

DRAFT



MEMORANDUM

Date: February 26, 2001

To: The Honorable Chair and Members
Pima County Board of Supervisors

From: C.H. Huckelberry
County Administrator

A handwritten signature in black ink, appearing to read "CHH", is written over the printed name "C.H. Huckelberry".

Re: **Floodplain Primer**

Background

As we near completion of the Sonoran Desert Conservation Plan, opportunities arise to make changes to County ordinances and operations that will assist in plan implementation. The Pima County Flood Control District was formed in 1978. In less than a quarter century, we have seen the functions of the District expand from a narrow focus on the mitigation of flood and erosion damage to include environmental restoration and enhancement of floodplain areas. The Riparian Preservation and Restoration Division of the Flood Control District, which the Board established by direction on September 26, 2000, will ensure that the conservation role of the Flood Control District continues to evolve.

A similar shift is taking place with the District's primary federal partner: the Army Corps of Engineers. Just as water development was the mission of last century, conservation and preservation will become increasingly important in the next century. Pima County and the Army Corps of Engineers are leading this paradigm change at the federal and local level through a series of jointly sponsored projects that serve as models for the new way of protecting floodplains and riparian areas.

At the same time, a new floodplain standard is being promoted by a national organization of floodplain professionals to address the general failure of the National Flood Insurance Program and federal flood assistance to improve annual rates of flood damage. Called the "good neighbor" floodplain policy, this approach is based on the premise of allowing no adverse impacts by landowners of adjacent property. In other words, a no adverse impact floodplain is one in which the actions of one property owner do not have a negative impact on the flood risk to other properties, as measured by flood peaks, flood stage, flood velocity, overbank storage, erosion and sedimentation. I directed staff to include considerations of this policy as part of the Sonoran Desert Conservation Plan and the major plan amendment of the Comprehensive Plan. Options to revise the existing floodplain ordinance will be forwarded to the Board.

This memorandum briefly summarizes the attached study entitled *Floodplain Primer*, which analyzes the status and current flood control approach of various reaches of ten watercourses in Eastern Pima County: (1) Santa Cruz River, (2) Rillito Creek, (3) Canada del Oro Wash, (4) Pantano Wash, (5) Tanque Verde Creek, (6) Agua Caliente Wash, (7) Sabino Creek, (8) Rincon Creek, (9) Black Wash, and (10) Brawley Wash.

1. Santa Cruz River -- The Santa Cruz River is discussed in terms of six reaches across Eastern Pima County. Currently planned approaches are subject to change under the Sonoran Desert Conservation Plan.

(1) Santa Cruz County Line to Nogales Highway Crossing

- **Status** -- Channel banks are mostly natural, except for bank stabilization along six stretches.
- **Flood Control Approach** -- Maintain the natural floodplain. Preserve overbank floodwater storage areas. Maintain sediment transport characteristics. Preserve riparian habitat.

(2) Nogales Highway to Pima Mine Road

- **Status** -- Channel banks are in a natural state. Limited bank stabilization occurs at the Pima Mine bridge. No additional bank stabilization is planned.
- **Flood Control Approach** -- Maintain the natural floodplain, including preserving overbank floodwater storage areas. Maintain the sediment transport characteristics. Preserve existing riparian habitat.

(3) Pima Mine Road to Los Reales Road -- This area is within the San Xavier District.

(4) Los Reales Road to Grant Road

- **Status** -- Much of the watercourse has been bank stabilized.
- **Flood Control Approach** -- Currently, bank protection is planned along all of this reach. In some locations, low-flow protection may be provided as part of the proposed Paseo de las Iglesias project.

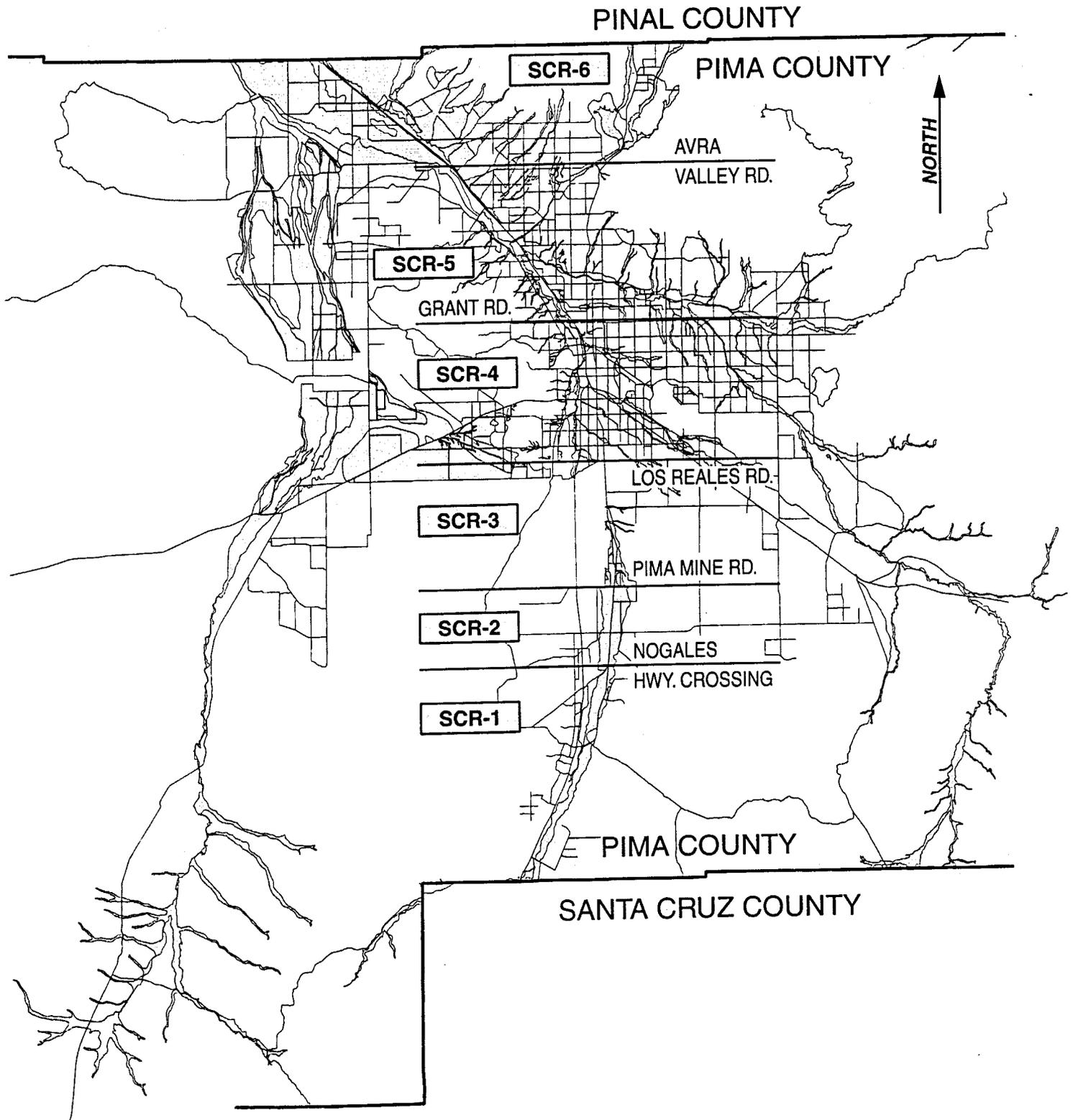
(5) Grant Road to Avra Valley Road

- **Status** -- Most of reach of the river is in the City of Tucson or Town of Marana and has stretches of river where bank stabilization exists.
- **Flood Control Approach** -- Currently bank stabilization is planned throughout most of this reach, except in areas where sand and gravel mining occurs.

(6) Avra Valley Road to the Pinal County Line

- **Status** -- Bank stabilization in areas; construction of Lower Santa Cruz River levee.
- **Flood Control Approach** -- Flood control levee planned along north bank for entire reach.

RIVER REACHES-SANTA CRUZ RIVER



2. Rillito River -- The Rillito River is discussed in terms of three reaches: Craycroft Road to Country Club Road; Country Club to La Cholla Boulevard; and La Cholla Boulevard to the Santa Cruz River. Bank stabilization has been ongoing since the late 1970s to protect development and public infrastructure that built out before local floodplain regulations were in place.

3. Canada Del Oro Wash -- The Canada Del Oro is discussed in terms of four reaches.

(1) Pinal County Line to Oracle Highway

- **Status** -- Channel banks are natural and no bank stabilization is planned.
- **Flood Control Approach** -- Maintain the natural floodplain, and preserve overbank storage to mitigate downstream flood peak discharges.

(2) Oracle Highway to La Canada Drive

- **Status** -- A flood control levee is located along the south bank. Bank stabilization protects the north bank in places. No additional structural improvements are planned.
- **Flood Control Approach** -- Current plans are that areas north of the channel will remain natural, to serve as an erosion buffer area along the north bank.

(3) La Canada Drive to La Cholla Boulevard

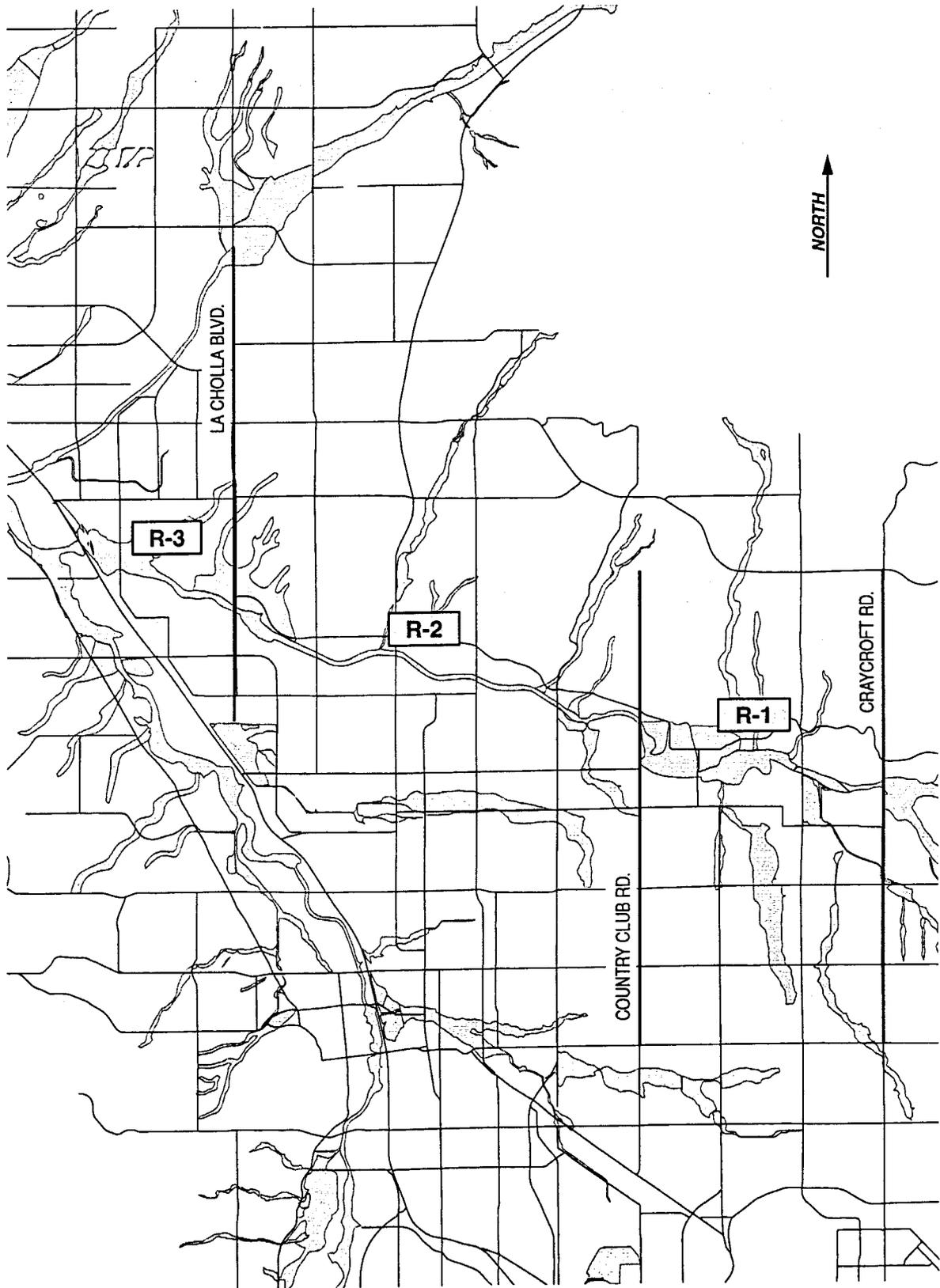
- **Status** -- The reach has natural channel banks except for 2500 feet of stabilization to protect a subdivision. No additional stabilization is planned.
- **Flood Control Approach** -- Maintain natural floodplain.

(4) La Cholla Boulevard to the Santa Cruz River

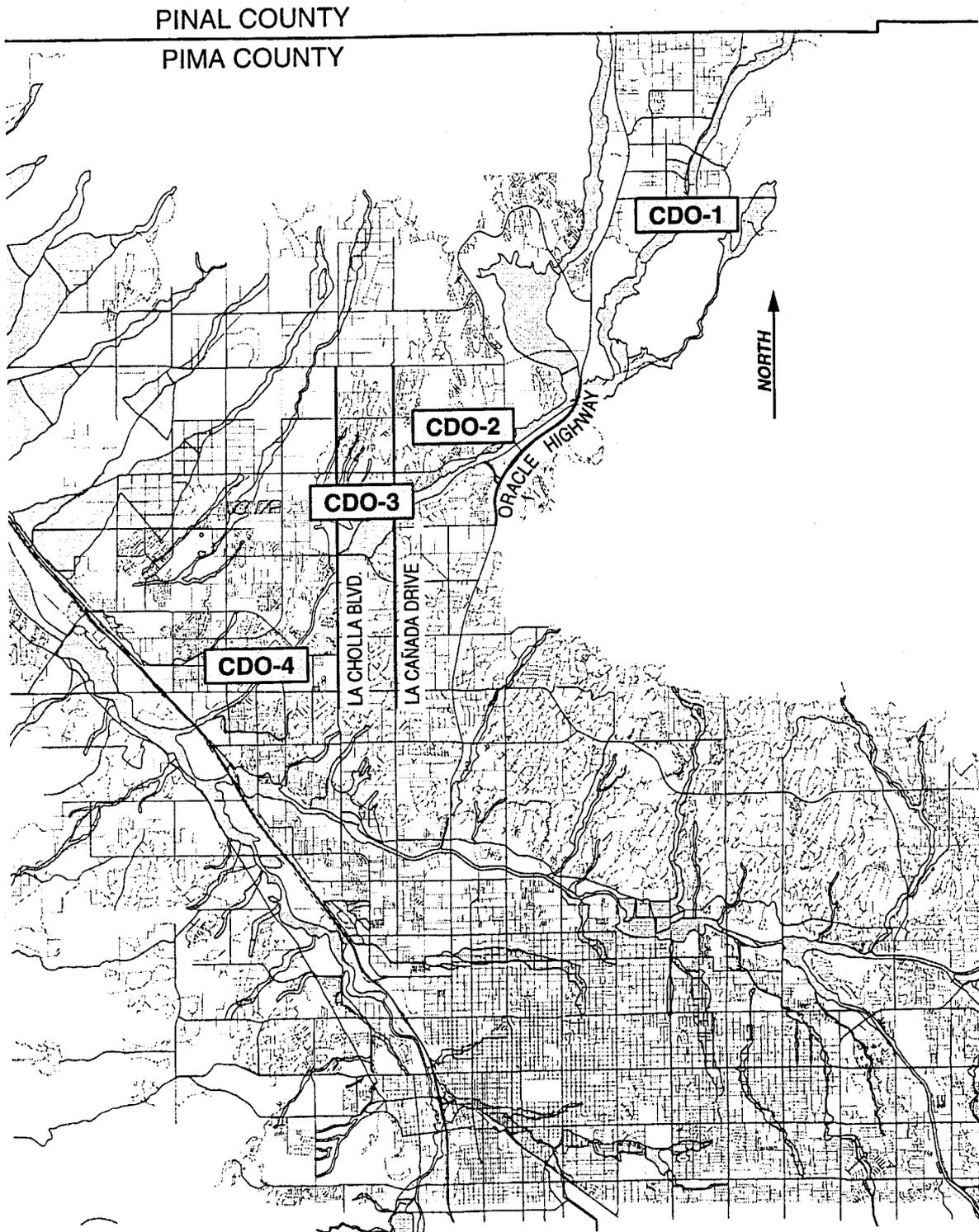
- **Status and Flood Control Approach** -- Most of the reach has been bank stabilized.

The figures on the next pages show the three reaches of the Rillito Creek and four reaches of the Canada Del Oro Wash described above.

RILLITO CREEK



CAÑADA DEL ORO WASH



4. Pantano Wash -- The Pantano Wash is described according to three reaches.

(1) Colossal Cave Road to Houghton Road

- **Status** -- The channel banks are natural, except for some localized stabilization. No additional stabilization is planned, although grade control structures may be required if sand and gravel mining continues.
- **Flood Control Approach** -- Preserve the natural channel.

(2) Houghton Road to Golf Links Road

- **Status** -- Mostly natural banks with some local soil cement stabilization.
- **Flood Control Approach** -- Increasing urbanization may call for additional bank protection.

(3) Golf Links Road to Craycroft Road

- **Status** -- Mostly stabilized banks along both sides of the reach.
- **Flood Control Approach** -- Natural banks between Golf Links and Tanque Verde Road may require stabilization.

5. Tanque Verde Creek -- The *Floodplain Primer* describes three reaches of the Tanque Verde.

(1) Coronado National Forest to Tanque Verde Road

- **Status** -- Banks are natural with stabilization at bridges and along segments.
- **Flood Control Approach** -- Leave channel banks natural except in vulnerable locations.

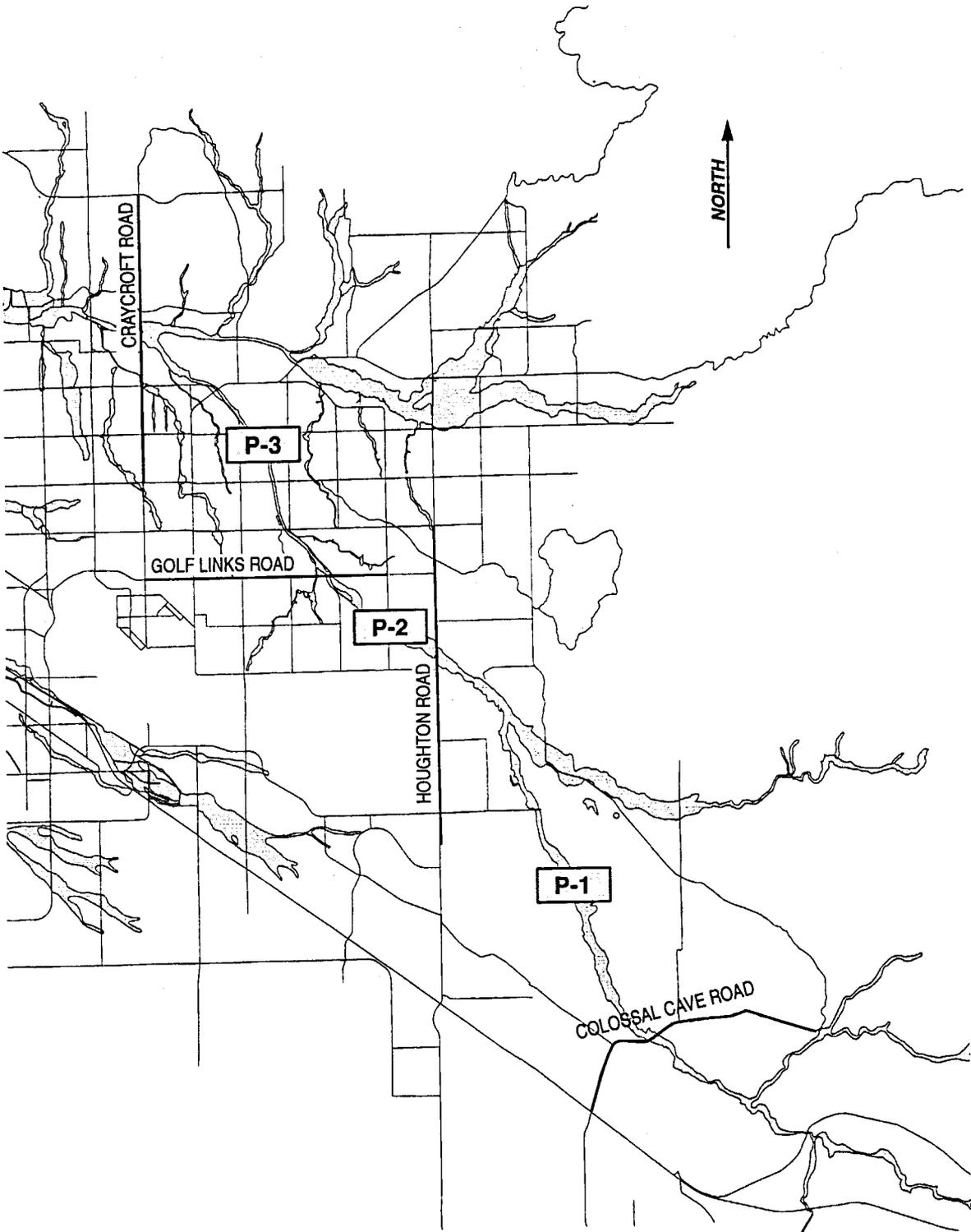
(2) Tanque Verde Road to Sabino Canyon Road

- **Status** -- The entire reach has been stabilized with soil cement.

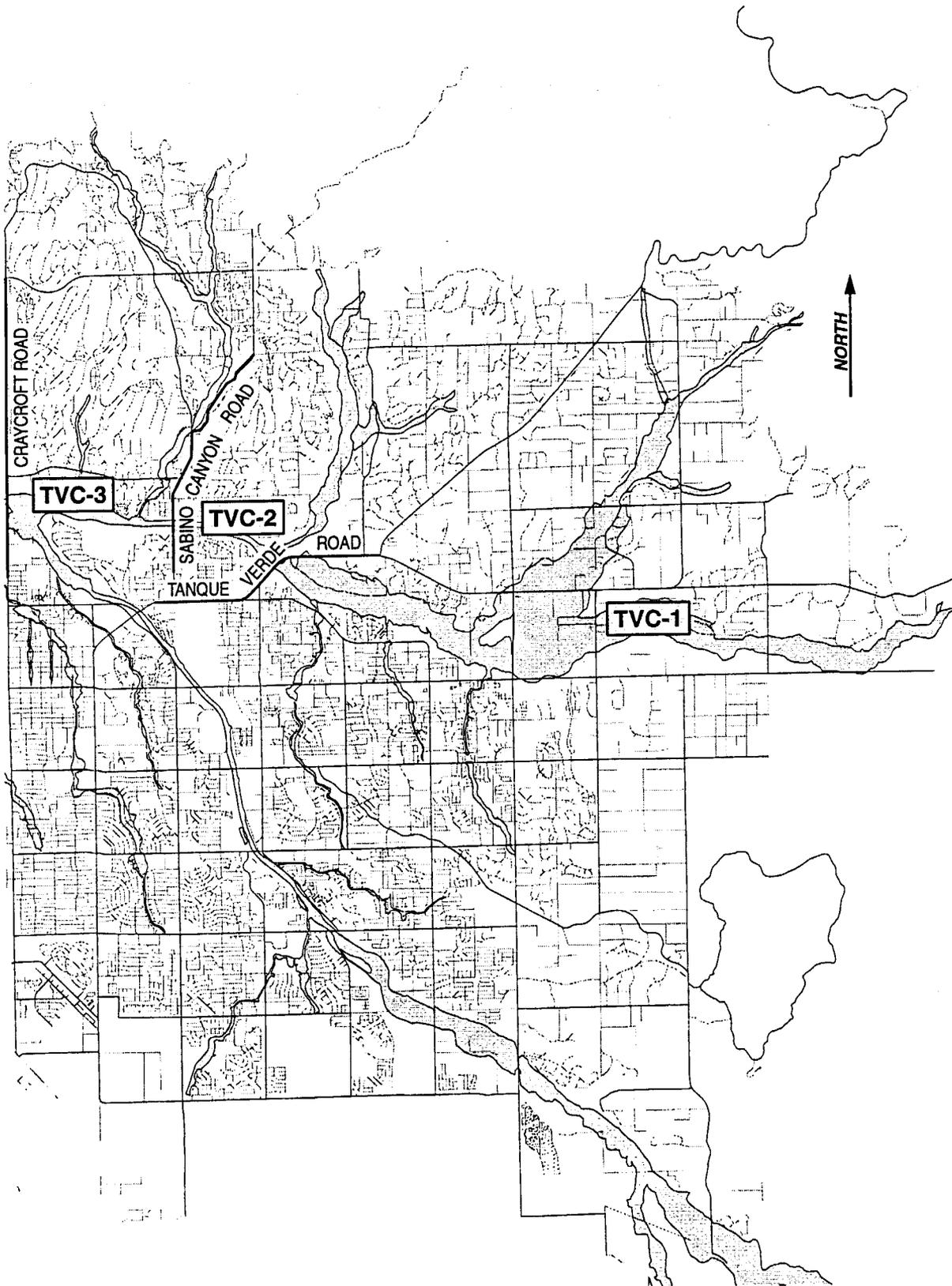
(3) Sabino Canyon Road to Craycroft Road

- **Status** -- Channel banks are natural except for localized stabilization.
- **Flood Control Approach** -- The District describes its recommendation to protect the entire south bank while leaving the north bank natural. Discussion of this will take place during the Sonoran Desert Conservation Planning process.

