Via Entrada Wash Letter of Map Revision
Technical Data Notebook

Prepared by:

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and
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Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701

Approved by

Suzanne Shields, PE
Director

Pima County Regional Flood Control District
97 E Congress Street
Tucson Arizona, 85701

Exp June 2013

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Exhibit

Section 1 Introduction

1.1 Propose

This Technical Data notebook (TDN) has been prepared for a Letter of Map Revision (LOMR) application for a portion of the Via Entrada Wash (VE) located in Pima County, Arizona. The objective of the TDN and LOMR submission is provide regulatory discharge rates and floodplain limits along the Via Entrada Wash using better topographic, hydrologic, and hydraulic data.

This TDN was prepared in accordance with the "Instructions for Organizing and Submitting Technical Documentation for Flood Studies" prepared by the Arizona Department of Water Resources, Flood Mitigation Section (Arizona State Standard, SSA 1-97) and FEMA Guideline. FEMA LOMR forms are included in this TDN.

1.2 Project Authority

The State of Arizona has delegated the responsibility to each county flood control district to adopt floodplain regulations designed to promote the public health, safety and general welfare of its citizenry as provided under the Arizona Revised Statutes, Title 48, Chapter 21, Article 1, Sections 48-3601 through 3627. More specifically, A.R.S. 3609 directs county flood control districts to adopt floodplain regulations that:

> A. Regulate all development of land, construction of residential, commercial or industrial structures or uses of any kind which may divert, retard or obstruct flood water and threaten public health or safety or the general welfare; and
> B. Establish minimum flood protection elevations and flood damage prevention requirements for uses, structures and facilities which are vulnerable to flood damage; and
> C. Comply with state and local land use plans and ordinances, if any.
> In conformance with A.R.S. 3609, this ordinance provides for protection of the public health safety and welfare by regulation of flood and erosion hazard areas to control flood hazards and prevent repetitive loss from flood damage.
> D. The flood hazard areas of Pima County are subject to periodic inundation which may result in loss of life and property, create health and safety hazards, disrupt commerce and governmental services, require extraordinary public expenditures for flood protection and relief, and impair the tax base, all of which adversely affect the public health, safety, and general welfare.
> E. These flood losses are caused by the cumulative effect of obstructions in areas of special flood hazards which increase flood heights, flow velocities, and cause flood and erosion damage. Uses that are inadequately flood-proofed, elevated, or otherwise protected from flood damage, also contribute to the flood loss. (Ord. 2005 FC-2 § 2 (part), 2005).

Section 16 of the Pima County Ordinance describes the provisions for floodplain regulation in Pima County.

This study has been prepared by the Pima County Regional Flood Control District (RFCD):

Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701

The project was prepared by:

Evan Jensen, BS, Interning Hydrologist
Akitsu Kimoto, Principal Hydrologist.
Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701

1.3 Project Location

The study reach of the Via Entrada Wash (VE1) is located within a Federal Emergency Management Agency (FEMA)-designated "Zone X" flood-hazard area, as depicted on FIRM Map Panel Number 04019C1630K, 1635K, and 1637K (February 8, 1999). No documented hydraulic analyses were found to determine the "Zone X", and the existing "Zone X" depiction is not consistent with current topography. The objective of the TDN and LOMR submission is provide regulatory discharge rates and floodplain limits along the Via Entrada Wash using better topographic, hydrologic, and hydraulic data.

The study was performed to provide drainage information for the Via Entrada Wash. The site includes Section 05, 07, 08, 17, 18, 19 of Township 13 South, Range 14 East, Sections 4, 5, 7, 8, 17, 18 and 19 of Township 13 South, Range 14 East; Pima County, Arizona. Watershed is part of in Flood Insurance Rate Map (FIRM) number 04019C1630K, 1635K, and 1637K.

The watershed is 1.69 square miles. The study watershed was divided into seven sub-basins (Fig.1.1). The study limits for the Via Entrada Wash extends from North of Campbell and Skyline to the intersection of River Rd and Via Entrada (Fig.1.2).

1.3 Hydrologic and Hydraulic Methods

Hydrologic analysis was preformed to estimate regulatory discharge rate at River Rd using PC-Hydro Version 5.4.2 (PC-Hydro). The parameters for PC-Hydro, such as rainfall intensity and subbasin characteristics (e.g. soil, vegetation, slope, flow distance, roughness), were selected using PC-Hydro User Guide (Arroyo Engineering, 2007). The proposed regulatory discharges are flow rates that have a 1-percent chance of being

