Catalina Foothills Watercourse Studies:
Technical Data Notebook for Hydrologic and Hydraulic Mapping of the Sabino Vista Wash,
Pima County Arizona.

FEMA FIRM Panel 04019C-1715L

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FLOOD CONTROL

Section 1 Introduction 4
1.1 Purpose 4
1.2 Project Authority 4
1.3 Project Location 4
1.4 Hydrologic and Hydraulic Methods 5
1.5 Acknowledgment 5
1.5 Study Results 5
Section 2 Local Government Abstract 9
2.1 Project Contact Information 9
2.2 General Information 9
2.3 Survey and Mapping Information 10
2.4 Hydrology 10
2.5 Hydraulics 10
Section 3 Survey and Mapping Information 11
3.1 Digital Projection Information 11
3.2 Field Survey Information 11
3.3 Mapping 11
Section 4 Hydrology 11
4.1 Method Description 11
4.2 Parameter Estimation 13
4.2.1 Drainage Area Boundaries 13
4.2.2 Watershed Work Maps 13
4.2.3 Gage Data 13
4.2.4 Spatial Parameters 13
4.2.5 Precipitation 13
4.2.6 Physical Parameters 13
4.3 Issues Encountered During the Study 14
4.3.1 Special Problems and Solutions 14
4.3.2 Modeling Warning and Error Messages 14
4.4 Calibration 14
4.5 Final Results 15
4.5.1 Hydrologic Analysis Results 15
4.5.2 Verification of results 16
Section 5 Hydraulics 16
5.1 Method Description 16
5.2 Work Study Maps 17
5.3 Parameter Estimation 17
5.3.1 Roughness Coefficients 17
5.3.2 Expansion and Contraction Coefficients 17
5.4 Cross-Section Description 17
5.5 Modeling Consideration 18
5.5.1 Hydraulic Jump and Drop Analysis 18
5.5.2. Bridges and Culverts 18

5.5.3 Levees and Dikes 18
5.5.4 Non-Levee Embankments 18
5.5.5 Island and Flow Splits 18
5.5.5 Ineffective Flow Areas 18
5.6 Floodway Modeling 18
5.7 Problems Encountered 18
5.7.1 Special Problems and Solutions 18
5.7.2 Model Warnings and Errors 18
5.8 Calibration 18
5.9 Final Results 19
5.9.1 Hydraulic Analysis Results 19
5.9.2 Verification of Results 19
Section 6 Erosion and Sediment Transport 19

List of Tables

Table 1 Methods used for a PC-Hydro analysis 14
Table 2 Subbasin Characteristics 14
Table 3 Summary of the Hydrologic Analysis 15
Table 4 Comparison of a peak discharge 16

List of Figures

Figure 1.1 Watershed Map 6
Figure 1.2 Study Limits 7
Figure 1.3 Soil Classification 8
Figure 4.1 Flow Chart of Mapping Process 12

Appendix A: References
Appendix B: FEMA MT-2 Forms, General Documentation and Correspondence
Appendix C: Survey Field Notes
Appendix D: Hydrologic Analysis, Supporting Documents
Appendix E: Hydraulic Analysis, Supporting Documents
Appendix F: Erosion Analysis, Supporting Documents

Exhibit

Exhibit 1 100-yr Floodplain Limit for the Sabino Vista Wash

Section 1 Introduction

1.1 Purpose

The objective of this Technical Data Notebook (TDN) is to provide 100-yr peak discharges at Concentration Points (CPs) for the Sabino Vista Wash and 100-yr floodplain boundary and erosion hazard information, using the most up-to-date 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 Guidelines. This is a local study and has not been submitted to FEMA.

1.2 Project Authority

The State of Arizona has delegated the responsibility to each county flood control district to delineate or require the delineation of floodplains and to regulate development within floodplains (ARS § 48-3609):

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:

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Civil Engineering Manager
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1.3 Project Location

The study was performed to provide drainage information for the Sabino Vista Wash. The study watershed includes portions of Sections 20, 21, 28, 29, 32 and 33 of Township 13 South, Range 15 East Pima County, Arizona. The entire watershed of the Sabino Vista Wash is in FEMA Zone X, as shown on the current Flood Insurance Rate Map (FIRM) number 04019C-1715L.

The study area for the Sabino Vista Wash is from the headwater of the wash southeast of the intersection of E. Snyder Road and N. Sabino Canyon to the confluence with

Tanque Verde Creek (Fig.1.1). The study watershed is .83 square mile and was divided into 7 sub-basins (Fig.1.2).

1.4 Hydrologic and Hydraulic Methods

A hydrologic analysis using PC-Hydro Version 5.4.2 (PC-Hydro) was performed to estimate regulatory discharge rates at the downstream concentration points of the sub-basins and at intermediate concentration points within sub-basins for peak discharges of approximately 200 to 300 cfs in order to identify appropriate flow change locations for hydraulic modeling. The parameters for PC-Hydro, such as soil, vegetation, slope, flow path length and roughness were selected in accordance with the 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). A hydraulic analysis was performed to determine a 100-yr floodplain boundary using HEC-GeoRAS, Version 10 (HEC-GeoRAS) and HEC-RAS Version 4.1 (HEC-RAS) for upper portions of the watershed. South of Cloud Road FLO-2D version 2009 was used.

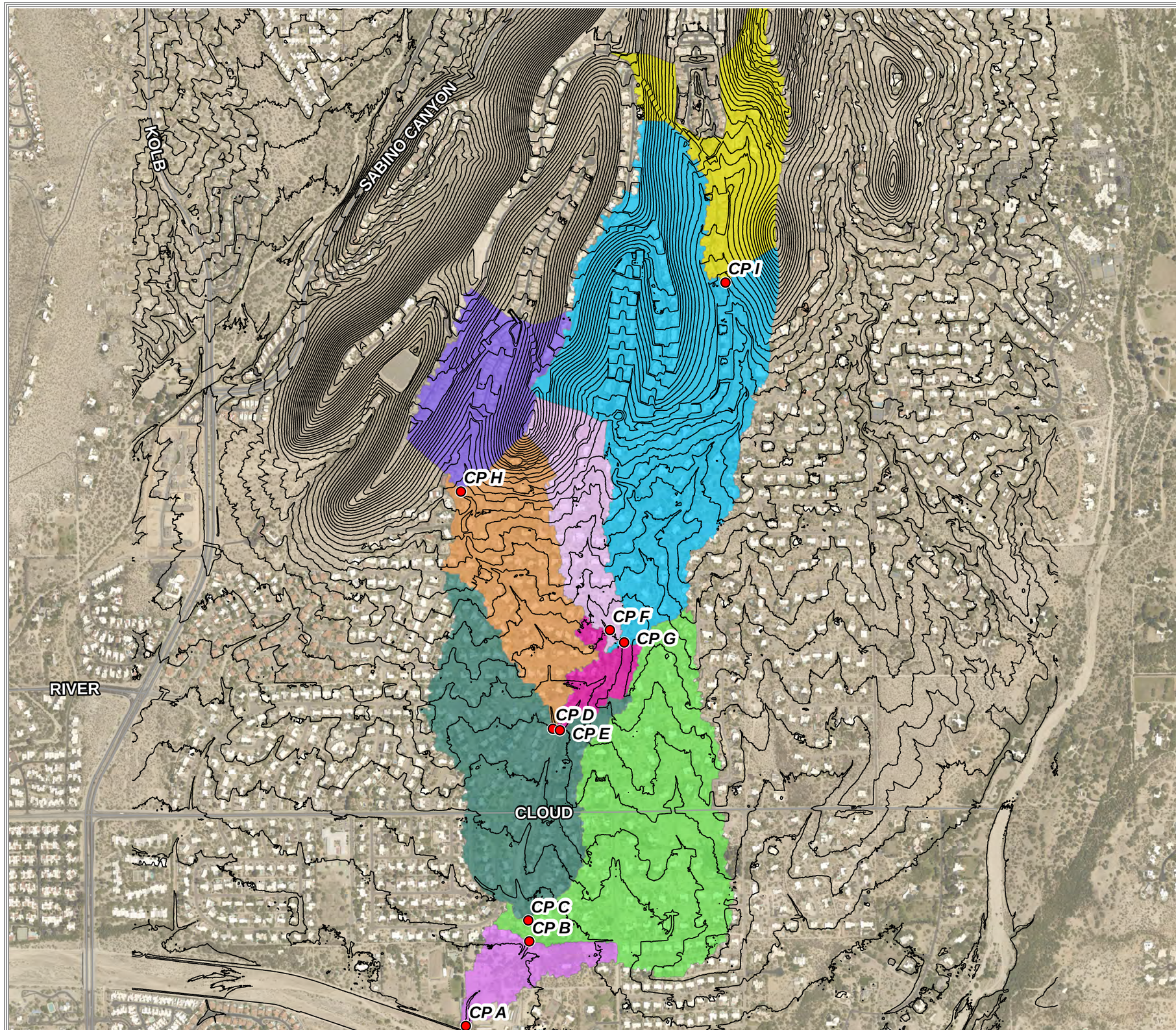
1.5 Acknowledgment

This study relied on assistance from RFCD GIS staff, Xavier Armendariz, who was integral to the development of the models and maps. Akitsu Kimoto assisted with determining floodplain boundaries for the entire watershed and preparing data input for the FLO-2D model. These important staff members allowed this project to reach completion.