PANTANO WASH



TANQUE VERDE CREEK



CORONADO NATIONAL FOREST

6. Agua Caliente Wash --

(1) Coronado National Forest to Soldier Trail

- **Status / Approach** -- The channel is natural. Maintain the natural channel and floodplain.

(2) Soldier Trail to Tanque Verde Road

- **Status / Approach** -- Banks are mostly natural with isolated protection. A diversion structure is proposed upstream of Tanque Verde Road. Maintain natural channel.

(3) Tanque Verde Road to Tanque Verde Creek Confluence

- **Status / Approach** -- The channel is natural. Maintain natural channel and floodplain

7. Sabino Creek

(1) Coronado National Forest to Snyder Road

- **Status / Approach** -- The channel is natural. Maintain the natural floodplain and overbank.

(2) Snyder Road to Tanque Verde Creek Confluence

- **Status / Approach** -- Channel banks are mostly natural. Maintain the natural floodplain.

8. Rincon Creek

(1) Coronado National Forest to Camino Loma Alta

- **Status / Approach** -- Channel banks are natural; maintain natural floodplain.

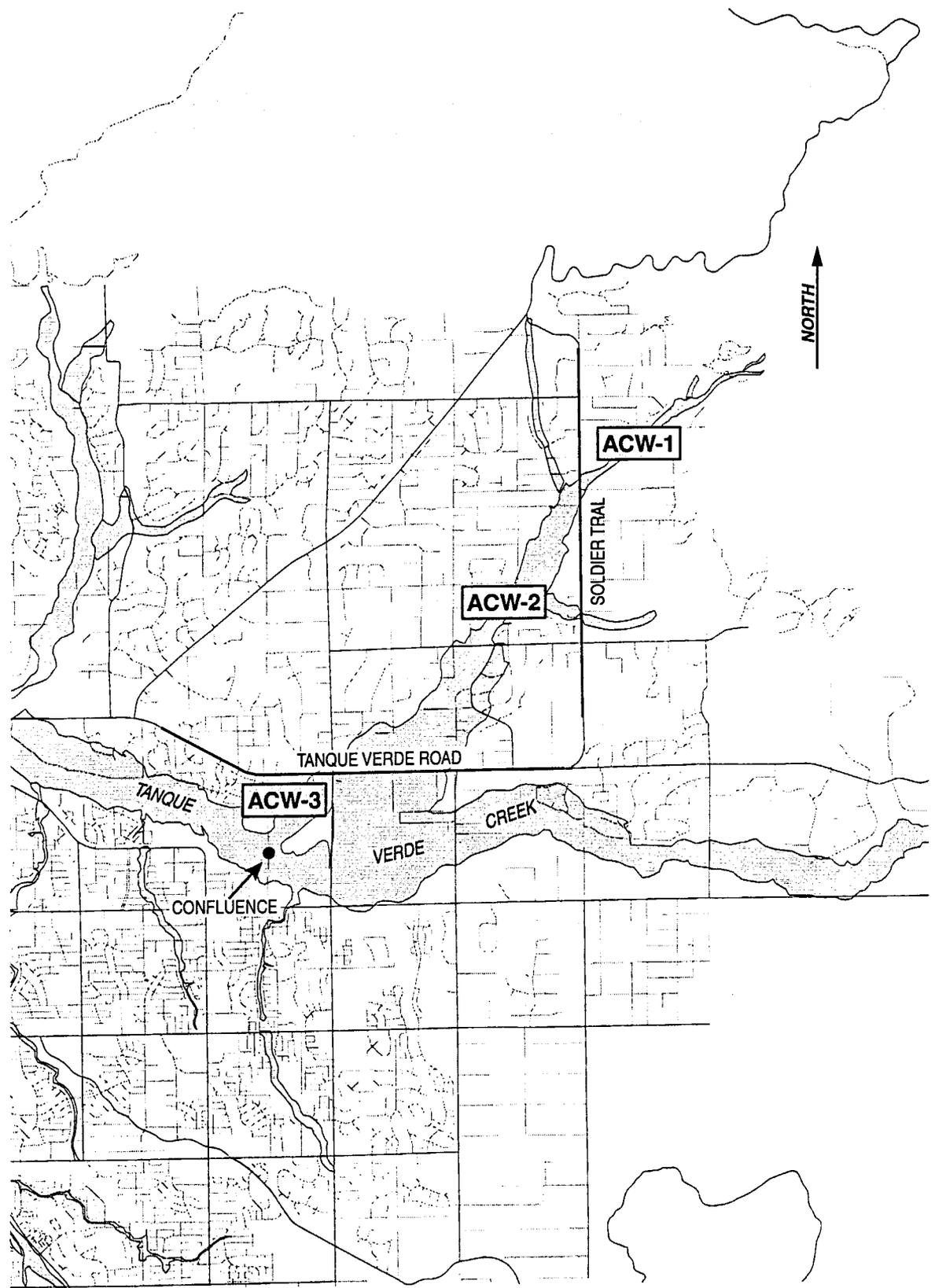
(2) Camino Loma Alta to Old Spanish Trail

- **Status / Approach** -- Channel banks are natural but entire floodplain was disturbed by prior agricultural uses. Flood Control plans call for maintaining a low flow channel to largely contain the 100 year flow within a 400 to 600 foot wide natural area.

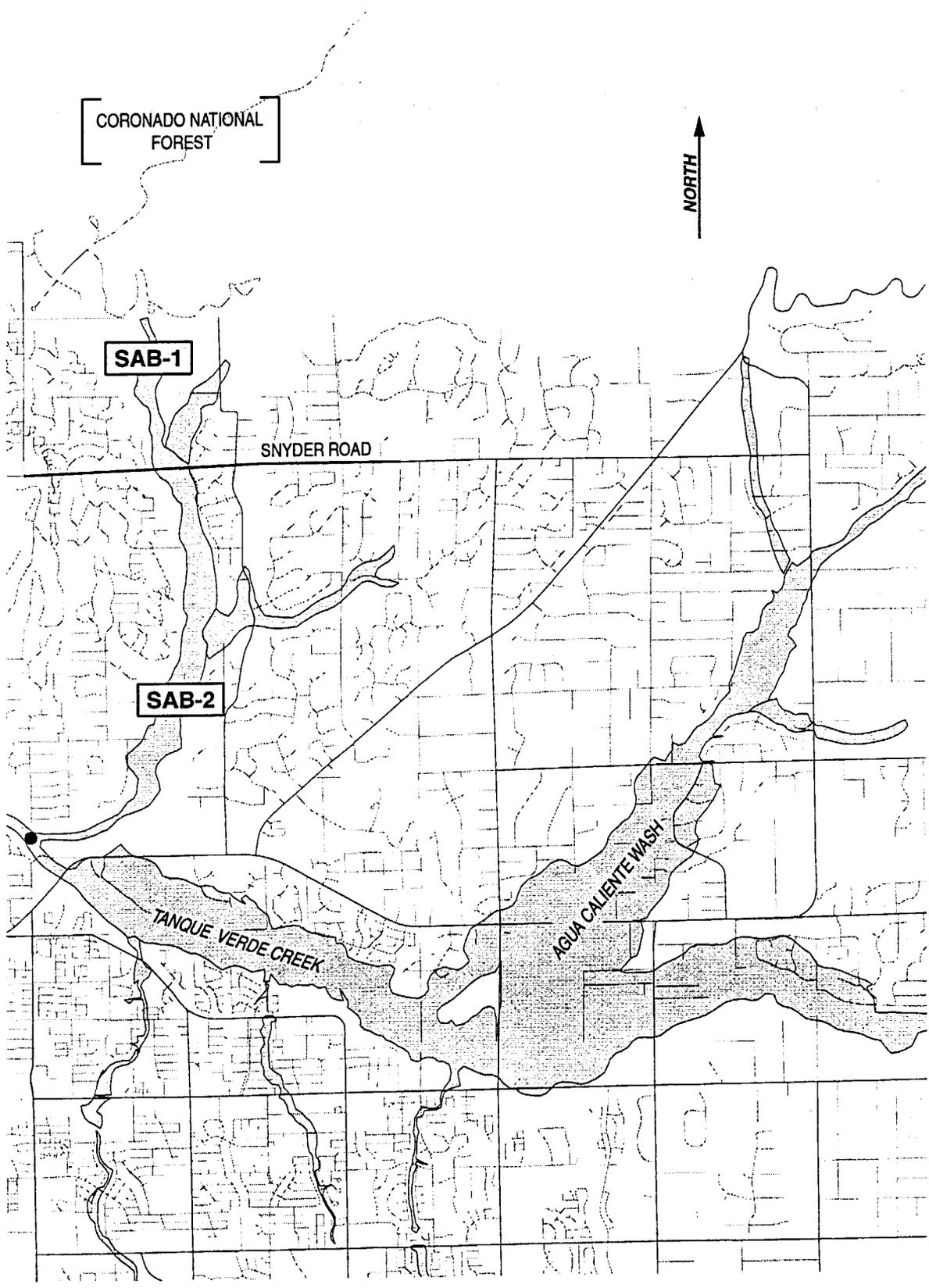
(3) Old Spanish Trail to Pantano Wash

- **Status / Approach** -- The channel banks are natural but the floodplain was disturbed by past agricultural uses. No structural improvements are planned. The current approach calls for maintaining the natural floodplain and overbank storage to reduce downstream peak discharge.

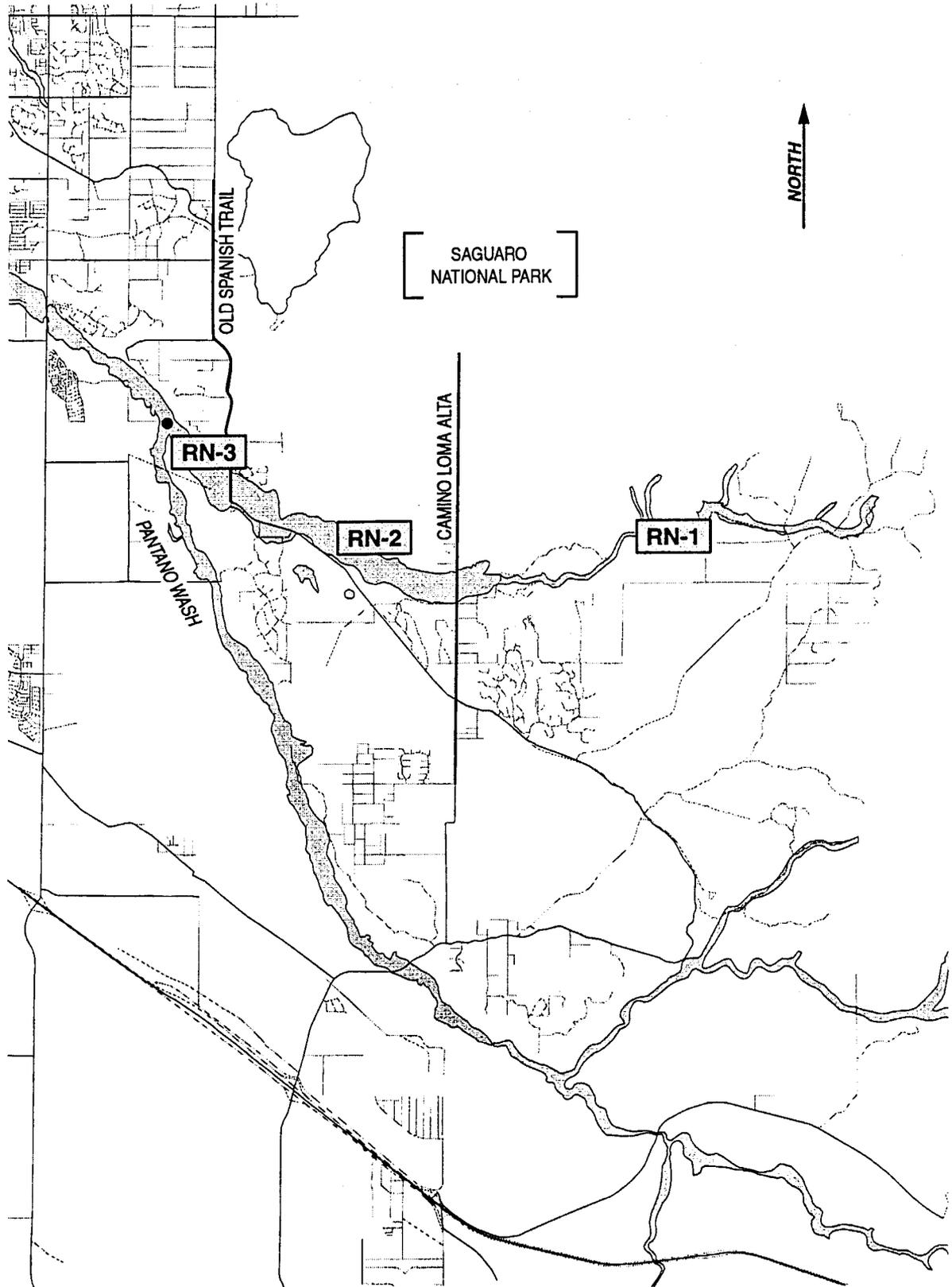
AGUA CALIENTE WASH



SABINO CREEK



RINCON CREEK



9. Black Wash

(1) Cardinal Avenue to Ajo Highway

- **Status / Approach** -- The channel is natural with no structural improvements planned. Preserve the natural floodplain and riparian vegetation.

(2) Ajo Highway to Sandario Road

- **Status/ Approach** -- The channel is natural with no structural improvements planned. Preserve the natural floodplain and riparian vegetation.

10. Brawley Wash

(1) Ajo Highway to Mile Wide Road

- **Status / Approach** -- The natural braided channel pattern extends across a broad floodplain. No structural improvements are planned. The approach is to preserve the natural floodplain and riparian vegetation.

(2) Mile Wide Road to Orange Grove Road Alignment

- **Status / Approach** -- The natural braided channel pattern extends across a broad floodplain. No structural improvements are planned. The approach is to preserve the natural floodplain and riparian vegetation.

(3) Orange Grove Road Alignment to Confluence with Blanco Wash at Silverbell Road

- **Status / Approach** -- The natural braided channel pattern extends across a broad floodplain. No structural improvements are planned. The approach is to preserve the natural floodplain and riparian vegetation.

Conclusion

There is a close correspondence between advance planning and the ability to preserve river channels, maintain riparian vegetation, and avoid bank protection. The status of, and planning approach toward the major watercourses in Eastern Pima County is described in greater detail in the attached *Floodplain Primer* and is intended to facilitate discussion during the next months of the planning process for the Sonoran Desert Conservation Plan.

Attachment



TABLE OF CONTENTS

1.0 INTRODUCTION	1-1
❖ District's Focus on Mitigating Flood and Erosion Damage	
❖ Watercourses Discussed in this Report	
❖ Watercourses Traversing Incorporated Communities and Unincorporated Pima County	
❖ Historic Overview of Major Watercourse Projects	
<i>Bank Stabilization/Erosion Protection/Levees</i>	
<i>Recharge and Replenishment Programs</i>	
<i>Environmental Enhancement and Restoration Programs</i>	
❖ Report Contents	
❖ Purpose of this Report	
2.0 SANTA CRUZ RIVER	2-1
❖ Overview	
❖ Floodplain/Land Use Description	
3.0 RILLITO CREEK	3-1
❖ Overview	
❖ Floodplain/Land Use Description	
4.0 CANADA DEL ORO WASH	4-1
❖ Overview	
❖ Floodplain/Land Use Description	
5.0 PANTANO WASH	5-1
❖ Overview	
❖ Floodplain/Land Use Description	
6.0 TANQUE VERDE CREEK	6-1
❖ Overview	
❖ Floodplain/Land Use Description	
7.0 AGUA CALIENTE WASH	7-1
❖ Overview	
❖ Floodplain/Land Use Description	
8.0 SABINO CREEK	8-1
❖ Overview	
❖ Floodplain/Land Use Description	

(Continued on next page)

TABLE OF CONTENTS (cont'd.)

9.0 RINCON CREEK	9-1
❖ Overview	
❖ Floodplain/Land Use Description	
10.0 BLACK WASH	10-1
❖ Overview	
❖ Floodplain/Land Use Description	
11.0 BRAWLEY WASH	11-1
❖ Overview	
❖ Floodplain/Land Use Description	

1.0 INTRODUCTION

❖ District's Focus on Mitigating Flood and Erosion Damage

The major watercourse program of the Pima County Flood Control District (District) has been evolving since the District was formed in July 1978. When the District was formed, the major watercourses were largely unimproved, although some surrounding development had occurred. In the past 22 years, however, the Tucson area has grown rapidly, with an accompanying increase in private and public development along the major watercourses.

Since 1978, the District has focused on developing and implementing programs intended to minimize flood and erosion damage to existing and proposed developments. Although these regulatory programs have been driven largely by federal regulations and national trends, the District has developed several innovative programs to address issues of local concern.

Beginning in the late 1980's and continuing today, the District has undertaken programs to preserve and enhance groundwater recharge. In 1994, the District began regulating development impacts to mapped riparian habitat, which occurs largely within regulatory floodplains. Consequently, although mitigation of flood and erosion damage continues to be the District's primary goal, increasing attention is being focused on environmental restoration and enhancement of floodplain areas, and recharge along the major watercourses.

❖ Watercourses Discussed in this Report

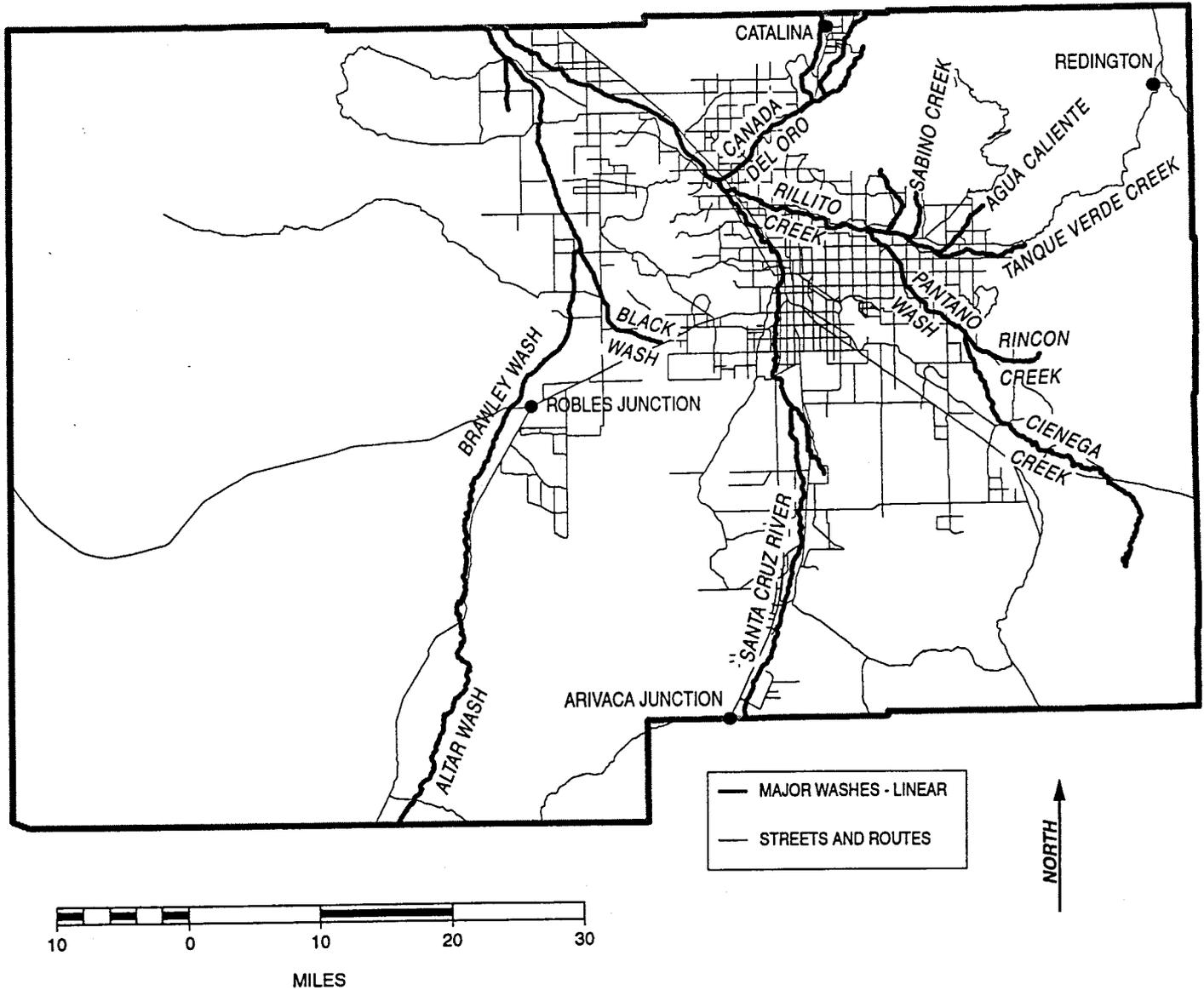
The following major watercourses are considered (see Figure 1-1):

- Santa Cruz River
- Rillito Creek
- Cañada del Oro Wash
- Pantano Wash
- Tanque Verde Creek
- Agua Caliente Wash
- Sabino Creek
- Rincon Creek
- Black Wash
- Brawley Wash

These watercourses were selected because, except for the Black Wash, each has a 100-year discharge in excess of 10,000 cfs, and each is located within an urbanized or urbanizing area (Rincon Creek), or in an area where an increasing number of permits are being sought to develop in the floodplain (Black Wash and Brawley Wash). The Black Wash was included because, although currently there is limited development along the wash, the areas that are developed have

Figure 1-1

MAJOR WATER COURSES IN EASTERN PIMA COUNTY



experienced repeated flood damage, and permits are continually being sought to develop in the Black Wash floodplain.

❖ *Watercourses Traversing Incorporated Communities and Unincorporated Pima County*

This report has been developed by District staff as an internal planning document. However, several of the major watercourses flow through incorporated communities.

Historically, the District has assumed a lead role in managing the major watercourses, because it has had more resources available than other local agencies to dedicate to floodplain management programs. This is because the District is the only local agency authorized to levy taxes on real property for the purpose of administering floodplain management programs. When the District undertakes projects along the major watercourses in incorporated areas, it must work with the community to achieve an agreement regarding the improvements to be implemented. A legally binding agreement must be entered into between the District and the municipality prior to initiation of construction-related activities.

Although the District is the only local agency authorized to levy taxes for floodplain management purposes, other local agencies are authorized to regulate their floodplains. In accordance with Arizona State Statutes, the City of Tucson, and the Towns of Oro Valley and Marana regulate the floodplain within their respective jurisdictions. The City of Tucson can and does implement projects and programs along the major watercourses within its jurisdiction; and the Towns of Oro Valley and Marana are assuming increasing responsibility for implementing major watercourses programs within their jurisdictions.

❖ *Historic Overview of Major Watercourse Projects*

Bank Stabilization/Erosion Protection/Levees

As indicated in Section 1.1, when the District was formed in 1978, there were limited flood control improvements along the major washes. Watercourses with the greatest amount of surrounding urbanization included the **Santa Cruz River, Rillito Creek, Cañada del Oro Wash and Pantano Wash**. Each was highly channelized, however, some areas experienced overbank flooding, and the earthen channel banks were susceptible to erosion, posing a threat to nearby development and public infrastructure. In addition, because development was present along both sides of these washes, bridges were needed to provide all-weather access across them.

The District identified selected reaches as priority areas where bank stabilization and/or levees would be constructed to protect adjacent areas and public infrastructure from erosion and flooding. Over the past 22 years, channel banks along many of the vulnerable reaches within the

urbanized areas have been stabilized.

Much development had also occurred adjacent to **Tanque Verde Creek, Agua Caliente Wash and Sabino Creek**. Located in the eastern and northeastern parts of the Tucson Valley, these washes are less channelized than those mentioned above, and overbank flooding occurs during moderate and larger events. More riparian vegetation is present, and these washes retain more of their natural floodplain areas than the Santa Cruz River, Rillito Creek, Pantano Wash and much of the Cañada del Oro Wash. Much of the development along these washes is of low density.

Of this second tier of major watercourses, **Tanque Verde Creek** is the most highly channelized, and 100-year bank stabilization has been constructed, or is planned, downstream of Tanque Verde Road. Upstream of Tanque Verde Road, several developed parcels are located in flood or erosion hazard areas.

Limited bank stabilization has been constructed along **Agua Caliente Wash**. The largest project to date was completed in 1994 as part of the Tanque Verde Road bridge project. Design work has been completed on a diversion structure upstream of Tanque Verde Road. Similar to Tanque Verde Creek, several developed properties are located within flood or erosion hazard areas.

Limited improvements have been constructed along **Sabino Creek**. The Creek is wide and consists of several braided flowpaths. Dense vegetation extends across the floodplain. Most of Sabino Creek is privately owned, and area property owners have voiced a strong desire to maintain the natural floodplain. A few developed properties are located within flood hazard areas.

Lesser amounts of development have occurred along **Rincon Creek, Black Wash and the Brawley Wash**. All three are located outside of the urbanized Tucson area. Rincon Creek has a well-defined channel, however, moderate floods result in overbank flow. Plans for the Rocking K master planned community call for alteration of the floodplain, as well as construction of some erosion protection. The Black and Brawley Washes are characterized by broad floodplains with ill-defined, distributary flow paths. Little development has occurred along these watercourses, but much of the development that has occurred is in a flood hazard area.