equaled or exceeded each year (“100-year” discharge rates). Hydraulic analysis was performed to delineate floodplain limit along the study reach of the Via Entrada Wash using U.S. Army Corps of Engineers Computer Backwater Model, HEC-RAS.
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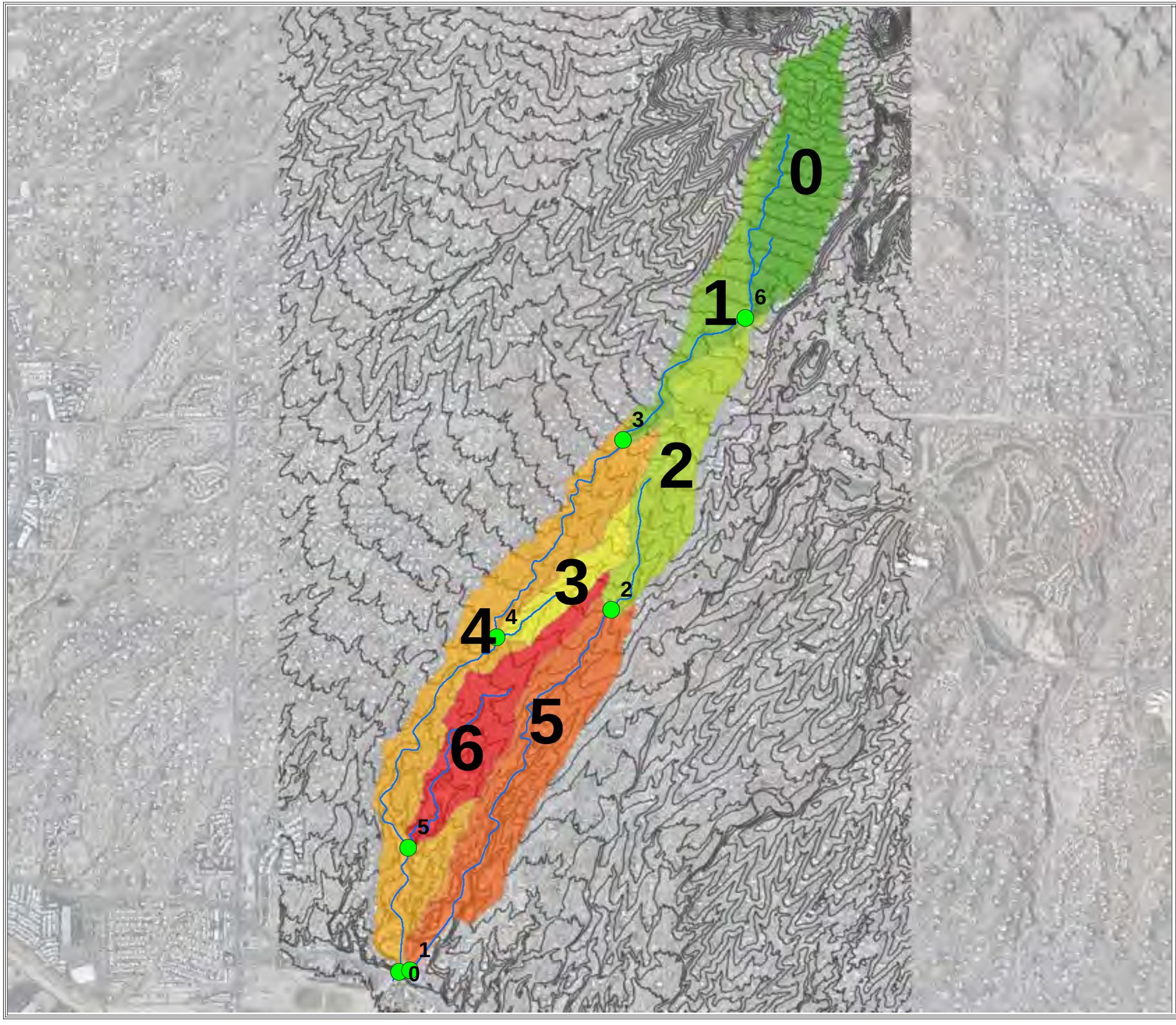
1.4 Acknowledgment

This study relied on assistance of RFCD GIS staff, who were integral to the development of the models and maps.

1.5 Study Results

The regulatory peak discharge rate was calculated at CPs. The estimated discharges are summarized in Table 3.