1.6 Study Results

The 100-yr discharges were calculated for the Sabino Vista Wash. Sub-basin boundaries and corresponding CPs are illustrated in Figure 1.2. Hydrologic characteristics for the studied sub-basins are presented in Table 2. Calculated discharges are summarized in Table 3. The calculated discharges are compared with the USGS Regional Regression Equation (Table 4). The comparison shows that the peak discharges calculated in this study significantly above the 100-year peak discharge estimated by the USGS equation. Higher peak discharges may be attributed to the conservative results generally produced by PC-Hydro and to the steep slopes in the upper part of the watershed. This study found some homes at risk for flooding during the 100-yr flood.

Figure 1.1
Watershed Map
Sabino Vista Wash



Discharge Point

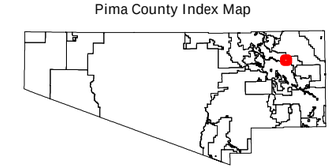
Contour 10 ft.

Subbasins

- A
- B
- C
- D
- E
- F
- G
- H
- I

Aerial : PictOrtho2014
Topo: 2008 Pima Association of Governments
Datum: NAVD 1988

Pima County Index Map



Index Map Scale 1:5,250,000

The information depicted on this display is the result of digital analyses performed on a variety of databases provided and maintained by several governmental agencies. The accuracy of the information presented is limited to the collective accuracy of these databases on the date of the analysis. The Pima County Regional Flood Control Department makes no claims regarding the accuracy of the information depicted herein.

This product is subject to the Department of Transportation Technical Services Division's Use Restriction Agreement.

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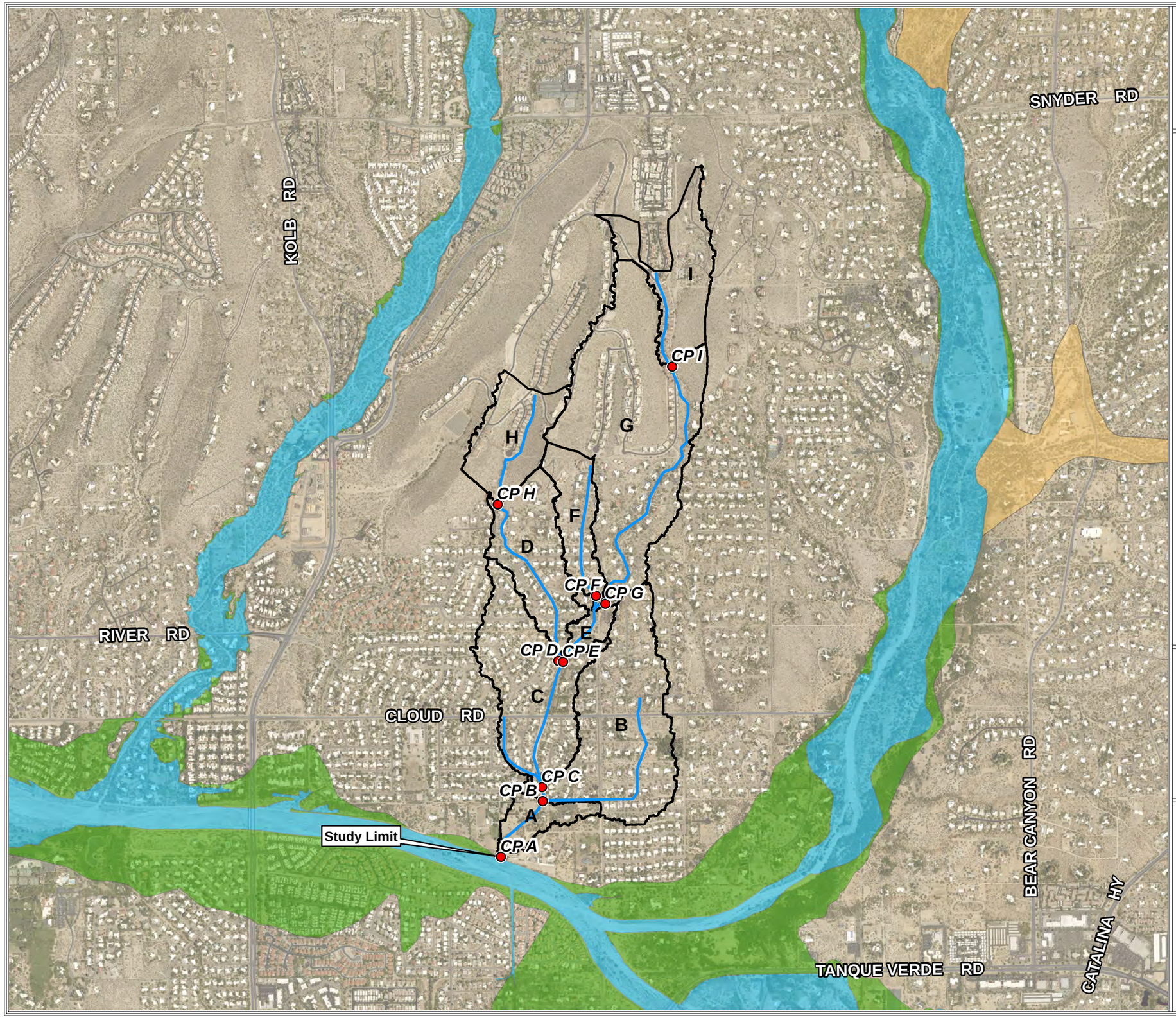

Figure 1.2
Study Limit
Sabino Vista Wash

Discharge Point

River

Watershed

Existing FEMA Floodplain

ZONE A

ZONE AE

ZONE X - SHADED

Aerial : PictOrtho2014

Pima County Index Map

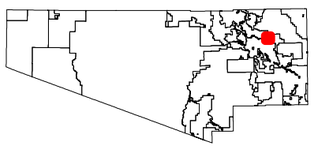

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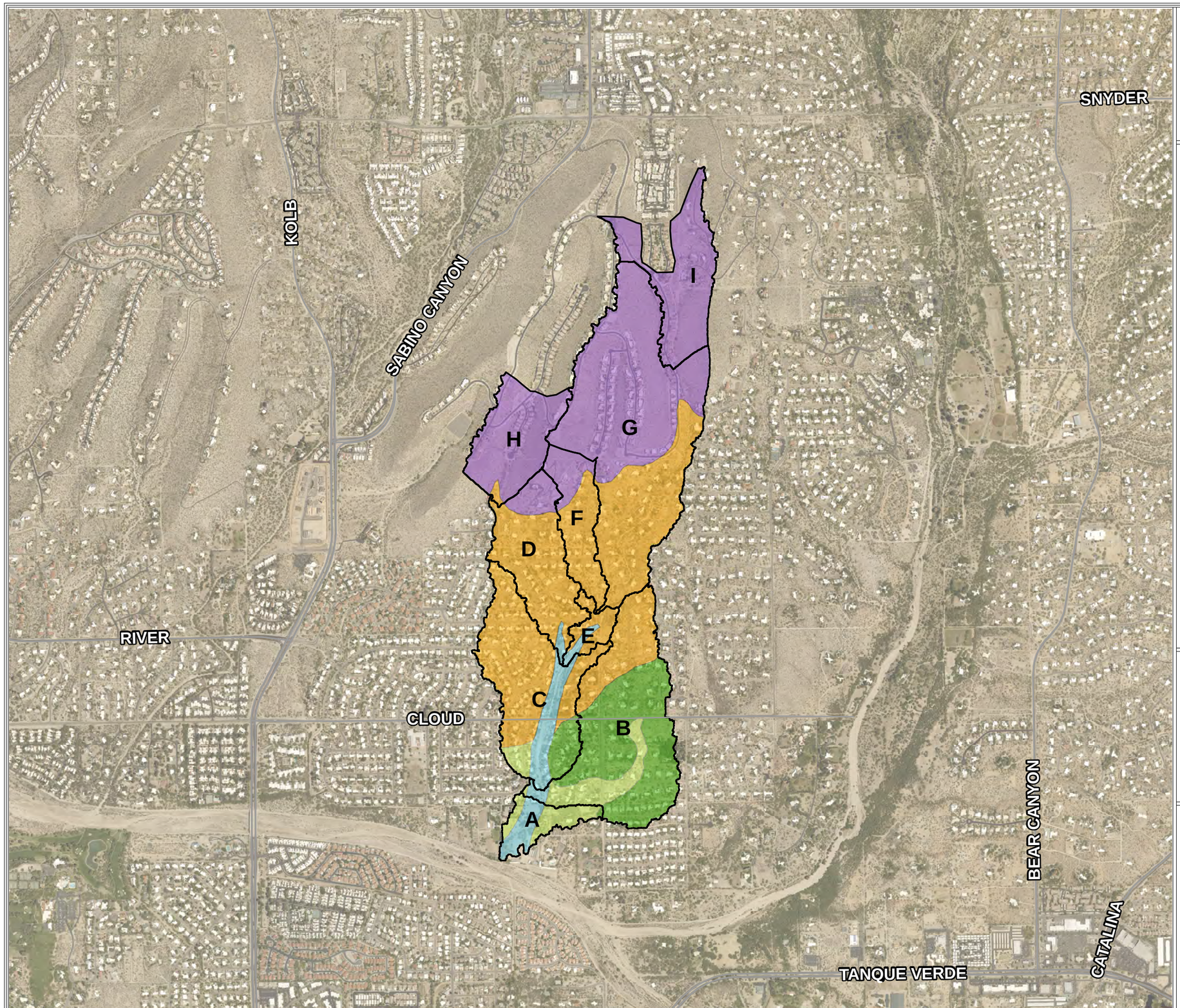
Figure 1.3
Soil Classification
Sabino Vista Wash