Recharge and Replenishment Programs

Due to the continued annual overdraft of area groundwater, programs and incentives from the Arizona State Department of Water Resources (ADWR), an abundance of Central Arizona Project (CAP) water that has been purchased but is not being used, and a water supply initiative approved by the electorate in 1995, greater attention is being focused on groundwater recharge. Several of the existing and proposed recharge projects are along the major watercourses. Although many are being constructed and managed by other agencies, they are mentioned because they are located along major watercourses of interest to the District.

The greatest number of existing and proposed projects is located along the **Santa Cruz River**. The Pima Mine Road project, which is operated by Tucson Water and the Central Arizona Water Conservation District (CAWCD), recharges CAP water. Tucson Water operates the Sweetwater Storage and Recovery Facility, which recharges and treats effluent, on Roger Road west of the Santa Cruz River. Further downstream, northeast of the Avra Valley Airport, CAWCD, Metropolitan Domestic Water District (MDWID) and the Arizona Water Banking Authority (AWBA) operate the Avra Valley Recharge Facility with CAP water.

The District has two recharge projects along the Santa Cruz River downstream of Avra Valley Road. In conjunction with CAWCD, the recently completed Lower Santa Cruz Replenishment Project has begun recharging CAP water. Near Sanders Road, the District, together with the Town of Marana, U.S. Bureau of Reclamation and ADWR, plans to recharge effluent that will be diverted from the Santa Cruz River into the basins. Design of the High Plains Effluent Recharge Project is nearing completion.

Attention has been focused on the feasibility of recharge along **Rillito Creek** since the mid-1980's, to halt the decline and promote the recovery of water levels in the central wellfield. The District, in the late 1980's and early 1990's, evaluated the feasibility of constructing a recharge project between Craycroft and Swan Roads. In 1995, it was decided not to proceed with construction due to technical, economic and institutional considerations. Currently, the U.S. Geological Survey (USGS) and ADWR are jointly funding a three-year study to evaluate the feasibility of long-term recharge in Rillito Creek, and effects on the ground water table and water storage in the central wellfield.

Another study, funded by ADWR, the Town of Oro Valley and MDWID, is further evaluating the feasibility of constructing a project to recharge CAP water along the **Cañada del Oro Wash** and Big Wash, and recover subsurface water from area wells. Study results are expected in 2000.

Finally, Tucson Water and CAWCD have been operating the Central Avra Valley Storage and Recovery Project (CAVSARP) in the **Brawley Wash** floodplain, northwest of the intersection of Mile Wide Road and Sanders Road. Full-scale operation of this project is currently the basis of Tucson Water's designation for an Assured Water Supply.

In summary, a few recharge projects have been constructed, design is underway on others, and feasibility studies are progressing. Given the increased attention being focused on recharge to assist in meeting ADWR's safe-yield requirement, it is expected that additional recharge projects will be developed along the major watercourses.

Environmental Enhancement and Restoration Programs

Along the **Santa Cruz River**, work is proceeding towards initiating a feasibility study for a comprehensive flood control and environmental restoration project from the San Xavier Mission at Bac to downtown Tucson. The Paseo de las Iglesias project would be a joint collaboration between the District, City of Tucson and U.S. Army Corps of Engineers (COE). The project would be administered by the COE under the Flood Hazard Mitigation and Riverine Restoration Program.

Two additional COE projects are under consideration along **Rillito Creek**. A Reconnaissance Study has been completed for the Rillito Creek Environmental Restoration project, to be located between Craycroft and Country Club Roads. Study findings recommended proceeding to a feasibility study. Another COE project, the Rillito/Swan Wetlands, is in the initial planning phase.

As indicated in the previous discussion on recharge projects, the Town of Oro Valley, MDWID, and ADWR are undertaking additional studies to investigate the feasibility of recharging CAP water, and recovering area water along the **Cañada del Oro Wash** and Big Wash, west of Highway 89. One of the project's components may include riparian habitat enhancement.

❖ *Report Contents*

The remainder of the report consists of ten chapters, one for each of the watercourses identified in Section 1.2 above. Each chapter begins with an overview, which includes a general discussion of the surrounding land use, and significant watercourse features or characteristics.

Following the overview, a more detailed description of the floodplain is provided, on a reach-by-reach basis. More specific descriptions of surrounding land use are provided, and the existing and proposed floodplain management approaches are identified. Representative aerial photographs (October 1998) are included to accompany the text descriptions. At the end of each chapter, a summary table lists the flood control status, flood control approach (structural versus non-structural), and special notes of interest, such as the presence of mapped riparian habitat, or information related to recharge projects, for each reach.

❖ ***Purpose of this Report***

This document is intended to serve as a status report for flood control and related programs along the major watercourses. It is the second such status report since 1990. The first was completed in April 1994 (Eastern Pima County River Corridors, Right-of-Way Study, April 1994, Pima County Flood Control District). In addition to providing an updated status of flood control programs along the major watercourses, this report is the first to provide photographic documentation of the major watercourses. If updated on a regular basis, for example, every five years or as warranted, it could serve as a convenient tool for observing the impacts of District and other programs on the major watercourses over time.

2.0 SANTA CRUZ RIVER

❖ Overview

The Santa Cruz River (SCR) watershed drains part of northern Sonora, Mexico, and a large area in southern Arizona, including the greater metropolitan Tucson area. Arising in the south-facing slopes of the Patagonia Mountains and the Canello Hills, southeast of Tucson, the SCR drains south across the international boundary into Mexico, then flows north into the United States, entering Santa Cruz County east of Nogales, and entering Pima County near Arivaca Junction.

From Arivaca Junction, the SCR flows north through the unincorporated community of Green Valley, east of the Town of Sahuarita, and through the eastern side of the San Xavier District of the Tohono O'Odham Indian Nation, entering the Tucson city limits at Los Reales Road. The SCR continues flowing north through downtown Tucson, then veers to the northwest, flowing through unincorporated Pima County and the Town of Marana before entering Pinal County west of Trico Road.

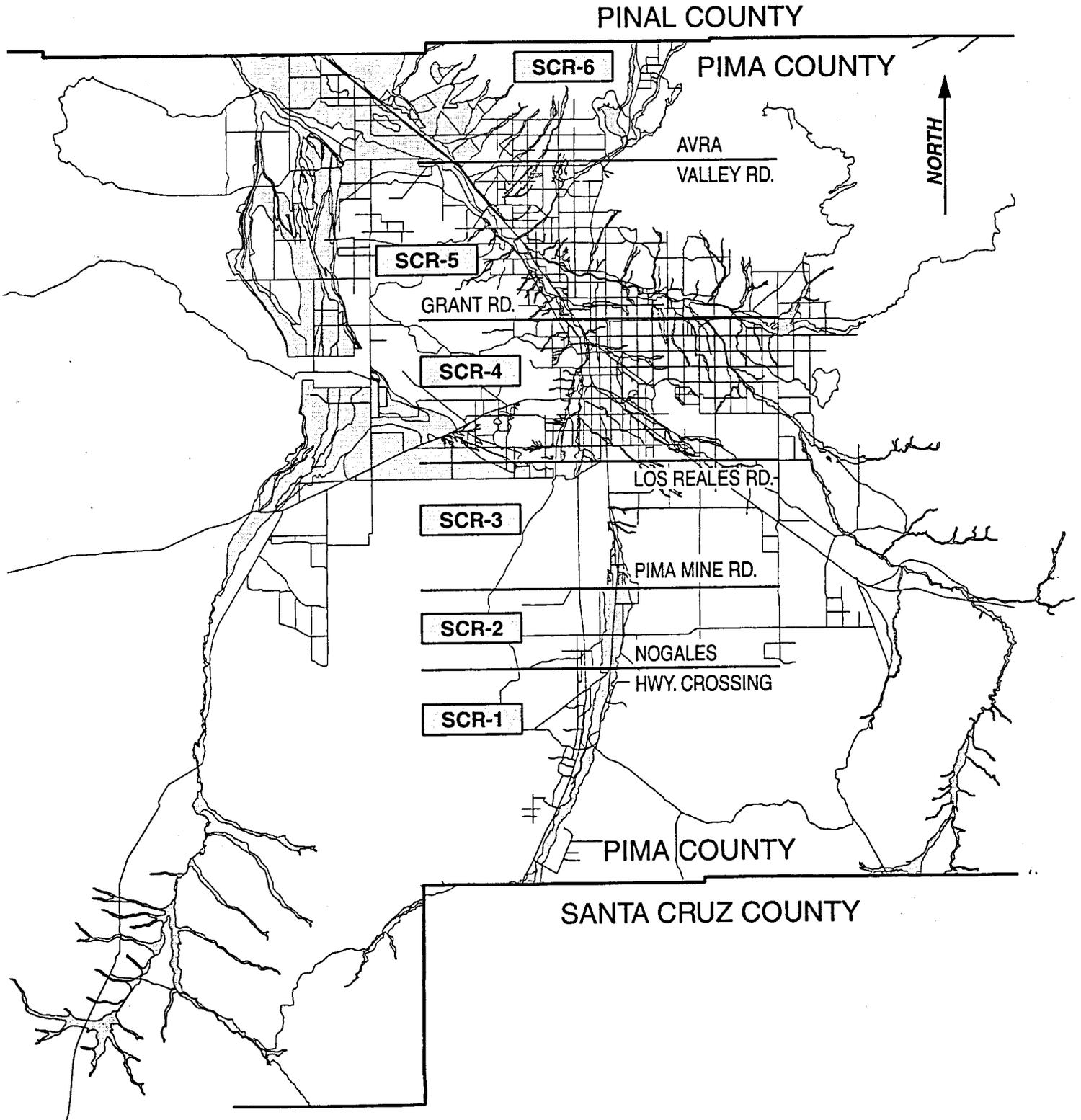
Shortly after flowing into Pinal County, the SCR loses definition, eventually emptying into the Santa Cruz River Flats, a broad area of discontinuous channels with little topographic relief. Continuous flow across the Santa Cruz River Flats to the Gila River in Maricopa County rarely occurs (USGS, 1993, Channel Change on the Santa Cruz River, Pima County, 1936-1986).

Since prehistoric times, civilizations have grown up around the river channel. Hohokam villages, early Piman villages, Spanish Colonial sites, and sites of early settlers of Tucson as we know it today, have been found along the Santa Cruz River, which provided water for crop irrigation. Today, in rural locations, the SCR floodplain retains some of its natural character. However, near urban centers, agricultural, industrial and urban uses are located in what is or was the natural floodplain of the Santa Cruz River.

For discussion purposes, the SCR in Pima County has been divided into six reaches (Figure 2-1). A brief description of each reach is provided, and representative aerial photographs are included. Following the reach descriptions, Table 1 lists constructed and proposed improvements, and the District's long-range plan, for each reach. The presence of mapped riparian habitat is noted.

Figure 2-1

RIVER REACHES-SANTA CRUZ RIVER



❖ Floodplain/Land Use Description

SCR-1: Santa Cruz County line to Nogales Highway Crossing

Throughout this reach and extending downstream, the SCR channel is bounded on the west by Interstate Highway 19 (I-19), and on the east by the Southern Pacific railroad (SPRR) tracks. The river channel itself is relatively narrow and tightly sinuous, however, it lies within a broad geologic floodplain, averaging 2600 feet wide. Although generally bounded between I-19 and the SPRR, the floodplain extends east of the railroad tracks in a few locations.

The floodplain in this reach is characterized by significant encroachment due to urban and agricultural uses. Spreading along both sides of I-19, dense residential development in Green Valley occupies areas west of the river channel. Cultivated fields lie east of the channel. Most of the floodplain is privately owned. The channel banks are mostly natural, except where isolated segments of bank stabilization have been constructed to protect public infrastructure and private development. The south boundary of the Town of Sahuarita is approximately one and one-half miles south of the Nogales Highway crossing.

⇒ *Representative Aerial Photo: 14-7*

SCR-2: Nogales Highway to Pima Mine Road

Although the channel is still largely confined by the railroad tracks on the east, I-19 has veered to the west, such that it no longer acts as a western boundary. The river channel is still narrow and tightly sinuous, and, for the first mile downstream of Nogales Highway, the width of the floodplain is consistent with that in upstream areas. Approximately one mile upstream of Sahuarita Road, the width of the floodplain broadens considerably, to approximately 6500 feet, with the overbank floodplain area extending to the east. This floodplain width is maintained downstream to Pima Mine Road.

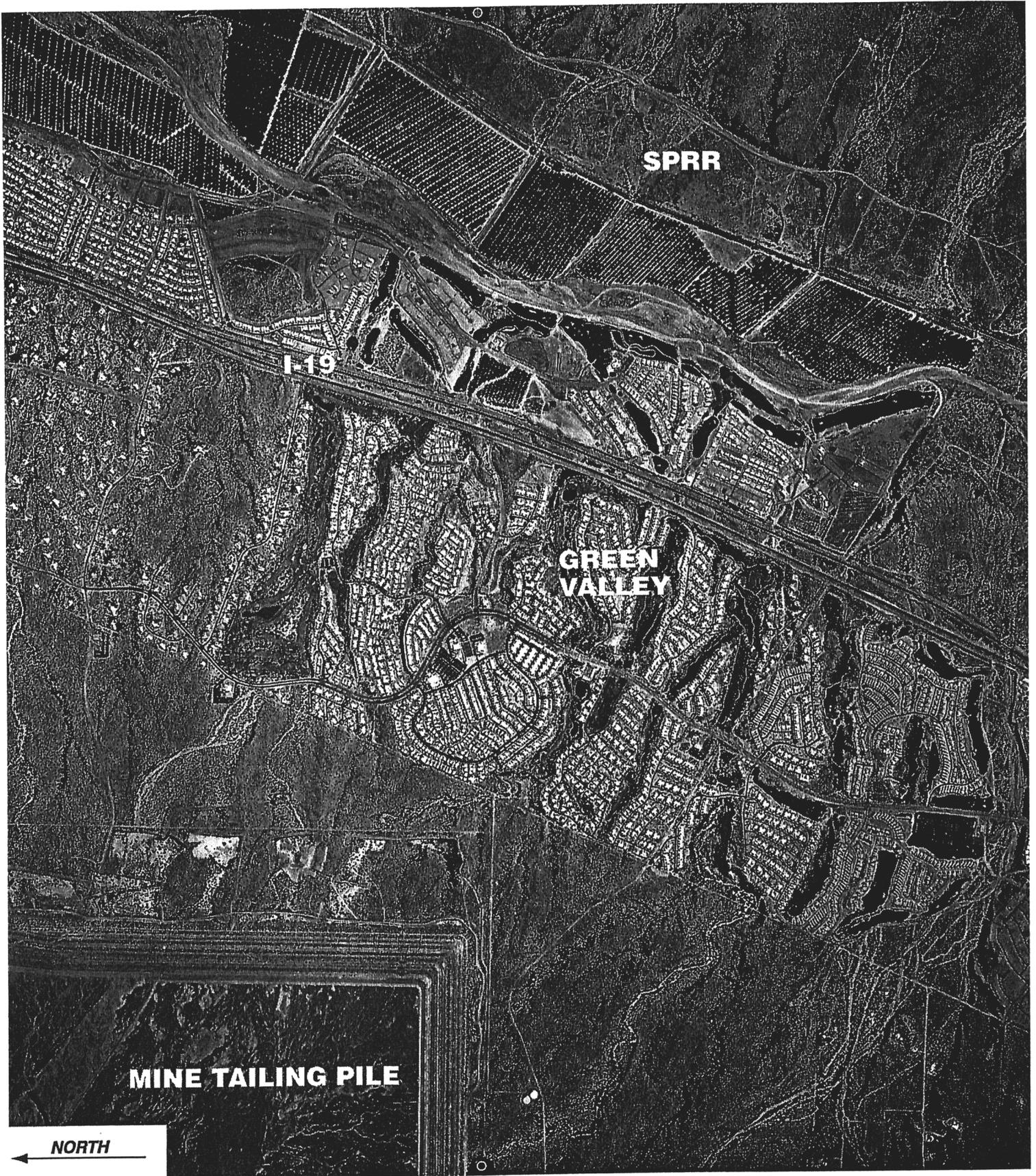
Agricultural fields line the east and west banks adjacent to the river channel, however, most of the fields that are currently cultivated lie east of the channel. The Town of Sahuarita lies along the west side of the floodplain, and extends from the beginning to the end of this reach. The channel banks are mostly natural. Most of the floodplain is privately owned.

⇒ *Representative Aerial Photos: 15-11 and 15-13*

SCR-3: Pima Mine Road to Los Reales Road

This reach is located entirely within the boundaries of the San Xavier District of the Tohono O'odham Indian Nation. The river channel assumes a more northwesterly alignment, such that at its downstream location, the river crosses under I-19 at Martinez Hill. From this location onward, the river continues to flow west of I-19. Although some segments of the river have been channelized, the river corridor is natural and undeveloped.

⇒ *Representative Aerial Photos: 15-13, 15-15 and 15-16*

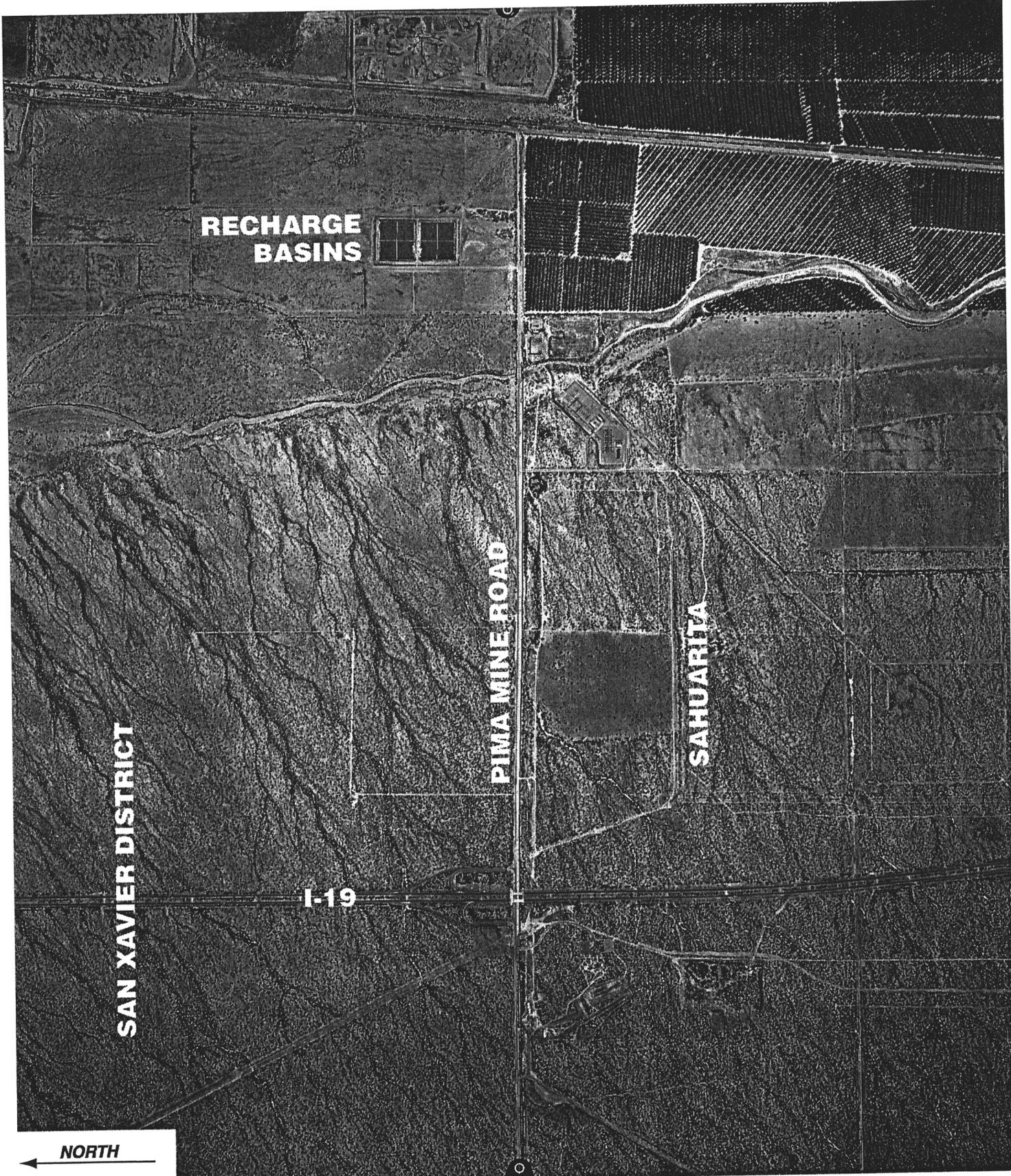




15-11

2-5

Santa Cruz River



RECHARGE
BASINS

SAN XAVIER DISTRICT

PIMA MINE ROAD

SAHUARITA

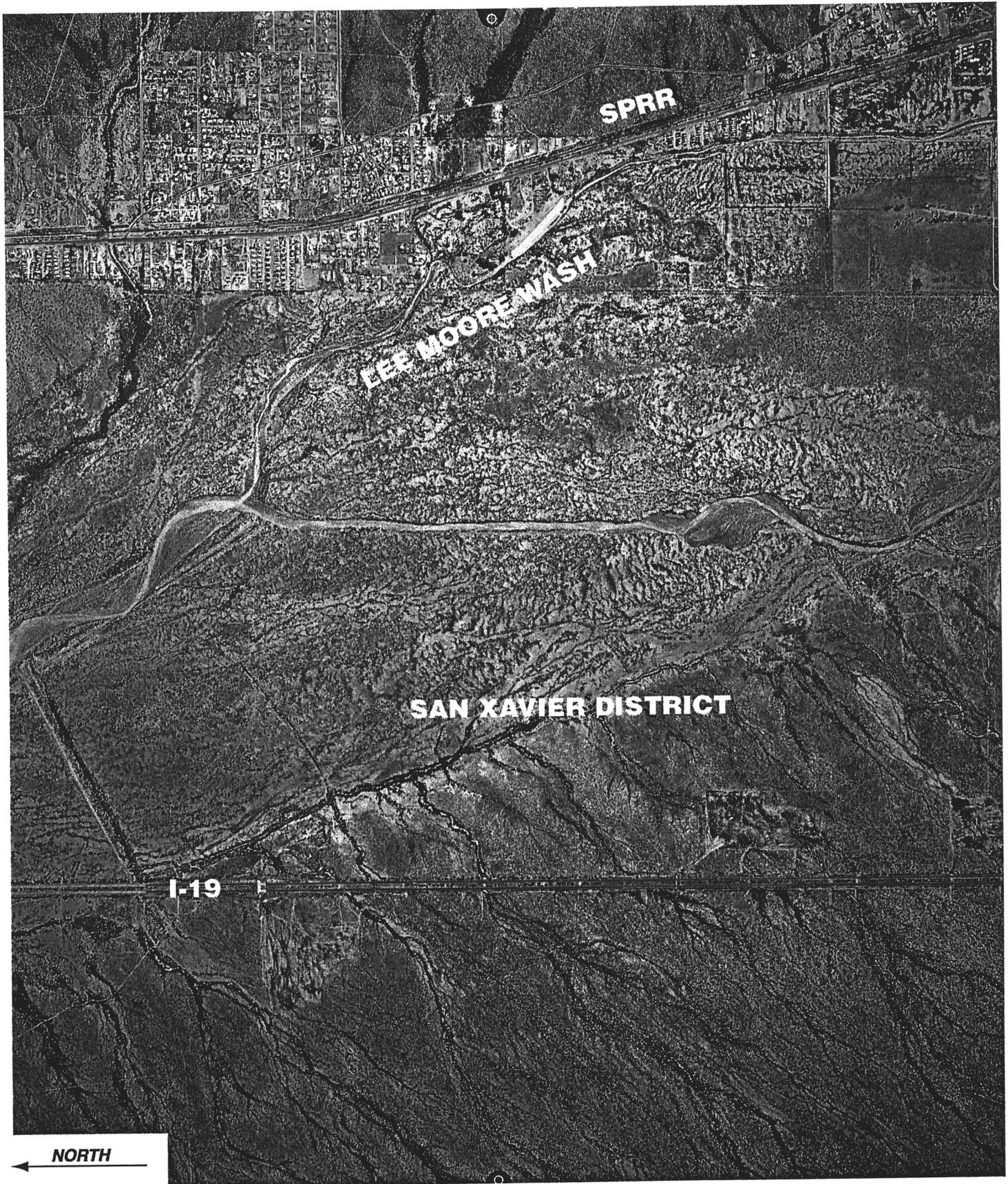
I-19

NORTH

15-13

2-6

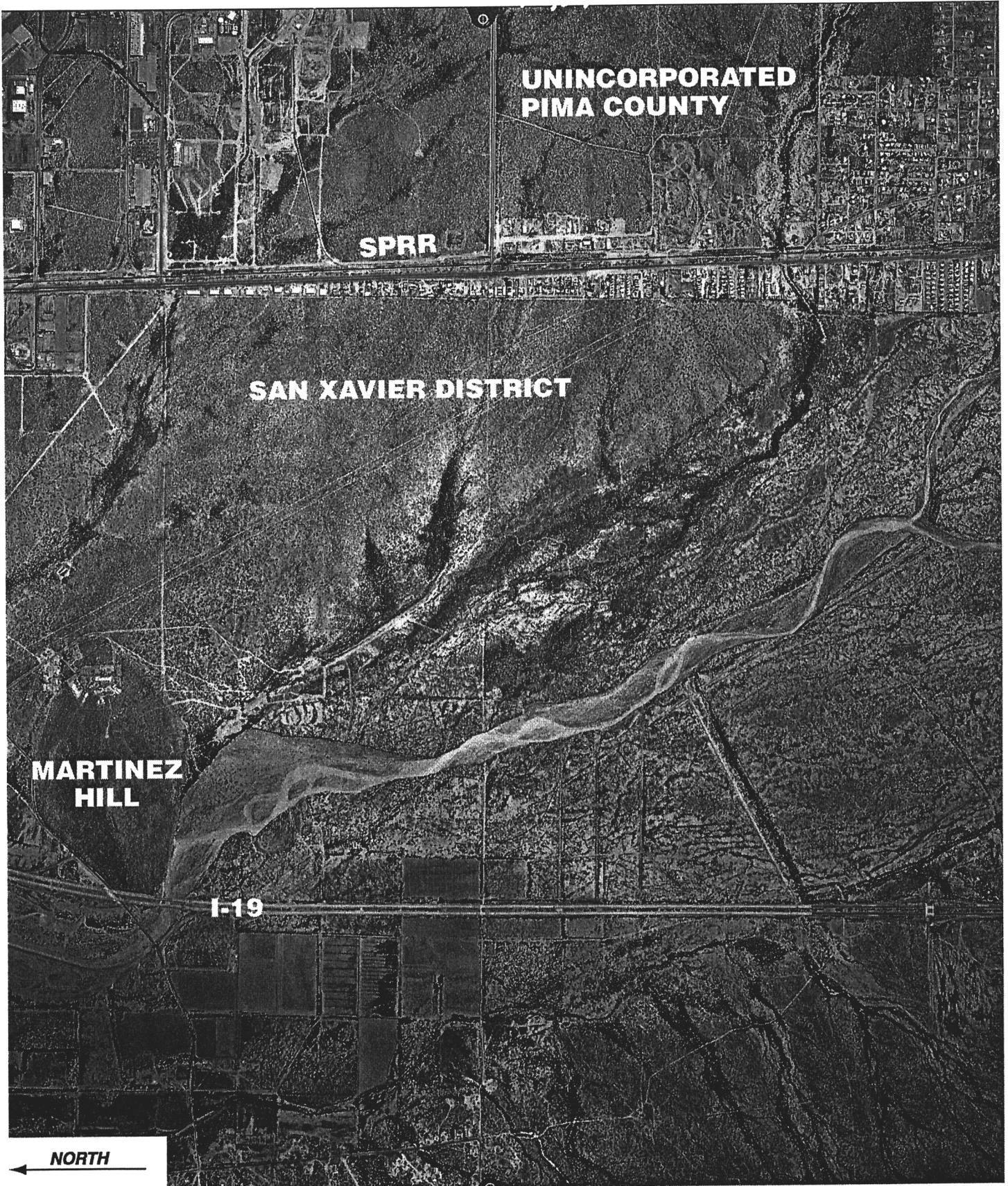
Santa Cruz River



15-15

2-7

Santa Cruz River



**UNINCORPORATED
PIMA COUNTY**

SPRR

SAN XAVIER DISTRICT

**MARTINEZ
HILL**

I-19

← NORTH

15-16

2-8

Santa Cruz River

SCR-4: Los Reales Road to Grant Road

Throughout the greater metropolitan area, the Santa Cruz River occupies a corridor of land west of and roughly parallel to I-19 and I-10. The river assumes a highly channelized form throughout the reach, and bank stabilization has been constructed in many locations. The floodplain is considerably narrower than in upstream areas, averaging 250 feet. In most locations the 100-year flood is contained within the channel banks.