Figure 1.1
Watershed Map
Via Entrada Wash



Legend

- Concentration Point
- River

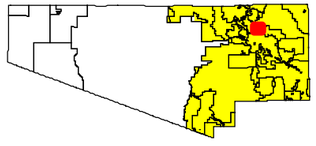
Subbasins

Name

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 20ft Contours

Aerial : 2008 Pima Association of Governments

Pima County Index Map



Index Map Scale 1:5,250,000

Pima County Regional Flood Control District

Pima County Regional FLOOD CONTROL DISTRICT

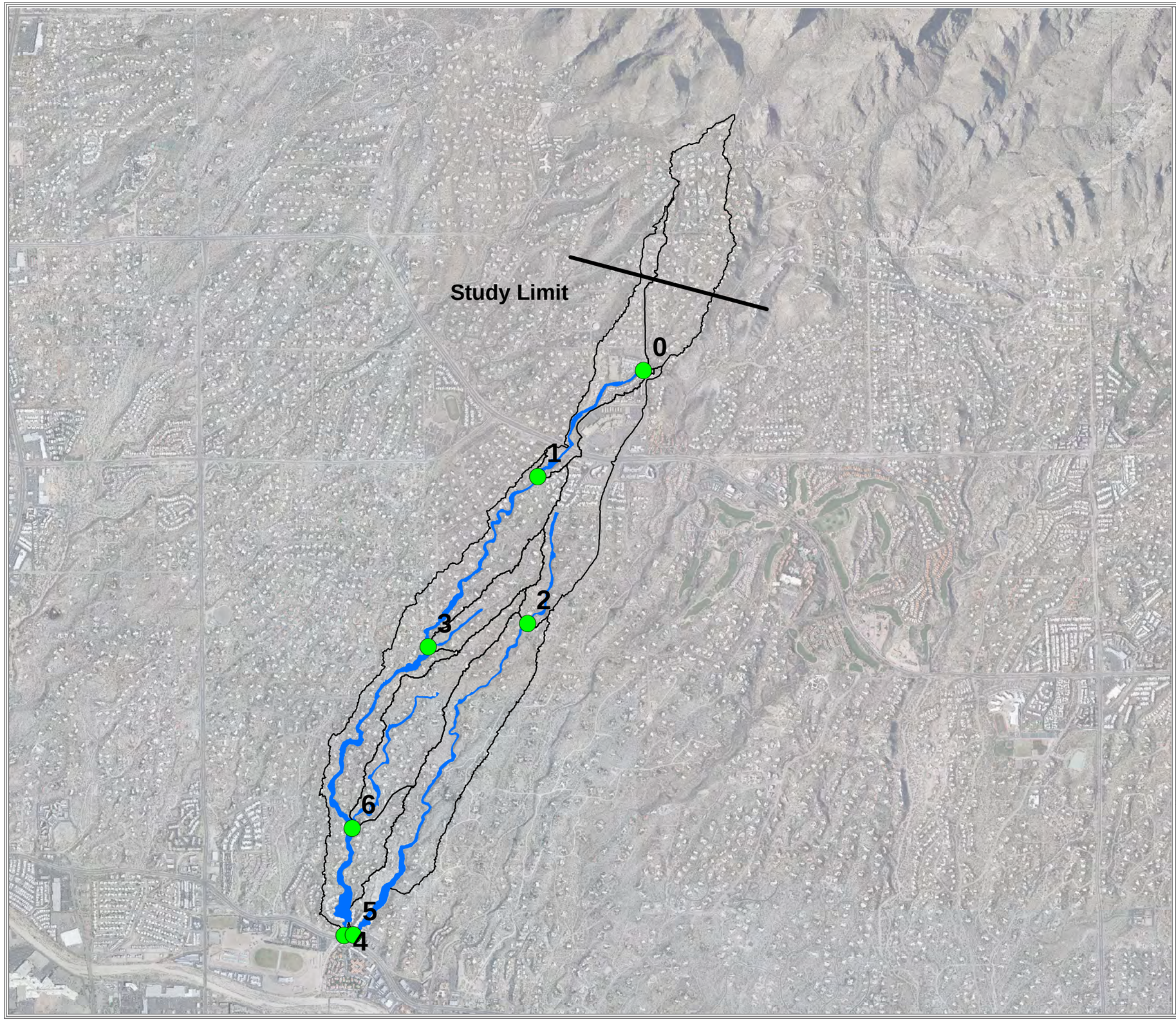
N

Feet

1/2011

\\gislib\rfcd\projects\imd\xavi\mxd\AKITSU\Via_Entrada\Via_Entrada_wash_Fig1_3.mxd

Figure 1.2
Study Limit Map
Via Entrada Wash



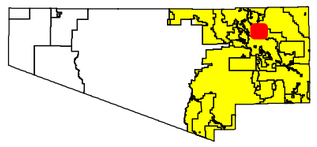
Concentration Point

100 yr Floodplain

Subbasins

Aerial : 2008 Pima Association of Governments

Pima County Index Map



Index Map Scale 1:5,250,000

Pima County Regional Flood Control District

Pima County Regional FLOOD CONTROL DISTRICT

910 455 0 910 Feet

1/2011

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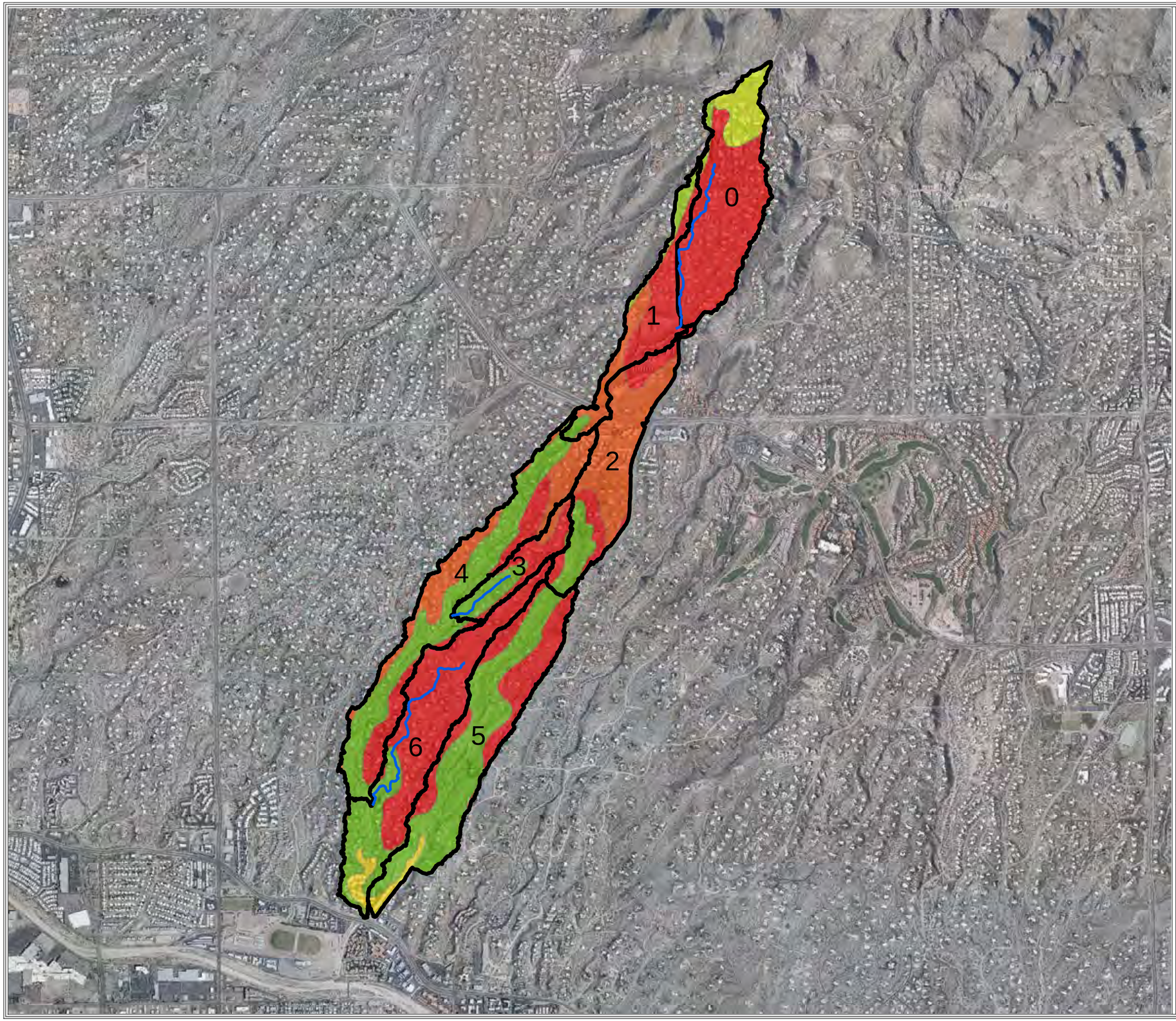
Figure 1.3
Soil Classification
Via Entrada Wash



