COE & VAN LOO
CONSULTANTS, INC.

DESIGN REPORT
FOR
NORTH SANTA CRUZ WASH
REGIONAL FLOOD CONTROL PROJECT
CITY OF MARICOPA, PINAL COUNTY, ARIZONA

December 3, 2007
1st Revision: August 5, 2008

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CVL Job Number: 1.01.0194301

Design Report
For
North Santa Cruz Wash Regional Flood Control Project

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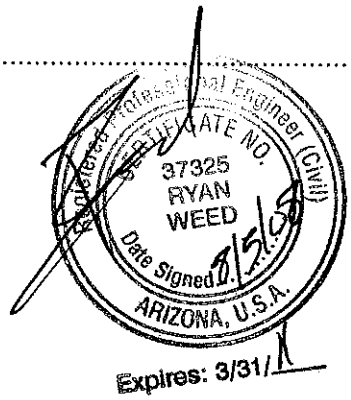

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List of Project Abbreviations

CFD	Community Facilities District
COM	City of Maricopa
FEMA	Federal Emergency Management Agency
FPC	Financial Participation Committee
MOU	Memorandum of Understanding
MSIDD	Maricopa-Stanfield Irrigation & Drainage District
NEPA	National Environmental Policy Act
RMA-2	Two-dimensional hydrodynamic model developed for Corps of Engineers (COE) in 1973 and revised into the current version by Resource Management Associates (RMA) in conjunction with the COE Waterways Experiment Station

EXECUTIVE SUMMARY

The North Santa Cruz Wash Regional Flood Control Project is a channelization project located in the City of Maricopa, Pinal County, Arizona, about 30 miles south of Phoenix. The proposed improvements will eliminate inundation from the 100-year base flood event for a seven-mile reach of the Santa Cruz Wash between the Gila River Indian Community and Peters & Nall Road. The City of Maricopa will assume responsibility for channel maintenance and repair upon completion of construction by sponsoring a Community Facilities District (CFD).

The Santa Cruz Wash is part of the Santa Cruz River system that originates in the San Rafael Valley in Santa Cruz County, Arizona, immediately adjacent to the international border. The Santa Cruz River flows in a northwesterly direction, roughly parallel to Interstate-10 through Tucson to the Town of Red Rock just north of the Pinal County line. At this point, the Santa Cruz River disappears and runoff is diverted into a series of artificial and natural drainage ways. The Santa Cruz Wash appears as the downstream reach of the Santa Cruz River about 30 miles northwest of Red Rock and flows about 20 miles through a combination of private and public land to the Gila River Indian Community where it merges with the Santa Rosa Wash and outfalls into the Gila River.

The Santa Cruz River system has been targeted as both a significant regional drainage course subject to unique institutional, climatological, geomorphological, and conjunctive use management constraints, and an important environmental resource particularly in the upstream reaches, which contain some of the few remaining grassland prairie environments in the desert southwest that provide substantial riverine habitat for Arizona's federally listed species.

The downstream reaches of the Santa Cruz River system are typical of desert drainage courses. Mountain runoff is conveyed by river channels that braid into washes, which meander through the desert plains as shallow concentrated flow with substantial overbank sheetflow during major storm events. The periodic overbank flow typically results in sediment deposition of a sandy loam material that creates excellent topsoil for agriculture. Many of the rivers that originate in the mountains surrounding the Maricopa Plain of southwestern Arizona disappear into the streambed and reappear downgradiant as surface flow in smaller wash channels or groundwater flow.

Two major storms struck southern Arizona in 1983 and 1993, resulting in overbank flooding that caused substantial damage to adjacent property and existing infrastructure. As development proceeds in the areas south and southwest of the Phoenix metropolitan region, desert washes, such as the Santa Cruz Wash, are being channelized to meet the objective of providing more reliable flood control infrastructure for urbanizing communities and, as planning opportunities permit, providing multi-use amenities that support habitat and recreation.

This Design Report is being submitted on behalf of North Santa Cruz Wash Financial Participation Executive Committee to the City of Maricopa as a support document for obtaining the local authorization to proceed with the proposed channel engineering. These improvements are an integral part of the Regional Master Planning effort under development for Pinal County to guide floodplain management within their jurisdiction and to coordinate structural

improvements with adjacent counties. When completed, the Regional Master Plan will provide a road map for structural flood control improvements being designed and engineered by multiple stakeholders along this reach of the Santa Cruz River, including the proposed seven-mile channelization project described in this design memorandum.

1.0 INTRODUCTION

The North Santa Cruz Wash Regional Flood Control Project (Project) is located in the City of Maricopa, Pinal County, Arizona. The Project includes flood control improvements for a seven-mile reach of the Santa Cruz Wash that flows in a northwesterly direction from the parallel embankments formed by the Union Pacific Railroad (formerly the Southern Pacific Railroad, as designated on older documents) and Maricopa-Casa Grande Highway in the south to the Hiller Road alignment in the north. Downstream of Hiller Road, the Santa Cruz Wash enters the Gila River Indian Community where it flows 15 miles in a northwesterly direction before joining the Santa Rosa Wash and discharging into the Gila River. The Project reach extends through the Maricopa Plain of southwestern Arizona, which is topographically shallow, with slopes generally under 0.5%.

The floodplain along the Project reach is categorized as Zone A, which is defined as a regulatory floodway for which the Base Flood Elevations and other flood hazard factors have not been determined [1-1]. The proposed Project will realign and reconstruct the Santa Cruz Wash to convey runoff from the design event in accordance with all applicable regulatory criteria governing design and floodplain management, which includes preparing a request to FEMA for a Letter of Map Revision to the mapped effective flood zones.

The proposed improvements do not include evaluation or channelization of the Santa Rosa Wash flood plain. Santa Cruz Wash and Santa Rosa Wash are not combined at the Maricopa Casa Grande Highway, therefore Santa Rosa Wash have to be addressed separately. Any improvement on Santa Rosa Wash will be addressed in a separate study which is not a part of this project.

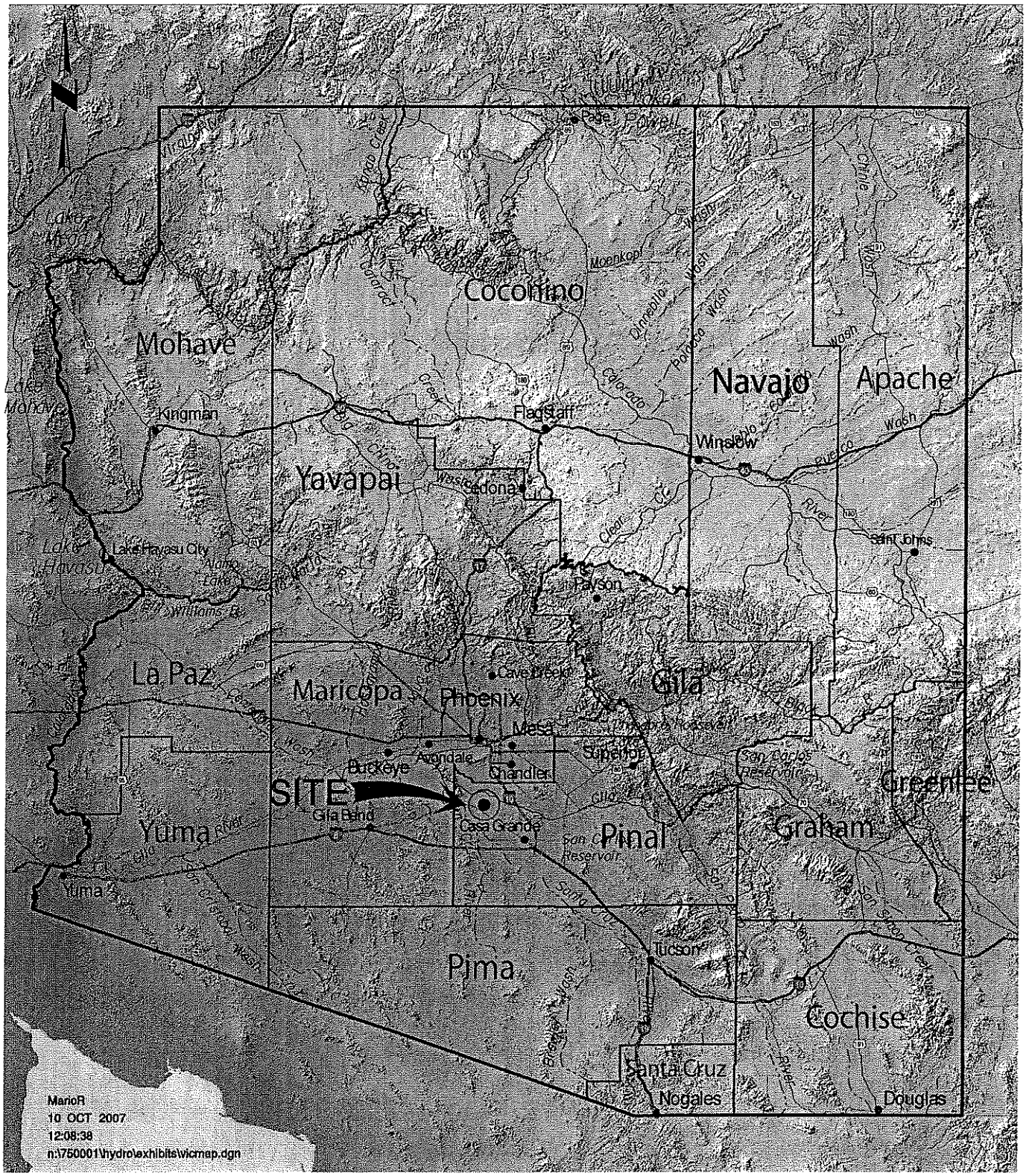
In December 2007, FEMA published updated Flood Insurance Rate Maps. FEMA Flood Insurance Rate Map Panel Number 775 of 2575, Community-Panel Number 04021C0775E revised December 04, 2007 was updated based generally on FEMA's decision to ignore all embankments or levees which were constructed without FEMA certification. In this instance, the Maricopa-Casa Grande Highway and Union Pacific Railroad embankment, although potentially structurally sound, were constructed without official FEMA certification. The updated rate map caused minor revisions to the Santa Rosa and Santa Cruz flood plains. The change to the Santa Cruz flood plain was already accounted for as a part of the North Santa Cruz Wash Regional Flood Control Project. The revision to the Santa Rosa Flood Plain will require a separate CLOMR/LOMR to be processed by the individual property owner of Eagle Shadow Phase 2 and 3. This CLOMR/LOMR being separate and unrelated to the Santa Cruz Wash flood plain will be processed independently from this project flood solution.

This Design Report is divided into chapters that address information specific to different reviewers. Chapter 2 describes the regulatory and permitting environment. Chapter 3 addresses the hydrologic basis of design. Chapter 4 presents a detailed description of the proposed structural improvements and includes a discussion of design issues requiring specific attention and/or coordination with the regulatory agencies and adjacent developments, both existing and planned. Chapter 5 describes the hydraulic analyses and design of the proposed improvements. Chapter 6 addresses scour. Chapter 7 presents a brief description of the planned maintenance

arrangements, and Chapter 8 concludes with a status report summarizing outstanding administrative and technical issues.

References:

1-1 Flood Insurance Rate Map, Pinal County, Arizona and Incorporated Areas, Map Nos. 04021C0735E, 04021C0745E and 04021C0775E (Revised 1987).



VICINITY MAP	NORTH SANTA CRUZ WASH REGIONAL FLOOD CONTROL PROJECT CITY OF MARICOPA, PINAL COUNTY, AZ	JOB NO 780001
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 1-1

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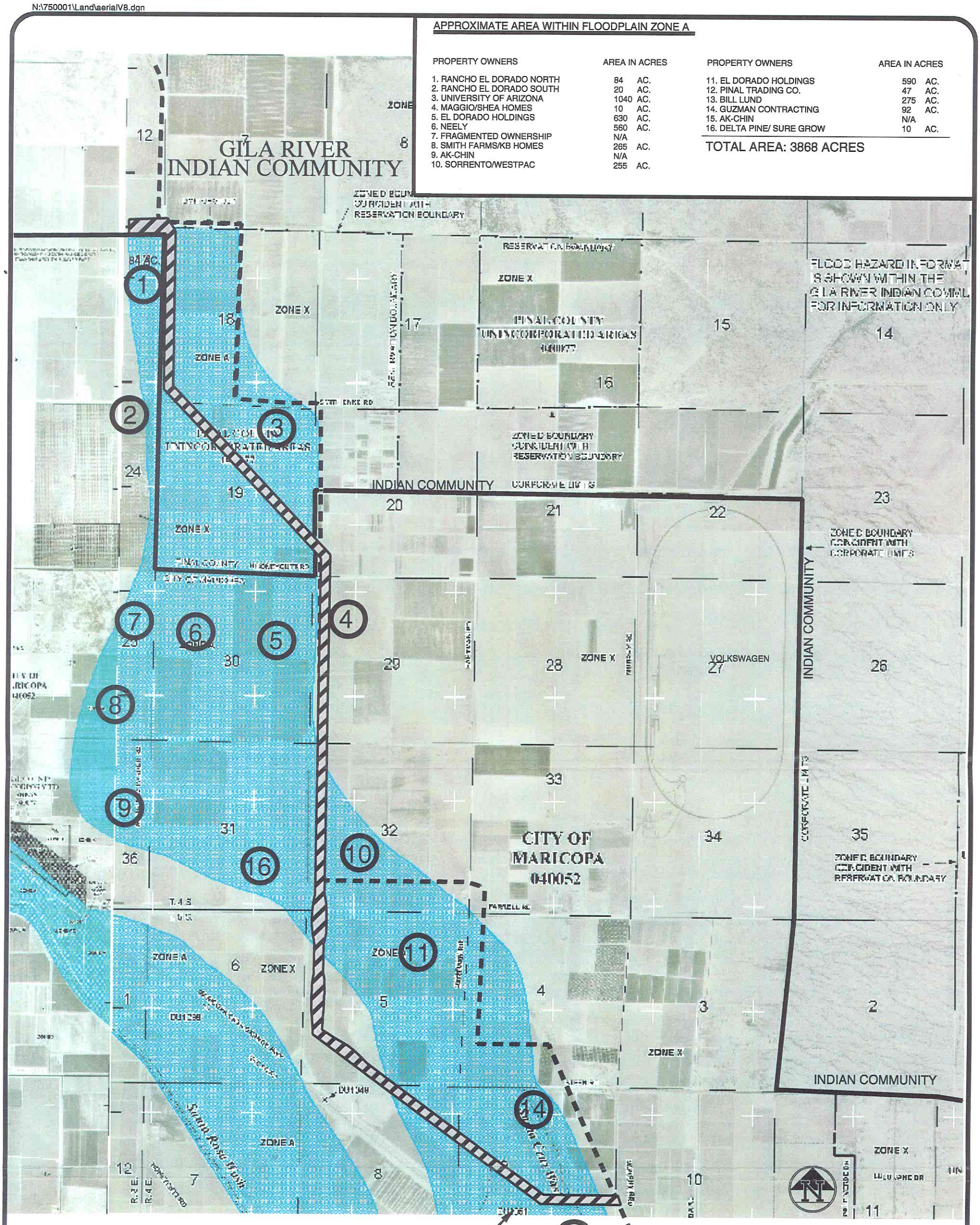
APPROXIMATE AREA WITHIN FLOODPLAIN ZONE A

PROPERTY OWNERS	AREA IN ACRES
1. RANCHO EL DORADO NORTH	84 AC.
2. RANCHO EL DORADO SOUTH	20 AC.
3. UNIVERSITY OF ARIZONA	1040 AC.
4. MAGGIO/SHEA HOMES	10 AC.
5. EL DORADO HOLDINGS	630 AC.
6. NEELY	560 AC.
7. FRAGMENTED OWNERSHIP	N/A
8. SMITH FARMS/KB HOMES	265 AC.
9. AK-CHIN	N/A
10. SORRENTO/WESTPAC	255 AC.