Between Valencia Road and Grant Road, residential, commercial and industrial uses extend virtually right up to the channel banks where bank stabilization has been constructed. As part of the 1997 Bond Program, bank stabilization will be constructed between Valencia Road and Irvington Road. As part of the proposed Paseo de las Iglesias project, low-flow bank stabilization may be constructed from Ajo Way to Silverlake Road. Two major tributaries, the West Branch (of the Santa Cruz River) and the Tucson Diversion Channel, drain into the Santa Cruz River between Irvington Road and Silverlake Road.

⇒ *Representative Aerial Photos: 14-18 and 15-21*

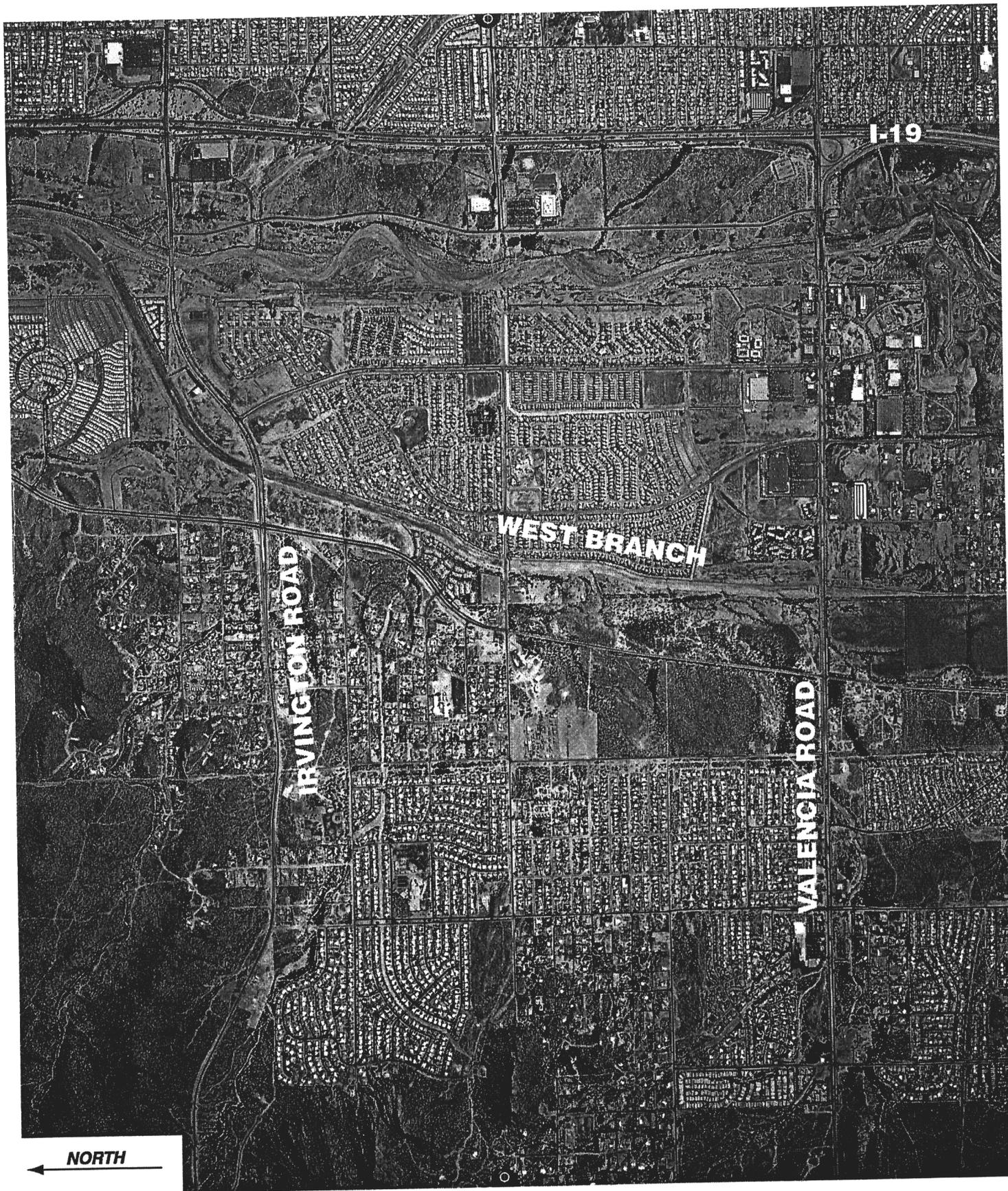
SCR-5: Grant Road to Avra Valley Road

From Grant Road to Cortaro Road, the river occupies a corridor bounded by I-10 on the east and Silverbell Road on the west. The river channel becomes wider as it progresses downstream, especially below the confluences of Rillito Creek and the Cañada del Oro (CDO) Wash. The floodplain also becomes wider, as the channel banks are mostly natural. Some overbank flooding occurs in this reach. Between Grant Road and Ina Road, the floodplain width averages 300 - 800 feet. From Ina Road to Avra Valley Road, including the Continental Ranch area, the floodplain widens to over 2000 feet.

Land adjacent to the channel is used primarily for open space and industrial uses. Both the Roger Road and Ina Road Wastewater Treatment Facilities are located in this reach, and both release treated effluent to the river channel. The City of Tucson's Sweetwater Wetlands facility is also located in this reach. Several sand and gravel mining operations are located in overbank areas, beginning near the Rillito Creek confluence and extending to the Cortaro Road area. Dense residential subdivisions have been constructed adjacent to the western side of the bank-stabilized floodplain in the Continental Ranch area.

Some bank stabilization has been constructed downstream of Grant Road. Both sides have been protected from Fort Lowell Road to Sweetwater Road, and the east bank is protected from Sweetwater Drive to Camino del Cerro. The east bank has been protected from the CDO Wash confluence downstream past the Wastewater Treatment Plant and Solid Waste facility. Both banks are protected in the Continental Ranch subdivision. As part of the 1997 Flood Control bond program, bank stabilization will be constructed from Grant Road to Fort Lowell Road.

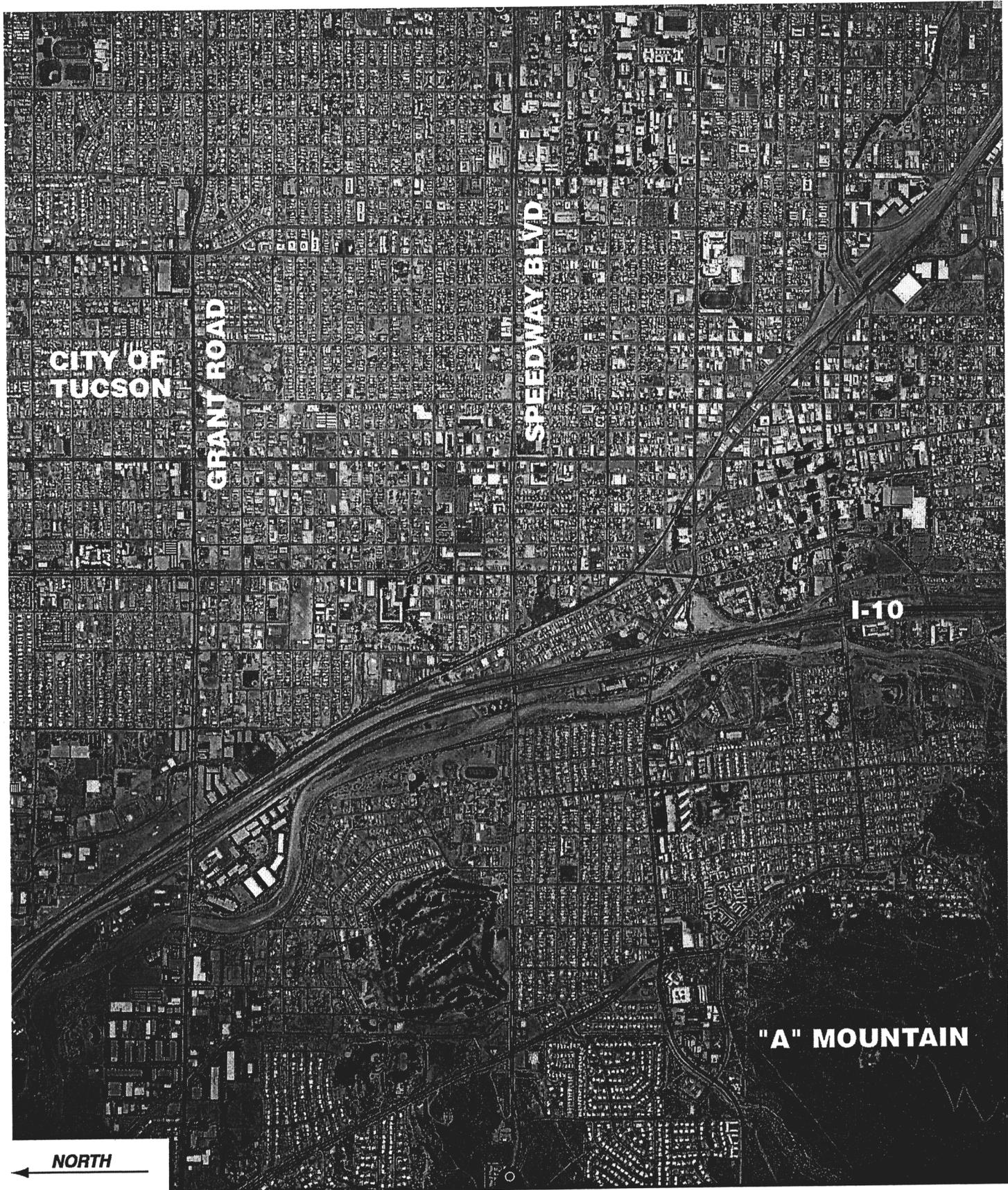
⇒ *Representative Aerial Photos: 13-23, 12-25*



14-18

2-10

Santa Cruz River



**CITY OF
TUCSON**

GRANT ROAD

SPEEDWAY BLVD

I-10

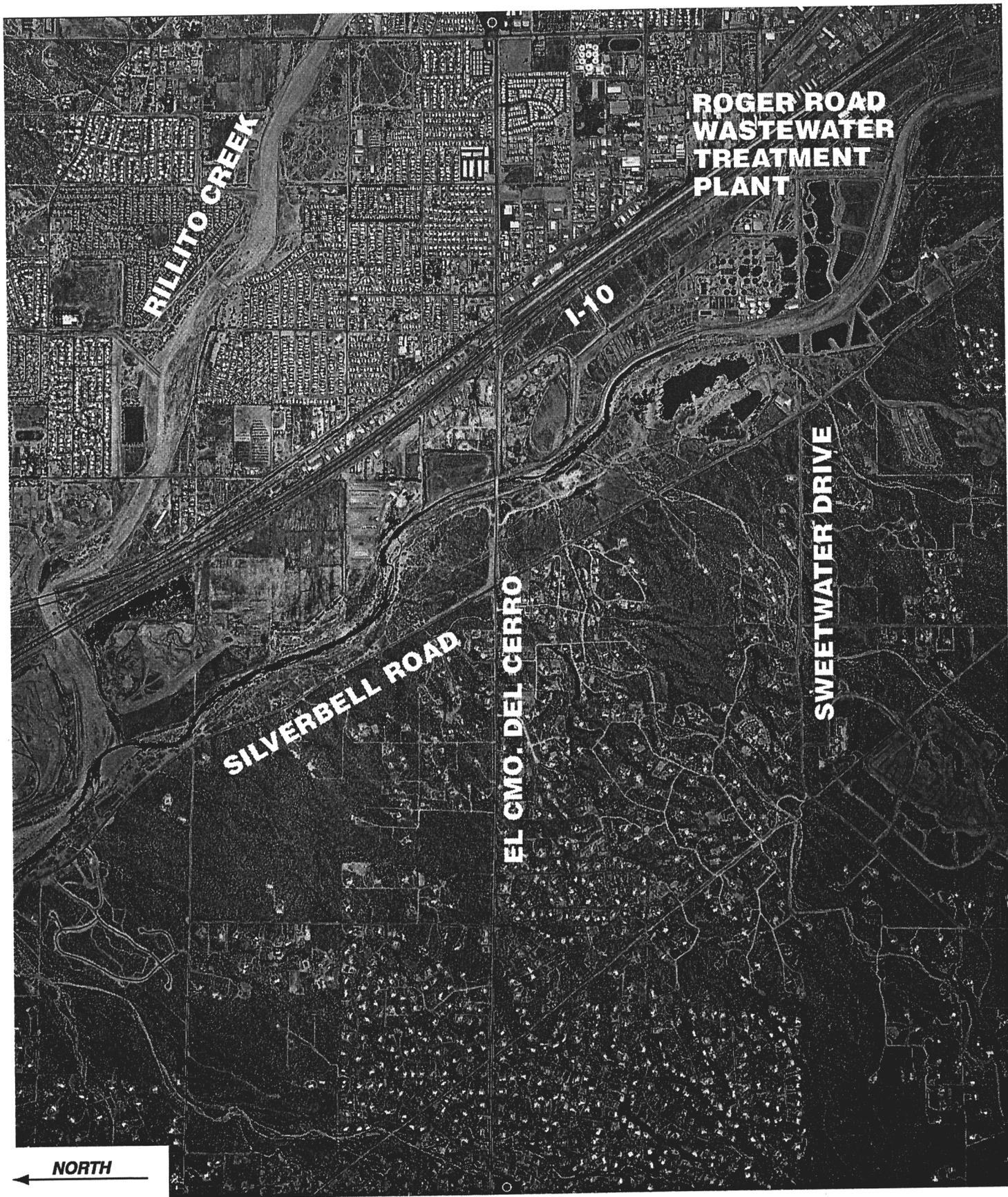
"A" MOUNTAIN

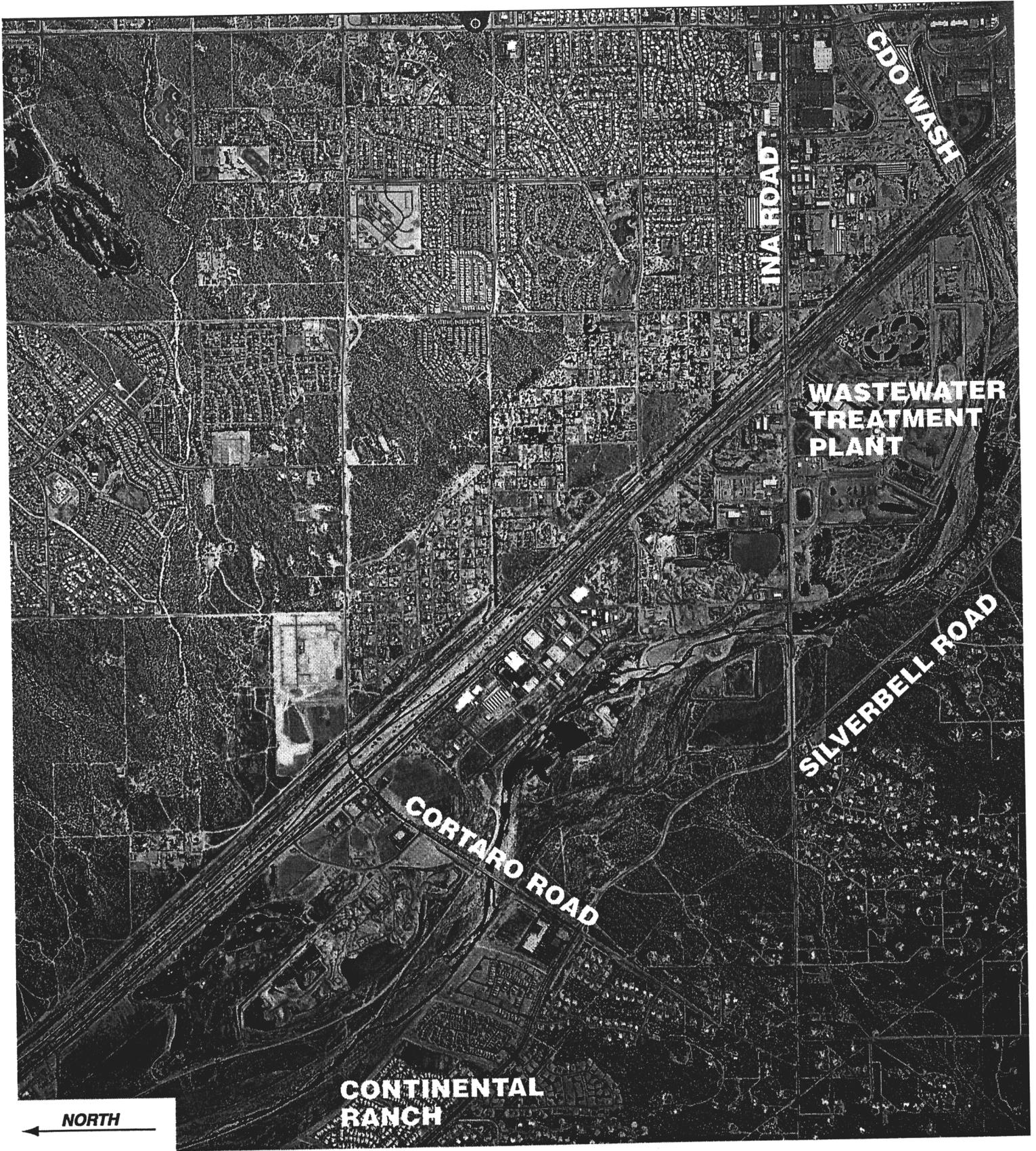
NORTH
←

15-21

2-11

Santa Cruz River





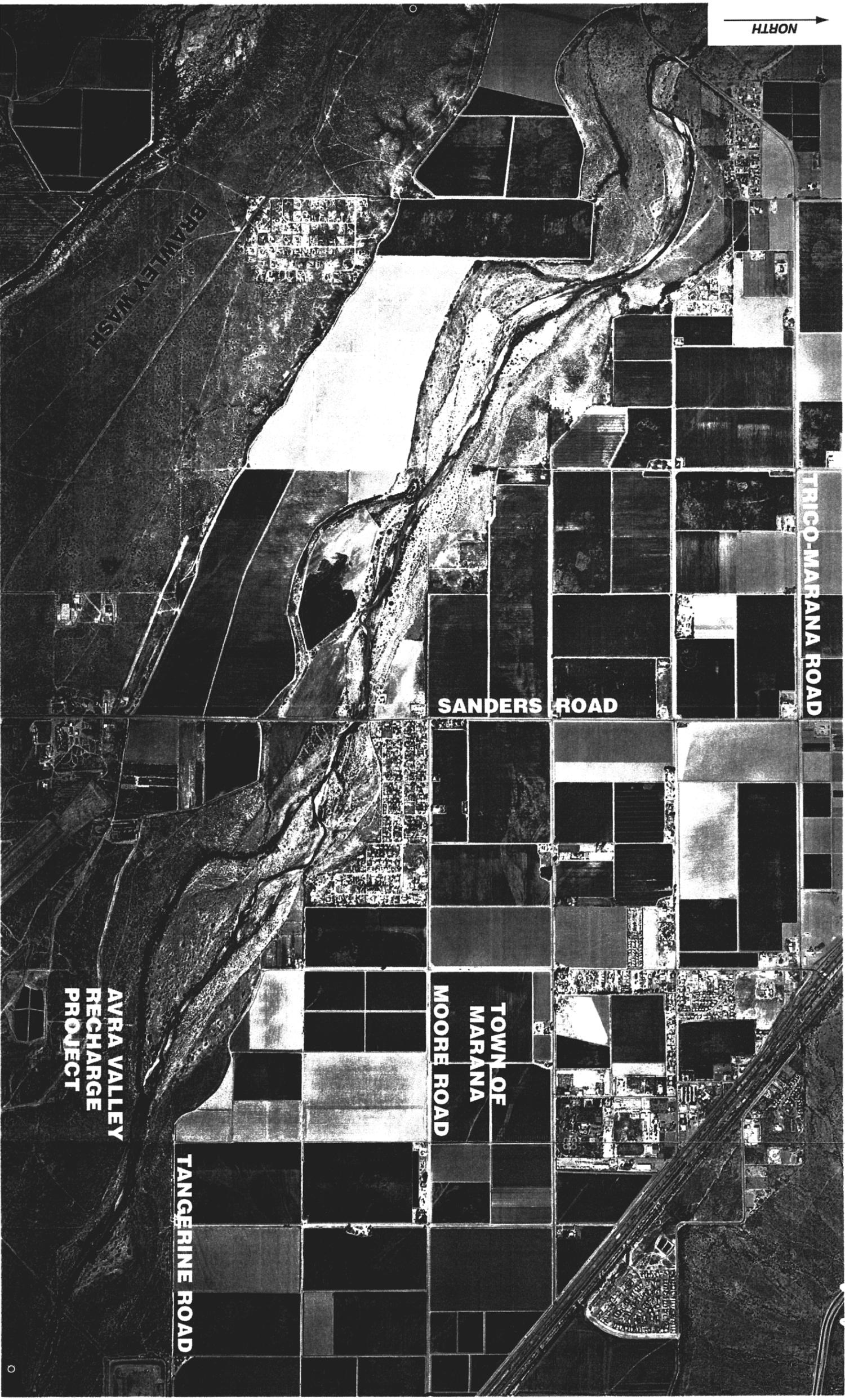
SCR-6: Avra Valley Road to Pinal County Line

Beginning at Avra Valley Road, the Santa Cruz River veers to the west, away from I-10. The effluent-dominated low-flow channel is still fairly narrow, however, unlike in the urbanized areas, the main channel has capacity only for small flood events. The floodplain becomes very broad, widening to over 6000 feet at Tangerine Road, and over 2.9 miles at Trico Road. Consisting primarily of cultivated farm fields, this area is sparsely populated. Most of the floodplain extending from Avra Valley Road to the Lockett Road alignment is located within the Town of Marana.

Due to floodwater inundation and sediment deposition, historical flood damage in areas downstream of Avra Valley Road has been extensive. During major flooding, large land areas become inaccessible, and people must be evacuated by helicopter, as occurred in the 1983 Flood.