River

subbasins

Soil Types

Soil Group: A (100%)

Soil Group: B (100%)

Soil Group: B (100%)

Soil Group: B (82%) C (18%)

Soil Group: C (47%) D (53%)

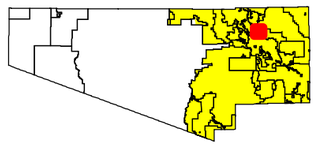
Soil Group: C (50%), D (50%)

Soil Group: D (100%)

Soil Group: D (100%)

Aerial : 2008 Pima Association of Governments

Pima County Index Map



Index Map Scale 1:5,250,000

Pima County Regional Flood Control District

Pima County Regional FLOOD CONTROL DISTRICT

1,200 600 0 1,200 Feet

1/2011

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Section 2.0 Summary of Key Facts

Section 2.1: General Information

2.1.1 Community: Pima County Regional Flood Control
2.1.2 Community Number: NFIP Community Number 04019C
2.1.3 County: Pima
2.1.4 State: Arizona
2.1.5 Date Study Accepted: Not Accepted –
2.1.6 Study Contractor: Pima County Regional Flood Control District – Evan Jensen
2.1.7 State Technical Reviewer: Not Applicable
2.1.8 Local Technical Reviewer: Suzanne Shields
2.1.9 River or Stream Name: Via Entrada
2.1.10 Reach Description: Via Entrada
2.1.11 Study Type: Hydrology and Hydraulics study of a Riverene System

Section 2.2: Mapping Information

2.2.1 FIRM Panels: 04019C1630K, 1635K, and 1637K
2.2.2 Mapping for Hydrologic Study: Lidar based on 2008 flight used to derive 2' contour interval maps using ARC-GIS 9.3.1
2.2.3 Mapping for Hydraulic Study: Lidar based on 2008 flight used to derive a DEM (5-ft cell size) for use with GeoRAS

Section 2.3: Hydrology

2.3.1 Model or Method Used: PC-Hydro, version 5.4.2
2.3.2 Storm Duration: NA
2.3.3 Hydrograph Type: NA
2.3.4 Frequencies Determined: 100 yr
2.3.5 List of Gages used in Frequency Analysis or Calibration: None
2.3.6 Rainfall Amounts and Reference: NOAA 14 Upper 90% Confidence Interval
2.3.7 Unique Conditions and Problems: None
2.3.8 Coordination of Q's: Comparison with previous studies on file with RFCD and discharge estimates

Section 2.4: Hydraulics

2.4.1 Model or Method Used: HEC-RAS 4.0, GeoRAS to parameterize
2.4.2 Regime: Modeled as subcritical
2.4.3 Frequencies for which Profiles were Computed: 100 yr
2.4.4 Method of Floodway Calculation: No Floodway
2.4.5 Unique Conditions and Problems: Boundary set at normal depth.

Section 2.5: Additional Study Information:

None

FOR FEMA Section 2 FEMA Forms

2.1 Study Documentation Abstract for FEMA submittals

2.1.1 Date Study Accepted: _____

2.1.2 Study Contractor:

Planning and Development Division,
Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701
(520) 243-1800

Prepared by Evan Jensen, BS, Interning Hydrologist

2.1.3 Local Technical Reviewer:

Bill Zimmerman, Division Manager and Terry Hendricks, C.F.M, Chief Hydrologist
Planning and Development Division,
Pima County Regional Flood Control District
97 East Congress, Tucson, AZ 85701
(520) 243-1800

2.1.4 Reach Description

The study reach of the Via Entrada Wash is located within a Federal Emergency Management Agency (FEMA)-designated "Zone X", as depicted on FIRM Map Panel Number 04019C-1635 K and FIRM number 04019-1637 K. (February 8, 1999). The study reach of the Via Entrada Wash is located primarily north of River Rd., Pima County, Arizona (Fig. 1.1). The study reach of the Via Entrada Wash is primarily composed of sand and gravel channel. The overbank of the reach is covered with desert brush.

2.1.5 USGS Quad Sheets

Not available for this study

2.1.6 Unique Conditions and Problems

None.

2.1.7 Coordination of Peak Discharges

The 100-year regulatory discharge rate at River Rd. was computed using PC-Hydro. The parameters for PC-Hydro, such as rainfall intensity and subbasin characteristics (e.g. soil, vegetation, slope, flow distance, roughness), were selected using PC-Hydro User Guide (Arroyo Engineering, 2007). The discharge rate was acceptable per Suzanne Shield, Director of the Pima County Regional Flood Control District.

2.2 FEMA Forms

Not applicable.

Section 3 Survey and Mapping Information

3.1 Field Survey Information

None.

3.2 Mapping

The topographic data was obtained using HEC-GeoRas and ArcGIS. Digital Elevation Model (DEM) derived from 2008 Light Detection and Ranging (LiDAR) data was used to create 5-foot interval contour map. The documentation showing that this Lidar data set is FEMA-compliant is included in Appendix C.