PROPERTY OWNERS	AREA IN ACRES
11. EL DORADO HOLDINGS	590 AC.
12. PINAL TRADING CO.	47 AC.
13. BILL LUND	275 AC.
14. GUZMAN CONTRACTING	92 AC.
15. AK-CHIN	N/A
16. DELTA PINE/ SURE GROW	10 AC.

TOTAL AREA: 3868 ACRES



EXISTING SANTA CRUZ WASH ALIGNMENT

PROPOSED SANTA CRUZ CHANNEL

FLOODPLAIN ZONE A

GILA RIVER & AK-CHIN INDIAN COMMUNITIES

(9) INDICATES OWNER (REFER TO TABLE)

3000' 1500' 0 3000'

SCALE: 1" = 3000'

PINAL COUNTY, AZ (INCORPORATED AREAS)
PANEL 04021C0735E REV. DEC. 4, 2007
PANEL 04021C0745E REV. DEC. 4, 2007
PANEL 04021C0775E REV. DEC. 4, 2007

FIGURE 1-2 | JOB NO 750001

EFFECTIVE FLOOD ZONES & PROPERTY IMPACT ASSESSMENT

NORTH SANTA CRUZ WASH REGIONAL FLOOD CONTROL PROJECT
CITY OF MARICOPA, PINAL COUNTY, ARIZONA

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

2.0 JURISDICTIONAL AUTHORITIES

The Santa Cruz watershed is atypical in many ways. The drainage area at the Santa Cruz-Pima County line several miles north of the international border is nearly 1,700 sq miles [2-1]. The watershed increases in size to over 6,000 sq. mi. at the City of Maricopa. The size and complexity of the watershed create a unique set of technical, permitting, and resource management challenges that require jurisdictional coordination among the development community and the local, regional, state, and federal regulatory entities.

North Santa Cruz Executive Committee. In order to more effectively administer and finance design and engineering of flood control and other infrastructure required for urban growth, local stakeholders formed the North Santa Cruz Wash Financial Participation Executive Committee. This Committee includes present and future developers operating near or adjacent to the proposed North Santa Cruz Flood Control Channel. The Committee performs as a group to coordinate the numerous agreements and stipulations required for design and permitting of the Project. This Committee is further responsible for representing the developers' interest when dealing with local, regional, state, and federal regulatory agencies.

In addition to the Executive Committee, the following land owners have a vested interest in the proposed Santa Cruz channelization project.

University of Arizona. The University of Arizona owns roughly 1,000 acres of land along the proposed channel, between Hiller and Honeycutt Road. The land is fully cultivated and is used to support experiments relating to agricultural production. After some fairly extensive consultation, the University agreed to dedicate a channel right-of-way through their property.

Rancho El Dorado Phase 3 - Maricopa Lakes Property. The Rancho El Dorado Phase 3 - Maricopa Lakes Property is partially under construction. The development is located along the west side of the proposed channel at the downstream Project terminus between Smith-Enke Road and Hiller Road alignment, immediately adjacent to the Gila River Indian Community. Proposed flood control infrastructure, which is currently under construction, includes elevated pads to confine Santa Cruz Wash flooding to the east onto University of Arizona land. Portions of the development are being processed and permitted on a separate track, independently of the proposed Santa Cruz Flood Control Channel. In addition, the spreader basin proposed for the North Santa Cruz channelization is located on the Rancho El Dorado Phase 3 - Maricopa Lakes Property.

In 2006, Rancho El Dorado Phase 3 - Maricopa Lakes Property, the City of Maricopa and the University of Arizona studied the influence of alternative improvements along Hiller Road alignment where channelized flow is redistributed to the existing Santa Cruz Wash and floodplain. They reached a consensus as to the suitable improvements and set stipulations, including extension and realignment of the proposed channel from Honeycutt Road to Hiller Road alignment.

As a precondition to permitting the North Santa Cruz Project, the City of Maricopa will formalize discussions with Rancho El Dorado Phase 3 - Maricopa Lakes Property by asking them to provide land for the downstream spreader basin. The hydraulic modeling and design of the basin must be included in the final development of the Rancho El Dorado Phase 3 - Maricopa Lakes Property in order to demonstrate the viability of the proposed North Santa Cruz Project. The near-term objective is to negotiate an agreement between the City of Maricopa and Rancho El Dorado Phase 3 - Maricopa Lakes Property that addresses land acquisition, facilities design and modeling, and permitting coordination with FEMA and the local jurisdictional authorities as well. The University of Arizona must approve the agreement also since their property will be impacted by any negotiated design solution.

2.1 Pinal County Flood Control District

In 1977, the Pinal County Flood Control District began the process of identifying watersheds within the county requiring further flood evaluation pending anticipated levels of development projected for the county. A Flood Insurance Study (FIS) was completed in 1981 and revised in 1990 [2-2]. The results presented in the FIS that pertain to the Santa Cruz Wash are discussed in more detail in the next chapter.

Pinal County Flood Control District is responsible for floodplain management and regulatory review of all structural flood control improvements proposed within Pinal County. However, the CFD, on behalf of the City of Maricopa, will ultimately assume maintenance and repair responsibility for the constructed channel and appurtenant facilities. The channel right-of-way will be owned by the City of Maricopa and the City-sponsored CFD (see City of Maricopa section below). Pinal County and the City of Maricopa have also acknowledged the need to work closely with Maricopa County who has jurisdictional authority over the Santa Cruz system to the north.

The County adopted a revised Storm Drain Design Manual in 2005 [2-3] containing changes that impacted the proposed channel design. Due to the advanced stage of the design and right-of-way acquisition, an agreement was negotiated with the City and County to allow the use of one foot of freeboard, as per the regulatory criteria in effect at the time of design. All other proposed design improvements described in this report were developed in accordance with the revised regulatory criteria presented in the new manual.

2.2 Federal Emergency Management Agency

As administrator of the National Flood Insurance Program, FEMA maintains a legal record of designated flood zones to support development of insurance guidelines for affected property owners [2-4]. Any and all proposed structural designs that impact a regulatory, or effective, flood zone are incorporated into the public record by requesting a Letter of Map Revision to revise the jurisdictional delineations. The LOMR is processed as a post-construction submittal that includes as-built construction drawings to certify the structural changes. For larger and/or more complicated projects, the LOMR is typically preceded by a pre-construction request for a Conditional Letter of Map Revision to identify any constraints and assumptions that must be

integrated into the proposed design to ensure final agency approval upon construction. CVL will prepare and submit CLOMR/LOMR requests to FEMA for the proposed channelization project after acquiring regulatory authorization from the local flood control administrator.

2.3 Army Corps of Engineers/Environmental Protection Agency

In October 2004, the Santa Cruz Wash was designated as a jurisdictional "water of the United States" under Section 404 of The Clean Water Act, which is jointly administered by the Army Corps of Engineers in cooperation with the Environmental Protection Agency. Section 404 requires issuance of a permit to ensure compliance with measures designed to protect the aquatic resources, wetlands and navigable channels, within the United States. The environmental permitting process is being coordinated with the Corps through consultants to the Project developer.

The Corps is also responsible for implementing the terms and conditions of the National Environmental Policy Act requiring impact assessment on a variety of environmental resources that include hydrology/geology, biology/ecology, social/health, and, more recently, archaeological, historical, and cultural resources. A preliminary work plan [2-5] has been completed that identifies four sites along the Maricopa-Casa Grande Highway that are potentially eligible for listing on the National Register of Historic Places.

Ultimately Corps participation in floodplain management and structural improvements in this large and complicated watershed is likely, especially, and possibly exclusively, in the upstream Pima County watershed, given the unique complexities of this river system. Near-term, however, all agency coordination required to regulate the impact of structural improvements along the Santa Cruz Wash will be based on the published hydrology contained in the 1990 FIS produced on behalf of Pinal County.

2.4. City of Maricopa

The local municipality exercises regulatory control over planning and development on property located within the corporate limits of annexation. This includes the full reach of the proposed channelization project. All flood control analyses and designs, including CLOMR/LOMR submittals to FEMA, will be submitted to the Engineering Department for review and approval.

About one mile of the upstream reach is aligned adjacent to the Maricopa-Casa Grande Highway, which requires coordination with City of Maricopa to ensure that alignment offsets and other design criteria are consistent with their maintenance protocols and other regulatory criteria. The dialogue has been initiated and final construction plans will be reviewed and approved by a designated representative.

The City is sponsoring development of a CFD, which will be responsible for construction and long-term maintenance and repair of the proposed channelization Project.

2.5 Maricopa-Stanfield Irrigation & Drainage District

Coordination will be required with the Maricopa Stanfield Irrigation District to ensure that the proposed design does not impact facilities within or adjacent to the Project reach. Technical consultants working on behalf of the Executive Committee will assume responsibility for coordinating with MSIDD to identify future expansion and abandonment plans for all MSIDD facilities impacted by the proposed project. This includes four siphons at various locations and a possible canal relocation. In addition, the CFD, on behalf of the City of Maricopa, as the designated maintenance provider for the constructed channel, will be required to negotiate access and maintenance easements directly with the MSIDD.

2.6 Indian Communities

The proposed Project improvements include a spreader basin upstream of the Gila River Indian Community along Hiller Road alignment. The spreader basin will be sited on land provided by the Rancho El Dorado Phase 3 - Maricopa Lakes Property and will be designed to return capacity flow to the existing Santa Cruz Wash while distributing the balance of the 100-year design runoff onto the floodplain to the west. This design element will preclude the need for a negotiated agreement with the Gila River Indian Community since no Project impacts will be translated into the downstream wash.

2.7 Regional Cooperative Agreements

The proposed channelization project represents an integral component of a developing regional solution to coordinate structural improvements to this reach of the Santa Cruz Wash. The purpose of a regional approach is two-fold. First, the administrative goal is to make a matter of record the outcome and consequences of the various studies and efforts which have been underway over the past two years by different parties, including CVL, University of Arizona, Pinal County, the City of Maricopa, the Gila River Indian Community, MSIDD, and the numerous developers in the study area. Stipulations have been methodically fashioned and shaped by the various stakeholders, along with a description of how they will be satisfied with design of the improvements. This information shall be assembled in an organized form together with the selected concept plan of improvements and hydraulic simulation results and exhibits of the existing and proposed conditions floodplain and floodway models.

Second, the technical goal of a regional approach is to provide an improved channel that will intercept Santa Cruz floodwaters at Peters & Nall Road, reduce the floodplain width to that of the proposed channel, return the floodwater to the existing floodplain at the south Gila River Indian Community Boundary (Hiller Road alignment), and satisfy the stipulations negotiated among the University of Arizona, City of Maricopa and Pinal County. The design objective is to safely contain floodwaters within the proposed channel and to include an outfall design that ensures no impact to the existing floodplain in the Gila River Indian Community.

The proposed regional solution for this reach of the Santa Cruz Wash shall be adopted by the Pinal County Board of Supervisors, the City of Maricopa City Council, and the University of Arizona Board of Regents. Endorsements of the regional solution will be requested from the MSIDD, the Gila River Indian Community, and the various developers in the study area.

References:

2-1 *Third Watershed Management Plan for Santa Cruz Active Management Area*, Arizona Department of Water Resources.
2-2 *Flood Insurance Study*, Pinal County, Arizona, Unincorporated Areas, Community Number 040077, FEMA, Revised March 5, 1990.
2-3 Pinal County Drainage Design Manual (2005).
2-4 Guidelines and Specifications for Study Contractors, Bulletin 37, FEMA.
2-5 A Work Plan for Archaeological Testing at Four Sites (AZ U:13:260-263 [ASM] on Private Land Along the North Santa Cruz Wash Six Miles Southeast of Maricopa, Pinal County, Arizona, Thomas E. Wright, Archaeological Research Services, Inc. (April 26, 2006).

3.0 HYDROLOGIC ANALYSIS

The Santa Cruz Wash flows in a northwesterly direction through the Grande Valley of the Maricopa Plain. The Project reach is located completely within the City of Maricopa in an undeveloped area of Pinal County that has historically been used for agriculture and dairy farming. As development encroaches into the Grande Valley, and the larger Maricopa Plain region in southwestern Arizona, improvements to the natural washes will be required to provide reliable flood control infrastructure.

The Santa Cruz watershed has experienced a number of changes from development activity both stateside and international, that complicate technical evaluation of hydrologic, hydraulic, geomorphic and environmental attributes within a watershed that exceeds 6,000 sq mi in area. Additionally, the watershed is located in the Sonoran Desert environment where perennial discharges are rare. Major overbank flooding and geomorphological transitions tend to cluster around single storm events, which cannot be easily analyzed using the standard set of one-dimensional steady-state models.

3.1 Drainage Patterns and Surface Features

The Santa Cruz drainage course is more accurately described as a system since it includes numerous artificial and natural features that affect both surface flow and groundwater flow. The entire watershed is criss-crossed with irrigation canals that divert and channelize much of the minor storm runoff, but are not designed as flood control facilities to safely or reliably convey runoff from major storm events.

The Santa Cruz Wash is part of the Santa Cruz River system that originates in the San Rafael Valley in Santa Cruz County, Arizona, immediately adjacent to the international border. The Santa Cruz River flows south from the San Rafael headwaters into Mexico where the alignment makes a 35-mile turn north back into the United States just east of Nogales, Sonora. The river continues to flow in a northwesterly direction, roughly parallel to Interstate-10 through Tucson to the Town of Red Rock just north of the Pinal County/Pima County line. At this point, the Santa Cruz River disappears and runoff is diverted into a series of artificial and natural drainage ways. The Santa Cruz Wash appears as the downstream reach of the Santa Cruz River about 30 miles northwest of Red Rock, just downstream of Interstate 8, and flows about 15 miles in a northwesterly direction to the Union Pacific Railroad tracks and the parallel Maricopa-Casa Grande Highway. The wash continues for about 7 miles in a northwesterly direction onto the Gila River Indian Community where it merges with the Santa Rosa Wash and outfalls into the Gila River.

3.2 Design Discharges

Design discharges used to perform the hydraulic analysis and civil design presented in this report were taken from the 1990 FIS prepared for Pinal County [3-1]. The 1990 FIS was a revision to the earlier 1981 study that included additional gage records to update the frequency analysis on data sets from USGS gages along the Santa Cruz Wash (Laveen Gage, near the Gila River

outfall) and the Santa Cruz River (Cortaro Gage, north of Tucson). The updated gage data included a major storm in 1983 that caused significant flood damage in the vicinity of the Project wash. Based on the analysis performed for the 1990 FIS, the design discharge for the 100-year event along the Project reach is 9,800 cfs. Any and all future development permitted within the tributary watershed will be required to retain or detain developed runoff to some level judged consistent with the analysis from the 1990 FIS and Pinal County regulatory requirements for regional flood control and urban storm water management. Excerpts from the 1990 FIS are included in the Technical Appendix to this report.

References:

3-1 Flood Insurance Study, Pinal County, Arizona, Unincorporated Areas, Community No. 040077, Revised March 5, 1990.

4.0 PROPOSED IMPROVEMENTS

The effort to channelize Santa Cruz Wash began nearly a decade ago in response to accelerating urbanization spreading south of Phoenix into the agricultural counties, such as Pinal County. Channelizing the wash has been complicated by a number of issues that are both technical and logistical. Multiple Indian communities use levees to capture the Santa Cruz Wash flood runoff for irrigation. Preliminary negotiations to integrate a full channelization design through their community land have not been successful. In the absence of channelizing a continuous reach, design elements for capturing flow at the upstream end, and redistributing flow, at the downstream end, are required to provide parity with the existing wash and floodplain through properties where channelization is not a viable option in the near-term future.

The proposed improvements include an upstream capture basin along Peters & Nall Road, 33,000 ft of below-grade channelization from Peters & Nall Road to Smith-Enke Road, 5,300-ft transition reach from channel to levee between Smith-Enke Road and Hiller Road alignment, and an outlet structure consisting of an overflow weir and spreader basin to discharge channelized flow onto the Gila River Indian Community land in a manner consistent with existing floodplain conditions. Maintenance access will be provided through local streets and in-channel ramps at various locations along the improved channel reach. The 300-ft right-of-way will include a 10-ft access road on the east and a 14-ft pedestrian trail on the west. The proposed construction and widening of the existing wash channels will require obtaining new right-of-way, which will be dedicated to the City and possibly the Community Facilities District, depending on future contractual arrangements to be negotiated between the two entities. Existing utilities and surface features are shown in Figure 4-1A. The preliminary design profile is shown in Figure 4-1A.P. The design alignment is shown schematically in Figure 4-1B and described in greater detail below.