Major Streets

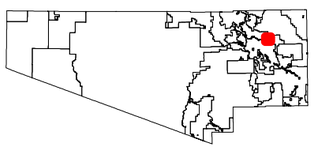
Watershed

Soil Classification

- Soil Group: A (100%), ARIZO-RIVERWASH COMPLEX, 0 TO 3 PERCENT SLOPES
- Soil Group: B (100%), ANTHONY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES
- Soil Group: B (100%), PINALENO-STAGECOACH COMPLEX, 5 TO 16 PERCENT SLOPES
- Soil Group: B (82%) C (18%),PINALENO-STAGECOACH-PALOS VERDES COMPLEX, 10 TO 35 PERCENT SLOPES
- Soil Group: C (53%) D (47%), PALOS VERDES-JAYNES COMPLEX, 2 TO 8 PERCENT SLOPES

Aerial : PictOrtho2014

Pima County Index Map



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Section 2 Local Government Abstract

2.1 Project Contact Information

Contact Information:

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Local Technical Reviewer:

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Terry.Hendricks@pima.gov

Date Study Submitted: July 2, 2014

Date Study Approved: _____

2.2 General Information

Community: Pima County Regional Flood Control
County: Pima County
River or Stream Name: Sabino Vista Wash
Reach Description: Wash in Catalina Foothills
Study Type: Hydrology and Hydraulics study of a Riverine System discharging into a Distributary Flow Area
Purpose of the Study: To provide regulatory discharges and map floodplain boundaries
Summary of Hydrology and Hydraulic Methods: A hydrologic analysis using PC-Hydro Version 5.4.2 (PC-Hydro) was performed to estimate regulatory discharges. A hydraulic analysis was performed to determine a 100-yr floodplain boundary using HEC-GeoRAS, Version 10 (HEC-GeoRAS) and HEC-RAS Version 4.1 (HEC-RAS) for upper portions of the watershed. South of Cloud Road FLO-2D version 2009.6 was used.
Brief Summary Description of the Study Results: The upper portion of the watershed is characterized by steep slopes with residential lots placed along lower contours with minor drainage channels up-slope from the lots. Except for one case where breakout was identified, the channels contain 100-year flows. South of this type of development and north of Cloud Road, generally residential subdivisions provide sufficient area for floodplains or for adequate channels. Street cross-drainage is provided at-grade, with 100-year flows spreading to fill the provided dip sections. Channels just north of and south of Cloud Road tend to be under-sized. In many locations, flows appear to be

contained by residential walls which most probably have not been designed as flood walls. Floodplains were mapped without considering wall locations. South of Cloud Road, flow is characterized as distributary.

Acknowledgements: Akitsu Kimoto, Felipe Ip, Terry Hendricks and Xavi Armendariz

2.3 Survey and Mapping Information

Digital Projection Information: NAD 1983 HARN State Plane Arizona Central
USGS Quad Sheets if available: NA
Mapping for Hydrologic Study: LiDAR based on 2008 flight used to derive 2-ft contour interval maps using ArcGIS 10.0, PAG 2011 orthophotos
Mapping for Hydraulic Study: LiDAR based on 2008 flight used to derive a DEM (5-ft cell size) for use with HEC-GeoRAS, PAG 2011 orthophotos

2.4 Hydrology

Model or Method Used: PC-Hydro Version 5.4.2
Storm Duration: Based on 1-hr Rainfall Depth
Hydrograph Type: NA
Frequencies Determined: 100 yr
List of Gages used in Frequency Analysis or Calibration: None
Rainfall Amounts and Reference: NOAA 14 Upper 90% Confidence Interval
Unique Conditions and Problems: None
Coordination of Q's: Comparison with a USGS Regression Equation and existing regulatory discharges if available

2.5 Hydraulics

Model or Method Used: HEC-GeoRAS, Version 10 (HEC-GeoRAS) and HEC-RAS Version 4.1 (HEC-RAS), and FLO-2D version 2009.6
Regime: Modeled as subcritical
Frequencies for which Profiles were computed: 100 yr
Method of Floodway Calculation: Floodway Not Determined in this Study
Unique Conditions and Problems: None

2.6 Erosion, Sediment Transport and Geomorphic Analysis

Summary of Method: NA
Issues Encountered During Study: NA
Summary of Findings: NA

2.7 Additional Study Information

None

Section 3 Survey and Mapping Information

3.1 Digital Projection Information

The data below are included in this TDN (see "GIS" folder)
Projection: State Plane, Arizona Central Zone
Horizontal Datum: NAD 83 HARN
Vertical Datum: NAVD 88
Units: International Feet
Aerial Photo: PAG 2011 Orthophotos
Contour: 2-foot interval
Topographic Data: 5-ft DEM

3.2 Field Survey Information

A survey was not necessary for this study.

3.3 Mapping

A Digital Elevation Model (DEM) derived from 2008 Light Detection and Ranging (LiDAR) data was used for the HEC-RAS analysis. The contour interval of the topographic map is 2 feet.

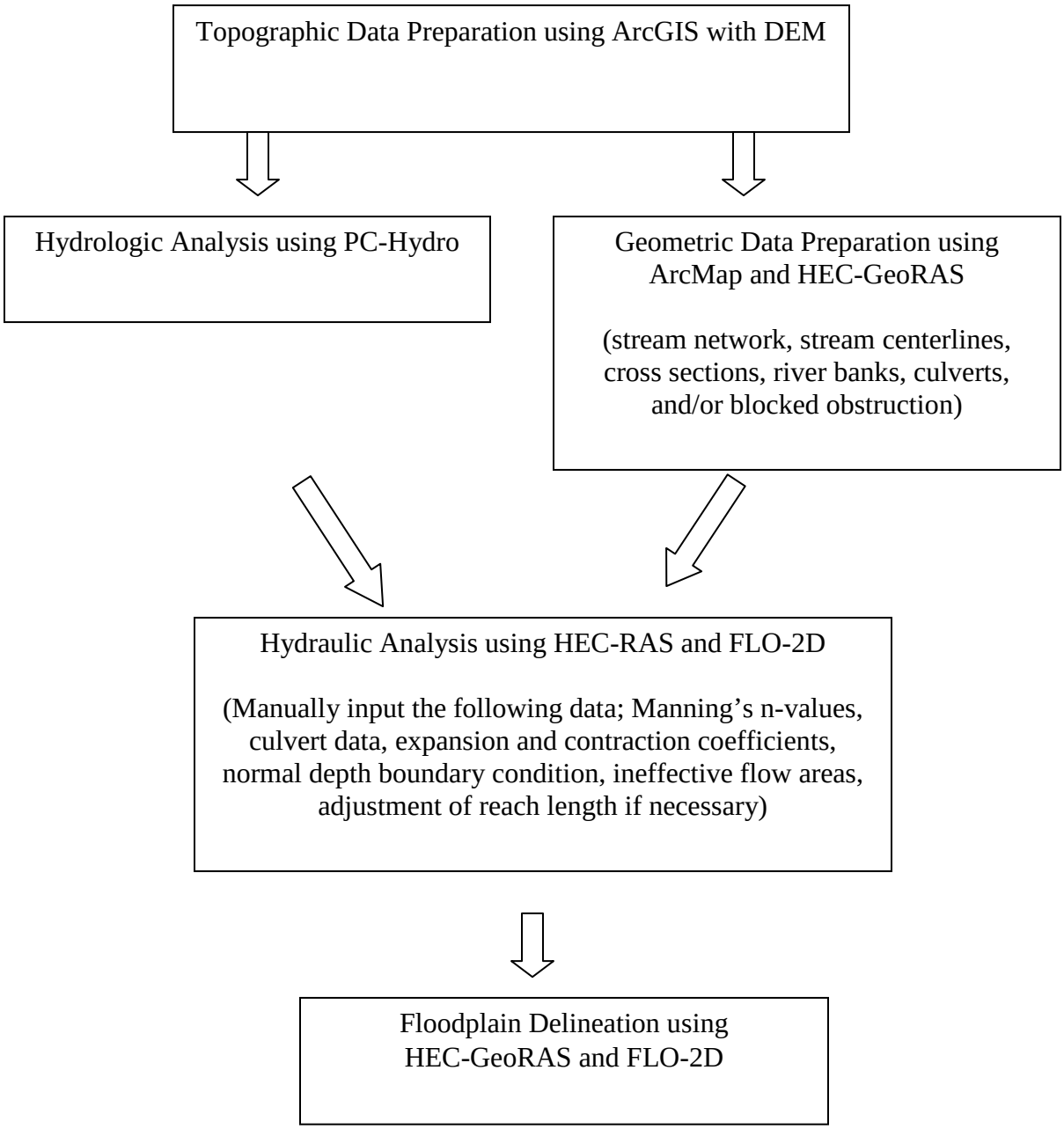
The following data are included in this TDN (see "GIS" folder):
Aerial Photo: PAG 2011 Orthophotos
Contour: 2 feet interval
Topographic Data: 5-ft DEM