The following data was used in this TDN;

The aerial photo: 2008 PAG aerial photo
Projection: UTM, Zone 12
Units: International feet
The contour interval of the topographic map is 5 feet.

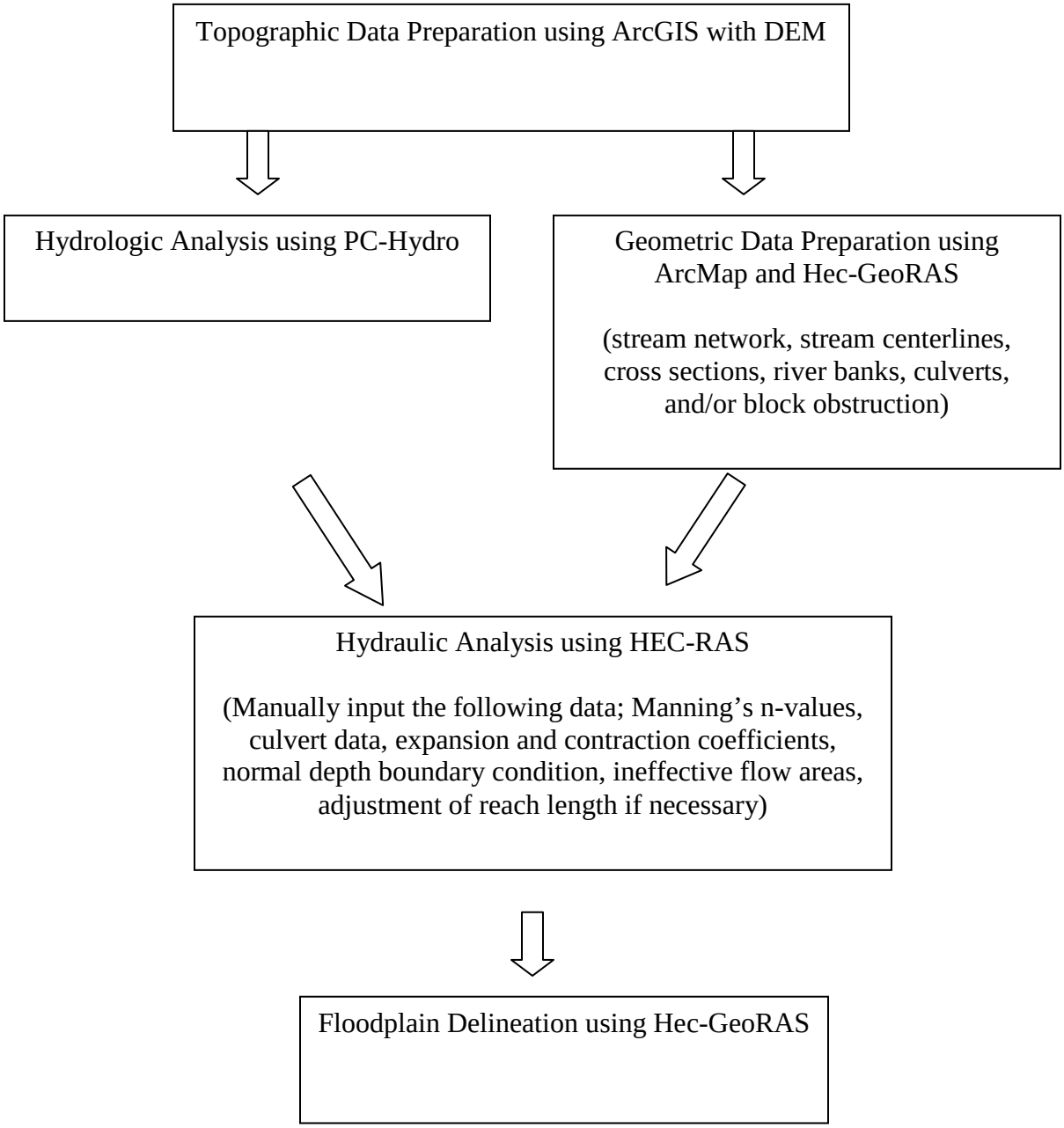
Section 4 Hydrology

4.1 Method Description

The 100-year peak discharges for the watershed outlet of the Via Entrada Wash (Fig. 1.3) were calculated using PC-Hydro Version 5.4.2 (PC-Hydro). The PC-Hydro uses a semi-empirical method, which is similar to the Rational Formula. The method is unique

to Pima County. Pima County has been using the Pima County Hydrology Procedures (PC-Hydro method) for over 30 years for a floodplain management. The method has been deemed as a FEMA-accepted hydrologic method for prediction of 100-yr peak discharge in Pima County. The method was used for the Friendly Village LOMR (case# 08-09-0473P) and it was approved by FEMA. The PC-Hydro method generally produces higher discharge values compared to HEC-HMS or USGS Regression equations. Peak discharge values produced by the PC-Hydro would be conservative, compared to using HEC-HMS or USGS Regression equations. The PC-Hydro model requires the parameters regarding rainfall, topography, soil, and vegetation to determine peak discharge. Those parameters were determined following the PC-Hydro User Guide (Arroyo Engineering, 2007). The PC-Hydro model is included in Appendix D.

Figure 4.1 Flow Chart of Mapping Process



4.2 Parameter Estimation

4.2.1 Drainage Area

Subbasin boundaries were delineated using the hydrology function of ArcGIS with 2008 Lidar Data. A 5-ft contour map was used to make sure if the subbasin delineation was reasonable.

4.2.2 Watershed Work Map

A watershed work map is included in Exhibit 1. A 100 year peak discharge was used for HEC-RAS hydraulic analysis.