The proposed channel improvements will begin at Maricopa-Casa Grande Highway, which lies to the northern boundary of Ak-Chin Indian Community. Ak-Chin Indian Community has a long history of not wanting to channelize flood water through their community forcing this project to start north of their community boundary. The proposed improvements of this project will function with no need for construction on the Ak-Chin Community. The improvements will also in no way negatively impact the Ak-Chin Community property. The proposed capture basin will accept all storm water from the existing flood plain freely and not create a back water impact on the property to the south of the Maricopa-Casa Grande Highway.

4.1 Structural Improvements

Capture Basin. The structure is designed to intercept flow from the unimproved Santa Cruz Wash emerging from the Ak-Chin Indian Community. The existing levees within the Ak-Chin community property do not contain, or completely collect, the design flow of the Santa Cruz Wash coming through the Ak-Chin Indian Community. The proposed capture basin is wide enough to intercept discharges from the floodway and from the floodplain west of the levees. The design consists of a stepped drop from existing grade to the below-grade design depth with banks generally matching existing grade at the south right-of-way line which allow the capture of

Santa Cruz Wash water without any adverse impact on the land south of the capture basin. The capture basin will be fully lined with gabions along both side slopes and the channel bed to provide energy dissipation and erosion protection. The typical section is shown in Figure 4-2.

The basin improvements may include relocation of the existing irrigation canal and extension of the existing siphon that is owned and operated by the MSIDD. Existing utilities located near this proposed feature also include a Qwest fiber optic cable and a Kinder-Morgan fuel line in Peters & Nall Road that cross the floodplain.

Conveyance Channel: Peters & Nall Road to Hiller Road Alignment. Downstream of the capture basin at Peters & Nall Road, the proposed floodway channel is designed as a below-grade section with no levees. The typical channel between Hartmann Road and Bowlin Road is a 12-ft deep trapezoidal section with a one-ft deep centerline low flow invert and 3.3:1 side slopes. The typical section for the reaches upstream of Hartmann Road and downstream of Bowlin Road is a 10-ft trapezoidal section with a one-ft deep centerline low flow invert and 4:1 side slopes. The 300-ft right-of-way includes a 10-ft access road to be provided on one side of the channel at selected locations and a 14-ft wide multi-use trail will be constructed along the entire length. The typical sections are shown in Figure 4-3.

The initial channel is designed as an unlined earthen section with a flow depth of 7.5 ft and a flow velocity of 6.5 fps. The freeboard varies from 2 ft (minimum) to 3.5 ft (average). The City of Maricopa has agreed to design and install landscaping to control flow velocities during the 100-year event for the channel reach upstream of Honeycutt Road Bridge. After landscaping, the flow depth is 9.5 ft and the flow velocity is 5 fps, assuming a maximum (Manning's n) roughness coefficient of 0.045. The freeboard is about 1.5 ft. Landscaping will include a combination of irrigated grass and desert xeriscaping. Xeriscape vegetation shall be limited to grass and small plant species that do not require irrigation. Large woody debris and/or trees and shrubs are not allowed except at low planting frequencies. As a general rule, the larger species are uprooted and present serious flow obstruction during major flood events and should be used sparingly, if at all, in major flood control channels. A list of acceptable plant species is provided in the following table.

North Santa Cruz Flood Control Channel
Species List for Future Landscaping Plan
By City of Maricopa

Shrubs:
Acacia greggii
Artemisia ludoviciana
Chilopsis linearis
Larrea tridentata
Simmondsia chinensis
Sphaeralcea ambigua

Accents:
Nolina microcarpa
Sporobolus airoides

Groundcover:
Acacia redolens
Ambrosia sp.
Baccharis "Starn"
Baileya multiradiata
Chrysactinia mexicana
Dyssodia pentachaeta
Encelia farinosa
Ericameria laricifolia
Oenothera sp.
Thymophylla acerosa
Verbena gooddingii

Some of these plants were chosen for their use in sites requiring erosion control and revegetation (as noted on the mswn website), while others were chosen for their ability to reseed readily, and still others for their predilection to grow in wash conditions in the Sonoran desert. This list is not comprehensive of all plants that may suit the Santa Cruz Wash.

We recommend that irrigated turf be designed for a minimum distance of 1,000 ft upstream and downstream of all structural crossings, particularly low flow crossings and 100-year culvert crossings. Additional flow depth, due to increased channel roughness from desert xeriscaping, will compromise the conveyance capacity of crossings in an environment that is already prohibitedly flat.

At this stage, hydraulic drop structures do not appear to be required, or particularly beneficial, for substantially reducing flow velocities, but they will be required to mitigate backwater at the low flow crossings. A minimum of one two-ft drop is proposed just upstream of the Hartmann Road low flow crossing. The need for some form of grade control will be determined during final design, but the number of possible structures, if any, appears limited to four or five, or approximately every mile at major road crossings.

The primary channel reach contains a number of new and existing features that require special treatment. Existing features that impact the Project (Figures 4-1A and 4-1AP) include:

- MSIDD irrigation canal along White & Parker Road that will outfall into the proposed channel at Smith-Enke Road, requiring a profile survey and junction design to ensure no backwater effects.
- Arizona Public Service overhead power line easement and City of Maricopa road easement adjacent to proposed channel at the downstream reach just south of the Gila River Community between Hiller Road alignment and Smith-Enke Road; the proposed channel alignment is located immediately east of the easements on land owned by the

University of Arizona who has tentatively agreed to deed the 300-ft right-of-way to the City of Maricopa.
- Edison (ED3) overhead power line easement.
- Four MSIDD irrigation siphon crossings that will require relocation, abandonment, or redesign, as per on-going consultation with the irrigation district.
- 100-year bridge crossing at Honeycutt Road, requiring channel dredging to grade the existing invert from 1,185 ft down to 1,180 ft (+/-); the bridge piers are buried to elevation 1140 ft according to drawings provided by the design engineering firm, Royden Construction, dated October 2005.
- Built-out development along the proposed channel alignment including Sorrento, Rancho Mirage, and Rancho El Dorado Phase 3 - Maricopa Lakes Property.

Additional design elements that are part of the proposed channel design (Figure 4-1B) include:

- Low water crossings at three locations that will be designed for a discharge of 1,000 cfs, as per agreement with the City of Maricopa; the low water crossings will result in localized flooding during the design event; floodplain delineations will be determined during final design.
- 100-year bridge crossing at Farrell Road and Bowlin Road.
- 100-year culvert crossing at Alumni Road.
- Channel transition design from below-grade channel to levee between Smith-Enke Road and Hiller Road alignment.
- Rancho El Dorado Phase 3 - Maricopa Lakes Property and University of Arizona stipulations for design reach between Smith-Enke Road and Hiller Road alignment.

Outfall Structure. A spreader basin of approximately 1,200 ft in length with an overflow weir along the west embankment is provided at the downstream (north) end of the channel. The proposed channel will discharge flows into the existing Santa Cruz Wash. Larger discharges will flow over the weir into the spreader basin for redistribution across the floodplain within the Gila River Indian Community. The current flow redistribution scenario is 3,500 cfs into the wash and 6,300 cfs into the floodplain. The spreader basin is considered as a semi-temporary or interim structure pending successful completion of negotiations to channelize the wash to the north through the Gila River Community land.

At present, the outlet structure will be constructed by the City of Maricopa and the CFD as part of the proposed channelization Project. The Rancho El Dorado Phase 3 - Maricopa Lakes Property containing this structure has already been mass graded for residential development. The pad elevations have been elevated along the east side, adjacent to the proposed Santa Cruz channel. It is anticipated that the FEMA submittals for floodplain mapping revisions will be coordinated in some fashion to present a coherent set of proposed regional improvements sponsored by multiple private stakeholders. The local and municipal regulatory entities are aware of the logistical permitting challenges and have contracted these responsibilities to the consultant creating the funding vehicles.

4.2 Downstream Impacts

The outfall structure was designed to duplicate the existing conditions of wash and floodplain runoff within the Gila River Indian Community, as delineated by 2-dimensional modeling. The hydraulic modeling is described in the next chapter.

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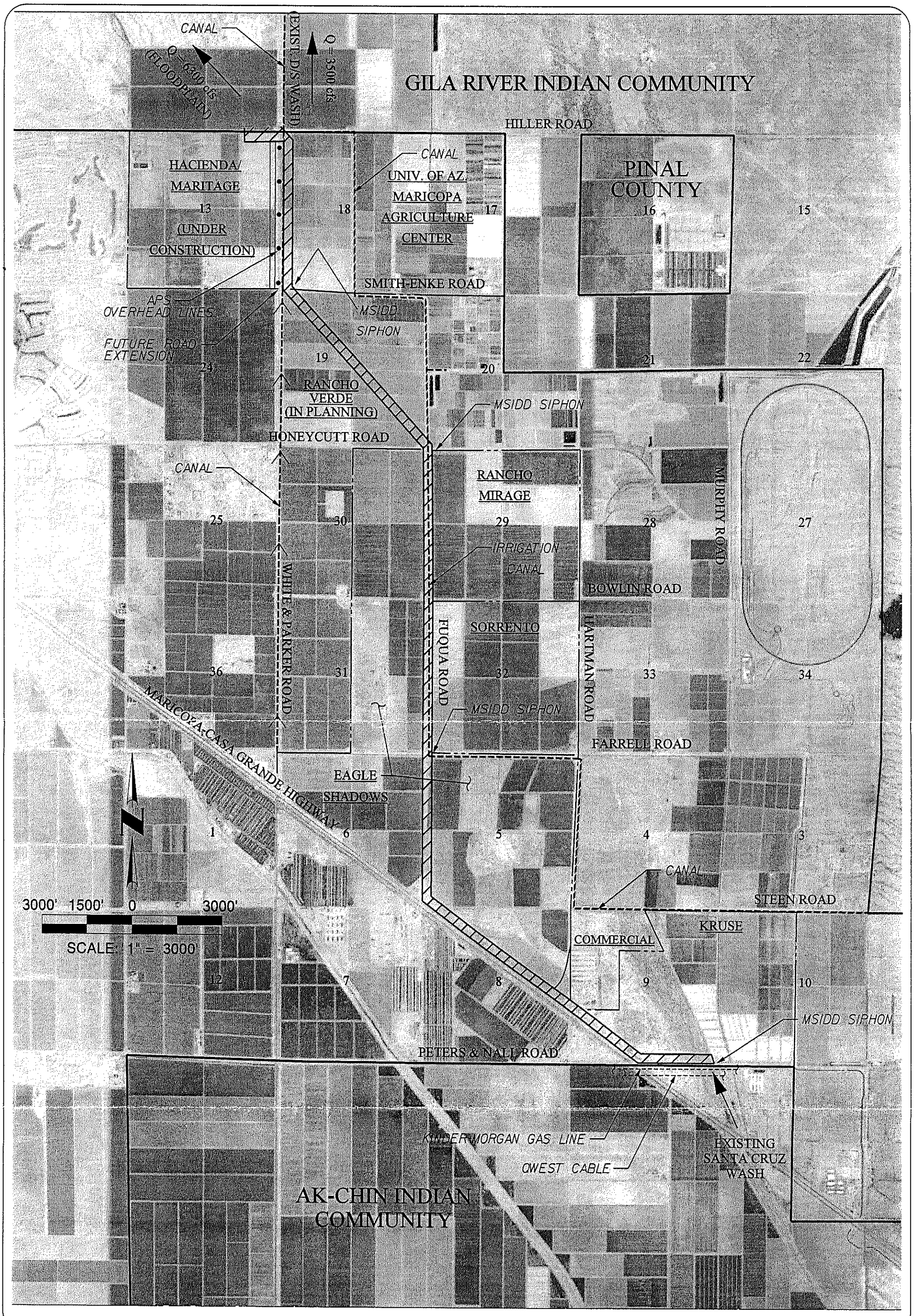
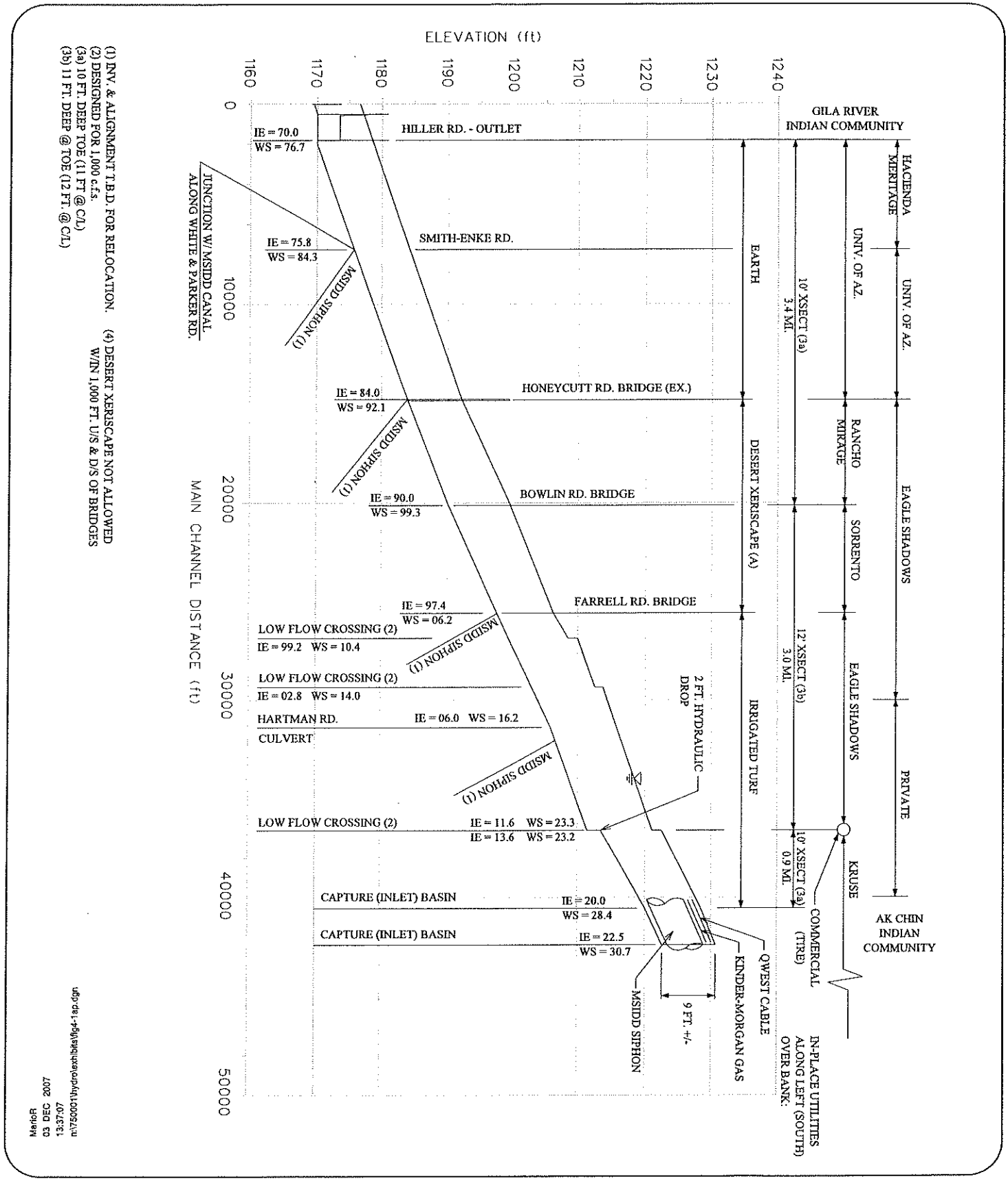