Section 4 Hydrology

4.1 Method Description

Hydrologic analysis was performed using PC-Hydro Version 5.4.3 (PC-Hydro). 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 floodplain management. The PC-Hydro method has been accepted by FEMA for prediction of 100-yr peak discharges in Pima County (i.e. Friendly Village LOMR, Case # 08-09-0473P). The PC-Hydro method produces conservative discharge on smaller watersheds and PC-Hydro is the accepted method for watersheds less than one square mile in Pima County as specified in Regional Flood Control District Technical Policy 018 (Tech-018, Appendix A). The PC-Hydro model requires parameters for 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 output is included in Appendix D.

Figure 4.1 Flow Chart of Mapping Process



4.2 Parameter Estimation

4.2.1 Drainage Area Boundaries

The Sabino Vista Wash watershed is located on private residential property. The upstream study limit is the headwater of the wash, while the downstream limit is the confluence with the Tanque Verde Creek (Fig.1.1). The entire study watershed is .83 square mile. The study watershed was divided into seven sub-basins (Fig.1.2).

4.2.2 Watershed Work Maps

A watershed work map is included in Exhibit 1. The work map includes sub-basin boundaries and concentration points. Where flow is characterized as riverine, flow center lines and cross sections with station numbers and water surface elevations are shown. Where flow is characterized as distributary, 100-year maximum flow depths of .2 foot or greater are presented. Soil group boundaries are shown for the drainage area in Figure 1.3.

Concentration points were named using the Prefix SVT for the Sabino Vista Wash followed by a letter assigned to each concentration point.

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

The NOAA 14 Atlas 90% upper confidence rainfall data was used. The rainfall intensity at the time of concentration for the Sabino Vista Wash watershed is 4.78 inches/hour. No areal reduction factor was applied.

4.2.6 Physical Parameters

The methods used in this study are summarized in Table 1. The PC-Hydro model calculates runoff coefficients using an adjusted Curve Number (CN) method, 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 is 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

CP Name	Area	Impervious Area	Vegetation Cover
	(Acre)	(%)	(%)
SVT A	531	32	16
SVT B	514	31	16
SVT B TRIB	102	20	16
SVT C	412	31	16
SVT C TRIB	30	30	20
SVT D	92	31	17
SVT E	242	34	16
SVT F	30	30	25
SVT G	202	34	16
SVT H	41	30	20
SVT I	47	30	20

4.3 Issues Encountered During the Study

4.3.1 Special Problems and Solutions

The calculated PC-Hydro peak discharges are considerably higher than the peak discharges estimated by USGS regression equations. The watershed is 531 acres in size, and District policy specifies use of PC-Hydro for watersheds less than one square mile.

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 discharge at SVT A at the confluence of Sabino Vista Wash and Tanque Verde Creek was determined using PC-Hydro. The results are summarized Table 3.

Table 3 Summary of the Hydrologic Analysis

CP Name	Location	Area (acre)	Rainfall Intensity at Tc (in/hr)	Time of Concentration (min)	Q100 (cfs)
SVT A	**Confluence of Sabino Vista Wash and Tanque Verde Creek**	531	4.78	27.5	**1,854**
SVT B	**~1300 feet south of Cloud Road north of Garland Road alignment**	514	4.99	25.3	**1,868**
SVT B TRIB	**Confluence of East Tributary and Sabino Vista Wash**	102	6.13	17.7	**453**
SVT C	**~1000 feet south of Cloud Road**	412	5.04	24.9	**1,490**
SVT C TRIB	**Confluence of West Tributary and Sabino Vista Wash**	60	7.83	10.9	**330**
SVT D	**~800 feet north of Cloud Road**	92	6.59	15.8	**435**
SVT E	**~800 feet north of Cloud Road**	242	5.76	19.6	**1,014**
SVT F	**~1800 feet north of Cloud Road north of Oakwood Place alignment**	30	9.21	7.2	**198**
SVT G	**~1800 feet north of Cloud Road north of Oakwood Place alignment**	202	6.04	18.1	**889**
SVT H	**~3500 feet north of Cloud Road at Sunset Cliff Place Cul-de-Sac**	41	9.71	6.3	**282**
SVT I	**~5900 feet north of Cloud Road at Saddle View Drive Cul-de-Sac**	47	9.06	7.6	**301**

4.5.2 Verification of results

The peak discharges calculated by PC-Hydro for the study concentration points were compared with the peak discharges obtained from USGS Regression Equation 13 (Thomas et al., 1997) (Table 4). The comparison showed that the PC-Hydro peak discharges are from 27.4% to 65.5% higher than the ones derived from the Regression Equation.

Table 4 Comparison of peak discharges

Concentration Point	Location	Area (sq. mile)	Q100 PC-Hydro (cfs)	Q100 RRE (cfs)	Q100 FPUP (cfs)	% Dff. PC/RRE
SVT A	Confluence of Sabino Vista Wash and Tanque Verde Creek	0.83	1854	1110		50.2
SVT B	Cloud Road	0.80	1868	1085		53.0
SVT B TRIB	Confluence of East Tributary and Sabino Vista Wash	0.16	453	320		34.5
SVT C	~1000 feet south of Cloud Road	0.64	1490	930		46.2
SVT C TRIB	Confluence of West Tributary and Sabino Vista Wash	0.12	330	251		27.4
SVT D	~800 feet north of Cloud Road	0.14	435	292		39.3
SVT E	~800 feet north of Cloud Road	0.38	1014	632		46.5
SVT F	~1800 feet north of Cloud Road	0.05	198	106		60.3
SVT G	~1800 feet north of Cloud Road	0.32	889	551		47.0
SVT H	~3500 feet north of Cloud Road	0.06	282	143	457	65.5
SVT I	~5900 feet north of Cloud Road	0.07	301	162		60.1

RRE: USGS Regression Equation 13

Section 5 Hydraulics

5.1 Method Description

During the initial phase of this study, steady flow analysis with HEC-RAS, Version 4.1, was performed to delineate a 100-year floodplain of the Sabino Vista Wash. Normal depth was used as a downstream boundary condition. Parameters for the hydraulic analysis were selected following the District Tech Policy 019.

The physical attributes of the wash were digitized in ArcGIS using the HEC-GeoRAS extension and 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 input into HEC-RAS. Normal-depth with a slope of .02 was assumed for the downstream boundary condition.

The hydraulic data obtained from HEC-RAS were imported into HEC-GeoRAS to delineate a floodplain boundary for the Sabino Vista Wash. Lack of containment within constructed channels north of the E. Garland Road alignment and within drainage paths south of E. Garland Road was evident.

Areas where flow was not contained were characterized as distributary, and a two-dimensional flow analysis with FLO-2D, Version 2009.06, was performed for the distributary flow area. The limits of the FLO-2D modeling are the drainage area south of Cloud Road to Tanque Verde Creek. Where North Manor Drive crosses a constructed drainage channel just north of East Manor Place the crossing is at-grade, allowing a significant portion of the drainage channel flow to break out to the west into Sabino Vista South No. 2 Subdivision. Sabino Vista South No. 2 was not delineated as part of the Sabino Vista Wash watershed; however, breakout flows have been shown as part of this study because the Sabino Vista Wash impacts this subdivision and the subdivision streets provide conveyance toward the Tanque Verde Wash.