4.2.3 Gage Data

No gage data were used in this TDN.

4.2.4 Spatial Parameters

No spatial parameters were used in this TDN.

4.2.5 Precipitation

One-hour rainfall was used to estimate 100-year peak discharge at River Rd.. The rainfall intensity at the time of concentration for the Via Entrada Wash watershed is 2.83 inches. No area reduction factor was applied.

4.2.6 Physical Parameters

Methods are summarized in Table 1. The PC-Hydro model calculates runoff coefficients using adjusted Curve Number (CN), which has been developed based on the results of the USDA-ARS research. This procedure assumes that high intensity, short duration storms result in raindrop impacts causing the surface of soils to seal up, resulting in reducing infiltration (Caliche Effect). The CN in the PC-Hydro model increases with increasing rainfall depth and intensity. The detail of the method was described in PC-Hydro User Guide (Arroyo Engineering, 2007).

Table 1 Methods used for a PC-Hydro analysis

	Selected Method
Rainfall Depth	NOAA 14, upper 90% Confidence Interval
Rainfall Loss	Adjusted SCS Curve number
Time of Concentration	Pima County Hydrology Procedure

Table 2 Watershed Characteristics

Sub basin	Area (mi2)	Impervious Area	Vegetation Cover
0	0.27	15	20
1	0.13	15	20
2	0.21	15	20
3	0.08	15	20
4	0.44	15	20
5	0.32	15	20
6	0.19	15	20

4.3 Problems Encountered During the Study

4.3.1 Special Problems and Solutions

There were no problems with the hydrologic modeling.

4.3.2 Modeling Warning and Error Messages

None

4.4 Calibration

No calibration was conducted in this study.

4.5 Final Results

4.5.1 Hydrologic Analysis Results

The 100-year peak discharges at CPs were determined using the PC-Hydro. The results are summarized Tables 3.

4.5.2 Verification of results

The estimated peak discharge at all CPs was also compared with the peak discharge obtained from USGS Regression Equation 13 (Thomas et al., 1997) (Table 3).

Table 3 Comparison of a peak discharge

Concentration Point	Reach	Location	Area (mi^2)	Q100 PC-Hydro(cfs)	Q100 RRE (cfs)
6	West	**Via Entrada/Entrada Sexta**	0.19	485	368
5	East	**At River Rd/Via Entrada**	0.54	944	821
4	West	**At River Rd/Via Entrada**	0.67	1630	957
3	West	**Camino Miraval/Camino Escalante**	0.08	300	175
2	East	**Camino El Ganado/Mina Vista**	0.21	672	400
1	West	**Avenida de Posada/Calle del Caballo**	0.40	1140	659
0	West	**Campbell/Table Mountain**	0.27	1010	488

RRE: USGS Regression Equation 13

Section 5 Hydraulics

5.1 Method Description

The hydraulic modeling for the Via Entrada Wash was performed using Hec-Ras, Version 4.1 (HEC-RAS), HEC-GeoRAS, Version 4.2.93 (HEC-GeoRAS), and ArcGIS, Version 9.3.1. Corrected model is proposed in this study. The model name is VE, and the plan name is Plan 01.

As previously mentioned, DEM derived from 2008 LiDAR data was used to create a 5-foot contour map. The locations of the stream centerline, cross-sections, and bank of the Via Entrada Wash were determined using the contour map and 2008 PAG aerial photos. The physical attributes of the wash were digitized in ArcGIS using the HEC-GeoRAS extension and then exported to HEC-RAS to create geospatially referenced geometric data (cross section, reach profile). Other parameters for the steady-state analysis, such as Manning's n-values, expansion and contraction coefficients, boundary condition, and ineffective flow areas were manually added in the HEC-RAS model. The hydraulic data obtained from HEC-RAS were then imported into HEC-GeoRAS to delineate a floodplain boundary of the Via Entrada Wash.

Hydraulic analysis was performed in the area currently mapped as FEMA Zone X. Steady flow analysis was performed to determine 100-year water surface elevations in the study area by using HEC-RAS. As described above, geometric data for HEC-RAS including stream centerline, flow paths and cross-sections were obtained using HEC-GeoRAS.

Normal-depth with a slope of 0.026-0.031 was assumed for the upstream boundary condition.

5.2 Work Study Maps

No work map is included in this study.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

Manning's n values were determined by a combination of a site visit and 2008 PAG aerial photo. Manning's n value of 0.055 was assigned for the overbank with desert brush along the Via Entrada Wash. The value of 0.035 was assigned to a channel.

5.3.2 Expansion and Contraction Coefficients

The channel of the Via Entrada Wash is assumed to have generally gradual transitions with minimum curvature. The expansion coefficient of 0.30 and contraction coefficient of 0.10 were used for the entire study reach.

5.4 Cross-Section Description

A 5-foot interval contour map was used to select the location of cross sections. Cross-section locations were determined primarily based on the channel topography. The cross-section lines were drawn to be perpendicular to flow paths in Hec-GeoRAS.

5.5 Modeling Consideration

5.5.1 Hydraulic Jump and Drop Analysis

No hydraulic, drop analyses or adjustment of the floodplain was conducted in this study.

5.5.2. Bridges and Culverts

Five culverts were modeled with HEC-RAS for the right channel, while one culvert was modeled for the left channel.

5.5.3 Levees and Dikes

There are no levees or dikes located within the study limit.

5.5.4 Island and Flow Splits

There were no islands or flow splits modeled.

5.5.5 Ineffective Flow Areas

Ineffective flow option was modeled in the situation that overbank areas are disconnected and would not convey flow to the next downstream cross-section.

5.6 Floodway Modeling

No floodway modeling was performed in this study.

5.7 Problems Encountered

5.7.1 Special Problems and Solutions

There are no special problems in the study limit.