FIGURE 4-1A	JOB NO 750001	EXISTING FEATURES & UTILITIES

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

NORTH SANTA CRUZ WASH REGIONAL FLOOD CONTROL PROJECT
CITY OF MARICOPA, PINAL COUNTY, ARIZONA

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE



(1) INV. & ALIGNMENT T.B.D. FOR RELOCATION.
(2) DESIGNED FOR 1,000 c.f.s.
(3a) 10 FT. DEEP TOE (11 FT @ C/L)
(3b) 11 FT. DEEP @ TOE (12 FT. @ C/L)
(4) DESERT XERISCAPE NOT ALLOWED W/IN 1,000 FT. U/S & D/S OF BRIDGES

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MarieR
03 DEC 2007
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DESIGN PROFILE	NORTH SANTA CRUZ WASH REGIONAL FLOOD CONTROL PROJECT	JOB NO 780001
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 4-1A.P

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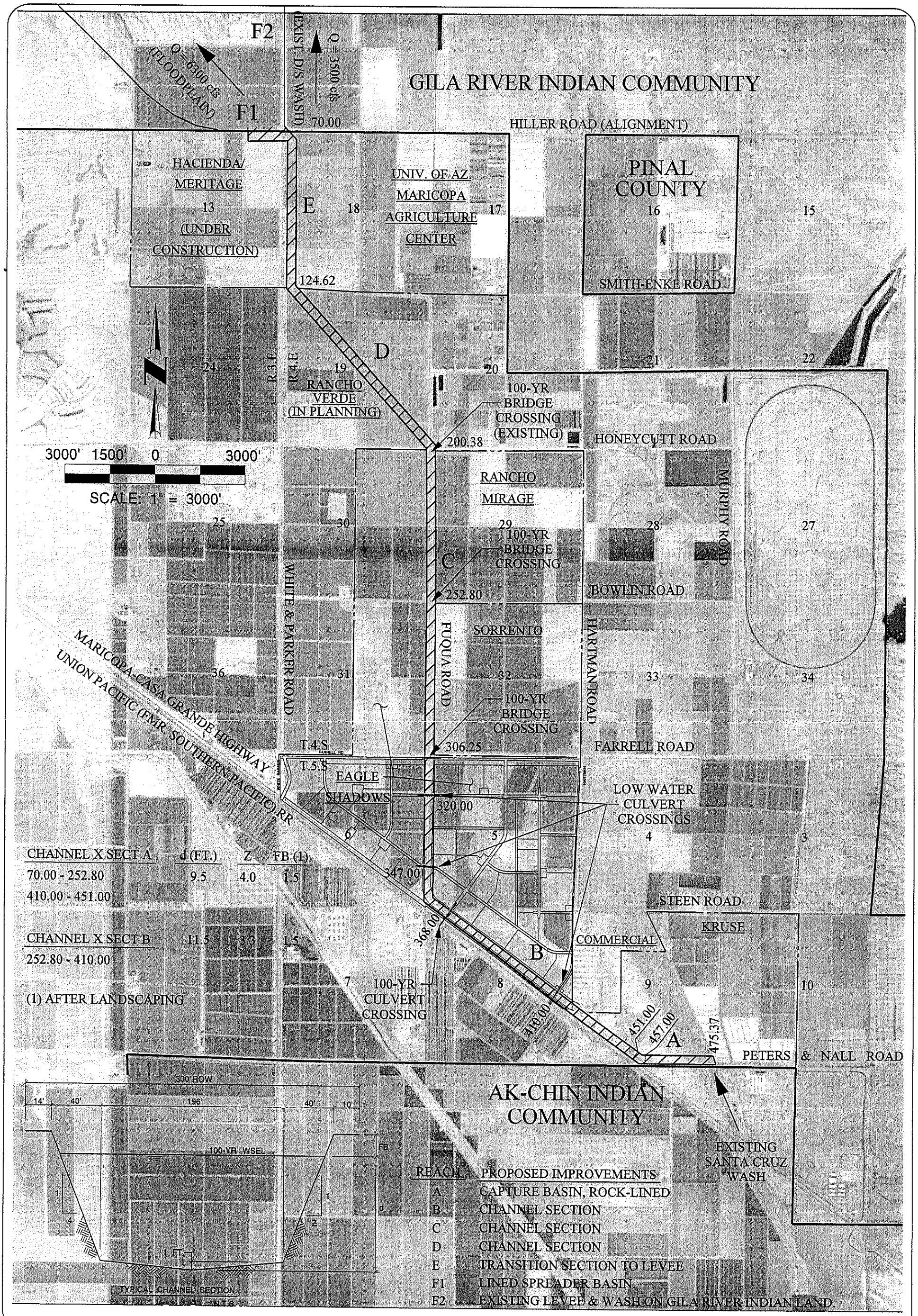

CHANNEL X SECT A	d (FT.)	Z	FB (1)
70.00 - 252.80	9.5	4.0	1.5
410.00 - 451.00			
CHANNEL X SECT B	11.5	3.3	1.5
252.80 - 410.00			

(1) AFTER LANDSCAPING

REACH	PROPOSED IMPROVEMENTS
A	CAPTURE BASIN, ROCK-LINED
B	CHANNEL SECTION
C	CHANNEL SECTION
D	CHANNEL SECTION
E	TRANSITION SECTION TO LEVEE
F1	LINED SPREADER BASIN
F2	EXISTING LEVEE & WASH ON GILA RIVER INDIAN LAND

FIGURE 4-1B

JOB NO 750001

PROPOSED IMPROVEMENTS

NORTH SANTA CRUZ WASH REGIONAL FLOOD CONTROL PROJECT
CITY OF MARICOPA, PINAL COUNTY, ARIZONA

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

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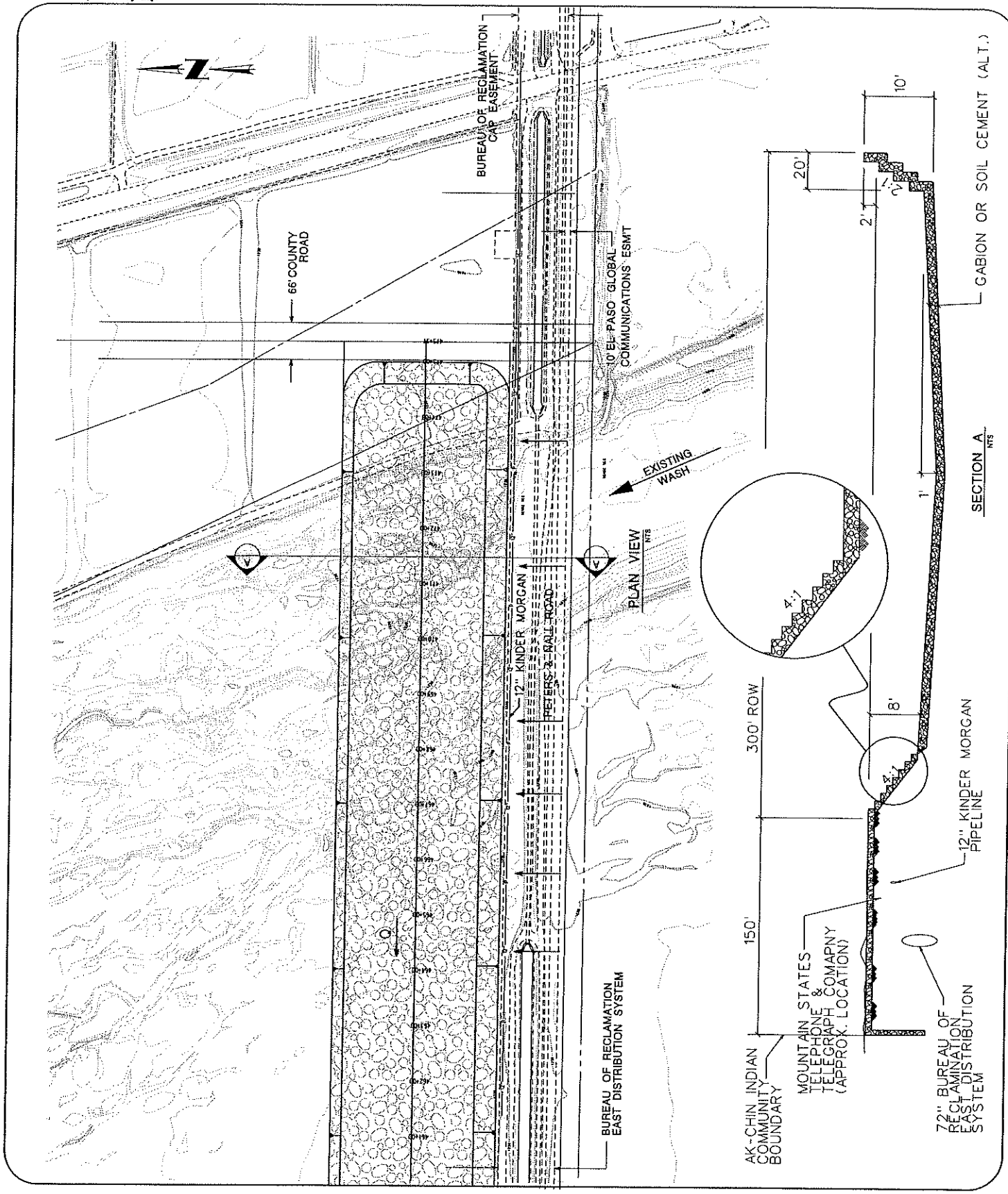

CAPTURE BASIN DETAIL

NORTH SANTA CRUZ WASH
REGIONAL FLOOD CONTROL PROJECT

JOB NO
780001

FIGURE
4-2

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

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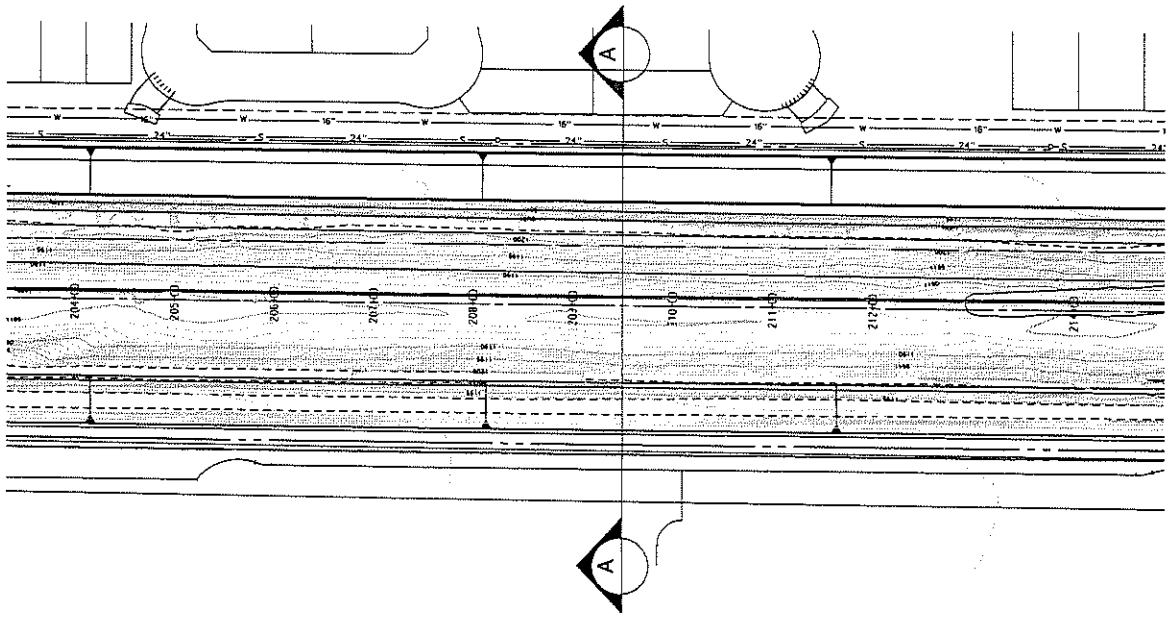
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

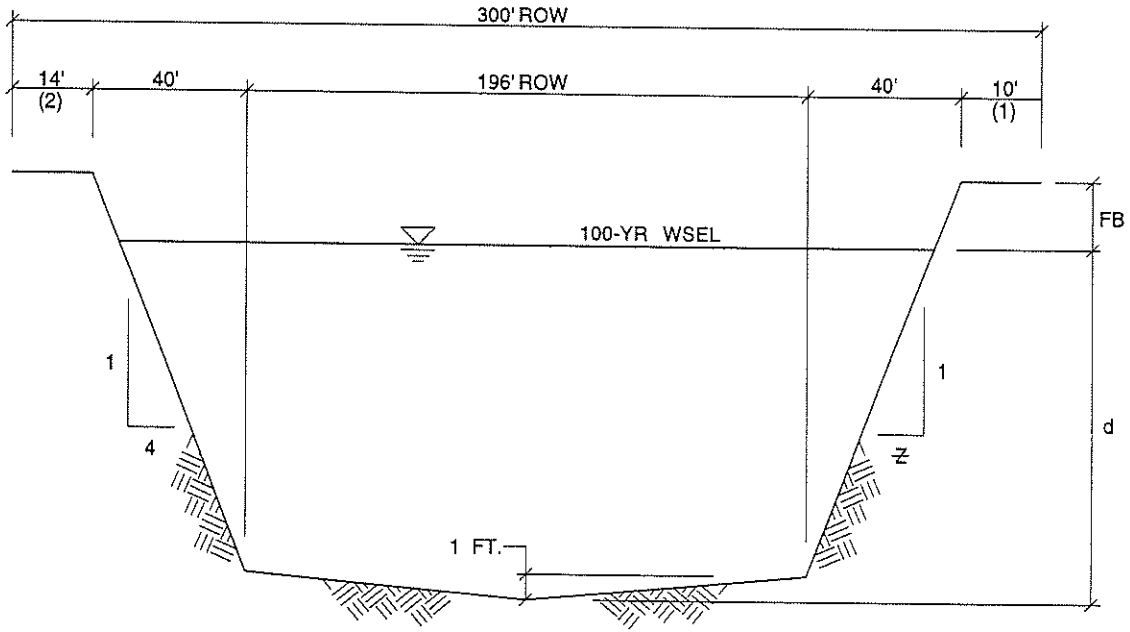
CHANNEL SECTION DETAIL

NORTH SANTA CRUZ WASH
REGIONAL FLOOD CONTROL PROJECT

JOB NO 780001

FIGURE 4-3





TYPICAL CHANNEL SECTION A
N.T.S.

CHANNEL X SECT A	d (FT.)	Z	FB (1)
70.00 - 252.80 410.00 - 451.00	9.5	4.0	1.5
CHANNEL X SECT B 252.80 - 410.00	11.5	3.3	1.5

(1) AFTER LANDSCAPING

BEFORE LANDSCAPING (3)

n = 0.030
d = 7.7 ft
FB = 3.3 ft
V = 6.2 fps

AFTER LANDSCAPING (3)

n = 0.045 (MAX.)
d = 9.5 ft
FB = 1.5 ft
V = 5.0 fps

NOTES:
(1) ACCESS ROAD
(2) PEDESTRIAN TRAIL
(3) FUTURE LANDSCAPING BY CITY OF MARICOPA-COMBINATION OF IRRIGATED GRASS & DESERT XERISCAPING

5.0 HYDRAULIC ANALYSIS

The effective floodplain formed by the Santa Cruz Wash is designated as FEMA Zone A, which is defined as an area of 100-year flooding where base flood elevations have not been determined. The effective floodplain has been substantially altered by agricultural development, in particular, irrigation canals and levees, as well as the recent southward migration of urban development into agricultural counties, such as Pinal County. Hydraulic models were developed to compare the existing (baseline) flow conditions and the future (proposed) facilities at ultimate build-out. The model coverage includes the channel reach from Peters & Nall Road in the south to Hiller Road alignment in the north, which forms the boundary with the Gila River Indian Community where federally regulated floodplains are not defined. The confluence of the Santa Cruz Wash with the Santa Rosa Wash and, ultimately, the confluence with the Gila River is fully contained within the Indian Community.