The FLO-2D model utilized a 20-foot grid size with inflow hydrographs determined by PC-Hydro. Rainfall and infiltration were not modeled. All houses were represented by Aerial Reduction Factors. A street shapefile for roughness factor of .012 was included in the model to improve prediction of roadway conveyance.

5.2 Work Study Maps

A work study map is shown in Exhibit 1.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

Manning's n values were determined by a combination of a site visit and 2012 PAG aerial photo. Manning's n value of 0.06 was assigned for the overbank with desert brush along the Sabino Vista Wash. The value of 0.03 to 0.035 was assigned to a channel.

5.3.2 Expansion and Contraction Coefficients

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 2-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. The locations of cross sections and channels used for this study are shown in Exhibit 1.

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

None.

5.5.3 Levees and Dikes

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

5.5.4 Non-Levee Embankments

None.

5.5.5 Island and Flow Splits

There were no islands or flow splits modeled.

5.5.5 Ineffective Flow Areas

No ineffective flow areas were included.

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:

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

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 and FLO-2D models are included in Appendix E.

5.9.2 Verification of Results

The proposed floodplain limit tends to follow infrastructure and defined flow paths in the upper portions of the study area. Flow expansions occur at at-grade crossings. Where flood limits exceed the limits of channelized paths, aerial photography, topography and improvement plans were consulted for verification. In the lower portions of the watershed, it was determined that maximum channel design capacity was exceeded, resulting in opportunities for distributary flow outside of defined flow paths. FLO-2D modeling results showed flow along available conveyances such as minor channels and streets. Where flow conveyance was expected to occur overland, FLO-2D results were consistent. The results suggest that the proposed floodplain limit is reasonable based on the topography, lack of improved drainage crossings, and existing infrastructure.

Section 6 Erosion and Sediment Transport

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

Appendix A: References

A1: 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

O, Brien, Jimmy S, et. al., 2009, FLO-2D Data Input Manual.

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", 2014

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

A2: 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 General Documentation and Correspondence

There is no additional documentation or correspondence for this study.

Appendix C: Survey Field Notes

There are no survey field notes for this study.

Appendix D: Hydrologic Analysis Supporting Documentation

Models, spreadsheets and supporting information are provided digitally on the TDN disk.

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_A
Job #:

Watershed Area: 531.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	220.0	4,020	0.0547	.060
2	140.0	2,800	0.0500	.040
3	60.0	4,100	0.0146	.035

Length of Watercourse (Lc): 10,920 feet
Mean Slope: 0.0295
Length to Cen. of Gravity (Lca): 5,460 feet
Weighted Basin Fac.: 0.043
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 16 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	80	84.	88.06	0.591
C	14	88.	91.15	0.681
D	6	92.	94.08	0.775
Imp.	32	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.725
Time of Concentration: 27.5 min
Rainfall Intensity (i) @ Tc: 4.78 in/hr
Runoff Supply Rate (q) @ Tc: 3.46 in/hr

PEAK DISCHARGE: 1,854 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Project Name: Sabino Vista
Concentration Point: SVT_B

Prepared by: AM
Date: 1/23/2012
Job #:

Watershed Area: 514.0 ac Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	220.0	4,020	0.0547	.060
2	140.0	2,800	0.0500	.040
3	44.0	2,980	0.0148	.035

Length of Watercourse (Lc): 9,800 feet Mean Slope: 0.0327
Length to Cen. of Gravity (Lca): 5,000 feet Weighted Basin Fac.: 0.044
Veg. Cover Type(s): Desert Brush Veg. Cover Density: 16 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	79	84.	88.06	0.591
C	14	88.	91.15	0.681
D	6	92.	94.08	0.775
Imp.	31	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.722
Time of Concentration: 25.3 min
Rainfall Intensity (i) @ Tc: 4.99 in/hr
Runoff Supply Rate (q) @ Tc: 3.60 in/hr

PEAK DISCHARGE: 1,868 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 11/19/12
Concentration Point: SVT_BTRIB
Job #:

Watershed Area: 102.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	55.0	3,000	0.0183	.045
2	20.0	1,900	0.0105	.032

Length of Watercourse (Lc): 4,900 feet
Mean Slope: 0.0145
Length to Cen. of Gravity (Lca): 2,000 feet
Weighted Basin Fac.: 0.039
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 16 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	39	83.	87.4	0.573
C	33	88.	91.15	0.681
D	29	91.	93.42	0.753
Imp.	20	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.719
Time of Concentration: 17.7 min
Rainfall Intensity (i) @ Tc: 6.13 in/hr
Runoff Supply Rate (q) @ Tc: 4.41 in/hr

PEAK DISCHARGE: 453 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_C
Job #:

Watershed Area: 412.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	220.0	4,020	0.0547	.060
2	140.0	2,800	0.0500	.040
3	44.0	2,980	0.0148	.035

Length of Watercourse (Lc): 9,800 feet
Mean Slope: 0.0327
Length to Cen. of Gravity (Lca): 4,700 feet
Weighted Basin Fac.: 0.044
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 16 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	89	84.	88.06	0.591
C	10	88.	91.15	0.681
D	1	92.	94.08	0.775
Imp.	31	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.712
Time of Concentration: 24.9 min
Rainfall Intensity (i) @ Tc: 5.04 in/hr
Runoff Supply Rate (q) @ Tc: 3.59 in/hr

PEAK DISCHARGE: 1,490 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 8/6/2012
Concentration Point: SVT_C TRIB
Job #:

Watershed Area: 60.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	85.0	3,740	0.0227	.035

Length of Watercourse (Lc): 3,740 feet
Mean Slope: 0.0227
Length to Cen. of Gravity (Lca): 1,800 feet
Weighted Basin Fac.: 0.035
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 20 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2600 Longitude: -110.8300

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.89	1.36	1.69	2.27	2.81	3.14	3.28	3.58	3.89	4.17
Areal Values (in)	0.89	1.36	1.69	2.27	2.81	3.14	3.28	3.58	3.89	4.17

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	90	83.	87.36	0.570
C	5	88.	91.12	0.678
D	5	91.	93.4	0.751
Imp.	30	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.697
Time of Concentration: 10.9 min
Rainfall Intensity (i) @ Tc: 7.83 in/hr
Runoff Supply Rate (q) @ Tc: 5.45 in/hr

PEAK DISCHARGE: 330 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_D
Job #:

Watershed Area: 92.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	220.0	4,020	0.0547	.050
2	140.0	2,800	0.0500	.040
3	14.0	950	0.0147	.015

Length of Watercourse (Lc): 7,770 feet
Mean Slope: 0.0429
Length to Cen. of Gravity (Lca): 3,885 feet
Weighted Basin Fac.: 0.039
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 17 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	89	84.	88.06	0.591
C	11	88.	91.15	0.681
D	0	92.	94.08	0.775
Imp.	31	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.712
Time of Concentration: 15.8 min
Rainfall Intensity (i) @ Tc: 6.59 in/hr
Runoff Supply Rate (q) @ Tc: 4.69 in/hr

PEAK DISCHARGE: 435 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_E
Job #:

Watershed Area: 242.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	220.0	4,020	0.0547	.060
2	140.0	2,800	0.0500	.040
3	14.0	950	0.0147	.035

Length of Watercourse (Lc): 7,770 feet
Mean Slope: 0.0429
Length to Cen. of Gravity (Lca): 3,500 feet
Weighted Basin Fac.: 0.048
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 16 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	89	84.	88.06	0.591
C	11	88.	91.15	0.681
D	0	.	.	0.000
Imp.	34	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.722
Time of Concentration: 19.6 min
Rainfall Intensity (i) @ Tc: 5.76 in/hr
Runoff Supply Rate (q) @ Tc: 4.16 in/hr

PEAK DISCHARGE: 1,014 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 11/19/2012
Concentration Point: SVT_F
Job #:

Watershed Area: 30.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	190.0	670	0.2836	.060
2	90.0	2,230	0.0404	.040

Length of Watercourse (Lc): 2,900 feet
Mean Slope: 0.0551
Length to Cen. of Gravity (Lca): 1,350 feet
Weighted Basin Fac.: 0.042
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 25 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	87	84.	88.06	0.591
C	13	88.	91.15	0.681
D	0	.	.	0.000
Imp.	30	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.709
Time of Concentration: 7.2 min
Rainfall Intensity (i) @ Tc: 9.21 in/hr
Runoff Supply Rate (q) @ Tc: 6.53 in/hr

PEAK DISCHARGE: 198 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_G
Job #:

Watershed Area: 202.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	220.0	4,020	0.0547	.060
2	140.0	2,800	0.0500	.040