In early 1999, construction began on Phase 1 of the Lower Santa Cruz River Levee. This 7.4-mile long earthen levee with a soil-cement face on the river side will extend along the north bank from I-10 near Avra Valley Road to Sanders Road. Areas to the north will be protected from the 100-year flood. In conjunction with construction of the levee, three basins have been excavated on the south side of the river, near the end of the Tangerine Road alignment, as part of the Northwest Replenishment Project. These basins are intended to recharge CAP water to the regional aquifer. Additional recharge basins are planned nearby as part of the High Plains Effluent Recharge Project. The currently operating Avra Valley Recharge Project is also located in this reach.

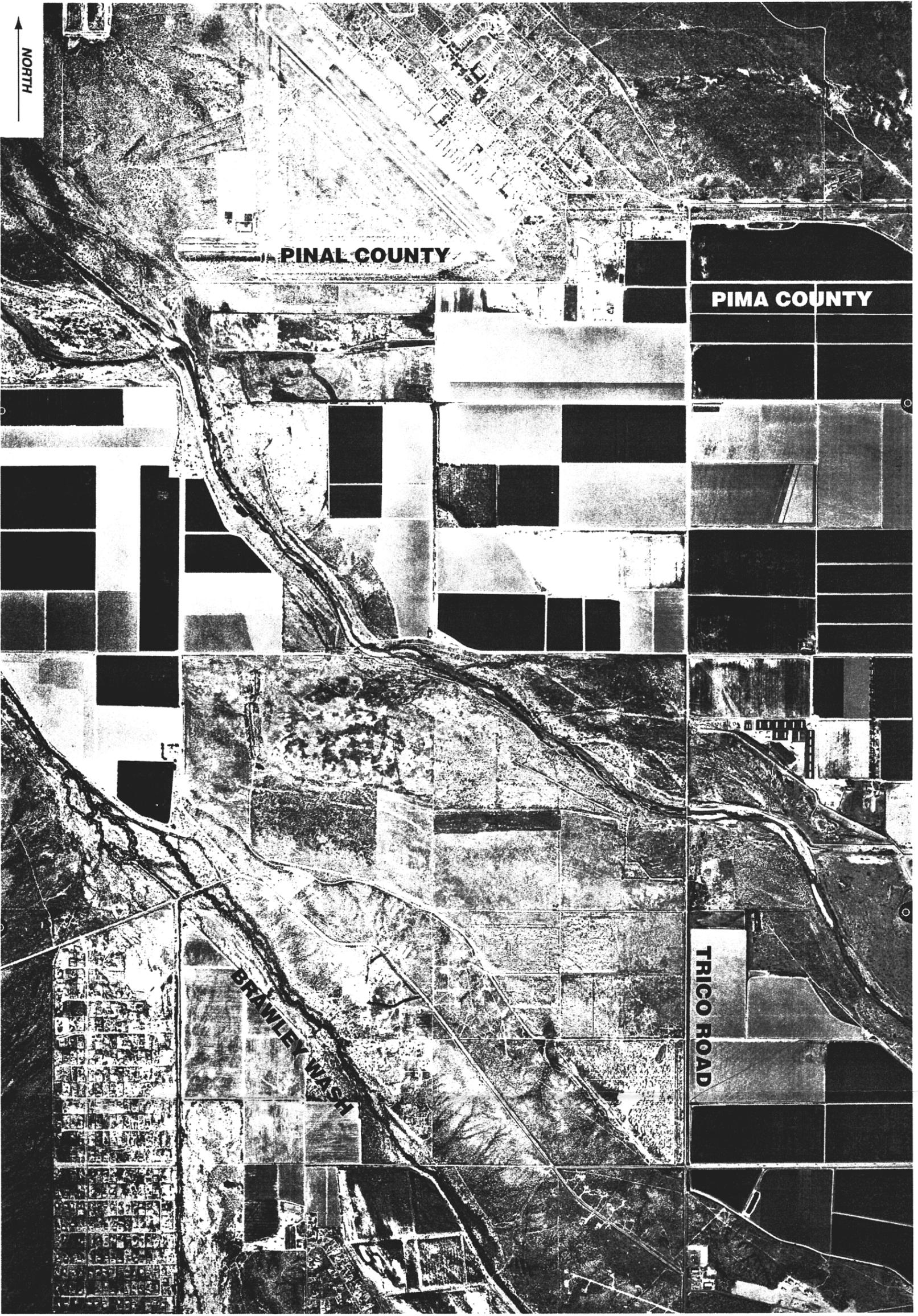
⇒ *Representative Aerial Photos: 7-28 & 8-28, 5-30*



7-27, 8-28

2-15

Santa Cruz River



5-30, 5-29

2-16

Santa Cruz River

FLOOD CONTROL STATUS - SANTA CRUZ RIVER (July 2000)

Watercourse Reach	Status	Flood Control Approach	Notes
<p>1. Santa Cruz River, Santa Cruz Co. line to Nogales Highway (SCR-1)</p>	<p>Channel banks mostly natural, except for bank stabilization as follows: at Elephant Head Road bridge, 2000 feet of bank stabilization on the west bank, and 1000 feet on the east bank; approx. 1500 feet at the outer edge of the west bank in S9-T19S-R13E, to protect the I-19 interchange; approx. 2.3 miles along the west bank in the Santa Rita Springs Master Plan area (most is 10-year); approx. 4900 feet on the east bank and 2000 feet (in two segments) on the west bank near the Continental Road bridge; 4100 feet on the west bank at the Green Valley Wastewater Treatment Plant, near Duval Mine Road; and 1000 feet along the east bank upstream of the Nogales Highway bridge crossing. <u>No additional bank stabilization is planned, except for some that may be constructed by private interests in the Canoa Ranch Specific Plan Area.</u></p>	<p>Maintain the natural floodplain. Preserve overbank floodwater storage areas, which act to attenuate downstream flood peak discharges, and provide for recharge of floodwaters. Maintain the sediment transport characteristics of the river system. Preserve riparian habitat.</p>	<p>The COE, with local sponsors as mentioned below, is conducting a comprehensive planning study of the SCR in Pima County, extending from the Santa Cruz County line to the Pinal County line. The study is expected to result in a comprehensive, integrated basin management plan for the SCR in Pima County. In addition to the District, local sponsors include Wastewater Management, the City of Tucson Transportation Dept., and Tucson Water. The unincorporated area of Green Valley is in this reach. Some mapped xero-riparian habitat is present: Types A, B, and C.</p>
<p>2. Santa Cruz River, Nogales Highway to Pima Mine Road (SCR-2)</p>	<p>Channel banks in natural state. Limited bank stabilization is present at the Pima Mine Road bridge. <u>No additional bank stabilization is planned.</u></p>	<p>Maintain the natural floodplain, including preserving overbank floodwater storage areas. Maintain sediment transport characteristics. Preserve existing riparian habitat.</p>	<p>Small amount of xero-riparian habitat Type C is present, just upstream of Pima Mine Road.</p>

Watercourse Reach	Status	Flood Control Approach	Notes
<p>3. Santa Cruz River, Pima Mine Road to Los Reales Road (SCR-3)</p>	<p>San Xavier Indian Reservation. The proposed Paseo de las Iglesias, a comprehensive flood control and environmental restoration project to along the Santa Cruz River, would extend from the Mission San Xavier del Bac to downtown Tucson. The project would be administered by the COE. Negotiations are underway, as of 8/99, to conduct a feasibility study.</p>	<p>This area is within the San Xavier District's jurisdiction. Any potential District plans, such as Paseo de las Iglesias, would need to be approved by the San Xavier District.</p>	<p>Tohono O'odham Indian Nation, San Xavier District land.</p> <p>The City of Tucson's Pima Mine Road Recharge Basins are located just downstream of Pima Mine Road, and east of the San Xavier District boundary.</p>
<p>4. Santa Cruz River, Los Reales Road to Grant Road (SCR-4)</p>	<p>Much of the watercourse has been bank stabilized. Limited bank stabilization exists along the east bank north of Los Reales, to protect I-19; and at the Valencia Road bridge, on both banks. Bank stabilization is present along both banks between Irvington Road and Ajo Way, and from Silverlake Road to Grant Road. The segment from Speedway to Grant on the east bank is a levee.</p> <p><u>Bank stabilization is planned along both banks between Valencia and Irvington Roads,</u> as part of the 1997 Bond Program.</p> <p><u>The proposed "Paseo de las Iglesias" project,</u> which extends from the San Xavier Mission to downtown Tucson, <u>may include low-flow bank stabilization for unprotected segments.</u></p>	<p>Bank protection is planned along all of this reach. In some locations, low-flow protection may be provided as part of the proposed Paseo de las Iglesias project.</p>	<p>This reach is within the urbanized greater Tucson metropolitan area, and the river system is fully channelized, although not all channel banks have been stabilized. Unprotected channel banks are subject to significant erosion and lateral migration.</p> <p>Feasibility studies continue for a pilot project intended to recharge remediated water into the SCR channel between Ajo Way and Irvington Road (Tucson Airport Remediation Project, aka TARP).</p>

Watercourse Reach	Status	Flood Control Approach	Notes
<p>5. Grant Road to Avra Valley Road</p> <p>(SCR-5)</p>	<p>Approx. 1300 feet of bank stabilization exists north of Grant Road on both banks. In 1997, 900 feet of bank stabilization was added on the west bank by private interests. Both banks are stabilized from Fort Lowell Road to Sweetwater Drive; the east bank is protected from Sweetwater Drive to Camino del Cerro; and limited bank stabilization exists on the west bank, where Trails End Wash drains into the Santa Cruz; both bridge abutments are protected at Camino del Cerro, and bank stabilization extends approx. 1300 feet downstream of Camino del Cerro on the east bank adjacent to the landfill. Bank stabilization exists along the east bank from I-10 to the edge of the Ina Road Wastewater Treatment Facility; both abutments are protected at the Ina Road and Cortaro Road bridges; and most of the reach between Cortaro Road and Avra Valley Road is protected by bank stabilization within the Continental Ranch subdivision.</p> <p>As part of the 1997 Bond Program, <u>both banks will be protected between Grant Road and Fort Lowell Road.</u></p>	<p>Bank stabilization is planned throughout most of this reach, except in areas where sand and gravel mining occurs, near the confluences of Rillito Creek and the CDO Wash.</p>	<p>Most of this reach is located within the City of Tucson or the Town of Marana.</p> <p>A ribbon of hydro-meso riparian habitat is located along the low-flow channel upstream and downstream of Avra Valley Road.</p>

Watercourse Reach	Status	Flood Control Approach	Notes
<p>6.. Santa Cruz River, Avra Valley Road to Pinal Co. line (SCR-6)</p> <p>(END SANTA CRUZ RIVER)</p>	<p>There is existing bank stabilization on the upstream side of the Sanders Road bridge: 1900 feet on the northeast bank, and 400 feet on the southwest bank ; also, at Trico-Marana Road, 3000 feet on the north bank upstream of the bridge to protect the Berry Acres subdivision, and 1600 feet of Erconets (erosion protection) on the south bank, beginning at the bridge and extending upstream. At Trico Road, there's 2900 feet on the upstream north bank.</p> <p>Construction of Phase 1 of the Lower Santa Cruz River Levee was completed in 7/00. This segment will be 7.4 miles long, and will extend from Avra Valley Road to Sanders Road. An extension of this levee to the Pinal County line is proposed.</p>	<p>A flood control levee is planned along the north bank throughout the entire reach. Construction began in 1999 on the first phase of the levee.</p> <p>Existing riparian habitat will be preserved.</p>	<p>In conjunction with construction of Phase 1 of the levee, three groundwater replenishment basins are being excavated on the south side of the river channel opposite the west end of the Tangerine Road alignment, as part of the Lower Santa Cruz River Replenishment Project. CAP water will be recharged in the basins, which are being created as the levee construction material is excavated. Plans are being developed to recharge effluent diverted from the SCR into proposed recharge basins located east of the LSCR replenishment basins, as part of the High Plains Effluent Recharge Project.</p> <p>A ribbon of hydro-meso riparian habitat has been mapped along the length of the low-flow channel in areas within unincorporated Pima County.</p>

3.0 RILLITO CREEK

❖ Overview

The Rillito Creek watershed is the second largest to impact the greater metropolitan Tucson area, after the Santa Cruz River watershed. Headwaters are located along the south-facing slopes of the Santa Catalina Mountains and the west-facing slopes of the Rincon Mountains. Although Rillito Creek is located entirely within the urbanized area, several large tributaries collect water from outer watershed reaches. Two major tributaries that drain into Rillito Creek are Tanque Verde Creek and Pantano Wash, which join at Craycroft Road to form Rillito Creek.

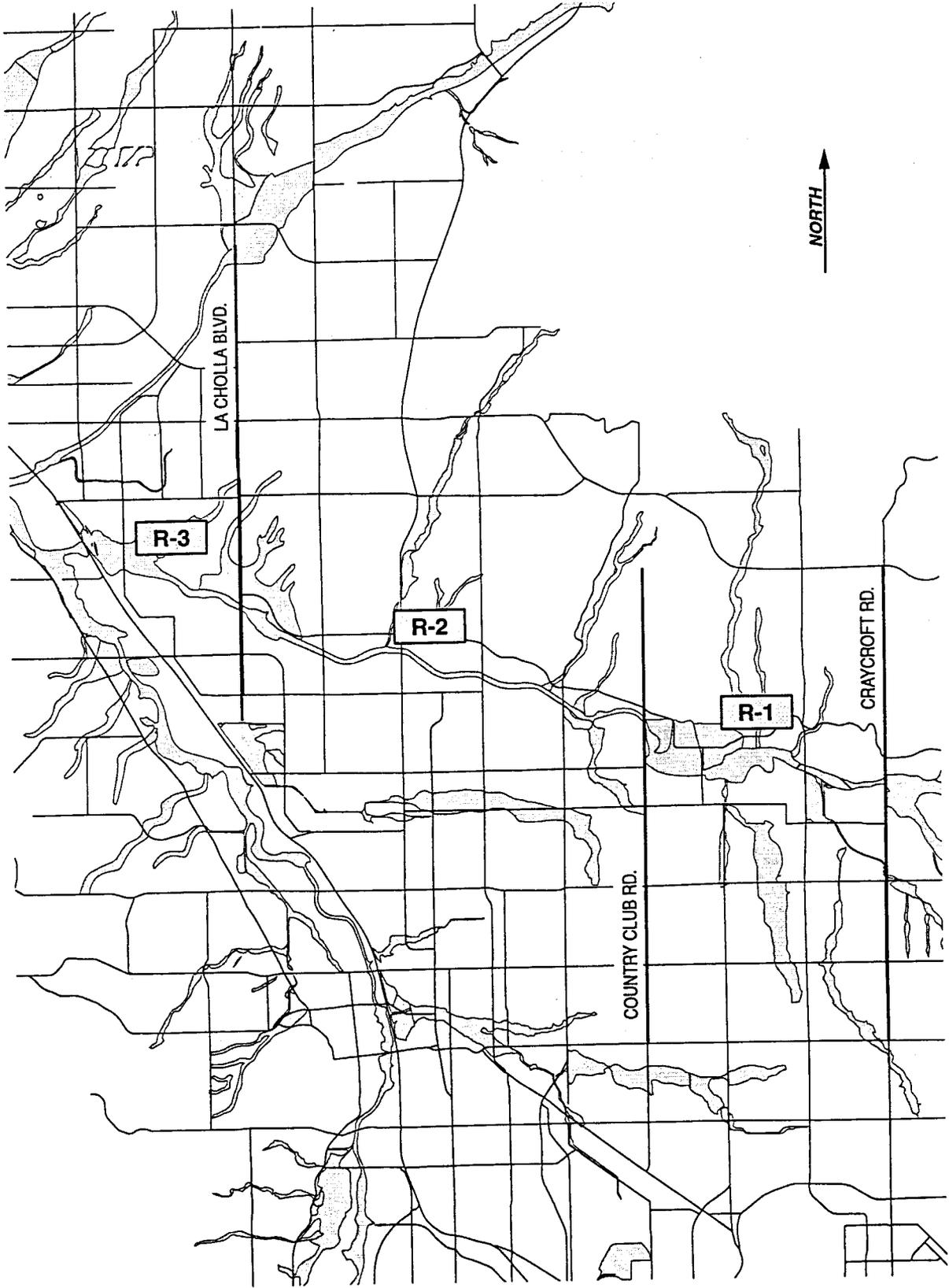
From Craycroft Road, Rillito Creek flows to the west/northwest along the northern boundary of incorporated Tucson. It is south of, and roughly parallel to, the southern edge of the Santa Catalina Mountains. Flowing back and forth across the jurisdictional boundary between unincorporated Pima County and the City of Tucson, Rillito Creek eventually passes through the Town of Marana near its confluence with the Santa Cruz River, south of Orange Grove Road.

Prior to the rapid urbanization beginning in the 1970's, areas along Rillito Creek were used mostly for agricultural purposes. Aerial photos from the 1940's through the 1960's show a combination of farm fields and large vacant, open space areas lining the channel banks. Beginning in the 1960's, residential and some industrial/commercial development was moving closer to the river banks. However, in general, land immediately adjacent to the natural channel banks was left vacant or used for open space purposes.

Since the late 1970's, the District has been constructing bank stabilization along Rillito Creek to protect public infrastructure and development that occurred prior to the enactment of local floodplain management regulations. Development adjacent to the river banks has generally followed the construction of bank stabilization. In late 1996, the COE, with the District acting as a local sponsor, completed the Rillito Creek Bank Protection Project. Except for a few planned openings, bank stabilization has been constructed along all of Rillito Creek from Craycroft Road to the Santa Cruz River. Phase 3 of the Rillito Creek Bank Protection project, which is being constructed as of September 1999, consists of constructing river trails and accompanying facilities adjacent to the channel banks.

For discussion purposes, Rillito Creek has been divided into three reaches (Figure 3-1) A brief description of each reach is provided, and representative aerial photographs are included. As the structural flood control program has been largely implemented, no table has been provided to identify the flood control strategy. However, it is anticipated that the feasibility of implementing environmental restoration projects along Rillito Creek will be investigated within the next few years. Also, with respect to concerns about the local water supply, increased attention is being focused on the potential for recharging Tucson Water's central well field via percolation through the Rillito Creek channel bed. The USGS and ADWR are currently conducting a three-year study to further evaluate the feasibility of long-term instream recharge along Rillito Creek.

Figure 3-1
RILLITO CREEK



❖ Floodplain/Land Use Description

R-1: Craycroft Road to Country Club Road

Throughout this 3-1/2 mile reach, Rillito Creek generally flows along an east-west alignment until it reaches Country Club Road, where the channel bends sharply to the north then to the west, in an area known as the "Country Club Bend Area". The river is fully channelized, with an average width ranging from 350-500 feet. There is a small gap in the bank stabilization on the south bank halfway between Craycroft and Swan Roads.

Prior to the completion of the Rillito Creek Bank Protection Project in 1996, only a few segments of bank protection had been constructed in this reach: localized bank protection at Swan Road, to protect the bridge; and along the south bank from Alvernon Way to Country Club Road and beyond. The current FEMA floodplain delineations reflect conditions prior to the completion of the bank protection project from Craycroft Road to the Santa Cruz River.

Overbank flood areas are delineated at Columbus Boulevard, Alvernon Way, along the north overbank in the vicinity of Finger Rock Wash (east of Country Club Road), and along the south bank in the vicinity of Country Club Road. Much of the overbank flooding shown is due to tributaries draining into Rillito Creek, and not from overbank flow of Rillito floodwaters. A large overbank flow area is along the north bank in the bend area, where Finger Rock Wash drains into Rillito Creek.

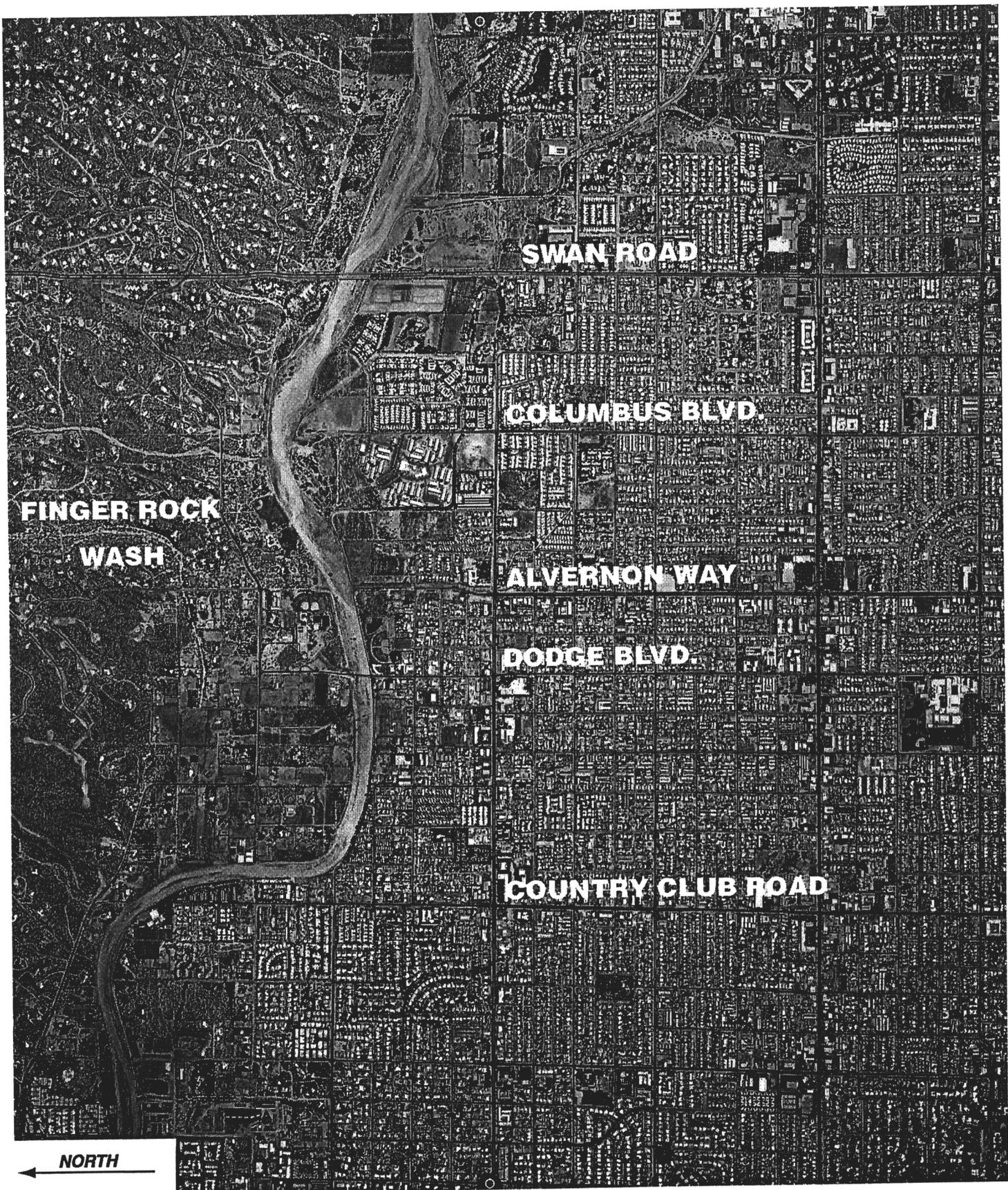
With the recent completion of the bank stabilization, infill development along several previously undeveloped or underdeveloped areas is occurring, and is expected to continue. Several open space uses are expected to remain. The District is in the process of revising the FEMA flood limits along all of Rillito Creek and it should be completed by July 2001. Within the next few years, the COE may undertake two reconnaissance studies of environmental restoration projects along Rillito Creek. One would be for a wetlands in the vicinity of Swan Road; the other would be for environmental restoration between Craycroft Road and Campbell Avenue.

⇒ *Representative Aerial Photo: 17-22*

(Note: The date of all aerial photos in this report is Oct. 1998, after the Rillito Creek Bank Protection Project had been completed.)

R-2: Country Club Road to La Cholla Boulevard

Beginning at Country Club Road, Rillito Creek assumes a more northwesterly alignment. The river channel is relatively straight, with one slight bend to the north in the vicinity of Oracle Road. Channel geometry is similar to that in upstream areas, with an average channel width of 300-400 feet.



17-22

3-4

Rillito Creek

Located north of the central part of the City of Tucson, dense urbanization occurred along this part of Rillito Creek earlier than along upstream and downstream reaches. Also, bridges at Campbell Avenue, First Avenue, Oracle Road, La Cañada Drive and La Cholla Boulevard that provided access to developed areas north of Rillito Creek needed to be protected. From about 1985 through 1990, the District constructed bank stabilization along both banks between Campbell Avenue and La Cholla Boulevard, leaving a small gap in the bank stabilization on the south bank upstream of La Cholla Boulevard. In the fall of 1993, following the January 1993 Floods, bank stabilization was completed from Campbell Avenue to Country Club Road.

The floodplain is generally contained within the channel throughout the length of this reach. A review of aerial photographs shows that most of the land adjacent to the channel banks between Tucson Boulevard and La Cañada Drive has been developed for dense residential or commercial uses. Overbank flows along the north bank between La Cañada Drive and La Cholla Boulevard are due primarily to tributary washes draining in from the Riverside Terrace area. Several open space areas are adjacent to the channel between La Cañada Drive and La Cholla Boulevard.

⇒ *Representative Aerial Photo: 15-23*

R-3: La Cholla Boulevard to the Santa Cruz River

Downstream of La Cholla Boulevard, the channel assumes a relatively straight alignment, with a decidedly northwest trend. Just upstream of the railroad tracks, the channel makes a sharp 90-degree bend to the southwest, flowing under the railroad tracks and I-10 and to the Santa Cruz River. The channel geometry of this downstream segment is similar to that in upstream areas, however the average channel width is a bit wider.

