: In accordance with the National Flood Insurance Program (NFIP) regulations, communities or other parties seeking recognition of a levee system as providing protection on NFIP maps must provide data and documentation demonstrating compliance with regulations set forth in the Code of Federal Regulations (CFR) at Title 44, Chapter 1, Section 65.10 (44 CFR Section 65.10). Once compliance with 44 CFR Section 65.10 is demonstrated, the levee system will be accredited on NFIP maps, reflecting the appropriate risk zones for levee-impacted areas. Accreditation by itself is not a guarantee or warranty of performance of levee/levee systems during a flooding event. It is a determination that the levee system meets the minimum design, operation, and maintenance standards set forth in 44 CFR Section 65.10, to be shown on the NFIP maps as providing protection from the base (1-percent-annual-chance) flood.

Issue: By regulations, communities and levee owners have the responsibility to provide 44 CFR Section 65.10-compliant data and documentation, when seeking recognition of a levee system on an NFIP map. Following issuance of Procedure Memorandum (PM) Nos. 34 and 43, dated August 22, 2005, and September 25, 2006, respectively, and revised PM 43 dated March 16, 2007, the Federal Emergency Management Agency (FEMA) has seen an increase in the number of accreditation request submittals. Therefore guidance is being provided to improve and clarify the process of review for compliance with 44 CFR Section 65.10. These reviews must be consistent for all accreditation submittals including, but not limited to new and continued accreditation requests as part of a mapping project, requests submitted as Letters of Map Change (LOMCs), Physical Map Revisions (PMRs), and Provisionally Accredited Levees (PALs).

Action Taken: The attached guidelines are being issued to improve and clarify the process of review for compliance with 44 CFR Section 65.10. Please note that a FEMA

determination of a levee system meeting the minimum regulatory requirements for accreditation on an NFIP map does not constitute a determination by FEMA as to how a levee system will perform in a flood event. The review process, henceforth referred to as the "completeness check", is described in detail in the attached document, entitled "Guidelines for Reviewing Levee Accreditation Submittals."

The completeness check is to be implemented by all FEMA Regions and contractors. This check can also be shared with levee system owners and communities to further clarify the FEMA role in the accreditation process. The completeness check is intended only for structures designed to serve as levee systems, and shall not be implemented for any other lateral structure, or non-levee embankment, without consultation with FEMA Headquarters (HQ). These guidelines may be used for reviewing coastal levee accreditation submittals; however, due to the complexity and uniqueness of each coastal levee, coordination and consultation must occur with FEMA HQ for each coastal submittal.

Attachments:

Guidelines for Reviewing Levee Accreditation Submittals
Checklist and Contact Information for Levee Accreditation Submittals
Title 44, Chapter 1, Section 65.2, of the Code of Federal Regulations
Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations

cc: See Distribution List

Distribution List (electronic distribution only):

Office of the Acting Assistant Administrator for Flood Insurance and Mitigation
Risk Analysis Division
Risk Reduction Division
Risk Insurance Division
Regional Mitigation Division Directors
Regional Risk Analysis Branch Chiefs
Legislative Affairs
Office of Chief Counsel
Indefinite Delivery Indefinite Quantity Contractors
Cooperating Technical Partners
Program Management Contractor
Customer and Data Services Contractors
Production and Technical Services Contractors

Guidelines for Reviewing Levee Accreditation Submittals

Introduction

This document outlines the process FEMA will follow when reviewing levee accreditation submittals. This process, *i.e.*, the completeness check, is the same for all types of submittals, including those for new and existing levee systems that have not yet been evaluated in accordance with Procedure Memorandum (PM) No. 34, Provisionally Accredited Levees (PALs), Letters of Map Change (LOMCs), Physical Map Revisions (PMRs), and new studies that include accredited levee systems impacted by changes in the Base Flood Elevations (BFEs). Please note that for PAL reviews, PM 53 requires a mapping action to be initiated upon expiration of the PAL period if the submittal is not complete. Any dialogue regarding additional data after the expiration of the 24-month timeframe cannot delay the initiation of such a mapping action without consultation with FEMA HQ.