Length of Watercourse (Lc): 6,820 feet
Mean Slope: 0.0527
Length to Cen. of Gravity (Lca): 3,410 feet
Weighted Basin Fac.: 0.052
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 16 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	87	84.	88.06	0.591
C	13	88.	91.15	0.681
D	0	.	.	0.000
Imp.	34	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.724
Time of Concentration: 18.1 min
Rainfall Intensity (i) @ Tc: 6.04 in/hr
Runoff Supply Rate (q) @ Tc: 4.37 in/hr

PEAK DISCHARGE: 889 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_H
Job #:

Watershed Area: 41.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	200.0	1,940	0.1031	.060

Length of Watercourse (Lc): 1,940 feet
Mean Slope: 0.1031
Length to Cen. of Gravity (Lca): 970 feet
Weighted Basin Fac.: 0.060
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 20 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	83	83.	87.4	0.573
C	17	88.	91.15	0.681
D	0	.	.	0.000
Imp.	30	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.702
Time of Concentration: 6.3 min
Rainfall Intensity (i) @ Tc: 9.71 in/hr
Runoff Supply Rate (q) @ Tc: 6.81 in/hr

PEAK DISCHARGE: 282 cfs

PC-Hydro, Ver 5.3.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Pima County Regional Flood Control District

Client: RFCD Special Studies
Prepared by: AM
Project Name: Sabino Vista
Date: 1/23/2012
Concentration Point: SVT_I
Job #:

Watershed Area: 47.0 ac
Watershed Type: Suburban-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	240.0	2,420	0.0992	.060

Length of Watercourse (Lc): 2,420 feet
Mean Slope: 0.0992
Length to Cen. of Gravity (Lca): 1,210 feet
Weighted Basin Fac.: 0.060
Veg. Cover Type(s): Desert Brush
Veg. Cover Density: 20 %

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2800 Longitude: -110.8248

Duration:	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25
Areal Values (in)	0.90	1.37	1.70	2.29	2.83	3.16	3.30	3.62	3.95	4.25

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	83	83.	87.4	0.573
C	17	88.	91.15	0.681
D	0	.	.	0.000
Imp.	30	99.	99.	0.958

Weighted Runoff Coef. (Cw): 0.702
Time of Concentration: 7.6 min
Rainfall Intensity (i) @ Tc: 9.06 in/hr
Runoff Supply Rate (q) @ Tc: 6.35 in/hr

PEAK DISCHARGE: 301 cfs

PC-Hydro, Ver 5.3.1

Appendix E: Hydraulic Analysis

Models, spreadsheets and supporting information are provided digitally on the TDN disk.

Appendix F: Erosion and Sediment Transport Analysis Supporting Documentation

There is no erosion and sediment transport analysis with this study.

Exhibit 1
100-year Floodplain with cross sections Sabino Vista Wash
Sheet 1 of 2

River	ReA	Station	TotA
SVT	A	6594	2633.99
SVT	A	6525	2632.78
SVT	A	6461	2631.24
SVT	A	6406	2628.48
SVT	A	6347	2624.21
SVT	A	6276	2619.28
SVT	A	6227	2615.93
SVT	A	6158	2611.31
SVT	A	6091	2608.07
SVT	A	6037	2606.39
SVT	A	5963	2604.16
SVT	A	5904	2602.35
SVT	A	5851	2601.31
SVT	A	5775	2599.94
SVT	A	5721	2598.01
SVT	A	5662	2596.18
SVT	A	5604	2593.74
SVT	A	5564	2591.76
SVT	A	5509	2589.96
SVT	A	5460	2587.27
SVT	A	5406	2585.96
SVT	A	5338	2583.44
SVT	A	5297	2581.74
SVT	A	5269	2580.42
SVT	A	5214	2579.3
SVT	A	5145	2578.14
SVT	A	5102	2577.24
SVT	A	5061	2574.65
SVT	A	5011	2571.46
SVT	A	4969	2570
SVT	A	4900	2566.85
SVT	A	4854	2564.42
SVT	A	4775	2562.59
SVT	A	4711	2561.92
SVT	A	4668	2561.25
SVT	B	4321	2556.41
SVT	B	4261	2555.31
SVT	B	4191	2554.07
SVT	B	4129	2553.02
SVT	B	4050	2551.55
SVT	B	3965	2549.53
SVT	B	3906	2547.33
SVT	B	3811	2544.53
SVT	B	3744	2543.62
SVT	B	3690	2542.85
SVT	B	3609	2541.67

River	ReA	Station	TotA
SVTTR1	A	6118	2740.18
SVTTR1	A	6050	2739.04
SVTTR1	A	5978	2732.44
SVTTR1	A	5918	2719.06
SVTTR1	A	5843	2716.6
SVTTR1	A	5778	2714.44
SVTTR1	A	5712	2710.82
SVTTR1	A	5654	2702.73
SVTTR1	A	5575	2702.72
SVTTR1	A	5493	2701.59
SVTTR1	A	5408	2700.48
SVTTR1	A	5335	2699.18
SVTTR1	A	5237	2698.11
SVTTR1	A	5173	2696.92
SVTTR1	A	5096	2695.05
SVTTR1	A	5046	2694.25
SVTTR1	A	4976	2692.35
SVTTR1	A	4918	2689.8
SVTTR1	A	4836	2687.32
SVTTR1	A	4787	2683.48
SVTTR1	A	4747	2681.66
SVTTR1	A	4707	2675.46
SVTTR1	A	4668	2674.89
SVTTR1	A	4597	2673.55
SVTTR1	A	4538	2671.53
SVTTR1	A	4473	2667.08
SVTTR1	A	4418	2663.71
SVTTR1	A	4364	2659.06
SVTTR1	A	4317	2656.1
SVTTR1	A	4258	2653.64
SVTTR1	A	4200	2652.04
SVTTR1	A	4135	2650.45
SVTTR1	A	4085	2649.78
SVTTR1	A	4043	2648.8
SVTTR1	A	3962	2645.76
SVTTR1	A	3897	2643.99
SVTTR1	A	3828	2641.87
SVTTR1	A	3771	2640.16
SVTTR1	A	3717	2638.51
SVTTR1	A	3668	2637.57
SVTTR1	A	3604	2636.62
SVTTR1	A	3569	2636.05
SVTTR1	A	3511	2633.88
SVTTR1	A	3466	2632.85
SVTTR1	A	3404	2630.3
SVTTR1	A	3313	2628.3
SVTTR1	A	3225	2626.47
SVTTR1	A	3147	2625.53
SVTTR1	A	3071	2622.41
SVTTR1	A	2994	2618.98
SVTTR1	A	2925	2616.82
SVTTR1	A	2823	2615.09
SVTTR1	A	2729	2612.42
SVTTR1	A	2651	2610.97
SVTTR1	A	2578	2608.25
SVTTR1	A	2495	2605.47
SVTTR1	A	2420	2603.58
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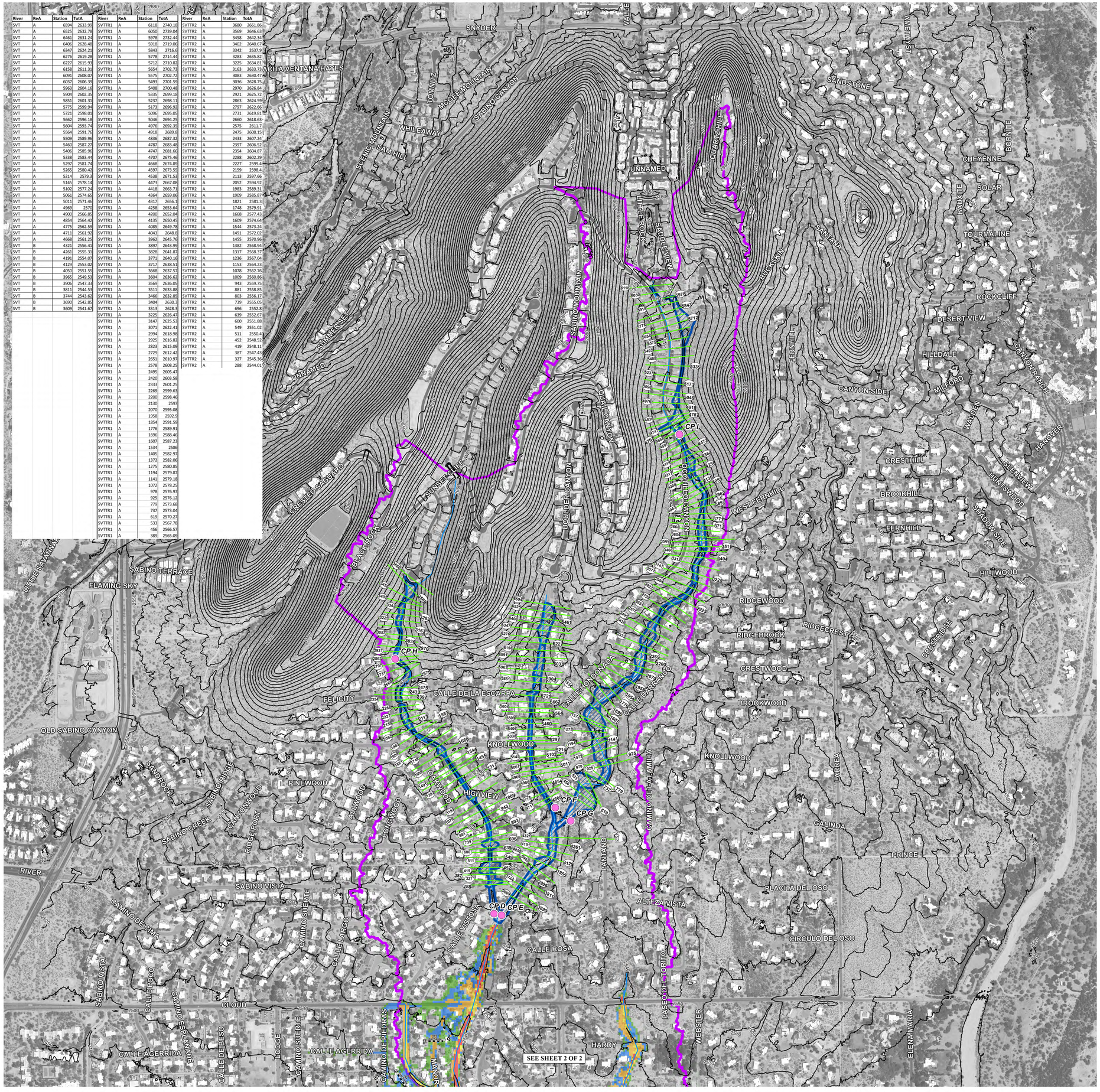
SVTTR1	A	1958	2592.9
SVTTR1	A	1854	2591.59
SVTTR1	A	1776	2589.91
SVTTR1	A	1696	2588.46
SVTTR1	A	1607	2587.23
SVTTR1	A	1534	2586
SVTTR1	A	1405	2582.97
SVTTR1	A	1372	2582.06
SVTTR1	A	1275	2580.85
SVTTR1	A	1194	2579.87
SVTTR1	A	1141	2579.18
SVTTR1	A	1072	2578.25
SVTTR1	A	978	2576.97
SVTTR1	A	925	2576.12
SVTTR1	A	779	2573.68
SVTTR1	A	737	2573.04
SVTTR1	A	619	2570.27
SVTTR1	A	533	2567.78
SVTTR1	A	456	2566.57
SVTTR1	A	389	2565.09