5.7.2 Model Warnings and Errors

No errors occurred. The following warning messages occurred:

Divided flow
Energy loss greater than 1.0
Energy equation could not be balanced and defaulted to critical.
Cross-section extended vertically.
Multiple critical depths calculated.
Conveyance ratio is less than 0.7 or greater than 1.4.

Inspection indicated that the modeling is accurate given the steep channel conditions. Most of these errors force a critical solution which is reasonable for these steep watercourses.

5.8 Calibration

The model was not calibrated in this study.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

The HEC-RAS model is included in Appendix E.

5.9.2 Verification of Results

The proposed floodplain limit tends to follow the existing floodplain limit. The results suggest that the proposed floodplain limit is reasonable based on the topography.

Section 6 Erosion and Sediment Transport

No erosion or sediment transport analysis was conducted in this study.

Section 7 Draft FIS Report Data

7.1 Summary of Discharges

Peak discharges used for the hydraulic analysis in this study were summarized in Table 3.

7.2 Floodway Data

Not applicable.

7.3 Annotated Flood Insurance Rate Map

An annotated Flood Insurance Rate Map (FIRM) is not included in this study.

7.4 Flood Profiles

Flood profiles are included in the HEC-RAS model in Appendix E.

A.1 Data Collection Summary

Aldridge, B. and J. Garrett. 1973. Roughness Coefficients for Stream Channels in Arizona. US Department of the Interior Geological Survey. Tucson, AZ.

Arizona Department of Water Resources, Flood Mitigation Section
"Instruction for Organization and Submitting Technical Document for Flood Studies" SSA1-97, November 1997

Arizona Department of Water Resources, Flood Mitigation Section
"Requirements for Flood Study Technical Documentation" SS1-97, November 1997

Arroyo Engineering. 2007. PC-Hydro User Guide. Pima County Regional Flood Control District

City of Tucson (COT), Department of Transportation, 1989. Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona. Revised in 1998.

National Weather Service. 1984. Depth-Area Ratios in the Semi-Arid Southwest United States, NOAA Technical Memorandum NWS Hydro-40

Phillips, J., and S. Tadayon. 2006. Selection of Manning's roughness coefficient for natural and constructed vegetated and non-vegetated channels, and vegetation maintenance plan guidelines for vegetated channels in central Arizona: U.S. Geological Survey Scientific Investigations Report 2006–5108, 41 p.

Phillips, J., and T. Ingersoll. 1998. Verification of Roughness Coefficients for Selected Natural and Constructed Stream Channels in Arizona. U.S. Geological Survey Professional Paper 1584.

Pima County Regional Flood Control District
"Pima County Mapguide Map", 2008

U.S. Army Corps of Engineers (COE). 1998. HEC-1 Flood Hydrograph Package, Users Manual, CPD-1A, Hydraulic Engineering Center, Davis, CA.

U.S. Army Corps of Engineers (COE). 2001. HEC-RAS, River Analysis System, Hydraulic
Reference Manual, CPD-69, Hydraulic Engineering Center, Davis, CA.

U.S. Army Corps of Engineers (COE). 2003. Geospatial Hydrologic Modeling Extension HEC-GeoHMS, (v 1.1) CPD-77, Hydraulic Engineering Center, Davis, CA.

U.S. Army Corps of Engineers (COE). 2006. HEC-HMS, Hydrologic Modeling System User's Manual, (v. 3.1.0) CPD-74A, Hydraulic Engineering Center, Davis, CA.

U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), 1986. Urban Hydrology for Small Watersheds, Technical Release 55. Washington, DC.

A 2. Referenced Documents

Arroyo Engineering. 2007. *PC-Hydro User Guide*. Pima County Regional Flood Control District

Eychaner, J.H., 1984. Estimation of magnitude and frequency of floods in Pima County, Arizona, with comparisons of alternative methods: U.S. Geological Survey Water-Resources Investigations Report 84-4142, 69 p.

Haan, C.T., Barfield, B.J., Hayes, J.C. 1994. Design Hydrology and Sedimentology for Small Catchments, Academic Press.

Thomas, B.E., H.W. Hjalmarson, and S.D. Waltemeyer. 1997. Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States. USGS Water Supply Paper 2433. 195 p.

U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), 1986. Urban Hydrology for Small Watersheds, Technical Release 55. Washington, DC.

Appendix B FEMA MT-2 Form, General Documentation and Correspondence

Appendix C: Survey Field Notes

Terry Hendricks

From: Curtis, Edward [mailto:Edward.Curtis@dhs.gov]
Sent: Tuesday, November 10, 2009 2:44 PM
To: Manny M. Rosas
Cc: Terry Hendricks; Lucero, Andrew; Caldwell, Jason; Akl, Pascal
Subject: RE: PAG 2008 Orthos/Lidar

Mr. Rosas –

I apologize for the delay in responding to you regarding the Sanborn LiDAR report. Pascal Akl of Michael Baker, Jr. reviewed the updated July 2009 report on behalf of FEMA and advised me that all of the concerns raised in his May 18, 2009 memorandum titled “Pima County, CA [sic] Sanborn LiDAR Report Items” were addressed in the updated report except the comment that the original report lacked a sufficient number of checkpoints in urban areas and dense vegetation areas. No additional checkpoints were surveyed in such arease to permit analysis of data accuracy in these land cover categories. However, in the data voids analysis section of the updated report (p. 16), Sanborn states the following: "*Specific areas, dense vegetation or undergrowth near small streams, for example, prevents the LiDAR pulses to fully penetrate to the true ground surface. Thus, for mapping products such as floodplain or contour mapping, LiDAR data must often be manually supplemented with breaklines and mass-points to accurately model the terrain surface.*" As long as the data is used with caution and supplemented with additional ground survey data where necessary in accordance with this statement, I am satisfied that the terrain data meets FEMA standards for use in detailed flood studies.