In order to adequately address floodplain issues on Indian Community land, the hydraulic analysis was performed using two-dimensional modeling for floodplain delineation. The proposed channel will be modeled using the (one-dimensional) HEC-RAS software package [5-1]. The floodplain impact assessment and design of the outfall structure will be performed using the two-dimensional RMA-2 model [5-2]. The existing topography was surveyed in 2005. Preliminary modeling performed to date is described below.

5.1 Existing Floodplain

The existing conditions model was developed to reflect extensive levels of development, both agricultural and urban, within Pinal County and in the vicinity of the proposed channelization that are not reflected in the effective FEMA floodplains. The existing conditions model establishes a more representative baseline for impact assessment.

The existing floodplain, as delineated by two-dimensional modeling [5-3], is shown in Appendix D. Pursuant to the preliminary agreement reached among the Executive Committee, Rancho El Dorado Phase 3 - Maricopa Lakes Property and the University of Arizona, the existing conditions model includes the levee design along the Rancho El Dorado Phase 3 - Maricopa Lakes Property property between Smith-Enke Road and Hiller Road and the North Santa Cruz outfall design along Hiller Road alignment adjacent to the Gila River Indian Community.

5.2 Proposed Floodplain

The proposed floodplain model [5-3] is shown in Appendix D. The proposed model includes the Santa Cruz channel and outfall structure. The one-dimensional HEC-RAS model of the channel, which fully contains the base flood discharge, is currently under development. The one-dimensional model will be used to evaluate flow through existing and proposed bridges and culvert crossings and to assess the hydraulic impact of various forms of future landscaping.

References:

5-1 River Analysis System (HEC-RAS), V3.1.3, Hydrologic Engineering Center, David, CA.
5-2 RMA-2, V4.5, Barbara P. Donnell, Joseph V. Letter, William H. McAnally, Jr. et al, U.S. Army Corps of Engineers Corps of Engineers, Engineering Research and Development Center, Vicksburg, MS (2005).
5-3 River Research & Design, Inc., Gary Freeman, Ph.D., P.E., Mesa, AZ (2007).

6.0 SCOUR

A scour analysis was performed to establish depth of bridge piers and cutoff walls at culvert crossings.

The approach was derived from procedures developed specifically for the State of Arizona [6-1] and procedures developed for alluvial washes in the desert southwest [6-2]. The approach is structured as a linear summation of individual scour components that include general (short-term) scour, long-term (equilibrium) scour, and spatially localized scour due to artificial structures, bends, contractions, and bed-form roughness. The total scour was adjusted by a safety factor to estimate the design burial depth of cutoff walls.

General scour and long-term scour were approximated using the respective equations adopted by the Arizona State Department of Water Resources, both of which are empirical equations based on the 100-year discharge. Bed form scour was approximated using the Yalin equation, and bend scour was approximated using the Zeller equation [6-1]. The total scour depth relative to the thalweg elevation is the sum of the individual scour components. The design scour depth is the computed depth plus one to two feet as a factor of safety or a minimum of 1.3 times the design depth.

For low velocity, sub-critical flow, the primary scour components reduce to general scour and long-term scour, or, on the order of 15 ft for the channelized reach of the Santa Cruz Wash. The piers supporting the existing bridge at Honeycutt Road were designed for this magnitude of scour. Preliminary analysis suggests, however, that armoring will occur prior to hydraulic scour to this depth. Regardless, the proposed landscaping plan – irrigated turf combined with desert xeriscaping – will reduce velocities to near non-erosive levels for bare soil and well within tolerable ranges for full cover with long-term vegetation.

Scour is not anticipated to be a significant maintenance issue. Localized patterns of deposition from smaller events may present more of a maintenance issue. For natural channels, the maintenance program is often a more cost-effective and technically efficient vehicle than design for addressing degradation and aggradation within the channel.

References:
6-1 Arizona Department of Water Resources, *Design Manual for Engineering Analysis of Fluvial Systems* (1985).
6-2 Bureau of Reclamation, *Computing Degradation and Local Scour*, Pemberton, Ernest L. and Lara, Joseph M.. (January 1984).

7.0 MAINTENANCE AND REPAIR GUIDELINES

The CFD, on behalf of the City of Maricopa, has agreed to assume maintenance and repair responsibility for specific elements of the proposed improvements. These include the bank to bank cross section of the channel reaches and all appurtenant in-line structures, such as hydraulic drops, the capture basin and the spreader basin.

Monitoring and instrumentation could be critical to the successful performance and long-term viability of the proposed drainage facilities. It is anticipated that Maintenance Guidelines will include monitoring of sediment accumulation from smaller events, particularly during the early years of operation. Major events will require inspection and cleaning to maintain the design sediment volume. It is further anticipated that some form of data collection program will be implemented to evaluate the sediment transport behavior to support future adjustments to the long-term maintenance protocols.

8.0 CONCLUSIONS

This Design Report is being submitted to City of Maricopa for approval of the proposed structural improvements as a precondition to requesting a Letter of Map Floodplain Revision from FEMA. Approval of this Project at the local and federal levels will provide conditional authorization for revising the effective floodway delineations within and adjacent to the Project site, based on future constructed facilities, allowing private land to become available for alternative uses related to development.

As of this point in time, October 2007, work remaining to be done is as follows:

Administrative Agreements and Stipulations

- Acquire Memorandum of Understanding between the Executive Committee and Rancho El Dorado Phase 3 - Maricopa Lakes Property governing land acquisition, hydraulic modeling, design, and FEMA coordination. The MOU must be approved by University of Arizona as a co-signatory or through written means.
- Coordinate with City of Maricopa to identify future road easement requirements and other offsets impacting proposed channel alignment between Hiller Road alignment and Smith-Enke Road.
- Begin dialogue with MSIDD is to coordinate their plans for facilities expansion and abandonment in the project vicinity.

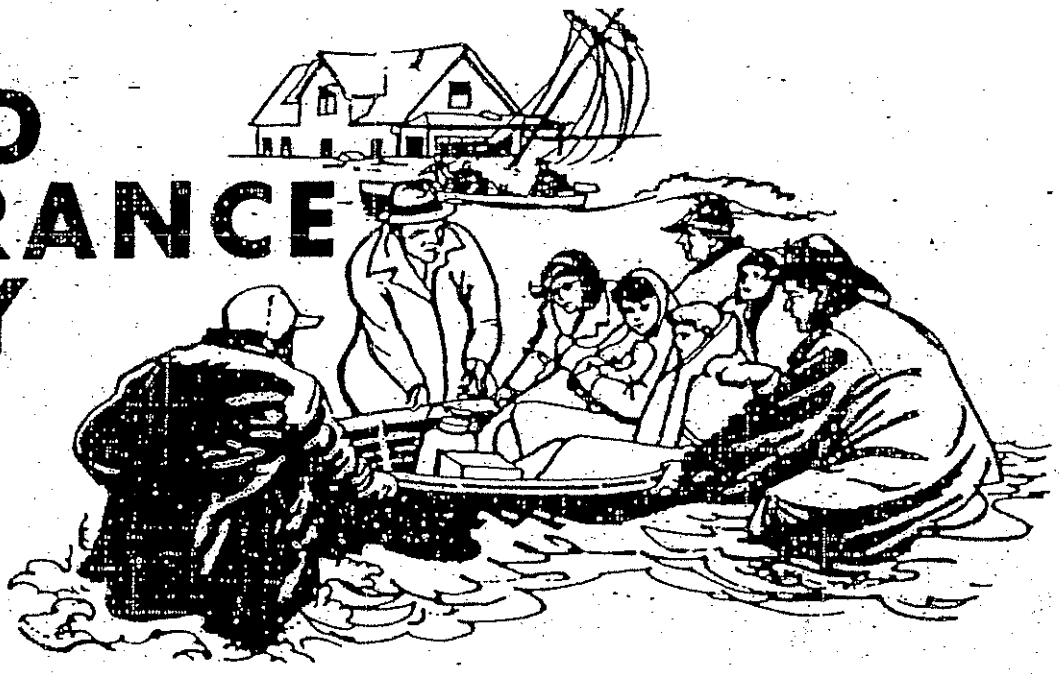
Technical Issues

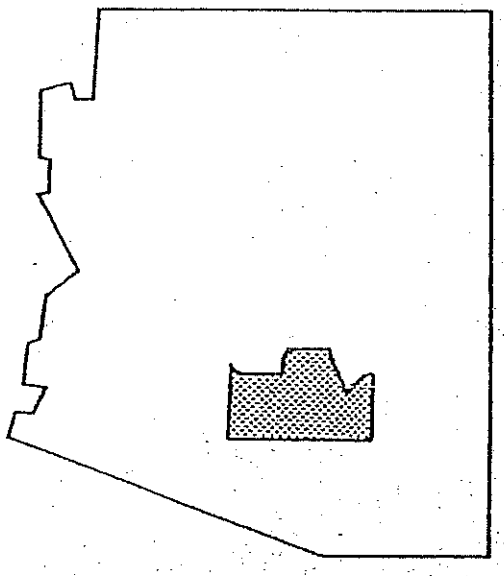
- Survey downstream Santa Cruz Wash within the Gila River Community to define capacity; finalize two-dimensional hydraulic modeling for existing and proposed development using (1) the surveyed wash profile and calculated capacity, and (2) the revised 12-ft deep channel section for the main project reach.
- Evaluate existing bridge crossing relative to revised (deeper) channel section.
- Finalize utilities and site constraints investigation.
- Finalize additional survey needs.

APPENDIX A

1990 Flood Insurance Study
Pinal County, AZ
(Selected Excerpts)

FLOOD INSURANCE STUDY



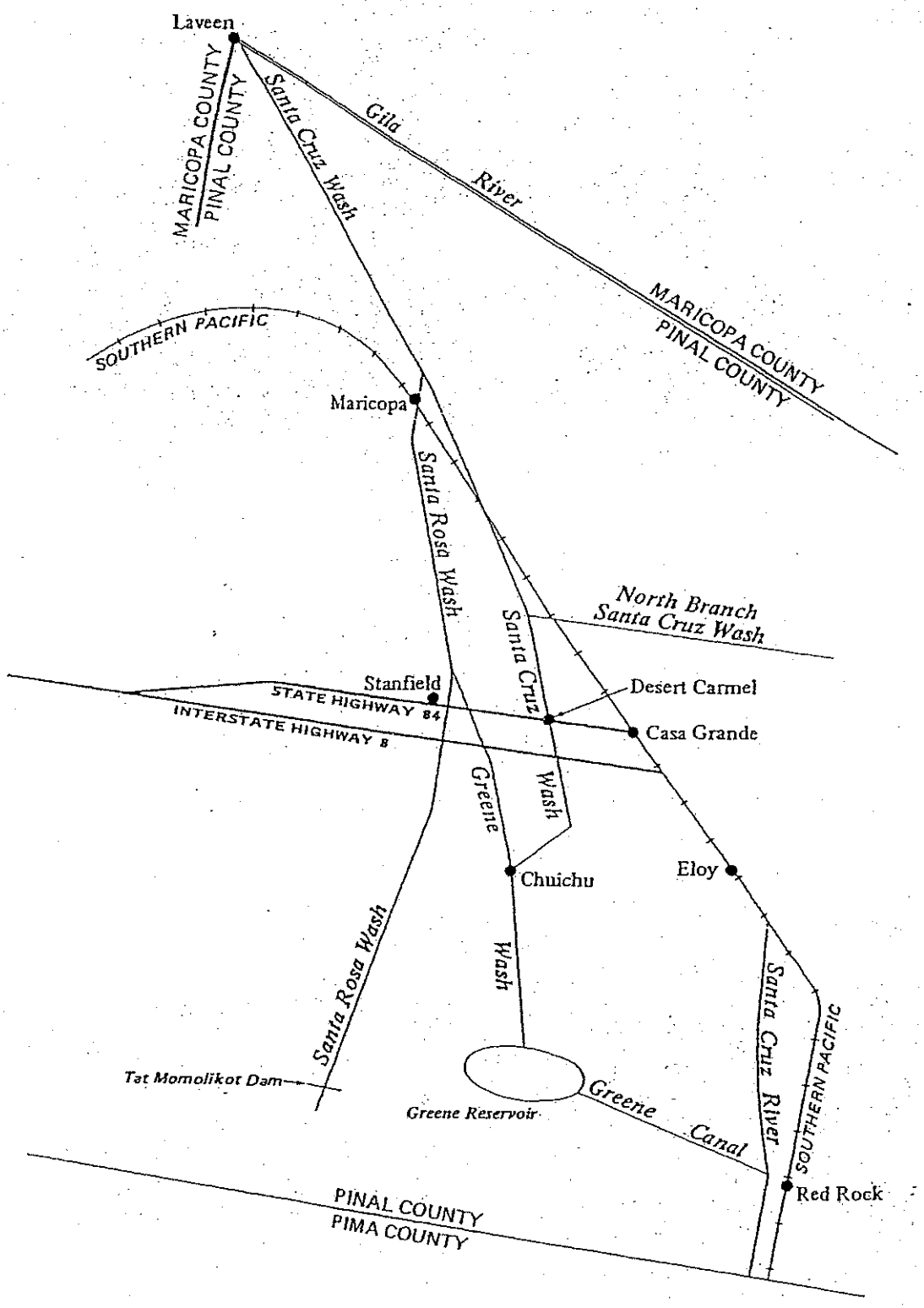


PINAL COUNTY, ARIZONA
UNINCORPORATED AREAS

REVISED: MARCH 5, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 040077



SCHEMATIC DIAGRAM

LOWER SANTA CRUZ RIVER SYSTEM

FEDERAL EMERGENCY MANAGEMENT AGENCY

PINAL COUNTY, AZ
(UNINCORPORATED AREAS)

FIGURE 2

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Table 1. Historic Flood Information

Study Site	Flooding Source	Peak Discharges (cfs)	Flood Date	Recurrence Interval (Years)
Riverside	Gila River	100,000	10/02/83	Unknown
		82,000	09/28/26	Unknown
		42,800	08/08/30	22
		38,200	08/14/40	19
		28,600	08/30/31	Unknown
		28,000	08/09/44	Unknown
		26,300	12/23/65	10
		27,700	12/20/67	12
		27,000	12/19/78	11
Dudleyville	San Pedro River	85,000	09/28/26	600
		45,000	08/14/40	75
		25,000	08/08/30	18
		20,000	08/13/19	10
		20,000	08/28/35	10
		18,000	12/18/78	Unknown
		16,800	12/22/65	Unknown
		16,000	10/11/77	8
Mammoth	San Pedro River	90,000	09/28/26	Unknown
		50,000	08/14/40	Unknown
		22,000	10/11/77	10
Stanfield	Greene Wash	6,200	12/22/67	25
		4,300	09/25/62	6
		1,700	10/09/77	2
Desert Carmel	Santa Cruz Wash	3,060	09/25/62	7
		3,000	10/09/77	6.5
		2,000	12/22/67	3

Table 1. Historic Flood Information (Cont'd)

Study Site	Flooding Source	Peak Discharges (cfs)	Flood Date	Recurrence Interval (Years)
State Highway 84	Santa Cruz Wash	3,060	09/26/62	7
		3,000	10/09/77	6.5
		2,000	12/22/67	3
		Unknown	10/04/83	300
State Highway 84	Greene Wash	6,200	12/22/67	25
		4,300	09/26/62	6
		1,700	10/09/77	2
		Unknown	10/14/83	300
State Highway 84	Santa Rosa Wash	8,430	09/26/62	6
Southern Pacific Railroad	Santa Cruz and Santa Rosa Wash	36,400	10/04/83	300
Southern Pacific Railroad	Maricopa (Santa Rosa Wash)	Unknown	09/26/62	Unknown
		15,400	10/04/83	300