The completeness check is not a technical review, or an evaluation of design, nor is it performed to determine how a levee will perform in a flood event. The incoming data supporting 44 CFR 65.10 requirements must be certified by a registered Professional Engineer (P.E.), licensed by their respective states, or by a Federal agency with responsibility for levee design. The completeness check is performed to ensure that all data demonstrating compliance with 44 CFR Section 65.10 is submitted, so FEMA can delineate the appropriate risk zones on NFIP maps. However, if FEMA is presented with conflicting data, a more in-depth review can be performed. This additional and more in-depth review would require approval and consultation with FEMA HQ. Although FEMA performs a completeness check for 44 CFR Section 65.10 compliance, submittals must include back-up data and supporting information for all calculations, in case a more detailed review is needed/warranted. Certified summary reports without all back-up data are not acceptable.

The three tiered approach described below is structured so that each tier represents a different level of review, and subsequently an opportunity for additional data to be requested. This approach is intended to make the levee accreditation process more efficient. The reviewer shall not move forward to subsequent tiers if data is missing for the previous tier. A data request should be compiled and sent to the requestor noting the extent of what has already been reviewed and that additional data requests might be forthcoming once the review is restarted.

Tier 1 Review

STEP 1: All Items Signed by a registered P.E.
The reviewer will evaluate the submitted materials to ensure that all of the components required in 44 CFR Section 65.10 are included in the submittal and are stamped, as appropriate, by a registered P.E.

While the complete submittal for levee accreditation must be certified by a registered P.E., the submittal may include several subsets of engineering data, dealing with separate portions of 44 CFR Section 65.10, certified by different P.E.s. Certifications are subject to the definition provided in 44 CFR Section 65.2. In such cases, the P.E. who certifies the completed package, will be considered the requestor and will be contacted if additional information is needed.

P.E. certification is required for data showing compliance with the design criteria set forth under 44 CFR Section 65.10(b), as well as the as-built plans. For existing levees, there are no restrictions on the age of certifications or the engineering data and as-built plans, as long as the overall certification of the accreditation submittal is new and references the data used to make this determination. It is the P.E.'s responsibility to ensure that the supporting data is still valid.

Certified as-built plans must be submitted as required by 44 CFR Section 65.10(e). A new levee survey may be required if certified as-built plans are missing, or do not cover the entire length of the levee. The new survey must include all the necessary information for the review, including but not limited to topographic information, location and dimensions of all structures, pipes and utilities crossing the levee, and all the facilities that are part of the interior drainage system. Additionally, each submittal must include officially adopted maintenance plans and operation plans. (See step 4)

STEP 2: Freeboard Check

The submitted report must contain a profile of the currently effective BFE and levee crest (top of levee) elevation that shows adequate freeboard exists. The reviewer will verify the submittal contains information showing that the levee ties into high ground and that the levee's elevation at the tie-in location is within a tenth of a foot of the levee crest at the upstream and downstream ends. The report must provide freeboard information showing the levee meets the requirements of 44 CFR Section 65.10(b)(1), including freeboard requirements for structures, constrictions, and ice jam situations (where warranted). In certain circumstances, exceptions to the minimum riverine freeboard requirement may be approved by FEMA when a minimum of 2-foot freeboard exits throughout the levee as described under 44 CFR Section 65.10(b)(1)(ii). Requests for exceptions, however, shall be coordinated with FEMA HQ prior to submittal of the accreditation request.

Sandbags or any other temporary structure or measures used solely to reach freeboard requirements generally will not be considered for accreditation. In certain situations, where the inverts of closures are above the BFE, sandbags can be used to reach the required freeboard with FEMA HQ's approval. This activity must be part of the adopted operations plan.

Tier 2 Review

STEP 3: Regulations
The submittal must adequately address all applicable Federal, State, and local laws, regulations and requirements, including, but not limited to, Federal and local floodplain management laws, environmental laws, and permit requirements. This can be verified through communication with the requestor. A record of these communications must be kept in file for future reference.