River	ReA	Station	TotA
SVTTR2	A	3680	2661.86
SVTTR2	A	3569	2646.63
SVTTR2	A	3458	2642.34
SVTTR2	A	3402	2640.67
SVTTR2	A	3342	2637.9
SVTTR2	A	3283	2635.82
SVTTR2	A	3225	2634.81
SVTTR2	A	3163	2633.73
SVTTR2	A	3083	2630.47
SVTTR2	A	3036	2628.75
SVTTR2	A	2970	2626.84
SVTTR2	A	2921	2625.72
SVTTR2	A	2863	2624.59
SVTTR2	A	2797	2622.66
SVTTR2	A	2731	2619.81
SVTTR2	A	2660	2618.63
SVTTR2	A	2575	2611.7
SVTTR2	A	2475	2608.15
SVTTR2	A	2433	2607.24
SVTTR2	A	2397	2606.52
SVTTR2	A	2354	2604.87
SVTTR2	A	2288	2602.29
SVTTR2	A	2227	2599.4
SVTTR2	A	2159	2598.4
SVTTR2	A	2113	2597.66
SVTTR2	A	2052	2594.92
SVTTR2	A	1983	2589.31
SVTTR2	A	1909	2585.87
SVTTR2	A	1821	2581.1
SVTTR2	A	1748	2579.91
SVTTR2	A	1668	2577.43
SVTTR2	A	1609	2574.64
SVTTR2	A	1544	2573.24
SVTTR2	A	1491	2572.02
SVTTR2	A	1455	2570.96
SVTTR2	A	1382	2568.94
SVTTR2	A	1317	2568.37
SVTTR2	A	1236	2567.04
SVTTR2	A	1153	2564.23
SVTTR2	A	1078	2562.76
SVTTR2	A	1009	2560.86
SVTTR2	A	943	2559.75
SVTTR2	A	881	2558.85
SVTTR2	A	803	2556.17
SVTTR2	A	739	2555.05
SVTTR2	A	696	2552.8
SVTTR2	A	639	2552.67
SVTTR2	A	600	2551.88
SVTTR2	A	549	2551.02
SVTTR2	A	511	2550.4
SVTTR2	A	452	2548.52
SVTTR2	A	419	2548.11
SVTTR2	A	387	2547.43
SVTTR2	A	327	2545.36
SVTTR2	A	288	2544.01



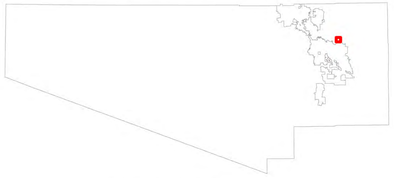
- Discharge Points
- FLO Cross Section
- Cross Sections
- Contour10ft
- River
- Study Area
- Sabino Vista 100-yr Floodplain

Flow Depth at Cell

- 0.010 - 0.500
- 0.501 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000
- 3.001 - 5.390

Aerial : Pictometry Ortho 2014 ©
Topo: 2008 Pima Association of Governments
Datum: NAVD 1988

Pima County Index Map



Index Map Scale 1:1,500,000

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PIMA COUNTY
FLOOD CONTROL

2/2015

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

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Exhibit 1
100-year Floodplain with cross sections Sabino Vista Wash
Sheet 2 of 2

River	ReA	Station	TotA
SVT	A	6594	2633.99
SVT	A	6525	2632.78
SVT	A	6461	2631.24
SVT	A	6406	2628.48
SVT	A	6347	2624.21
SVT	A	6276	2619.28
SVT	A	6227	2615.93
SVT	A	6158	2611.31
SVT	A	6091	2608.07
SVT	A	6037	2606.39
SVT	A	5963	2604.16
SVT	A	5904	2602.35
SVT	A	5851	2601.31
SVT	A	5775	2599.94
SVT	A	5721	2598.01
SVT	A	5662	2596.18
SVT	A	5604	2593.74
SVT	A	5564	2591.76
SVT	A	5509	2589.96
SVT	A	5460	2587.27
SVT	A	5406	2585.96
SVT	A	5338	2583.44
SVT	A	5297	2581.74
SVT	A	5265	2580.42
SVT	A	5214	2579.3
SVT	A	5145	2578.14
SVT	A	5102	2577.24
SVT	A	5061	2574.65
SVT	A	5011	2571.46
SVT	A	4969	2570
SVT	A	4900	2566.85
SVT	A	4854	2564.42
SVT	A	4775	2562.59
SVT	A	4711	2561.92
SVT	A	4668	2561.25
SVT	B	4321	2556.41
SVT	B	4261	2555.31
SVT	B	4191	2554.07
SVT	B	4129	2553.02
SVT	B	4050	2551.55
SVT	B	3965	2549.53
SVT	B	3906	2547.33
SVT	B	3811	2544.53
SVT	B	3744	2543.62
SVT	B	3690	2542.85
SVT	B	3609	2541.67