Table 2. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Gila River at Florence	18,500	19,000[1]	46,000[1]	120,000[1]	230,000[1]
Gila River at Riverside	18,011	26,000[1]	66,000[1]	140,000[1]	240,000[1]
Gila River at Kearny	18,000	28,000[1]	68,000[1]	140,000[1]	240,000[1]
Gila River at Hayden and Winkleman					
Downstream of San Pedro River	17,757	28,000	67,000	140,000	250,000
Upstream of San Pedro River	13,270	22,000	64,000	120,000	210,000
San Pedro River at Dudleyville	4,471	20,000	38,800	49,600	2,600
San Pedro River at Mammoth	3,610	23,200[1]	38,300[1]	46,800[1]	72,400[1]
Queen Creek					
Upstream of West Branch	1.79	900	1,885	2,215	2,920
West Branch					
At Queen Valley Drive	1.60	530	1,065	1,250	1,630
North Branch Santa Cruz Wash					
At Burris Road	57.4	3,389	6,999	8,969	15,000
At Pinal Avenue	48.9	2,910	5,999	7,679	13,000
At Trekell Road	32.4	1,534	3,235	4,177	7,400

[1]Discharges Increase With Decreasing Drainage Area Due to Overbank Storage

Table 2. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Weekes Wash					
At North Apache Trail (State Highway 88)	9.37	2,145	5,610	6,480	9,847
Santa Cruz Wash					
At Maricopa	6,100[2]	2,900[1]	5,900[1]	7,600[1]	12,700[1]
At Desert Carmel	5,961	5,300[1]	9,950[1]	12,600[1]	21,350[1]
At Southern Pacific Railroad	N/A	---	---	9,800	---
Downstream of Southern Pacific Railroad	N/A	---	---	7,600	---
Greene Wash					
At Stanfield	5,961[2]	5,300[1]	9,500[1]	11,800[1]	18,500[1]
Santa Rosa Wash					
At Maricopa	8,100[2]	2,150[1]	4,400[1]	5,800[1]	11,200[1]
Big Wash					
At San Manuel	2.65	745	1,325	1,605	2,290
South Wash					
At San Manuel	2.05	690	1,160	1,380	1,915
Santa Rosa and Santa Cruz Wash					
Upstream of Southern Pacific Railroad	6,159	---	---	24,600	---

[1] Discharges Increase With Decreasing Drainage Area Due to Overbank Storage
[2] Includes Combined Drainage Areas for Santa Cruz Wash and Greene Wash

Table 2. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Culvert Flows					
Between Santa Cruz and Santa Rosa Washes	N /A	---	---	2,200	---
Santa Rosa Wash (Greene Wash)					
At Southern Pacific Railroad	N /A	---	---	14,800	---
Downstream of Southern Pacific Railroad	N /A	---	---	8,500	---
Through Maricopa	N /A	---	---	6,300	---
Vekol Wash Tributary					
At Southern Pacific Railroad	156	---	---	13,700	---
Vekol Wash					
At Southern Pacific Railroad	297	---	---	18,850	---
Vekol Wash and Vekol Wash Tributary Downstream of Southern Pacific Railroad	453	---	---	23,300	---

17. Cella Barr Associates, Oblique Aerial Photographs of Maricopa During the October 1983 Floods, flown October 4, 1983

18. Cooper Aerial Mapping Company, Aerial Photography of the Santa Cruz River during the October 1983 Floods, flown October 3, 1983

19. Pinal County and Florence-Coolidge Soil Conservation District, assisted by U.S. Department of Agriculture, Soil Conservation Service, Watershed Work Plan, Florence Area Watershed, October 1961

20. U.S. Water Resources Council, Guidelines for Determining Flood Flow Frequency, September 1981

21. U.S. Department of the Interior, Geological Survey, Methods For Estimating the Magnitude and Frequency of Floods in Arizona, R.H. Roeske, Sponsored by Arizona Department of Transportation, September 1978

22. U.S. Department of the Interior, Geological Survey, Flood Frequencies for San Pedro River at Winkelman, Arizona, unpublished

23. U.S. Department of Agriculture, Soil Conservation Service Engineering Division, Technical Release 20, Computer Program for Project Formulation-Hydrology, May 1965

24. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume VIII-Arizona, R.H. Frederick, J.D. Miller, and R.J. Tracey, 1973

25. U.S. Department of the Army, Corps of Engineers, Planning Study of Lower Santa Cruz River, Los Angeles, California, Completed May 1979, unpublished

26. U.S. Geological Survey, Water Resources Data for Arizona, 1940-1983

27. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, Generalized Comuter Program 723-X6-L202A, HEC-2 Water-Surface Profiles, Davis, California, updated November 1981

28. Cooper Aerial Surveys, Topographic Maps, Scale 1:2,400, Contour Interval 2 feet: Dudleyville, Arizona (March 1979); Mammoth, Arizona (February 1979); Queen Valley, Arizona (March 1979); Riverside, Arizona (March 1979)

29. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 5 feet: Antelope Peak NE, Arizona (1981); Chuichu, Arizona (1965); Double Peak, Arizona (1965); Maricopa, Arizona (1952); Sacaton Butte, Arizona (1952) Photorevised 1967; Stanfield, Arizona (1965); Casa Grande West, Arizona (1965)

58. U.S. Department of Agriculture, Soil Conservation Service, "Hydrology," National Engineering Handbook, Section 4, August 1972

59. U.S. Department of Agriculture, Soil Conservation Serivce, Report of Preliminary Investigation, Proposed Flood Control Project, Santa Cruz River Near Red Rock, Arizona, Phoenix, Arizona, May 1955

9.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study. To assure that users are aware of all revisions, they should contact the community repository of flood hazard data located at the Pinal County Planning and Development Services, Floodplain Division, Administration Building No. 2, Pinal County Complex, Florence, Arizona 85232.

9.1 First Revision

This study was revised on March 5, 1990, to incorporate the effects of revised hydrologic and hydraulic analyses along the North Branch Santa Cruz Wash and Santa Cruz Wash. The North Branch Santa Cruz Wash was reanalyzed from a point approximately 600 feet upstream of Burris Road to a point approximately 2,800 feet upstream of Trekell Road, a reach of approximately 3 miles. Portions of this reach pass through the City of Casa Grande. The Santa Cruz Wash was reanalyzed from a point 0.3 mile upstream of the confluence of the North Branch Santa Cruz Wash to a point 1.2 miles upstream of State Route 84, a reach of approximately 6.1 miles.

North Branch Santa Cruz Wash:

The revised hydrologic analyses of the North Branch Santa Cruz Wash were based on a study performed by CBA of Phoenix, Arizona, and utilized the SCS hydrologic model TR-20. The result of this analysis was a decrease in discharges. The revised hydraulic analyses were performed using the COE HEC-2 step-backwater computer program. Flood profiles were generated from the HEC-2 model which, as a result of the lower discharges, resulted in lower base flood elevations, modifications to the 100-and 500-year floodplain boundaries, and realignment of the floodway as shown on the revised Flood Insurance Rate Map Panel 0695 D and Flood Boundary and Floodway Map Panel 0695. Topographic maps with a scale of 1:4,800 and a contour interval of 4 feet, produced by CBA, were utilized to produce the new boundaries. The Summary of Discharges Table, Floodway Data Table, Flood Insurance Zone Data Table, and Flood Profiles have been revised to reflect the effects of the reanalyses.

Santa Cruz Wash:

The revised hydrologic analyses of the Santa Cruz Wash were based on a study also performed by CBA. This study utilized the log-Pearson Type III peak disharge-frequency analysis, presented in the Water Resources Council Bulletin 17B, for the USGS gages along the Santa Cruz River at Cortaro and Laveen. The result of these analyses was an increase in discharges. The revised hydraulic analysis for this reach was also performed using the COE HEC-2 step-backwater computer program. Flood profiles were produced from the HEC-2 model, and, as a result, changes were made to the 100-year floodplain boundaries and zone designations. Base flood elevations were also added to the reach reanalyzed as shown on revised Flood Insurance Rate Map Panels 0700 D and 0925 D. Topographic maps with a scale of 1:4,800 and a contour interval of 2 feet, produced by CBA, were utilized for the revisions. The Summary of Discharges Table and Flood Insurance Zone Data Table have been revised to reflect the higher discharges.

Also included in this revision is the addition of the Apache Junction Floodwater Retarding Structure (FRS) and the Apache Junction Floodway on FIRM Panels 0025 and 0125. These structures were designed and constructed by the U.S. Soil Conservation Service based on a 100-year flood design. The Flood Control District of Maricopa County, Arizona acted as the local sponsor.

The Apache Junction FRS was designed as a single purpose flood control dam that will collect all water from its own uncontrolled watershed along with water carried to it by the Apache Junction Floodway. Flooding from Bulldog Wash will flow into the Apache Junction FRS, and thus decrease the threat of 100-year flooding downstream in the City of Apache Junction, Arizona.

APPENDIX B

University of Arizona – Correspondence

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, Arizona 85014-4291
Phone: 602-264-6831 Fax: 602-264-0928

DRAFT

HYDROLOGY – MEMORANDUM

To: Doug Both, cfm, Ryan Weed, PE and Les Olson, PE
Project Name: North Santa Cruz River Flood Study
Project Number: 1.01.1780001
Subject: University of Arizona Regional Plan Questions
From: Charley Scott, PE and Ricardo Aguirre, PE **Phone: 602-285-4750 or 602-285-4788**
E-mail: cscott@cvlci.com or raguirre@cvlci.com
Date: May 16, 2006 at 1:30 PM

University of Arizona's Input to the Regional Plan for the Santa Cruz River Floodplain and Subject Property:

Preparation of the Regional Plan for the Santa Cruz River Floodplain in the reach between Peters & Nall Road (Ak-Chin Indian Community boundary) and Hiller Road (Gila River Indian Community boundary) is currently in progress; and the University of Arizona (U of A) owns farmland in that floodplain immediately south of the Gila River Indian Community (GRIC). They have brought to the table five specific questions regarding the anticipated effects to the regional floodplain that will result from the proposed subdivisions and Santa Cruz River drainage improvements in the area south of the GRIC boundary. The U of A subject property is located in the City of Maricopa, Pinal County, Arizona. Generally, the area affected is bound on the south by Honeycutt Road, on the north by Hiller Road, on the west by White and Parker Road, and on the east by Fuqua Road.

University of Arizona's Question No. 1
Past and Future Flood Magnitude at Gila River Indian Community (GRIC) Boundary:

Specifically, the U of A is interested in knowing the magnitude of floodwater losses due to soil infiltration along the Santa Cruz floodplain during the 100-year flood event, and thus the expected flow at the GRIC boundary under existing conditions and also for future conditions. The following narrative is focused on the area that consists of the 100-year floodplain between Peters & Nall Road (Ak-Chin Indian Reservation) on the upstream end and Hiller Road (Gila River Indian Reservation) on the downstream end.

The simulation results of the infiltration analysis have been determined by using the Green and Ampt Equation. The Green and Ampt method accounts for the soil texture classification, antecedent soil moisture, vegetative cover and depth of floodwater. The Green and Ampt method is a popular method used as a component in various physical models, such as the U.S. Army Corps of Engineer CASC-2D model, and it is also a method frequently outlined in guideline manuals, such as Arizona Department of Transportation Report #FHWA-AZ93-281 Highway

Drainage Design Manual - Hydrology, March 1993.
Approach:

Step 1 Overlay the existing floodplain onto the soils map to show the types of soil being affected during the 100-year flood event.

Step 2 Determine the infiltration rates using the Green and Ampt Method for each of the soil types affected by the limits of the floodplain area for saturation levels ranging from 0% to 100%, at 10% increments.

Postulation:

Ponding depth equals approximately 1.2 feet for existing conditions, and it equals approximately 1.35 feet for post improvement conditions. Ponding depth is the approximate average depth over the entire floodplain area corresponding to peak flow of 100-year flood event (9,800 cfs).

Existing Conditions Results:

The surface area of the existing 100-year floodplain located between Peters & Nall Road and Hiller Road is approximately 4,161 acres. Below is a table showing the infiltration rates in this area relative to the effective saturation of the soil for existing conditions; and the 100-year return frequency event (9,800 cfs) is reduced by the infiltration rate and also the existing channel capacity of 2,000 cfs which results in floodplain discharge values at the GRIC boundary.

Floodplain Discharge Reduced by Soil Infiltration Rate for Existing Conditions				
Effective Saturation (%)	Infiltration Rate (cfs)	Linear Reduction[1] (cfs/mile)	Floodplain Discharge at GRIC boundary (cfs)	Flow in Existing Channel or floodway (cfs)
100	342	49	5,958	3,500
90	874	126	5,426	3,500
80	1124	162	5,176	3,500
70	1329	191	4,971	3,500
60	1497	215	4,803	3,500
50	1643	236	4,657	3,500
40	1770	254	4,530	3,500
30	1895	272	4,405	3,500
20	2001	287	4,299	3,500
10	2106	303	4,194	3,500
0	2211	318	4,090	3,500

[1]To calculate, the infiltration rate is divided by the distance in between Peters & Nall Road and Hiller Road, which equal approximately 6.96 miles.

Assuming the cultivated fields are 100% saturated, e.g., and 3,500 cfs remains in the existing channel or floodway, the floodplain discharge at the GRIC boundary is 5,958 cfs for the 100-year return frequency event and existing conditions.

Post Improvement Conditions Results:

Below is a table showing the infiltration rates relative to the effective saturation of the soil along the proposed channel alignment for post improvement conditions; and the 100-year return frequency event (9,800 cfs) is reduced by the infiltration rate along the channel to give discharge values at the proposed spreader basin center of discharge which is ¼ mile north of Honeycutt Road.

Santa Cruz Channel Discharge Reduced by Soil Infiltration Rate for Post Improvement Conditions			
Effective Saturation (%)	Infiltration Rate (cfs)	Linear Reduction[1] (cfs/mile)	Discharge ¼ Mile North of Honeycutt Road (cfs)
100	104	15	9,718
90	301	43	9,564
80	396	57	9,490
70	468	67	9,434
60	526	76	9,388
50	583	84	9,344
40	626	90	9,310
30	674	97	9,272
20	717	103	9,238
10	756	109	9,208
0	794	114	9,178

The following table shows the infiltration rates relative to the effective saturation of the soil for post improvement conditions; and the 100-year return frequency event from the above table is reduced by the infiltration rate and also the existing downstream channel capacity of 3,500 cfs to give floodplain discharge values at the GRIC boundary.

Floodplain Discharge Reduced by Soil Infiltration Rate for Post Improvement Conditions				
Effective Saturation (%)	Infiltration Rate (cfs)	Linear Reduction[1] (cfs/mile)	Floodplain Discharge at GRIC boundary (cfs)	Flow in Existing Channel or Floodway (cfs)
100	54	22	6,100	3,500
90	203	81	5,691	3,500
80	273	109	5,494	3,500
70	325	130	5,345	3,500
60	367	147	5,226	3,500
50	409	164	5,110	3,500
40	443	177	5,014	3,500
30	475	190	4,915	3,500
20	508	203	4,828	3,500
10	536	214	4,748	3,500
0	565	226	4,676	3,500

Assuming the cultivated fields are 100% saturated, e.g., and 3,500 cfs remains in the existing channel or floodway, the floodplain discharge at the GRIC boundary is 6,100 cfs for the 100-year return frequency event and post improvement conditions.

A linear reduction rate was also determined, for the 1983 flood, by taking the flow difference from two USGS gauge locations separated by 100 miles of the Santa Cruz and Gila Rivers, i.e., the Cortaro and Laveen stations. That information was found in the Flood Insurance Study for Pinal County, Arizona; Revised March 5, 1990. For the 100-year return frequency, that linear reduction was found to be 358 cfs/mile. For this CVL inquiry, it is assumed that the soil in the study area is 100% saturated from crop irrigation and initial flooding prior to the peak; The linear reduction rate for existing conditions varies from 49 to 318 cfs/mile – see table above. The variation between values is likely due to temporary floodplain storage, timing effects of the storage and downstream Gila River soils.