STEP 4: Operations and Maintenance Plan
As required by regulation, the submittal must include a maintenance plan that has been officially adopted by the community. This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum the maintenance plans shall specify the maintenance activities, the frequency with which they will be performed, and the name or title of the person who will be responsible for ensuring that maintenance activities are accomplished. The activities and the frequency of their performance should conform to the risk associated with the levee. The maintenance plan should address the type of vegetation on and adjacent to the levee, the activities required to maintain the flood characteristics represented in the hydrologic and hydraulics (H&H) analyses and any special environmental considerations. Plans should also include provisions for inspection of the levee and maintenance of any mechanical systems, such as closure devices, pumps, valves and relief wells. Maintenance must be under the jurisdiction of federal or state agencies, an agency created by Federal or State law, or an NFIP participating community.

The submittal must include an officially adopted operation plan that includes information on both interior drainage systems and any closure structures or devices. The plan must include specific actions, assignments and personnel responsibilities and the name or title of the person responsible for each item. It must include provisions for inspection and testing of any mechanical systems. If flood fighting activities are listed in an operation plan, it must be ensured that these activities are not intended to be performed to stabilize any part of the levee system during a flood event, in lieu of meeting 44 CFR Section 65.10 requirements. The operation plan must document a flood warning system that triggers emergency operation activities. It must be demonstrated that there is sufficient warning time for activation and operation of the mechanized drainage system components. Operations must be under the jurisdiction of Federal or State agencies, an agency created by Federal or State law, or an NFIP participating community.

Officially adopted plans must be signed by the CEO of the community or the appropriate head of the agency that is accepting the ultimate responsibility of all the tasks and actions listed in those plans. Both the operation and maintenance plans must be prepared for the specific levee for which accreditation is being evaluated. Generic operations and maintenance plans, non-specific to the levee system, *i.e.*, plans that cover an entire county or state, are not acceptable.

STEP 5: "With Levees" and Without Levees" Analysis
The "with levee" analysis is used to determine the BFEs on the riverine side of the levee. If the levee is accredited to provide protection from the base flood, the "without levee" analysis is used to determine the area that is protected by the levee. In accordance with FEMA's current standard mapping procedure if the levee is not accredited, the "without levee" analysis is used to determine the flood hazards on the landward side of the levee. If new hydrologic and/or hydraulic analyses are submitted as part of a levee accreditation package, then both "with levee" and "without levee" analyses must be submitted by the requestor. In certain situations, the area protected by a levee could be different from the "without levee" analysis floodplain due to the effects of interior drainage.

Tier 3 Review

STEP 6: Levee System and Cross Reference Check
The reviewer will verify that all components, as described in 44 CFR Section 65.10, use the same flooding elevations and conditions, and that the entire levee system (if a system consists of different segments) is considered in the submittal. A levee system must constitute a "complete system" not reliant on any segments/systems that are not accredited. Partial accreditation is only acceptable for segments along a system that are hydraulically independent from upstream and downstream segments. The area protected by a hydraulically independent segment is not impacted by failure or interior drainage of upstream or downstream segments. Partial accreditation, however, needs to be coordinated through consultation with FEMA HQ.

STEP 7: Interior Drainage Analysis
The submittal must include an H&H study identifying the source(s) and extent of flooding due to interior drainage for any ponding area greater than 1-foot in depth, and a topographic work map showing the extent of these areas. A thorough H&H review must be performed for all flooding sources identified within the interior drainage area. The submittal must include the joint probability of interior and exterior flooding, describe storage and pumping systems, and identify the capacity of these facilities to evacuate interior flood waters. Operation information related to these facilities, including but not limited to pumping stations, must be included in the operation and maintenance plans submitted for the levee system. New BFEs resulting from the interior drainage analysis are subject to the appeal process set forth under 44 CFR Section 67.

STEP 8: Structural Design Requirements
The reviewer will verify that data for the structural design requirements of 44 CFR Section 65.10 have been submitted, including but not limited to:

1) **Closure Structure Data:** The submittal must include information for all levee openings and low points where closure structures are structurally part of the levee.
2) **Embankment Protection:** The design report must include an analysis addressing protection of the levee embankment from erosion. This analysis should include the embankment side slope, calculated flood water velocity,

expected duration of the flood at various stages, wind and wave action, and ice and debris flow where applicable.