River	ReA	Station	TotA
SVTTR1	A	6118	2740.18
SVTTR1	A	6050	2739.04
SVTTR1	A	5978	2732.44
SVTTR1	A	5918	2719.06
SVTTR1	A	5843	2716.6
SVTTR1	A	5778	2714.44
SVTTR1	A	5712	2710.82
SVTTR1	A	5654	2702.73
SVTTR1	A	5575	2702.72
SVTTR1	A	5493	2701.59
SVTTR1	A	5408	2700.48
SVTTR1	A	5335	2699.18
SVTTR1	A	5237	2698.11
SVTTR1	A	5173	2696.92
SVTTR1	A	5096	2695.05
SVTTR1	A	5046	2694.25
SVTTR1	A	4976	2692.35
SVTTR1	A	4918	2689.8
SVTTR1	A	4836	2687.32
SVTTR1	A	4787	2683.48
SVTTR1	A	4747	2681.66
SVTTR1	A	4707	2675.46
SVTTR1	A	4668	2674.89
SVTTR1	A	4597	2673.55
SVTTR1	A	4538	2671.53
SVTTR1	A	4473	2667.08
SVTTR1	A	4418	2663.71
SVTTR1	A	4364	2659.06
SVTTR1	A	4317	2656.1
SVTTR1	A	4258	2653.64
SVTTR1	A	4200	2652.04
SVTTR1	A	4135	2650.45
SVTTR1	A	4085	2649.78
SVTTR1	A	4043	2648.8
SVTTR1	A	3962	2645.76
SVTTR1	A	3897	2643.99
SVTTR1	A	3828	2641.87
SVTTR1	A	3771	2640.16
SVTTR1	A	3717	2638.51
SVTTR1	A	3668	2637.57
SVTTR1	A	3604	2636.62
SVTTR1	A	3569	2636.05
SVTTR1	A	3511	2633.88
SVTTR1	A	3466	2632.85
SVTTR1	A	3404	2630.3
SVTTR1	A	3313	2628.3
SVTTR1	A	3225	2626.47
SVTTR1	A	3147	2625.53
SVTTR1	A	3071	2622.41
SVTTR1	A	2994	2618.98
SVTTR1	A	2925	2616.82
SVTTR1	A	2823	2615.09
SVTTR1	A	2729	2612.42
SVTTR1	A	2651	2610.97
SVTTR1	A	2578	2608.25
SVTTR1	A	2495	2605.47
SVTTR1	A	2420	2603.58
SVTTR1	A	2333	2601.25
SVTTR1	A	2269	2599.63
SVTTR1	A	2200	2598.46
SVTTR1	A	2130	2597
SVTTR1	A	2070	2595.08
SVTTR1	A	1958	2592.9
SVTTR1	A	1854	2591.59
SVTTR1	A	1776	2589.91
SVTTR1	A	1696	2588.46
SVTTR1	A	1607	2587.23
SVTTR1	A	1534	2586
SVTTR1	A	1405	2582.97
SVTTR1	A	1372	2582.06
SVTTR1	A	1275	2580.85
SVTTR1	A	1194	2579.87
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SVTTR1	A	1072	2578.25
SVTTR1	A	978	2576.97
SVTTR1	A	925	2576.12
SVTTR1	A	779	2573.68
SVTTR1	A	737	2573.04
SVTTR1	A	619	2570.27
SVTTR1	A	533	2567.78
SVTTR1	A	456	2566.57
SVTTR1	A	389	2565.09

River	ReA	Station	TotA
SVTTR2	A	3680	2661.86
SVTTR2	A	3569	2646.63
SVTTR2	A	3458	2642.34
SVTTR2	A	3402	2640.67
SVTTR2	A	3342	2637.9
SVTTR2	A	3283	2635.82
SVTTR2	A	3225	2634.81
SVTTR2	A	3163	2633.73
SVTTR2	A	3083	2630.47
SVTTR2	A	3036	2628.75
SVTTR2	A	2970	2626.84
SVTTR2	A	2921	2625.72
SVTTR2	A	2863	2624.59
SVTTR2	A	2797	2622.66
SVTTR2	A	2731	2619.81
SVTTR2	A	2660	2618.63
SVTTR2	A	2575	2611.7
SVTTR2	A	2475	2608.15
SVTTR2	A	2433	2607.24
SVTTR2	A	2397	2606.52
SVTTR2	A	2354	2604.87
SVTTR2	A	2288	2602.29
SVTTR2	A	2227	2599.4
SVTTR2	A	2159	2598.4
SVTTR2	A	2113	2597.66
SVTTR2	A	2052	2594.92
SVTTR2	A	1983	2589.31
SVTTR2	A	1909	2585.87
SVTTR2	A	1821	2581.3
SVTTR2	A	1748	2579.91
SVTTR2	A	1668	2577.43
SVTTR2	A	1609	2574.64
SVTTR2	A	1544	2573.24
SVTTR2	A	1491	2572.02
SVTTR2	A	1455	2570.96
SVTTR2	A	1382	2568.94
SVTTR2	A	1317	2568.37
SVTTR2	A	1236	2567.04
SVTTR2	A	1153	2564.23
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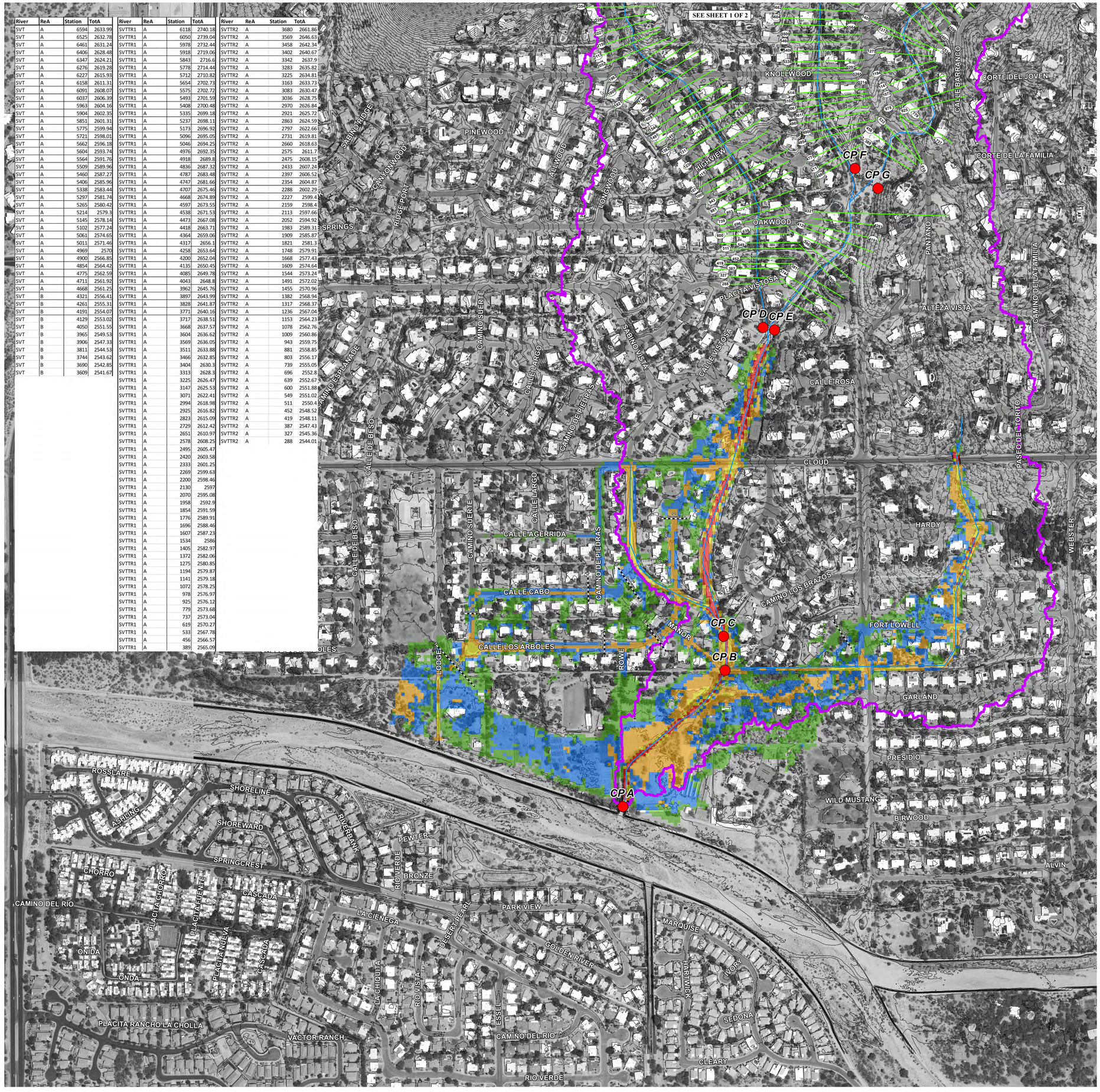
SVTTR2	A	1009	2560.86
SVTTR2	A	943	2559.75
SVTTR2	A	881	2558.85
SVTTR2	A	803	2556.17
SVTTR2	A	739	2555.05
SVTTR2	A	696	2552.8
SVTTR2	A	639	2552.67
SVTTR2	A	600	2551.88
SVTTR2	A	549	2551.02
SVTTR2	A	511	2550.4
SVTTR2	A	452	2548.52
SVTTR2	A	419	2548.11
SVTTR2	A	387	2547.43
SVTTR2	A	327	2545.36
SVTTR2	A	288	2544.01



Discharge Point
Contour 2ft
FLO Cross Section
Cross Sections
River
Study Area
Sabino Vista 100-yr Floodplain

Flow Depth at Cell

- >0.2 ft - 0.5 ft.
- >0.5 ft - 1 ft
- >1 ft. - 2 ft
- >2 ft. - 3 ft.
- >3 ft. - 5.39 ft

Aerial : Pictometry Ortho 2014 ©
Topo: 2008 Pima Association of Governments
Datum: NAVD 1988

Pima County Index Map

Index Map Scale 1:1,500,000

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