Other Variables of Uncertainty that vary with time and Can Affect The Outcome Of Any Particular Flood Event:

Any particular flood event can be quite different than that predicted by this inquire. When considering the many variables affecting the soil infiltration losses during the 100-year flood event there are other variables that can impact the results. A list of some of those variables includes but is not limited to the following:

Irrigation timing -	It is unknown and difficult to anticipate when farmers are going to be irrigating their fields, which presents almost an infinite number of possible combinations of when and which fields are going to be irrigated.
Crop type -	Different types of crops with different roots systems add variations to the process of infiltration. Again, there is an infinite number of possible combinations, which also includes the times when there are no crops.
Cultivation of fields -	Different cultivation practices for different crop types. For example, barely and wheat generally are grown on flat fields used for flood irrigation and no interim cultivation. Cotton is generally grown on built up rows, which is cultivated after each irrigation. The process of cultivation aerates the soil allowing for more voids, while the process of repeated irrigation compacts the soil reducing voids. Again, there is an infinite number of possible combinations.
Perimeter grading -	Irrigation ditches, dykes, and levees have been created, adjusted or torn down, which will change the surface storage affects in the area. From aerial photography, these changes can be verified by the paths the water took during the 1983 flood compared to the paths the water took during the 1993 flood, and again comparing the expected flow paths based on current

	topography in the area through hydraulic modeling.
Climate -	Changing climate conditions throughout the year creates an affect on how efficient the water penetrates the soil.
Hydrology -	Antecedent moisture conditions outside of irrigation can change do to the possibility recent storm events in the area.
Morphology -	Soils can change after major flooding events. For example, many farmers in the Pinal County area found a thick layer of silt cover after the flood water receded, during both the 1983, and the 1993 floods. This is a significant change to the process of how water infiltrates into the soil.

University of Arizona's Question No. 2
Return Frequency of Flooding across U of A Property in Santa Cruz River Floodplain Area:

Using field surveyed cross sections; CVL prepared a HEC-RAS model to analyze the existing channel or floodway between Honeycutt Road and Hiller Road at White & Parker Road. Simulation results show that water begins to overflow at the lowest cross section when adjusting the flow to 3,000 cfs. Therefore, the capacity of the existing channel through the U of A property is very close to 3,000 cfs.

The U.S. Water Resources Council recommended that the log-Pearson Type III distribution be used as a base distribution for flood flow frequency studies (U.S. Water Resources Council, 1967, 1976, 1977, and 1981: Benson, 1968). It follows that using the Log-Pearson Type III distribution, CVL found that the 3,000 cfs corresponds to a **7.5 year return frequency.**

It can be concluded that, on the average once every 7.5 years, flooding of a magnitude exceeding the existing channel capacity (3,000 cfs) will occur, and excess floodwaters will pass over the floodplain area. For the 100-year return frequency storm of 9,800 cfs, it is estimated that 6,800 cfs will pass from the existing channel and spread over the floodplain which consists mostly of cultivated fields.

University of Arizona's Question No. 3
Flooding Conditions on U of A Cultivated Fields:

The existing levees which bound the existing floodway or channel along the GRIC boundary at Hiller Road are not certified levees and they have not been evaluated for such; therefore, the extent to which they will erode away or breach and move downstream as sediment is uncertain.

CVL has prepared a two-dimensional hydraulic floodplain model from which to estimate the flooding limits and depth of the 100-year return frequency storm (9,800 cfs). Four sets of simulation results were prepared with variations of the model: first, the existing channel/floodway levees were removed entirely for both existing conditions and post improvement conditions; and second, said levees remained in place and became a barrier along

the easterly (Fuqua Road) and northerly (Hiller Road) floodplain boundary for both existing conditions and post improvement conditions.

For existing conditions:

For the first simulation, (levees removed) the floodwater depth varied over the U of A cultivated fields from about 3/4-foot at the higher elevations to 2-feet with patches over 2.0-feet along the east side of White & Parker Road. Depths reach 3 and 3.5-feet west of White & Parker Road.

The second simulation (levees remaining in place) the floodwater depth varied over the U of A cultivated fields from less 3/4-foot at the higher elevations to 2.5-feet near Hiller Road. Depths reach 3 and 3.5-feet west of White & Parker Road.

The floodwater is expected to pass over the property within about 4 days for existing conditions.

For Hacienda / Meritage post improvement conditions:

For the first simulation, (levees removed) the floodwater depth varied over the U of A cultivated fields from 1-foot at the higher elevations to 2.5-feet near white & Parker Road and Hiller Road.

The second simulation (levees remaining in place) floodwater depth varied over the U of A cultivated fields from about 1-foot at the higher elevations to 4.5-feet near White & Parker Road and Hiller Road.

The floodwater is expected to pass over the property within about 3½ days for post improvement conditions.

The reduction from 4 to 3½ days for post improvement conditions is related to the existing channel or floodway capacity. For existing conditions, only about 2,000 cfs can enter the upstream channel; therefore, 7,800 cfs is spread onto the floodplain. For post improvement conditions, the improved channel will carry the most of the 9,800 cfs from Peters & Nall Road to a point ¼ mile north of Honeycutt Road, and the existing channel from the spreader facility to the GRIC property at Hiller Road will carry about 3,500 cfs. Therefore, only 6,300 cfs will be spread to the floodplain which consists of U of A cultivated fields.

University of Arizona's Question No. 4
Projects Adjacent to the West Side of White & Parker Road:

Hacienda / Meritage is the name of the development located south of Hiller Road and west of White Parker Road. For existing conditions, their westerly floodplain limit is located about ¼-mile west of White and Parker Road at Smith-Enke Road, and about ½-mile west of White and Parker Road at Hiller Road. The initial proposal, for the post improvement simulation, was to provide a barrier along White & Parker Road which will place the west boundary of the floodplain at White and Parker Road. This will cause greater depths of flooding on the U of A cultivated fields.

However, design of proposed improvements in the area west of White & Parker Road is now in the final stages, and the outcome is currently uncertain. Therefore, simulation of future

conditions hydraulic floodplain models are currently being developed (trial & error method) for various solutions which are proposed by the engineers for Hacienda / Meritage.

University of Arizona's Question No. 5
Preliminary Drainage Report for Cortona Project:

Cortona is a 487-acre Planned Area Development located east of Hartman Road, South of Farrell Road , west of Murphy Road and north of Steen Road in the City of Maricopa.

AMEC's report[1] shows a 10.8 square mile drainage area east of the Cortona site. It contributes 2,900 cfs to the Santa Cruz River at Steen Road. The report says nothing to suggest that the 9,800 cfs and the 2,900 cfs are additive. The time of concentration corresponding to the 2,900 cfs is on the order of a few hours while the time of concentration corresponding to the 9,800 cfs is a week or more.

The Report says *"...Currently, the Santa Cruz wash impacts the site at its southern boundary, approximately 1/4 mile east of Hartman Road. The 100-year flow in this wash has been identified in a preliminary technical analysis of the site entitled* ***Section 4 Property - Hydrologic and Hydraulic Analysis,*** *prepared be Coe & Van Loo Consultants, Inc., dated December 2, 2004 (Ref. 5). This analysis conservatively estimates the 100-year flow in the wash at 9,800 cfs."*

For the 100-year return frequency flood event, the hydrographs are not additive. Therefore, the 100-year event for the Santa Cruz River at the Maricopa-Casa Grande Highway is 9,800 cfs.

University of Arizona's Question No. 6
Concept of Retention on U of A Property:
A hydrograph was developed from data recorded at the Cortaro monitoring station for the 1983 flood. A prorated hydrograph was developed for the 9,800 cfs peak flow at the U of A project site. The runoff volume of 26,375 acre-feet was calculated (area under the curve) for the project site hydrograph. An approximate method of calculating the required storage volume, knowing the total runoff volume, inflow rate and outflow rate, is described in TR-55[2]. From the Tables in Question No. 1 above, the peak inflow is 6,100 cfs and the peak outflow is 5,958 cfs. From TR-55, figure 6-1, page 6-2, the ratio of storage volume to runoff volume is 0.15 which yields a total storage volume of 3,956 acre-feet. Detention area size is shown in the following table for depths ranging from 1-foot to 10-feet.

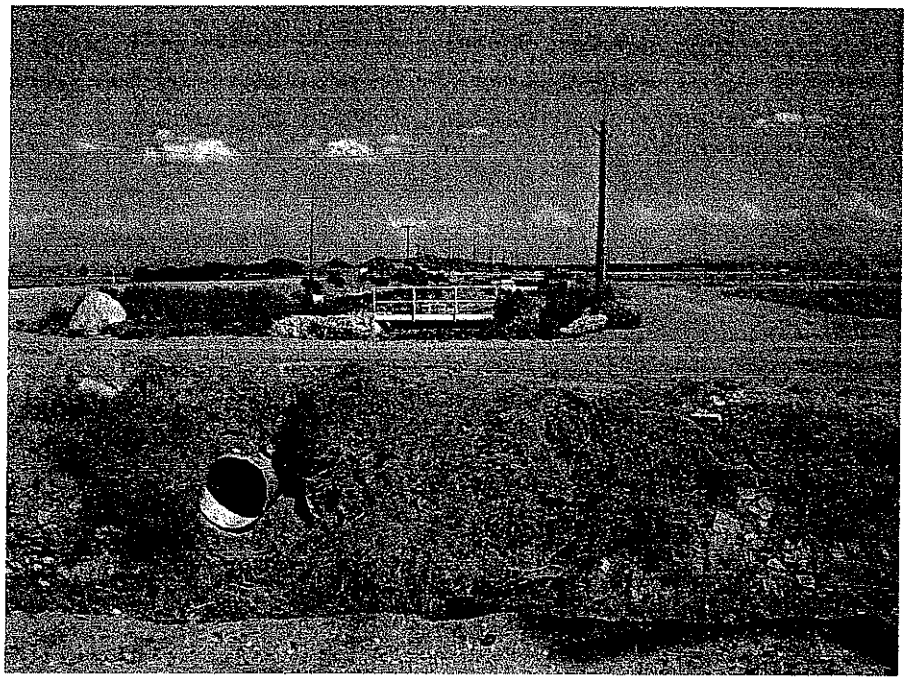
Detention Basin Size			
Depth Feet	**Area Acres**	**Depth Feet**	**Area Acres**
1	3,956	6	659
2	1,978	7	565
3	1,319	8	495
4	989	9	440
5	791	10	396

[1] Preliminary Drainage Report for Cortona, ***amec*** Project No. 01-2005-003, Tim Anderson, February 2006.
[2] Urban Hydrology for Small Watersheds, Technical Release 55, Soil Conservation Service, June 1986.

University of Arizona's Question No. 7

Is the Drainage Flow from this Irrigation Tailwater Ditch Additive to the Santa Cruz Regional Flood Peak?

This irrigation ditch extends easterly from the existing Santa Cruz River floodway or channel a distance of 2 ½ miles to where potentially it can receive irrigation water overflow from two existing tailwater ponds. The two ponds are on GRIC property and provide irrigation water for cultivated fields.



Looking Easterly from Santa Cruz Channel at Irrigation Tailwater Ditch ½ Mile North of Honeycutt Road

There is a 26 square mile upstream basin that contributes both irrigation tailwater and runoff flows to the two ponds. These ponds are relatively large and have a sizeable detention capacity. Time of concentration at the two ponds is about 5 hours, and The time of concentration for the Santa Cruz River floodwaters is two to three weeks. Therefore, the runoff hydrographs for this 26 square mile basin and the 9,800 cfs corresponding to the Santa Cruz River 100-year return frequency event are not additive.

The ditch's hydraulic capacity (determined by field observation of ditch characteristics) is about 600 cfs. If the existing tailwater ponds were to be filled by storm runoff and if pond overflow were to exceed the ditch's capacity, the excess discharge will overflow the west bank and flow northwesterly across the GRIC cultivated fields. Excess runoff will eventually enter the Santa Cruz River channel at a location 2 or 3 miles north of Hiller Road on the GRIC property.

APPENDIX C

City of Maricopa – Correspondence

August 29, 2007

Ms. Linda Cheney
Project Manager
El Dorado Holdings, Inc.
426 N. 44th Street, Suite 100
Phoenix, Arizona 85008

Re: Eagle Shadow Phase 2 and 3 MPD (Master Planned Development) Amendment (PAD 07-03).

The Planning, Engineering and Transportation Departments upon review of the Eagle Shadow Phase 2 and 3 MPD amendment application request have made a final determination based on the exhibits, narrative, discussions and verbal agreement reached with City staff.

The proposed Eagle Shadow MPD (Master Planned Development) application request for Phase 2 and 3 has been further determined by the Planning Department to be a minor amendment and is hereby administratively approved with the following stipulations:

CONDITIONS OF APPROVAL

1. This amendment is applicable to Eagle Shadow MPD Phase 2 & 3 only; Phase 4 and 5 are not included. With the administrative approval of the Eagle Shadow MPD, Phase 2 & 3 as minor amendment; all original stipulations imposed for Eagle Shadow MPD (Ordinance 05-13), and as approved by the City Council shall remain intact and effective.

2. Prior to the submittal of the Eagle Shadow Phase 2A Preliminary Plat, the applicant shall have a signed agreement (Letter of Understanding) between the City of Maricopa and the Developer (El Dorado Holdings) for the donation of a Public Park within the Eagle Shadow Phase 2A subdivision.

3. The Fire Station site located in Phase 2A in the TR (Transitional Zone) district (Parcel 5 of the Amended MPD Land Use Plan) is approved with this minor amendment. The Fire Station site shall be included in the Phase 2A preliminary plat and shall not be deleted or moved to another phase or sub-phase of Eagle Shadow. The approximately 2.5 to 3 acre fire station site shall be included in the Parcel 5 Final Plat. The applicant will not be responsible for the preparation or processing for

approval of the site plan, the on-site improvement plans or the building plans for the Fire Station.

4. As pert of this MPD minor amendment, and prior to approval of Phase 3 preliminary plat, a letter of agreement from the Maricopa Unified School District Board shall be submitted to the City for the location of school site in Parcel 11 of Phase 3 as shown in the proposed MPD amendment [WAITING ON RESPONSE FROM THE APPLICANT]

5. Prior to submittal of any preliminary plat review for Phase 2 & 3, the Developer shall provide 24"x 36" MPD exhibit and an electronic copy with modifications per the final approved MPD amendment (minimum 4 copies). Please remove RED Color designation (fire station site) from TR designation. It is confusing. KAZI ALSO.

6. Prior to the approval of the preliminary plat for Phase 2A, the timing and sequencing of each phase (Phase 2 & 3) shall be addressed along with all off-site improvements and expected timeline, including bridges for staff review and approval. Applicant will provide an estimated project schedules identifying the timing, sequence and duration of development for Phase 2 and 3.

7. The non-arterial street crossings (three locations) of the North Santa Cruz Wash located within Eagle Shadow Phase 2 and 3 shall be low water culvert crossings and shall be designed to carry 1000 cfs.

8. Stormwater retention is not permitted in the effluent lakes within the project unless permission is obtained from Global Water.