As in upstream areas, the floodplain delineation reflects conditions prior to the completion of the bank stabilization project. Flows are generally contained within the channel banks upstream of Shannon Road. Downstream of Shannon Road, significant overbank flooding is shown to the north, with some to the south. It is anticipated that much, if not all of this overbank flooding, will be removed from flood hazard status after the completion of a revision to the Flood Insurance Rate Maps.

East of the railroad tracks, land use adjacent to the channel consists of a mixture of large, undeveloped lots, dense residential subdivisions, and commercial uses. It is anticipated that many of the vacant areas will be developed in the near future, now that bank stabilization has been completed, and with the expected construction in the next year of the extension of River Road from La Cholla to Thornydale. Between I-10 and the Rillito confluence at the Santa Cruz River, sand and gravel mining operations are located north and south of the channel.

⇒ *Representative Aerial Photos: 13-23 & 14-23*





13-23 & 14-23

3-7

Rillito Creek

4.0 CAÑADA DEL ORO WASH

❖ Overview

The Cañada del Oro (CDO) Wash flows north out of the Santa Catalina Mountains, then turns to the southwest, draining the north and northwest sides of the Catalinas. Upon crossing the boundary between Pinal and Pima Counties, the wash flows through unincorporated Catalina, then Catalina State Park. After crossing under the Oracle Highway, the wash turns to the west-southwest, flowing through urbanized Oro Valley, unincorporated Pima County and Marana before it drains into the Santa Cruz River south of Ina Road.

Prior to urbanization, the CDO Wash consisted of a braided channel system, in places supporting lush riparian vegetation. Today, much of the wash retains this braided character, except for the downstream-most reach, which has been fully channelized.

Upstream of the Oracle Highway, the channel banks are natural. Development in the Catalina area has encroached into the floodplain, however, no major structural flood control improvements have been constructed in this reach. From Oracle Highway to La Cañada Drive, the Oro Valley Flood Control Levee protects areas along the south bank from flooding. Between La Cañada Drive and La Cholla Boulevard, the wash is natural. Downstream of La Cholla Boulevard to the Santa Cruz River, the wash is fully channelized.

In 1983, the Flood Control District identified the reach between La Cañada Drive and La Cholla Boulevard as an area where the natural floodplain should be preserved, in order to help stabilize the river system, and facilitate the transition from the upstream, braided channel system to the downstream, fully channelized system. Since 1984, the District has been actively acquiring parcels in the "Oasis" area.

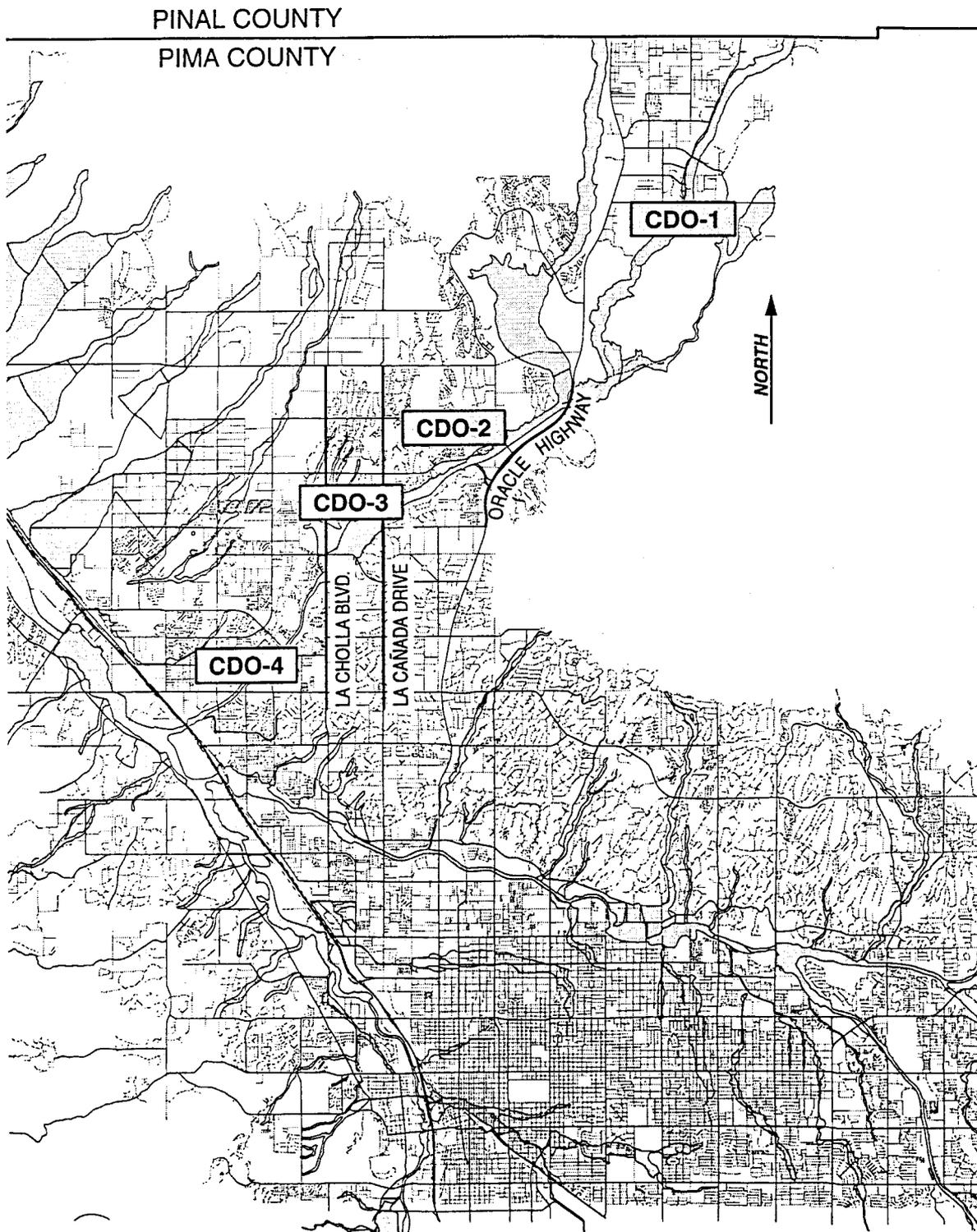
With increasing attention being focused on regional water supply issues, studies have identified the CDO Wash as having a high potential for recharging groundwater in the fast-growing northwest area. The Northwest Replenishment Program proposes to recharge the groundwater in the CDO Wash (and the Lower Santa Cruz River). Spreading basins would be located in Big Wash, upstream of the CDO confluence, and near La Cholla Boulevard and Overton Road (in the "Oasis" area). Water would flow down the CDO channel between Big Wash and the "Oasis" area, infiltrating the subsurface. In addition to recharging the groundwater, this would facilitate the re-establishment of riparian vegetation.

A feasibility study, which includes completing the hydrogeologic characterization of the proposed recharge sites, and evaluating the potential long-term recharge rate, is being conducted by the ADWR, the Town of Oro Valley, and the MDWID. The target date for completion of the feasibility study is mid-2000.

For discussion purposes, the CDO Wash has been divided into four reaches (Figure 4-1). Table 2 summarized the status of each reach. Preceding Table 2, a discussion of each reach is provided.

Figure 4-1

CAÑADA DEL ORO WASH



❖ Floodplain/Land Use Description

CDO-1: Pinal County Line to Oracle Highway

The CDO Wash in this reach occupies a “v”-shaped canyon located west of and roughly parallel to the mountain front. Within the floodway, which is, on average, 600 feet wide, the low flow channel meanders from side-to-side. Several channel braids are visible, and riparian vegetation is present. The 100-year flood overtops the channel banks, occupying an 1100-foot wide floodplain.

Prior to the adoption of current floodplain regulations, several residences were constructed within the flood hazard area. Because the only access into the wash area is from the west, all development in and around the wash relies on using Lago del Oro Parkway. This road, which runs north-south along the western side of the wash, is at-grade, and often becomes impassable when water overtops the road. Consequently, during severe flood emergencies when access is impassable, evacuations must be made by helicopter.

Most of the development east of the wash has occurred in the past ten years, and is outside the flood hazard area. A majority of the residents on the east side of the CDO Wash can leave the area via Golder Ranch Road, which provides all-weather access across the wash. However, for some residents, their only access is through at-grade dip crossings which become impassable when the CDO is flowing.

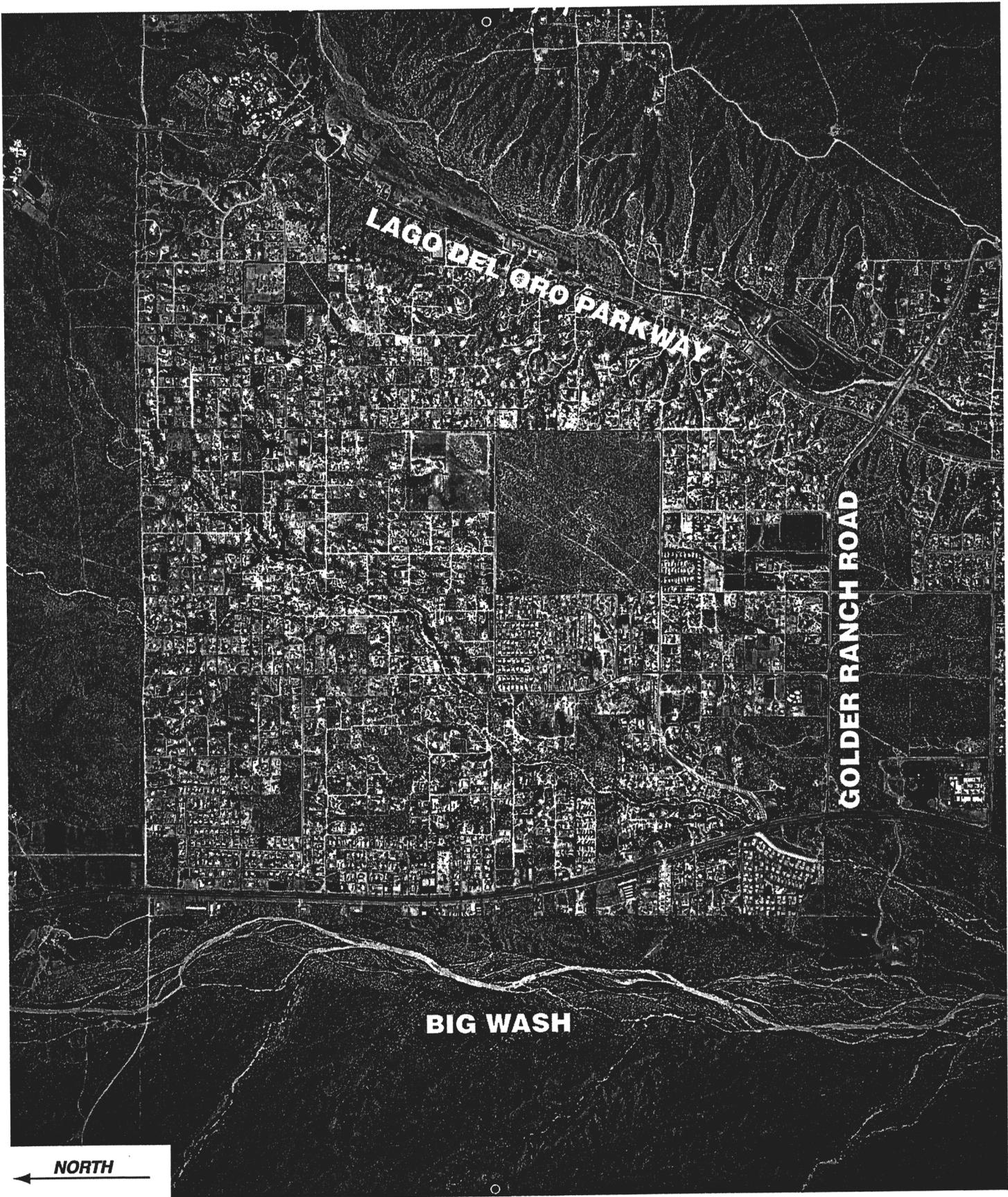
⇒ *Representative aerial photo: 17-30*

CDO-2: Oracle Highway to La Cañada Drive

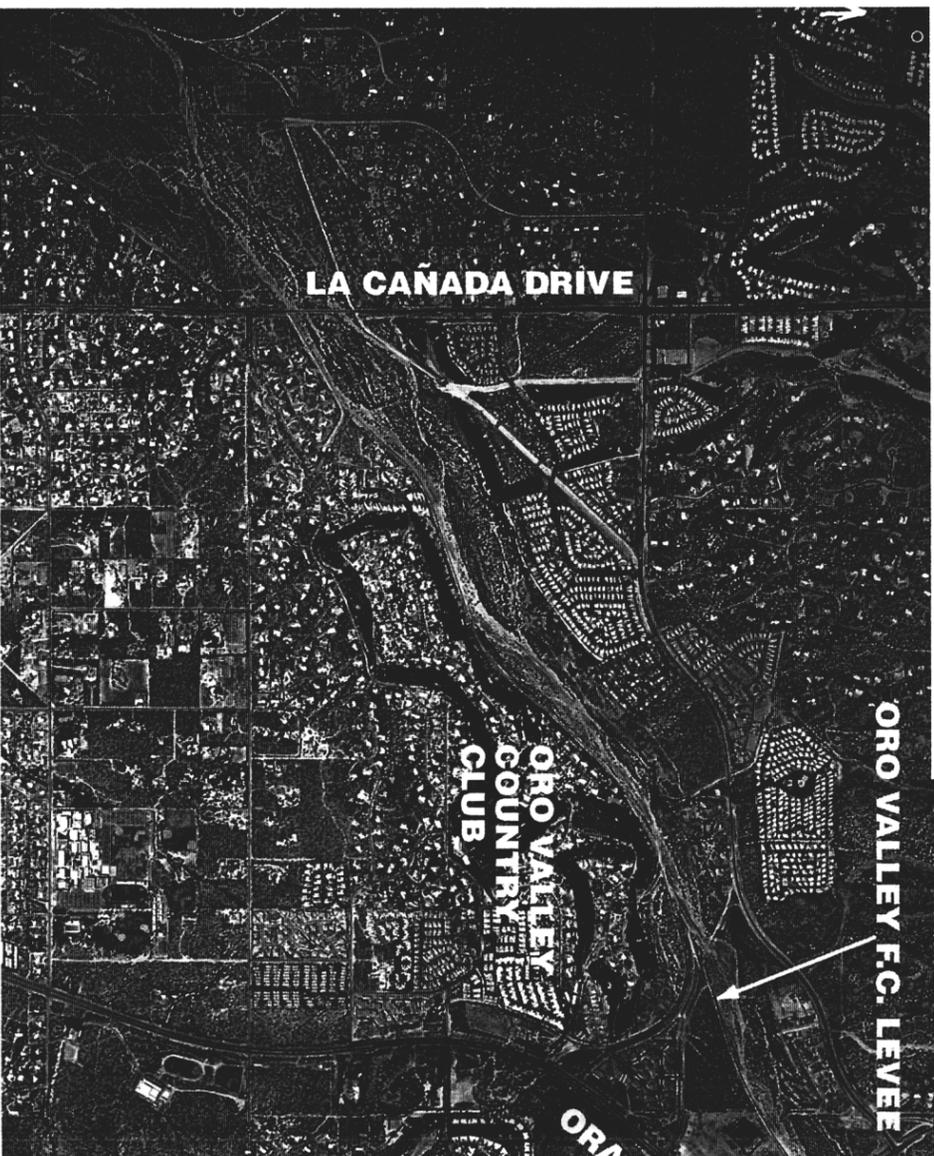
Beginning in the early 1960's, the Oro Valley Country Club was constructed along the south side of the CDO Wash. In order to provide flood protection to areas south of the wash, the ADWR, with assistance from the District, constructed the Oro Valley Flood Control Levee in the mid-1980's, which begins just east of the Oracle Highway and extends along the south bank to La Cañada Drive.

Although the wash is confined to the south, it retains much of its natural character north of the levee. As part of the levee design, an erosion buffer was left along the north bank, and the channel was allowed to meander within an 800-foot wide corridor. The wash in this reach retains a braided pattern, with riparian vegetation along the channel braids. Much of the land adjoining the wash on the north has been developed, with limited encroachment into the floodplain. This reach is located entirely within the Town of Oro Valley.

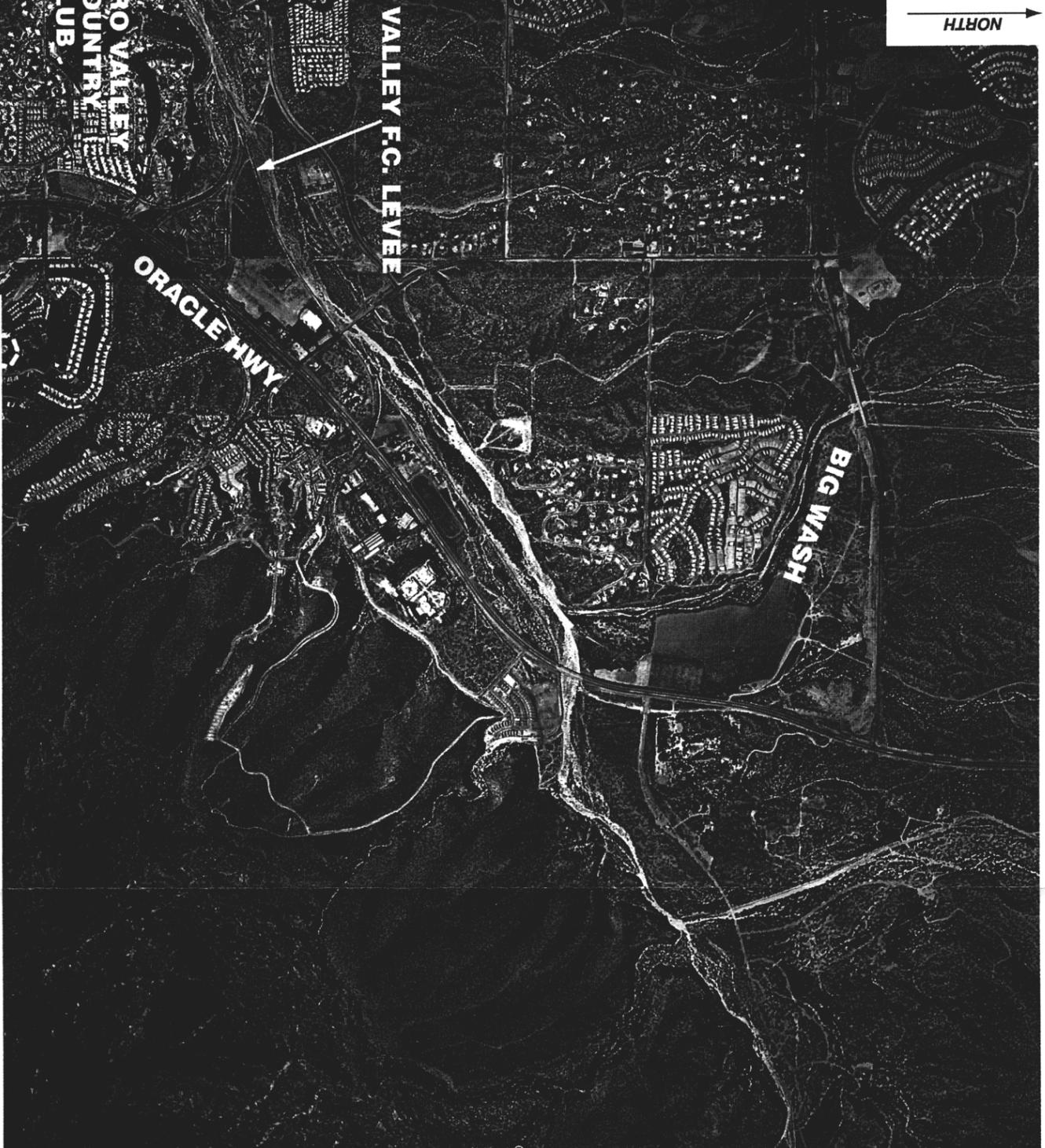
Big Wash, a major tributary, drains into the CDO Wash just west of the Oracle Highway. As part of the Northwest Replenishment Program, spreading basins for recharging groundwater are proposed in the Big Wash, upstream of the CDO confluence, and at the “Oasis” area downstream of La Cañada Drive. According to the proposed concept, water would be allowed to drain along



15-26, 16-27



NORTH →



4-5

the CDO wash between the two spreading basin areas, with the intent of recharging the groundwater and promoting the growth and establishment of riparian vegetation.

⇒ *Representative aerial photos: 16-27, 15-26*

CDO-3: La Cañada Drive to La Cholla Boulevard

According to the Cañada del Oro River Master Plan, completed by the District in 1983, this reach, identified as the "Oasis" area, would remain natural. The intent was to provide a buffer area between the braided, upstream reach and the fully channelized downstream reach.

In contrast to upstream and downstream areas, the floodplain becomes quite broad, with a width of over 3000 feet. This is due in part to several tributaries that drain into the CDO Wash from the north. To preserve the integrity of the natural floodplain, the District has been acquiring parcels in this area since 1984, as part of the nonstructural Floodprone Land Acquisition Program. In addition, the two major roadway crossings, at Overton Road and La Cholla Boulevard, are at-grade. Access across the wash is restricted during major flooding.

When viewed on an aerial photograph, this reach stands out as an undeveloped natural area located between urbanized land uses in both the upstream and downstream directions. As mentioned in the description for the upstream reach, recharge spreading basins may be constructed in this area as part of the Northwest Replenishment Program.

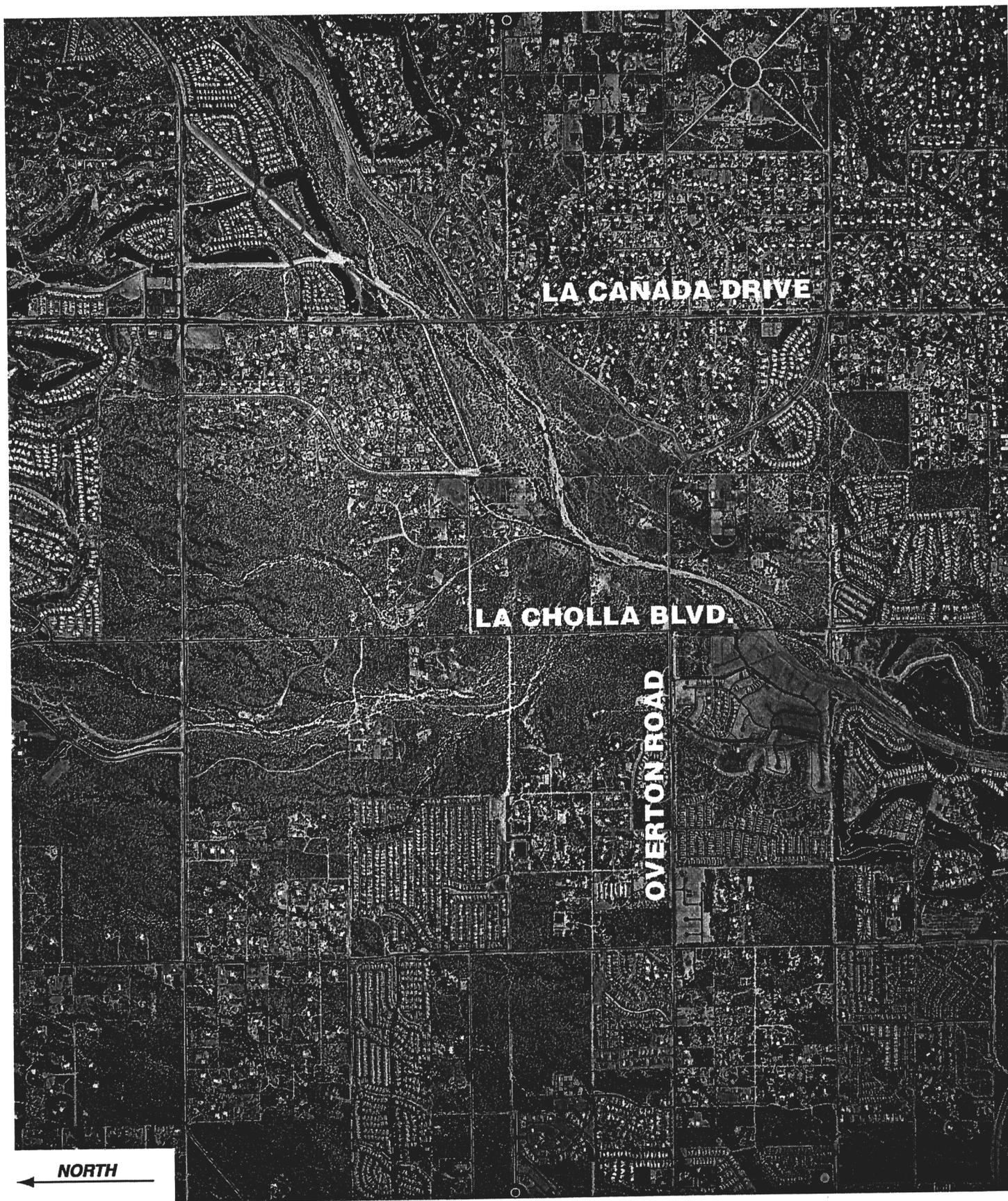
⇒ *Representative aerial photo: 14-26*

CDO-4: La Cholla Boulevard to the Santa Cruz River

This downstream reach is located within the densely urbanized metropolitan area, and is fully channelized. Bank stabilization has been constructed along most of the channel banks, and, where the banks are stabilized, the 100-year flood is contained within the channel. The average channel width is 300 feet.