3) **Embankment and Foundation Stability**: The report must include an analysis of the embankment and foundation stability. This should include an examination of component material characteristics of the foundation and levee embankment, compaction design, seepage at critical locations, and penetrations and their associated filter materials. Additionally, the impact of any structure, including but not limited to bridges and roads crossing the levee must be addressed.
4) **Settlement**: The report must provide an engineering investigation that assesses the potential settlement of the levee and reduced freeboard over time. Consideration should be given to embankment loads, compressibility of foundation soils, age of the levee, and the construction methods used.

STEP 9: Inspection Reports
Documentation or reports on tests and inspections that are required by regulation under 44 CFR Section 65.10(c)(1)(iii) and Section 65.10(c)(2)(iv) must be provided.

All other applicable inspection reports from either the United States Corps of Engineers (USACE) or other sources must be considered as part of the FEMA review to ensure that any issues related to 44 CFR Section 65.10 have been addressed.

Mapping the Levee

STEP 10: Final Completeness Check
Once the completeness check is finished and all required components have been submitted and deemed complete, FEMA will accredit the corresponding levee on the NFIP maps. If any component is found to be missing or erroneous and the requestor cannot provide missing data to show compliance with 44 CFR Section 65.10, FEMA will not accredit the levee and reserves the right to suspend or deny the request

Checklist and Contact Information for Levee Accreditation Submittals

	Passed	
• Tier 1 Review		
▪ STEP 1: All Items Signed by a registered P.E.	☐Yes	☐No
▪ STEP 2: Freeboard Check	☐Yes	☐No
• Tier 2 Review		
▪ STEP 3: Regulations	☐Yes	☐No
▪ STEP 4: Operations and Maintenance Plan	☐Yes	☐No
▪ STEP 5: "With Levees" and "Without Levees" Analysis	☐Yes	☐No
• Tier 3 Review		
▪ STEP 6: Levee System and Cross Reference Check	☐Yes	☐No
▪ STEP 7: Interior Drainage Analysis	☐Yes	☐No
▪ STEP 8: Structural Design Requirements		
1) Closure Structure Data	☐Yes	☐No
2) Embankment Protection	☐Yes	☐No
3) Embankment and Foundation Stability	☐Yes	☐No
4) Settlement	☐Yes	☐No
5) All Other, as Applicable	☐Yes	☐NA
▪ STEP 9: Inspection Reports	☐Yes	☐No
• Mapping the Levee		
▪ STEP 10: Final Completeness Check	☐Yes	☐No

Comments:

Reviewer
- o Name: _____
- o Phone No.: _____
- o E-mail: _____

FEMA Regional Contact
- o Name: _____
- o Phone No.: _____
- o E-mail: _____

FEMA Headquarters Contact (if applicable)
- o Name: _____
- o Phone No.: _____
- o E-mail: _____

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• Tier 2 Review		
▪ STEP 3: Regulations	☐Yes	☐No
▪ STEP 4: Operations and Maintenance Plan	☐Yes	☐No
▪ STEP 5: "With Levees" and "Without Levees" Analysis	☐Yes	☐No
• Tier 3 Review		
▪ STEP 6: Levee System and Cross Reference Check	☐Yes	☐No
▪ STEP 7: Interior Drainage Analysis	☐Yes	☐No
▪ STEP 8: Structural Design Requirements		
1) Closure Structure Data	☐Yes	☐No
2) Embankment Protection	☐Yes	☐No
3) Embankment and Foundation Stability	☐Yes	☐No
4) Settlement	☐Yes	☐No
5) All Other, as Applicable	☐Yes	☐NA
▪ STEP 9: Inspection Reports	☐Yes	☐No
• Mapping the Levee		
▪ STEP 10: Final Completeness Check	☐Yes	☐No

Comments:

Reviewer
- o Name: _____
- o Phone No.: _____
- o E-mail: _____

FEMA Regional Contact
- o Name: _____
- o Phone No.: _____
- o E-mail: _____

FEMA Headquarters Contact (if applicable)
- o Name: _____
- o Phone No.: _____
- o E-mail: _____