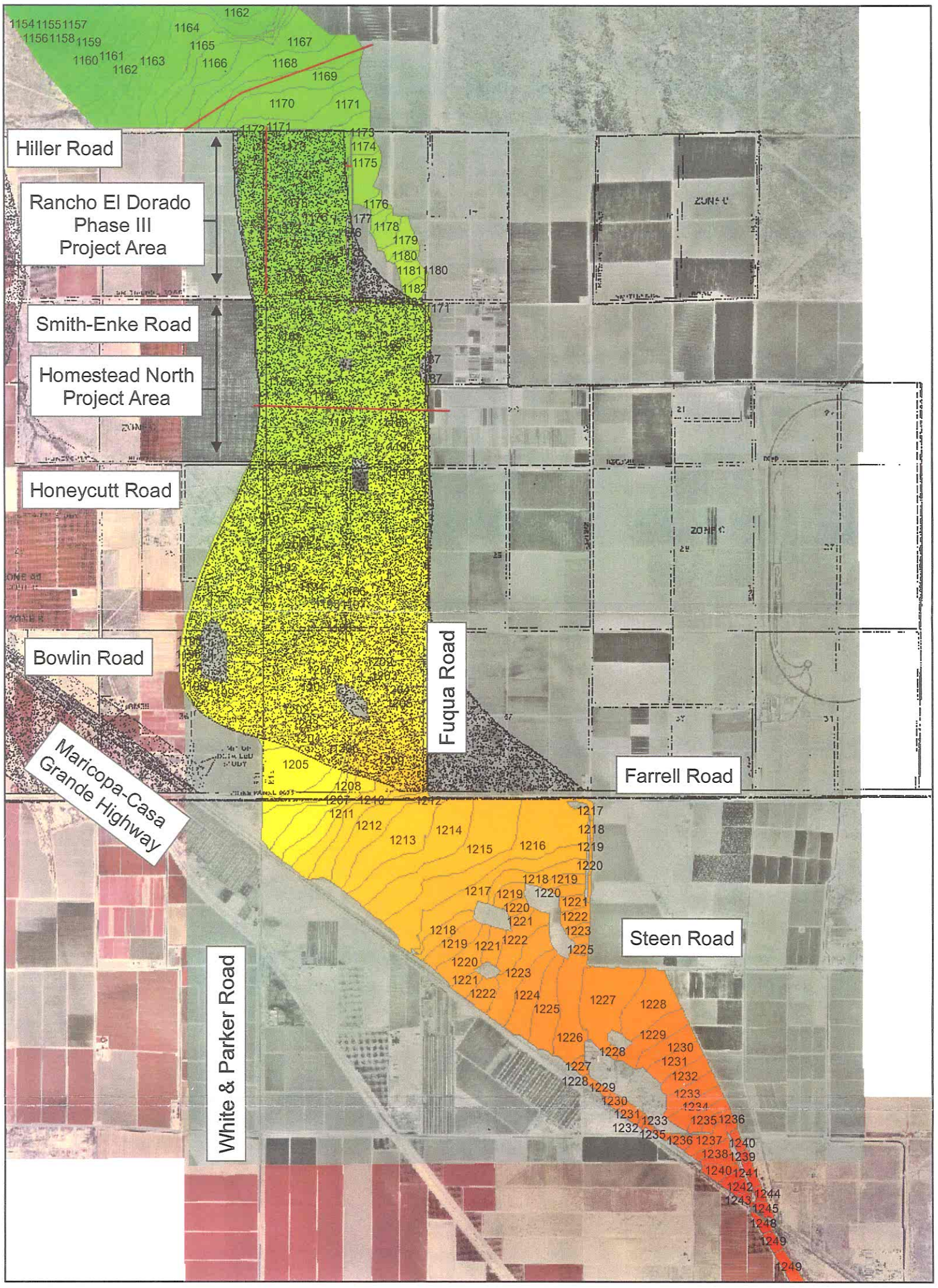
9. No final plats within Phase 2 and 3 where there are residential lots that lie within the North Santa Cruz Wash (NSCW) flood plain will be recorded until the NSCW regional solution is approved by City Council and FEMA has issued a Conditional Letter of Map Revision (CLOMR) on the channelization.

10. It is understood that the Developer will be satisfying a stipulation for the four (4) lane bridge on Bowlin Road as stipulated with the approval of the preliminary plat of Eagle Shadow Phase 1 (REVISED). — NO FARRELL —

APPENDIX D

Floodplain Delineations

Santa Cruz Wash Floodplain
Water Surface Elevations
Existing Conditions
Rancho El Dorado
Phase III



0 800 1,600 3,200 4,800 Feet

N

Legend

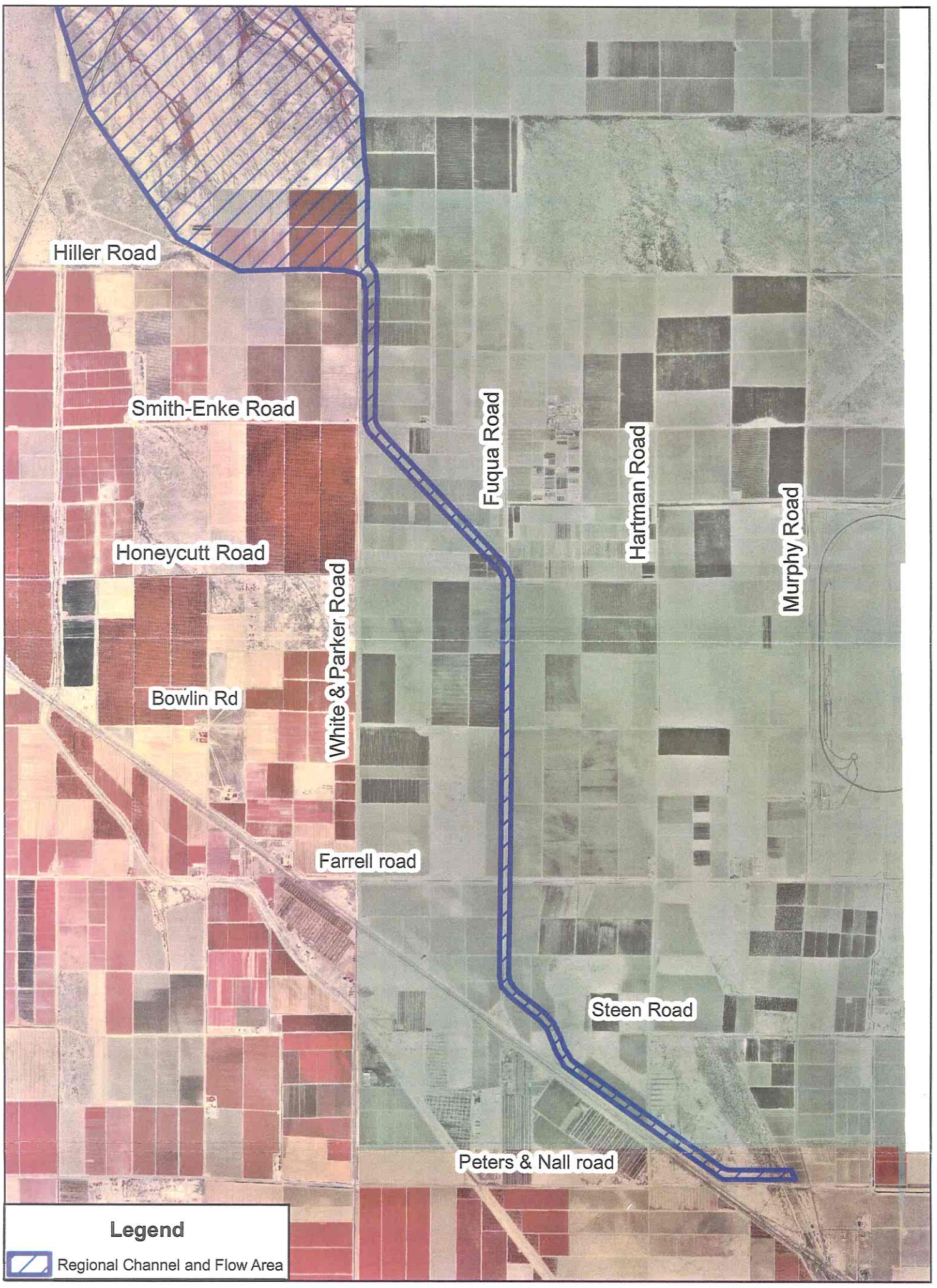
Model Tie In Lines

River Research & Design, Inc.

North Santa Cruz Wash

Proposed Regional Flood Control Project

Channel, Weir, and Splitter in Place



R2D
River Research & Design, Inc.

WILLDAN
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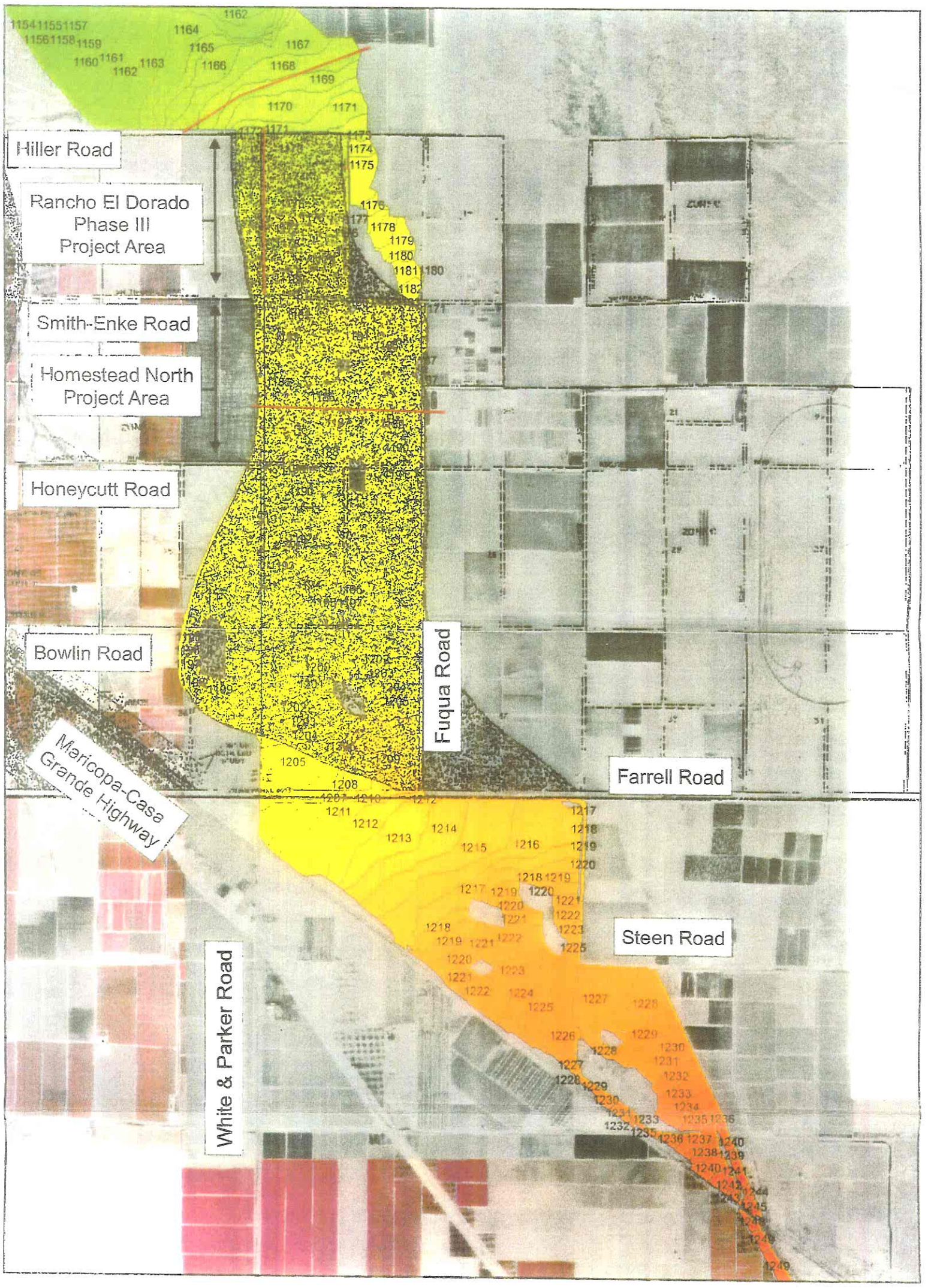
Santa Cruz Wash Floodplain
Water Surface Elevations
Existing Conditions
Rancho El Dorado
Phase III



0 800 1,600 3,200 4,800 Feet

N

Legend

Model Tie In Lines

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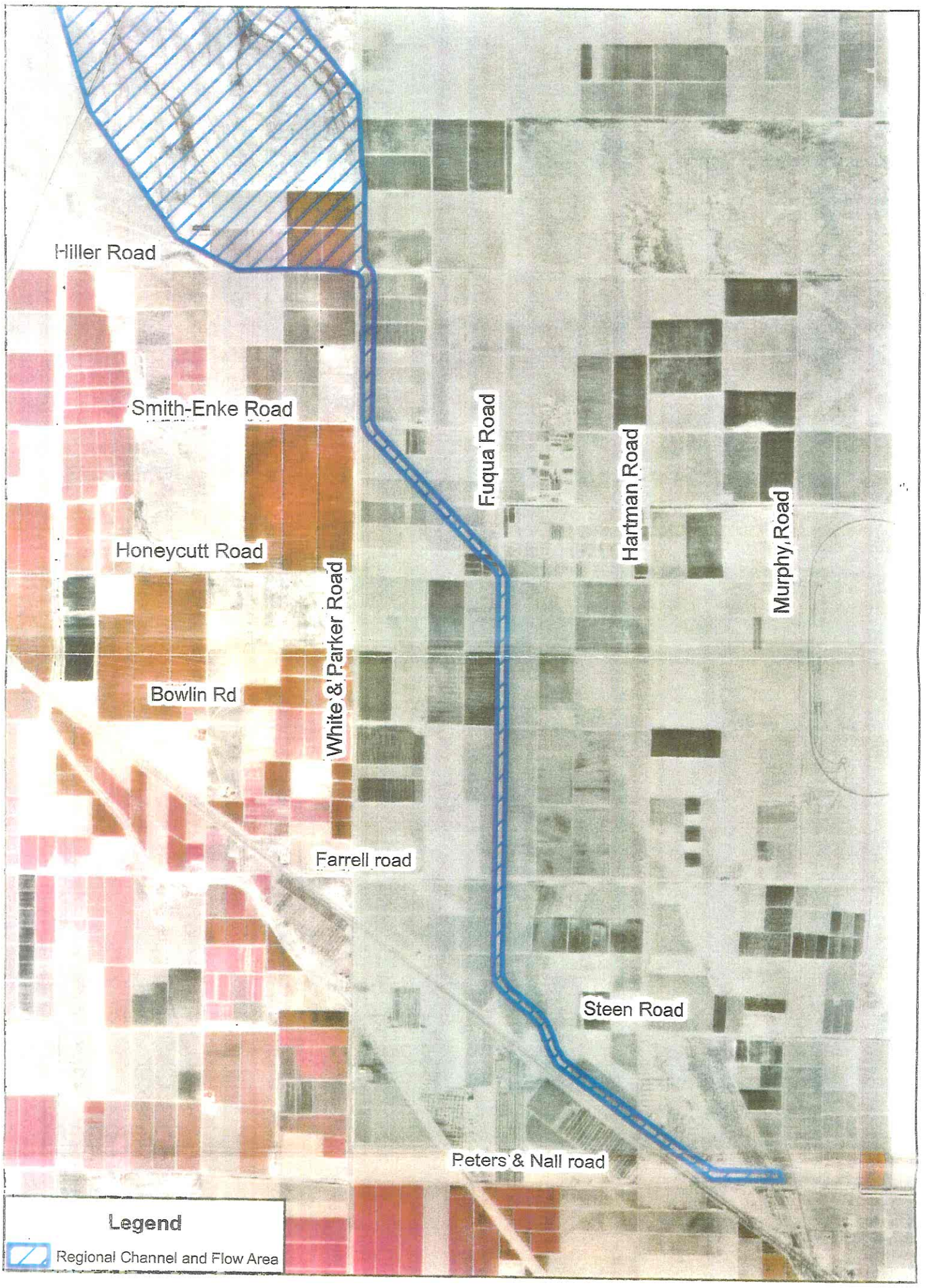
North Santa Cruz Wash

Proposed Regional Flood Control Project

Channel, Weir, and Splitter in Place



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APPENDIX E

Archaeological Resources

A WORK PLAN FOR ARCHAEOLOGICAL TESTING AT FOUR SITES (AZ U:13:260–263 [ASM]) ON PRIVATE LAND ALONG THE NORTH SANTA CRUZ WASH SIX MILES SOUTHEAST OF MARICOPA, PINAL COUNTY, ARIZONA

by

Thomas E. Wright

submitted by:

Lyle M. Stone, Ph.D., RPA
Archaeological Research Services, Inc.
2123 S. Hu-Esta Drive
Tempe, Arizona 85282

prepared for:

Ms. Noelle Sanders
Sage Landscape Architecture & Environmental
1438 W. Broadway Road, Suite 208
Tempe, Arizona 85282

April 26, 2006

Archaeological Research Services, Inc. Work Plan No. 2006:039

Archaeological Research Services, Inc.

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Figure 1. Project Area Location and Archaeological Sites