At the upstream end of this reach, the Omni Tucson National master planned community surrounds the wash. Most of the land adjacent to the channel has been developed as a golf course. Continuing downstream between Magee and Ina Roads, dense residential development surrounds the channel. Downstream of Ina Road, a mixture of residential, commercial and industrial land uses are found. Vacant land adjoins the channel where the banks are unprotected. Between I-10 and the Santa Cruz River, the County's Ina Road Wastewater Treatment Facility is located along the north bank of the CDO Wash, and a sand and gravel mining area is located along the south bank.

⇒ *Representative aerial photo: 13-25*



14-26

4-7

Cañada del Oro Wash



**OMNI TUCSON
NATIONAL**

INA ROAD

MAGEE ROAD

I-10

**WASTEWATER
TREATMENT
FACILITY**

NORTH
←

13-25

4-8

Cañada del Oro Wash

Watercourse Reach	Status	Flood Control Approach	Notes
<p>1. Cañada del Oro Wash, Pinal County line to Oracle Highway</p>	<p>Channel banks are natural in this reach. <u>No bank stabilization is planned.</u></p>	<p>Maintain the natural floodplain, and preserve overbank storage to mitigate downstream flood peak discharges.</p>	<p>The unincorporated community of Catalina is located south of the Pinal County line.</p> <p>Catalina State Park is owned and managed by the State Land Department.</p> <p>A continuous thread of xero-riparian Type B vegetation has been mapped from the Pinal County line to the State Park boundary. There are also several large patches of mapped hydro-meso riparian habitat.</p>

<p>2. Cañada del Oro Wash, Oracle Highway to La Cañada Drive</p>	<p>A flood control levee is located along the south bank throughout the entire reach. Bank stabilization also protects the north bank at the Tucson-Florence Highway bridge over the CDO Wash, and at the confluence where Big Wash drains into the CDO Wash.</p> <p>Upstream of La Cañada Drive on the north bank, approx. 1400 feet of bank stabilization guides flow under the bridge. <u>No additional structural flood control improvements are planned.</u></p>	<p>Areas south of the channel are protected by a flood control levee.</p> <p>It is intended that areas north of the channel will remain natural, to serve as an erosion buffer area along the north bank.</p>	<p>This reach is located entirely within the Town of Oro Valley.</p> <p>From the Oracle Highway downstream to its confluence with the Santa Cruz River, the CDO Wash traverses the urbanized greater Tucson metropolitan area.</p>
<p>Watercourse Reach</p>	<p>Status</p>	<p>Flood Control Approach</p>	<p>Notes</p>
<p>3. Cañada del Oro Wash, La Cañada Drive to La Cholla Boulevard</p>	<p>Approximately 2500 feet of bank stabilization protects a residential subdivision on the north bank, downstream of La Cañada Drive. The remainder of the reach has natural channel banks. See "Notes." <u>No additional bank stabilization is planned in this reach.</u></p>	<p>Maintain the natural floodplain.</p>	<p>This is one of two sites being considered for recharge as part of the Northwest Replenishment Program (the other is in Big Wash upstream of the CDO confluence). A feasibility study is underway (as of 7/00).</p> <p>Since the "Oasis" area is intended to remain natural, no bridges have been constructed at Overton Road and La Cholla Boulevard.</p> <p>Xero-riparian Type C vegetation has been mapped along several of the flowpath braids.</p>

<p>4. Cañada del Oro Wash, La Cholla Boulevard the Santa Cruz River</p> <p>(END CAÑADA DEL ORO WASH)</p>	<p>From La Cholla Boulevard to the Hardy Road alignment, private interests have constructed 100-year bank stabilization on the west bank as part of The Bluffs development. From the Hardy Road alignment to Magee Road, low-flow bank stabilization has been constructed on both banks by private interests. There are also three grade control structures.</p> <p>100-year bank stabilization has been constructed on both banks between Magee and Thornydale Roads. There is bank stabilization on the south bank from Thornydale Road to I-10, on the north bank for approximately 600 feet downstream of the Thornydale Road bridge, and on the north bank from I-10 to the Santa Cruz River. <u>Bank stabilization is planned along the north bank from Thornydale Road to I-10. The south bank downstream of I-10 will also likely be protected.</u></p>	<p>Most of this reach has bank stabilization. Plans call for completing the gaps, such that the entire reach has bank protection and is fully channelized.</p>	<p>The Ina Road Wastewater Treatment Facility is located along the north bank of the CDO Wash downstream of I-10, at the confluence with the Santa Cruz River.</p> <p>A sand and gravel mining operation is located along the south bank of the CDO Wash between I-10 and the Santa Cruz River.</p>
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5.0 PANTANO WASH

❖ Overview

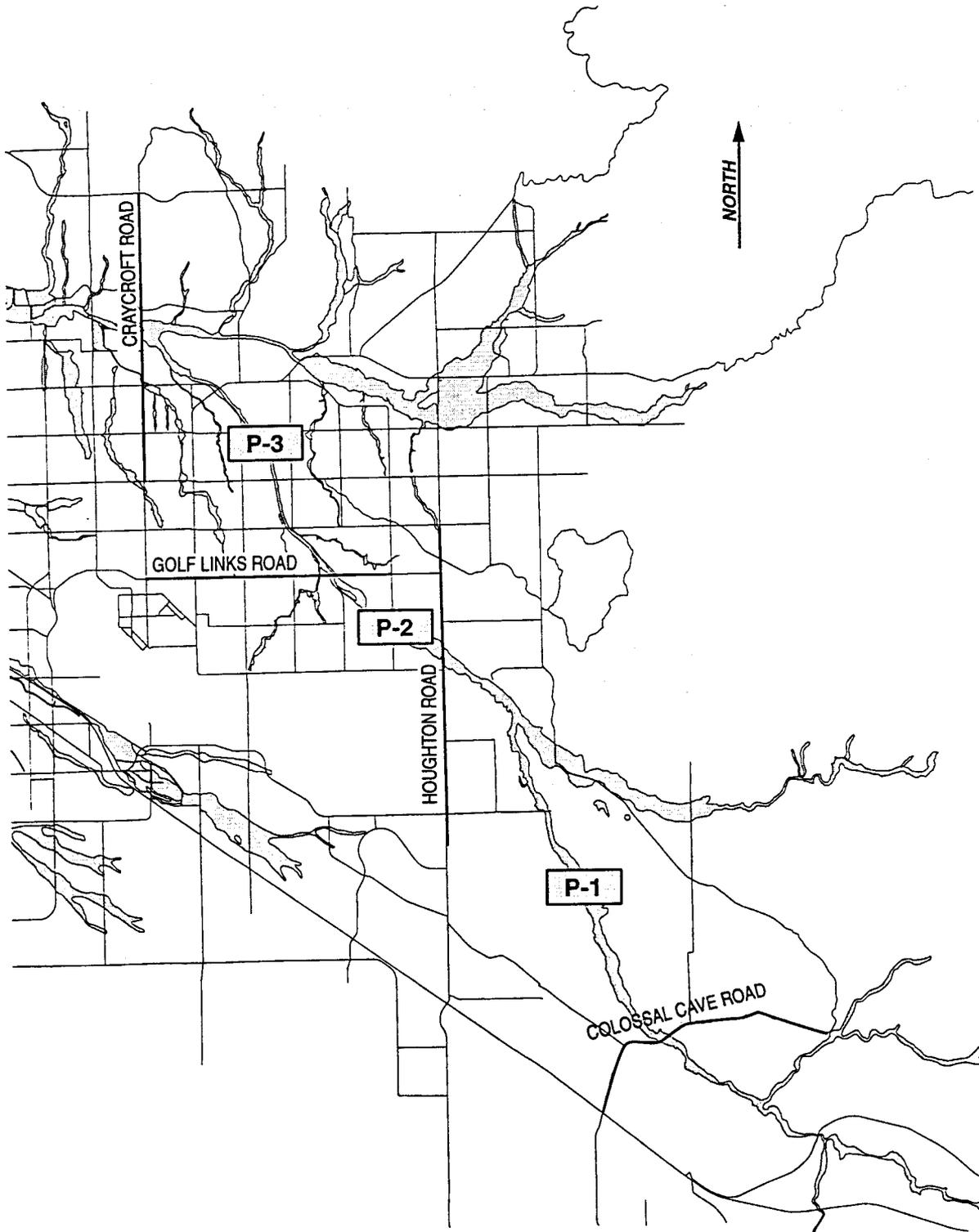
The headwaters of Pantano Wash originate southeast of Tucson near the Town of Sonoita, where runoff draining from the eastern slopes of the Santa Rita Mountains and the west side of the Whetstones, enters Cienega Creek. Cienega Creek drains to the north to Interstate 10 where it veers to the west towards Tucson. A portion of the south face of the Rincon Mountains drains into Cienega Creek as it heads west. At Colossal Cave Road, Cienega Creek becomes Pantano Wash. In addition to carrying runoff from the upstream areas, Pantano Wash collects runoff draining off the southwest side of the Rincon Mountains, and the southeast side of the metropolitan Tucson area.

From Colossal Cave Road, Pantano Wash flows to the northwest along the boundary between the City of Tucson and unincorporated Pima County, flowing back and forth between the two jurisdictions until upstream of Houghton Road, where it flows into the City of Tucson. The wash continues along a more west/northwest alignment for approximately eight and-a-half miles, draining through urbanized Tucson until it re-enters unincorporated Pima County downstream of Grant Road. From Grant Road, the Pantano flows mostly through unincorporated Pima County for one and-one-half miles, joining with Tanque Verde Creek at Craycroft Road to form Rillito Creek. The Pantano Wash is mostly channelized in the urban area.

A discussion of Pantano Wash would be incomplete without mentioning the role it has played in providing raw materials that have enabled the construction of masonry buildings in the Tucson area. Over the past 50 years, sand and gravel has been excavated from the Pantano Wash for construction purposes. In the urbanized area downstream of Irvington Road, the bed of the Pantano has degraded significantly, and many believe it is due to in-channel mining in the wash bed, before 1960. Since 1960, most of the sand and gravel excavation has occurred in overbank areas upstream of the urbanized area.

For discussion purposes, the Pantano Wash has been divided into three reaches: upstream of the urbanized area, a transition reach, and that reach within the urbanized area (Figure 5-1). Table 3 provides a summary of the existing flood control infrastructure as well as the flood control approach, for each reach.

Figure 5-1
PANTANO WASH



❖ Floodplain/Land Use Description

P-1: Colossal Cave Road to Houghton Road

This approximately 9.5-mile reach of the Pantano is located upstream of the densely urbanized metropolitan Tucson area. The low-flow channel is narrow, tightly sinuous, and meanders within an incised floodway that averages 600 to 800 feet wide, and trends to the northwest. In some locations, the floodplain extends beyond the floodway limits. A major tributary, Rincon Creek, drains into the Pantano from the east, approximately two miles upstream of Houghton Road.

Although this reach of the Pantano is decidedly rural, two established residential areas are located east of the wash and upstream of the Rincon Creek confluence. Both residential areas consist of relatively low density development. The northern-most developed area is part of the Rocking K Ranch subdivision. Increased urbanization to the east is expected with development of the Rocking K Ranch and Vail Valley developments. Downstream of the Rincon Creek confluence, development is occurring within the Civano master planned community, west of Pantano Wash and south of Irvington Road and in smaller high density residential subdivisions near Houghton Road. Within the next couple of decades, increased urbanization is expected to occur along this reach of Pantano Wash.

Several sand and gravel mining areas are located to the west of the incised floodway, with a few to the east. Excavation in overbank areas is expected to continue.

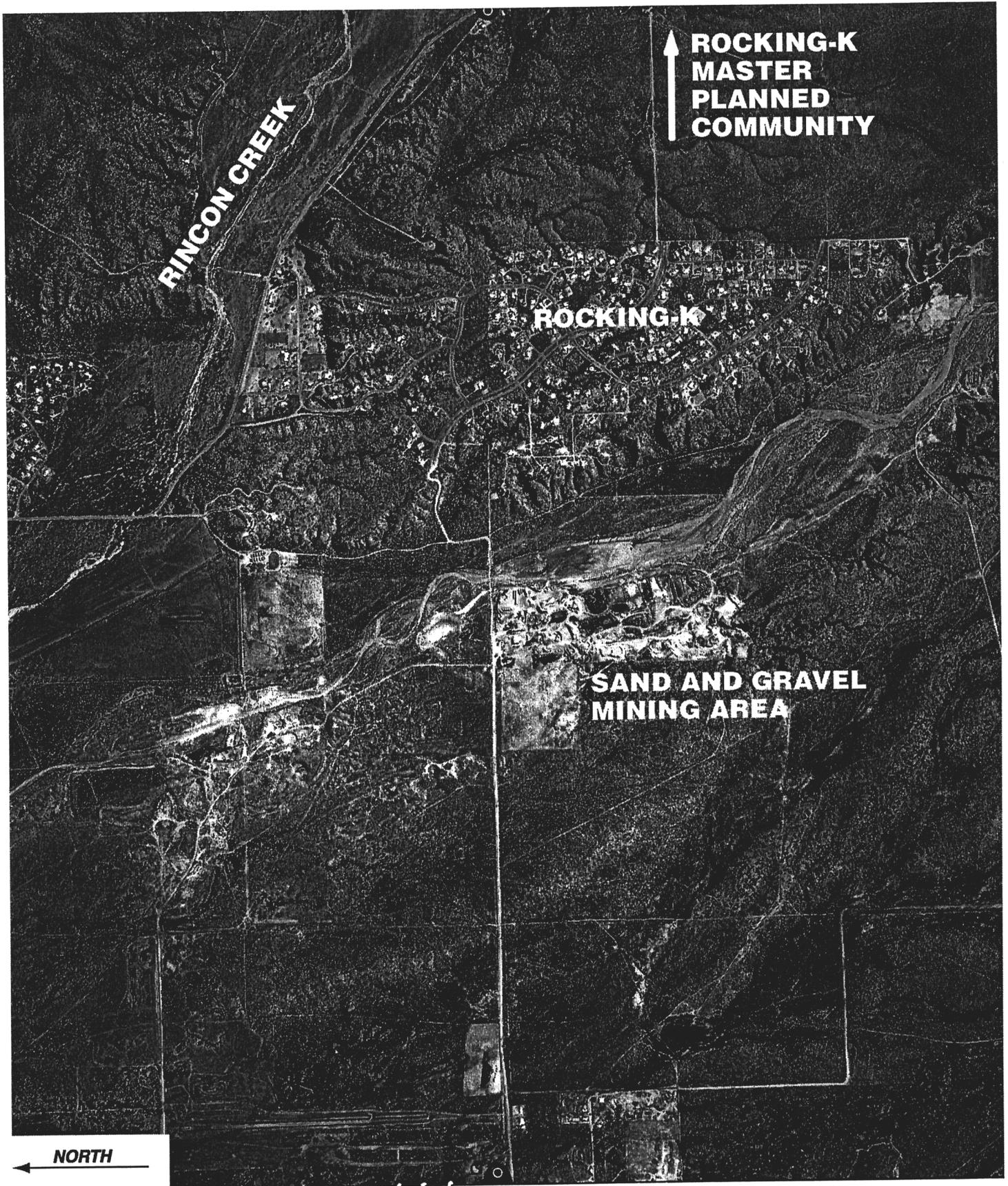
⇒ *Representative Aerial Photo: 22-17*

P-2: Houghton Road to Golf Links Road

This reach is a transition area between the mostly natural, rural upstream reach and the channelized, urban downstream reach. The floodplain is relatively wide, averaging 600 - 1200 feet, and appears as a relatively broad corridor, with a low-flow channel that migrates in a semi-braided manner within the corridor. A combination of dense, residential development and open space areas line the edges of the floodplain. The overall wash alignment is to the northwest, however, there are two major channel bends in this reach.

Discontinuous segments of bank stabilization have been constructed in three locations, two of which are at the outside of the bend areas. The first segment of bank stabilization, which begins at Harrison Road and extends west, appears to have been constructed to protect a sand and gravel mining operation south of the wash. The other two segments, one located along the west outer edge of the bend downstream of Harrison Road, and the other along the east outer edge of the bend upstream of Golf Links Road, protect adjacent residential areas.

Several landfills and wildcat dumps are located southeast of the channel in this reach. The Harrison Road landfill and some wildcat dump sites are currently used; other sites have been



closed. Some of the closed landfill and wildcat sites have been developed. The landfill and dump sites are generally not located adjacent to the channel.

⇒ *Representative Aerial Photo: 20-19*

P-3: Golf Links Road to Craycroft Road

Beginning at Golf Links Road and extending to one-half mile downstream of Tanque Verde Road, the Pantano is fully channelized, and bank stabilization has been constructed along most of this reach. The average width of the floodplain is approximately 300 feet, and the floodplain is fully contained within the channel banks. Upstream of Golf Links Road to the west of the Pantano Wash, the Kinneson Wash flows into the Atterbury Wash. This confluence area is the site of the City of Tucson's Atterbury Wash Wetlands Project. Downstream of Golf Links Road, the Atterbury Wash flows into the Pantano Wash.

From one-half mile downstream of Tanque Verde Road to one-half mile upstream of Craycroft Road, a distance of one mile, the channel assumes a more natural form, and the floodplain widens to 700 feet. The Pantano becomes more channelized immediately upstream of Craycroft Road.

Dense residential development, and a mixture of industrial, commercial, and open space areas are adjacent to the channel banks throughout the entire reach. In the few gaps where bank stabilization has not been constructed upstream of Tanque Verde Road, vacant land adjoins the channel banks. In the natural channel reach downstream of Tanque Verde Road, the Tucson Country Club Estates subdivision lies along the east channel bank, and a mixture of commercial, open space and residential uses are located along the west bank. It is likely that the remaining unprotected channel banks in this reach will be stabilized.

⇒ *Representative Aerial Photos: 19-21 and 18-22*



HARRISON ROAD

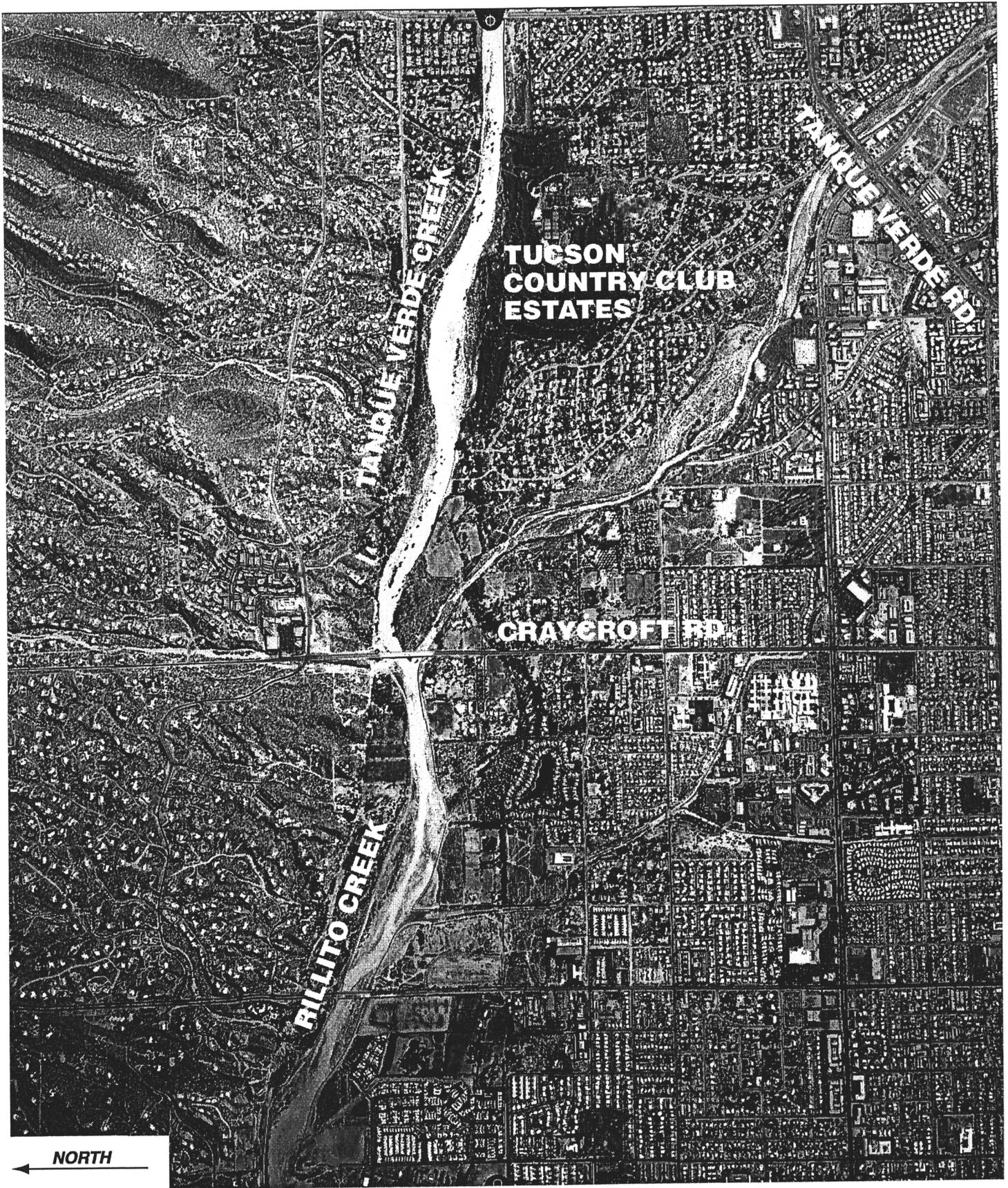
LANDFILL

IRVINGTON ROAD

GOLF LINKS

NORTH





Watercourse Reach	Status	Flood Control Approach	Notes
1. Pantano Wash, Colossal Cave Road to Houghton Road	Channel banks are natural, except for some localized bank stabilization at the Colossal Cave and Houghton Road bridges. One grade control structure downstream of Colossal Cave Road and three others at tributary confluences may be required if sand and gravel operations continue along the wash. <u>No additional bank stabilization is planned.</u>	Preserve the natural channel.	This reach, located partly within the City of Tucson, is used primarily for sand and gravel mining operations, which are expected to continue. The Rocking K Ranch master planned community is located between Rincon Creek and the Pantano, just upstream of the confluence. The Civano master planned community is located on the west bank of the Pantano at the confluence of Rincon Creek.
2. Pantano Wash, Houghton Road to Golf Links Road	This reach has mostly natural channel banks, however, in the most vulnerable locations, the banks have been stabilized with soil-cement. Limited abutment protection is present at the Houghton Road bridge. There is a short segment of bank stabilization on the west bank downstream of Escalante Road, and about 0.7 mile along the east bank, upstream of Golf Links Road. There is also a short segment on the west bank west of Harrison Road.	It is recommended that this entire transitional reach be protected as urbanization of this area continues.	If bank stabilization were to be constructed, approximately 2 miles is needed on the east bank, and 2.5 miles on the west bank. This reach is located on the outer fringe of the densely developed, urbanized area. There is some sand and gravel mining along the west bank.
3. Pantano Wash, Golf Links Road to Craycroft Road (confluence with Tanque Verde Creek at Rillito Creek) (END PANTANO WASH)	Both banks are stabilized throughout this reach, except at the following locations: from 22 nd St. to Kenyon Dr., Broadway to E. 5 th St., along the west bank upstream of Tanque Verde Road, and from Tanque Verde Road to Craycroft along the east bank, and Wilmot to Craycroft along the west bank. Bank stabilization is under construction along both banks between Broadway and E. 5 th St., as part of a City of Tucson Improvement District. Approximately 2000 feet along both banks downstream of Tanque Verde Road, I being proposed as a joint District-private project.	Stabilize the remaining natural banks between Golf Links and Tanque Verde Road	If bank stabilization were to be constructed, approximately 1.5 miles is needed on the east bank, and 1 mile on the west bank. At the upstream end of this reach, the Atterbury Wash confluence is located along the west bank downstream (north) of Golf Links Road.

6.0 TANQUE VERDE CREEK

❖ Overview

Tanque Verde Creek drains the northern Rincon Mountains, the southeastern Santa Catalina Mountains, and the northeastern metropolitan Tucson area. Flowing out of the Coronado National Forest on Tucson's northeast side, the creek flows to the west, joining with Pantano Wash at Craycroft Road to form Rillito Creek. Two major tributaries carrying runoff from the Santa Catalina Mountains flow into Tanque Verde Creek from the north: Agua Caliente Wash and Sabino Creek. Each of these will be discussed in other sections of this report.