Please contact me if you have any questions regarding our review and comments.

Ed Curtis, P.E., CFM
Risk Analysis Branch
FEMA Region IX
(510) 627-7207 - office
(510) 295-5249 - mobile

Appendix D: Hydrologic Analysis Supporting Documentation

(models, spreadsheets and supporting information is provided digitally in the TDN disk)

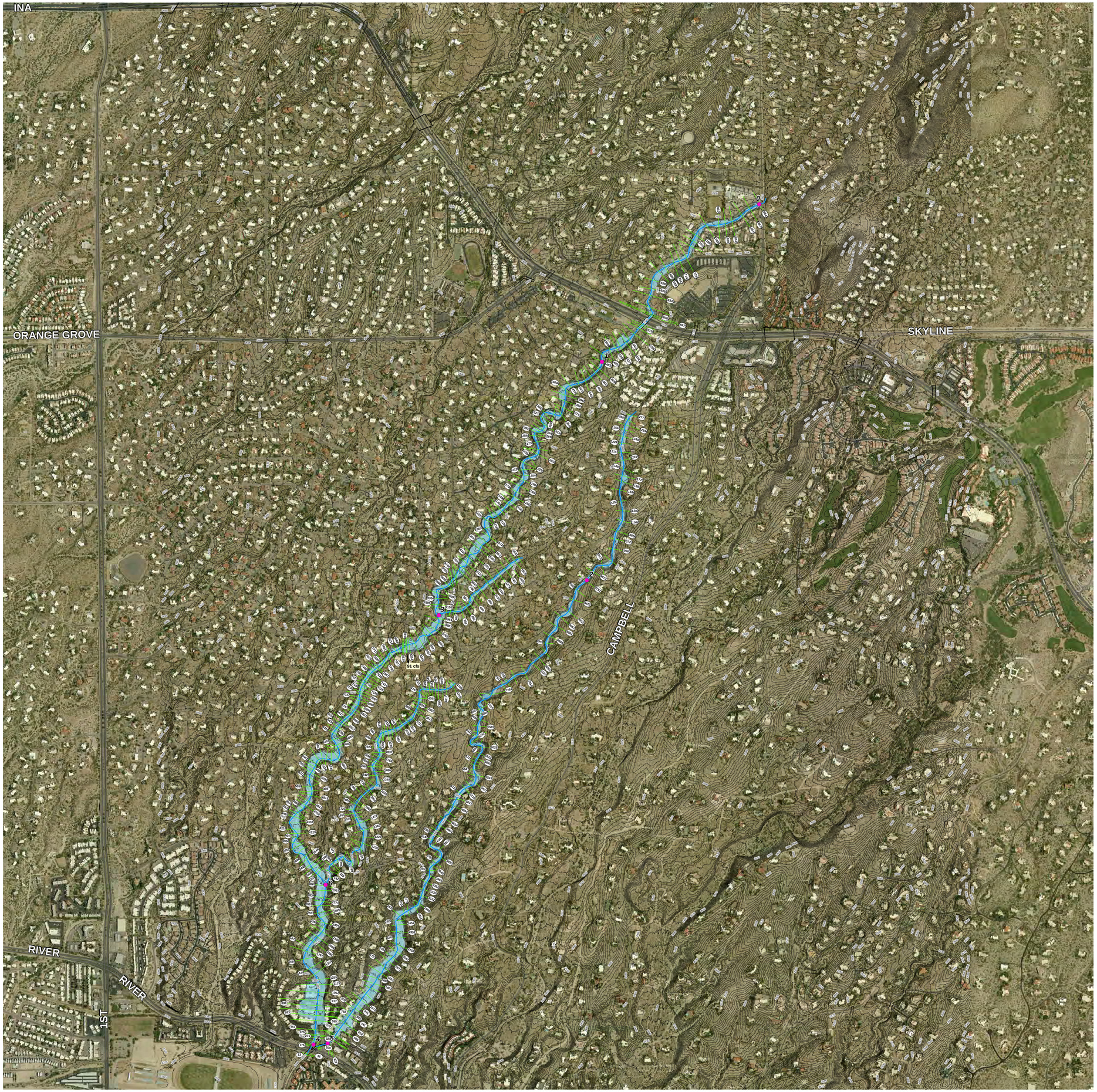
Appendix E: Hydraulic Analysis and As-Built Drawings for Hydraulic Structures

(models, spreadsheets and supporting information is provided digitally in the TDN disk)

Appendix F: Erosion and Sediment Transport Analysis Supporting Documentation

None

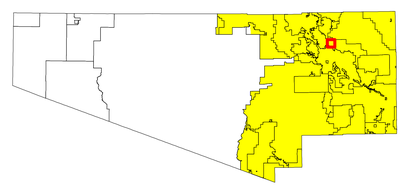
Exhibit 1
100-year Floodplain
with cross sections
Via Entrada Wash



- Discharge Point
- RiverEast
- Cross Section
- RiverWest
- Contour 5-ft
- 100yr Floodplain

Aerial : 2010 Pictometry
Topo: 2008 Pima Association of Governments
Datum: NAVD 1988

Pima County Index Map



Index Map Scale 1:1,500,000

N

0 500 1,000 Feet

Pima County Regional FLOOD CONTROL DISTRICT

THE SEAL OF PIMA COUNTY ARIZONA

Pima County Regional Flood Control
97 East Congress Street - 3rd Floor
Tucson, Arizona 85701-1207
(520)243-1800 - FAX (520)243-1821
http://www.rfcd.pima.gov

03/2012

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