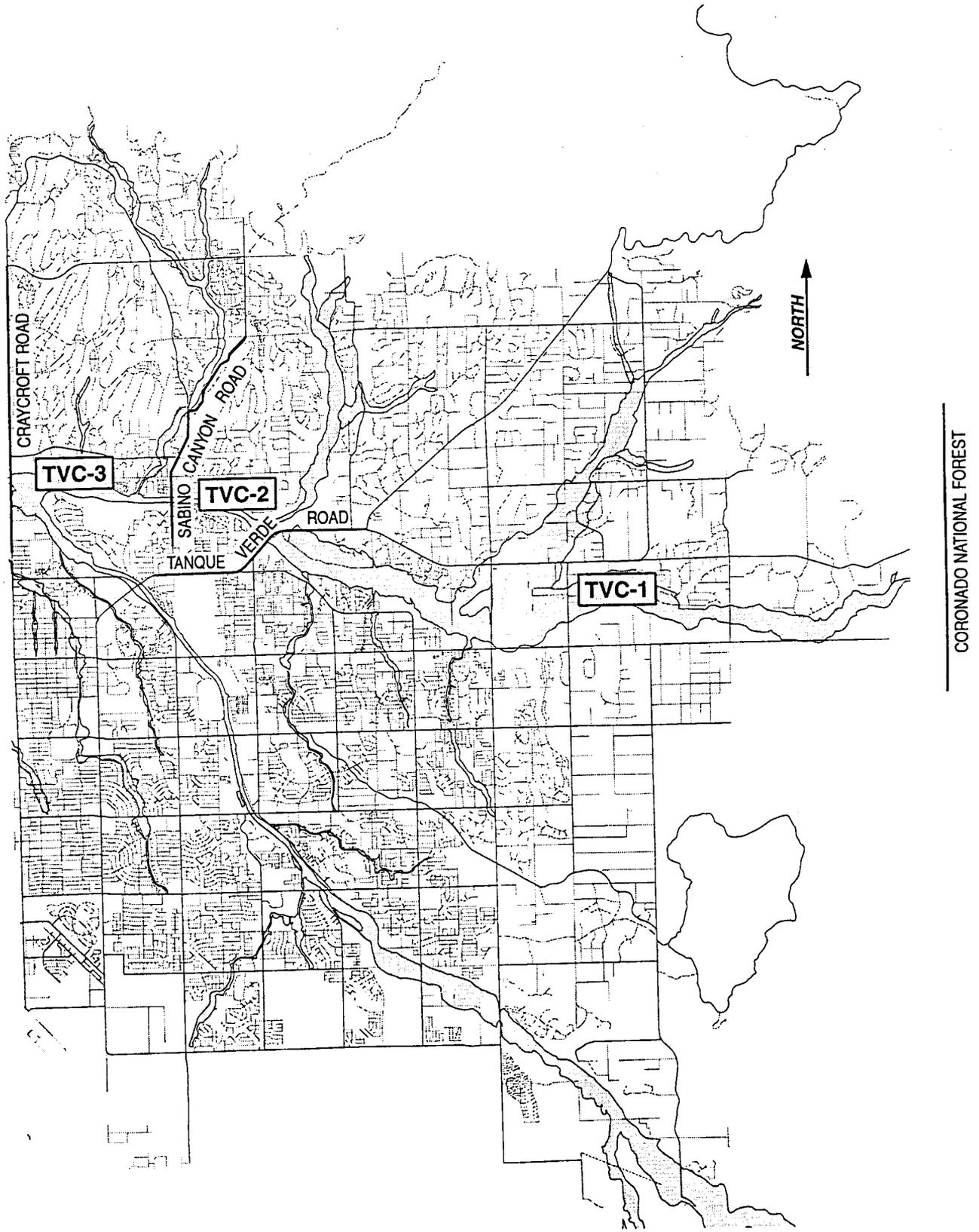
From the Coronado National Forest to Craycroft Road, Tanque Verde Creek has a large, well-defined channel. The channel banks are natural upstream of Tanque Verde Road, protected with soil-cement between Tanque Verde Road and Sabino Canyon Road, and mostly natural downstream of Sabino Canyon Road. Where unprotected, the channel banks are subject to lateral erosion during moderate and larger floods.

Even though the channel is large, the 100-year flood is not contained within the channel where the banks are natural. Larger flows spill out across overbank areas to the north and south. In addition, the depth to groundwater along eastern Tanque Verde Creek is relatively shallow. Consequently, from the Agua Caliente Wash confluence area eastward, overbank areas adjacent to the channel are well-vegetated, and appear as a green swath surrounding the main channel. Hydro-mesoriparian habitat has been mapped from Houghton Road eastward. It has also been mapped from Craycroft Road extending east of the Tucson Country Club.

As would be expected, where the banks are natural, limited development has occurred adjacent to channel. Where the banks have been protected, dense development occurs close to the channel. For the purposes of this report, Tanque Verde Creek has been divided into three segments: from the Coronado National Forest to Tanque Verde Road, Tanque Verde Road to Sabino Canyon Road, and Sabino Canyon Road to Craycroft Road (Figure 6-1). Table 4 provides a summary description of the flood control status of the watercourse. A discussion of each reach follows.

Figure 6-1

TANQUE VERDE CREEK



❖ Floodplain/Land Use Description

TVC-1: Coronado National Forest to Tanque Verde Road

Tanque Verde Creek passes through two jurisdictions in this reach. Upstream of Houghton Road, it is located within unincorporated Pima County. Downstream of Houghton Road to beyond Tanque Verde Road, Tanque Verde Creek is located within the City of Tucson.

The channel is characterized by natural earthen banks, except for a few isolated locations where bank stabilization has been constructed by individual property owners. Channel width varies from 300 - 400 feet at its widest, upstream of Wentworth Road, to 100 feet at its narrowest, in the vicinity of the Forty-Niners Country Club, and between Tanque Verde Loop Road and Houghton Road. The channel alignment is loosely meandering, and, in a few locations, vegetated islands have become well-established within the channel. The floodplain extends beyond the channel to the north and south.

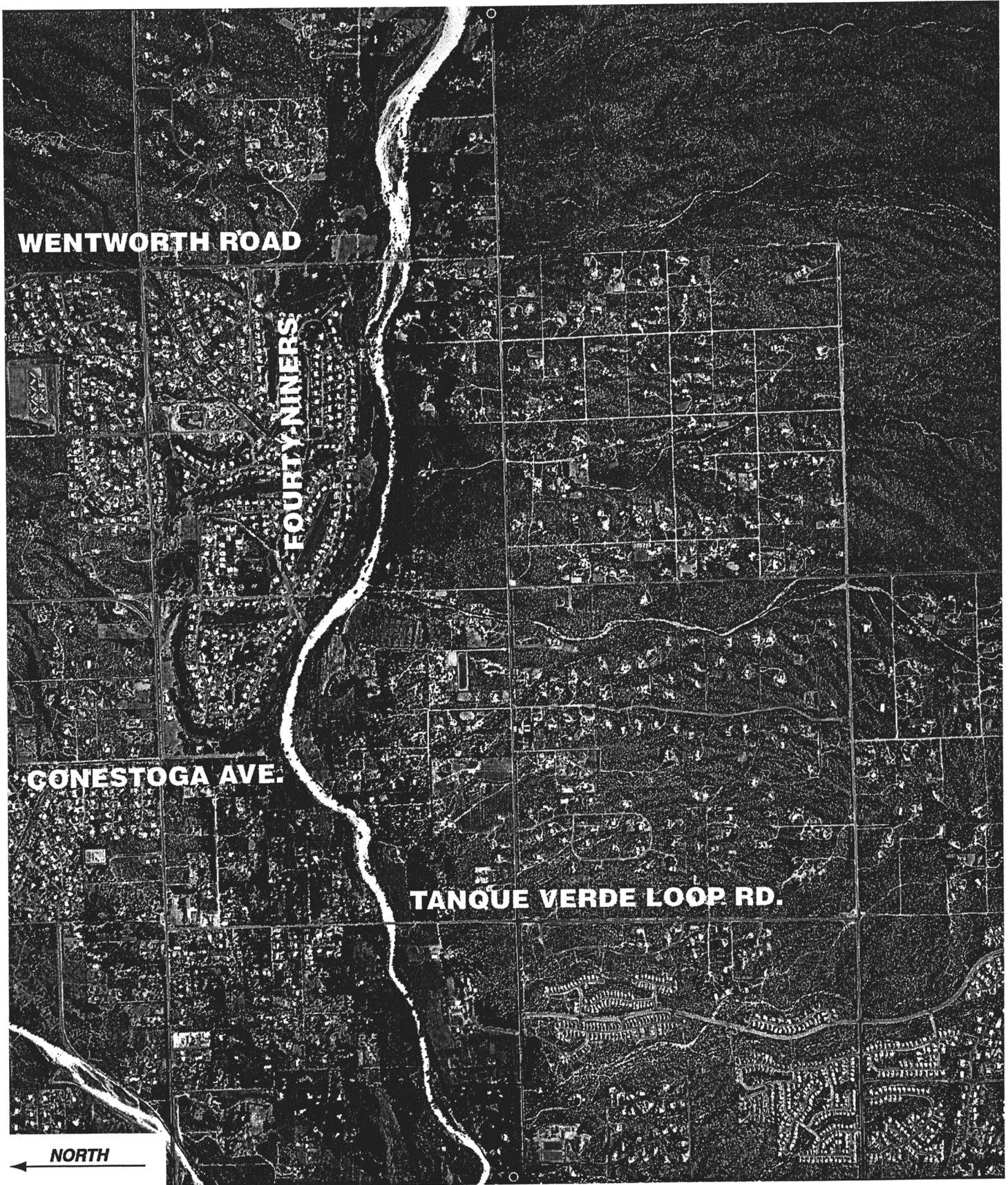
Agua Caliente Wash, a major tributary, drains into Tanque Verde Creek downstream of Houghton Road. Immediately downstream of this confluence area, the Tanque Verde Creek channel is highly dynamic, due in part to the inflow of water and sediment from Agua Caliente Wash.

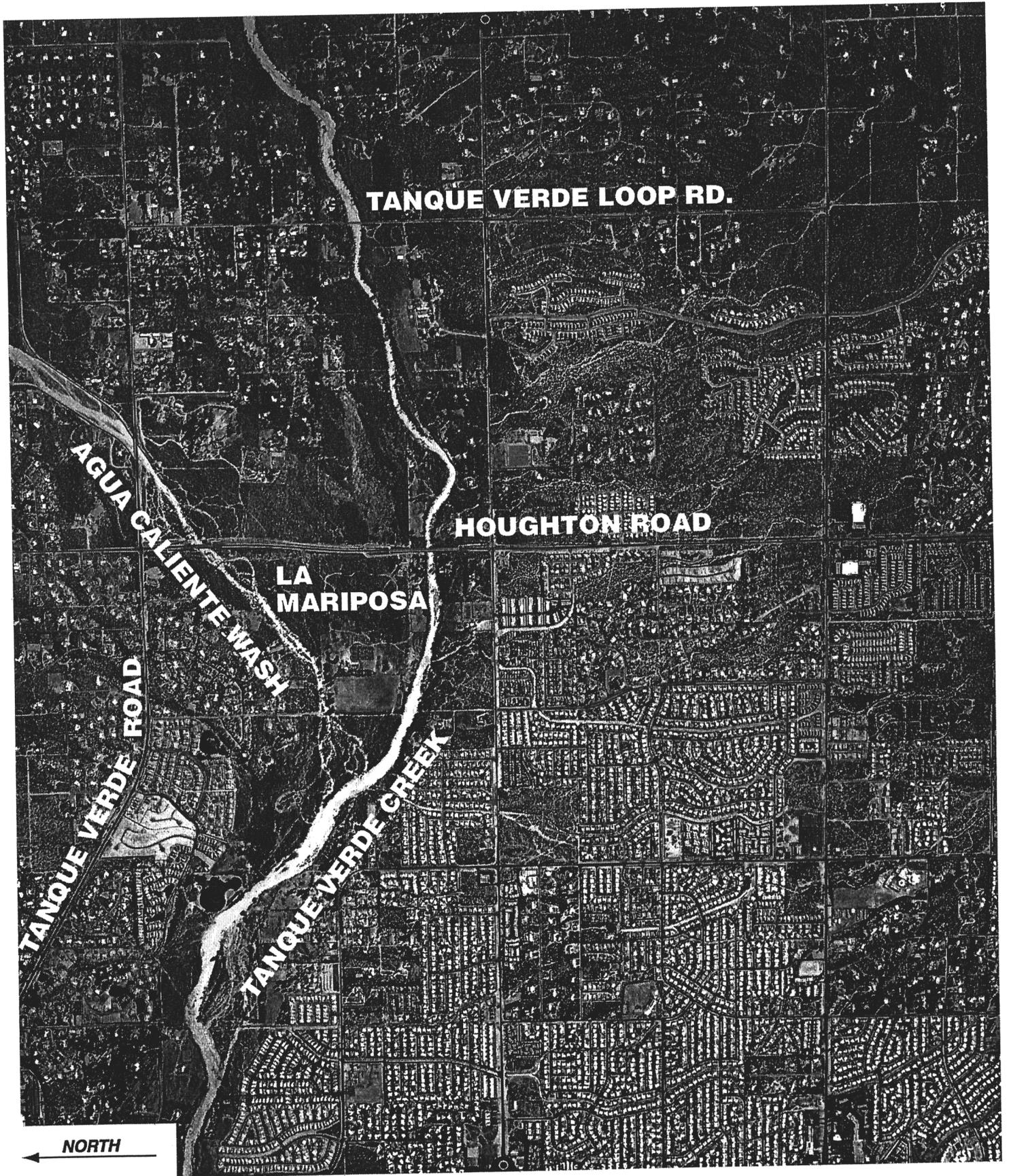
Consistent with the natural channel banks, residential development north and south of the creek is generally sparse. The properties are large, and are either vacant or have a few buildings set within large open space areas. Two areas have denser development near the channel. Along the north bank between Wentworth Road and Conestoga Avenue, the moderately dense Forty-Niners residential subdivision is located within 400 to 600 feet from the channel bank. Further downstream, between Houghton Road and Tanque Verde Road, four residential subdivisions are located within 400 to 600 feet from the south channel bank.

The District has constructed limited bank stabilization in the vicinity of the two major bridge crossings: at Houghton Road and Tanque Verde Road. Isolated bank stabilization has been constructed by private property owners along the reach. The District is planning to construct limited low-flow erosion protection in the vicinity of the Lakes at Castle Rock subdivision, downstream of the Agua Caliente Wash confluence.

Because the floodplain in this reach remains in a semi-natural state, there is significant vegetation along the channel overbank areas. Hydro-meso riparian habitat has been mapped across much of the floodplain from the Coronado National Forest boundary to Houghton Road. The presence of a significant stand of continuous riparian vegetation along this reach is one of Tanque Verde Creek's most distinguishing characteristics.

⇒ *Representative Aerial Photos: 22-21 and 21-21*





TVC-2: Tanque Verde Road to Sabino Canyon Road

Anchored by two major bridges on each end, Tanque Verde Creek is fully channelized throughout this reach. The channel banks are protected by soil-cement bank stabilization, and the 100-year flood is fully contained within the channel banks. Sabino Creek, a large tributary draining a watershed that extends far up into the Catalina Mountains to just below Mount Lemmon, flows into Tanque Verde Creek immediately downstream of the Tanque Verde Road bridge crossing. The confluence area has been fully stabilized with soil-cement.

In order to contain the 100-year flood, as well as flows from Sabino Creek, the channel in this reach is wider than in upstream areas, averaging over 350 feet. Some vegetated channel bars have formed along the channel bottom. When viewed on an aerial photograph, the highly channelized nature of this reach appears in marked contrast to the more natural upstream area.

This reach, and the downstream reach, are located within the urbanized metropolitan area. Dense residential development lines the south channel bank, while a narrow strip of mostly open space abuts the north bank. A few buildings are located close to the north edge-of-bank, however, the dense residential development is set back between 200 and 900 feet. Consistent with the highly disturbed nature of this reach, no riparian habitat has been mapped.

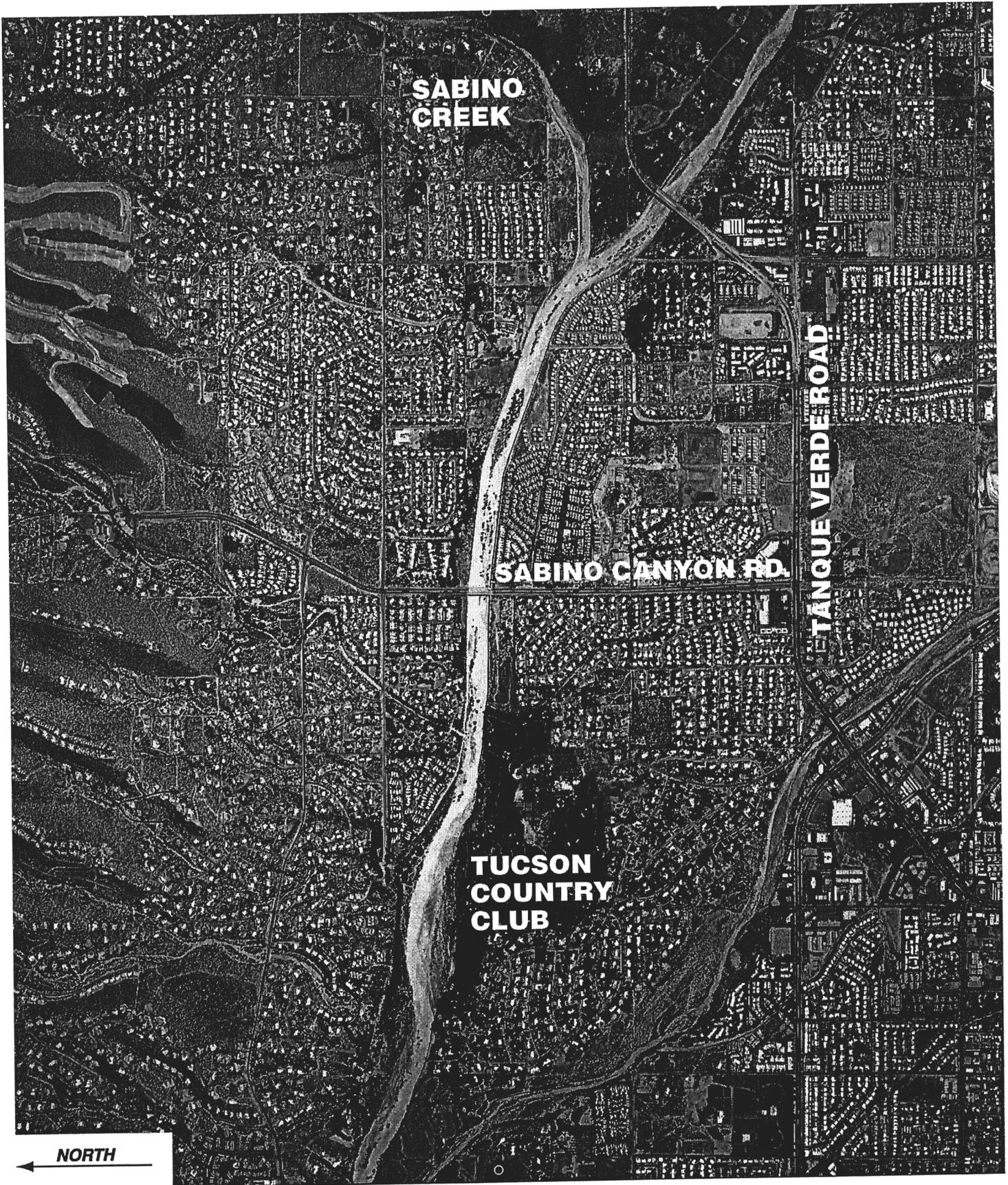
⇒ *Representative Aerial Photo: 19-22*

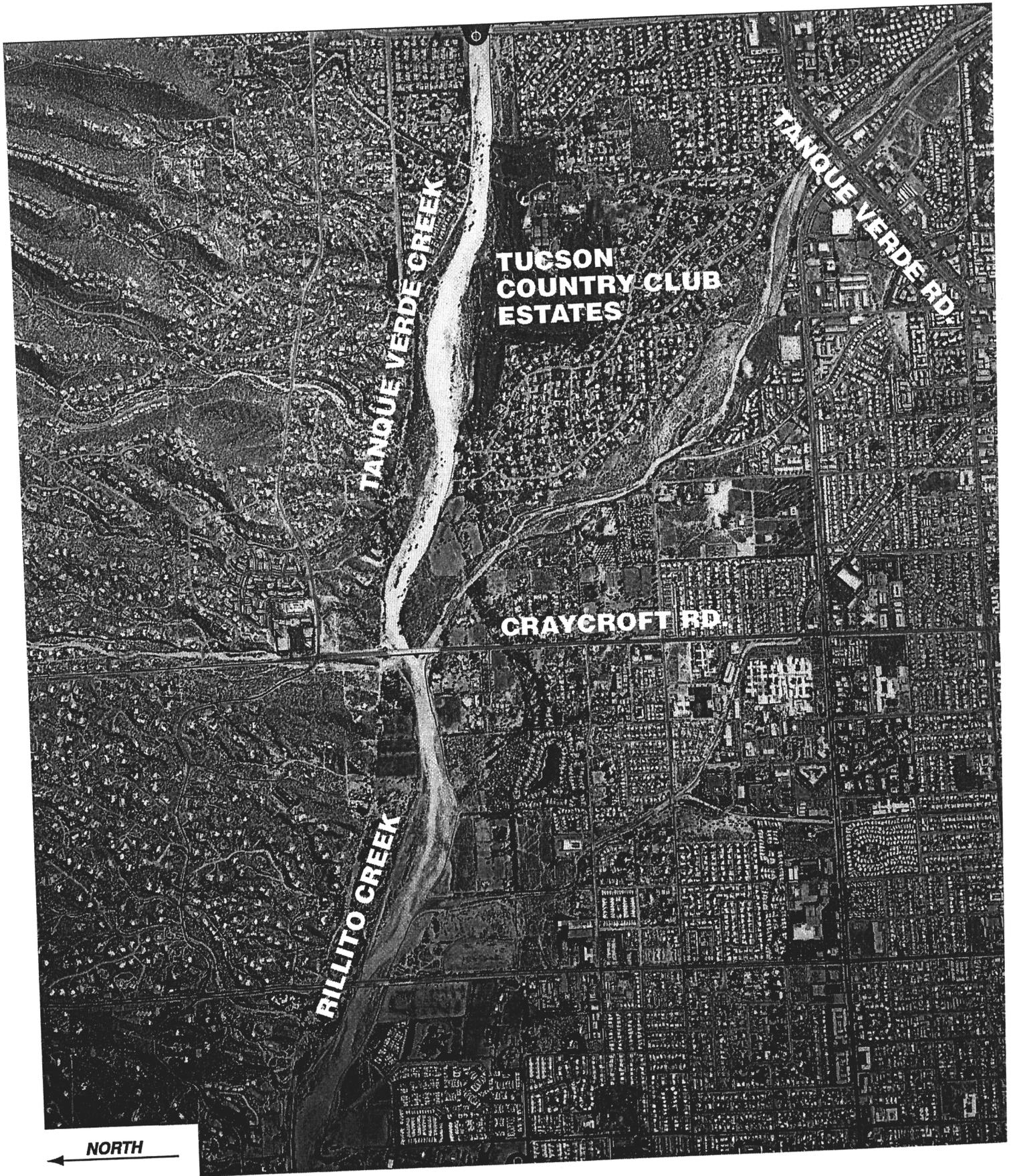
TVC-3: Sabino Canyon Road to Craycroft Road

This reach of the channel, with mostly natural banks, is less natural-appearing than the reach upstream of Tanque Verde Road, but is not as fully channelized as the reach between Tanque Verde Road and Sabino Canyon Road. It appears as somewhat of a compromise between the two: largely channelized, yet retaining some of its natural character. The channel width is consistent with that between Tanque Verde Road and Sabino Canyon Road, averaging 400 feet. Channel alignment is straight, with some minor meanders. In places, vegetated sandbars line the edges of the channel. The floodplain is largely, but not entirely, contained within the channel.

Although bank stabilization extends for 2500 feet along both banks downstream of Sabino Canyon Road, the remaining channel banks are natural, except for one small segment along the south bank adjacent to some homes in Tucson Country Club. In most locations there is a thin strip of vacant, open space adjoining the north and south banks. Where the banks are stabilized, moderately dense residential subdivisions have been constructed adjacent to the channel banks. Where the banks are natural, residences are generally set back at least 200 feet from the channel. Although the overbank floodplain has been largely disturbed, there is some dense natural vegetation remaining along the north bank, which been mapped as xero-riparian type B. It is likely that erosion protection will be constructed along the remaining channel banks.

⇒ *Representative Aerial Photo: 18-22*





← NORTH

18-22

6-8

Tanque Verde Creek

Watercourse Reach	Status	Flood Control Approach	Notes
<p>1. Tanque Verde Creek, Coronado Nat'l. Forest to Tanque Verde Road</p>	<p>The channel banks are natural, except for bank stabilization at Houghton Road and Tanque Verde Road bridges, and isolated segments of erosion protection installed on individual lots by property owners. <u>Limited erosion protection is planned along the north bank at the Lakes at Castle Rock, and along the south bank at the Fountain Park subdivision.</u></p>	<p>Leave channel banks natural, except in the most vulnerable locations, to preserve overbank floodwater storage and riparian habitat, and attenuate downstream flood peak discharges.</p>	<p>Hydro-meso riparian habitat has been mapped across most of the floodplain from Houghton Road east to the Coronado National Forest boundary. The existing habitat should be preserved. Agua Caliente Wash drains into Tanque Verde Creek just downstream of Houghton Road.</p>
<p>2. Tanque Verde Creek, Tanque Verde Road to Sabino Canyon Road</p>	<p>The entire reach has been stabilized with soil-cement bank protection, and the 100-year flood is contained within the channel banks. No additional flood control improvements are planned.</p>	<p>100-year flood is fully contained within the stabilized channel banks.</p>	<p>Sabino Creek drains into Tanque Verde Creek downstream of Tanque Verde Road.</p>
<p>3. Tanque Verde Creek, Sabino Canyon Road to Craycroft Road (END TANQUE VERDE CREEK)</p>	<p>Channel banks are natural, except for 2500 feet of bank stabilization on the north and south banks downstream of Sabino Canyon Road, and 1800 feet on the south bank adjacent to the Tucson Country Club. <u>Bank stabilization is planned along the entire south bank as part of a joint project between the District, WWM, and the COE.</u></p>	<p>Long-range plans call for constructing erosion protection along the entire south bank, and leaving the north bank natural, including preserving the riparian habitat.</p>	<p>Some xero-riparian habitat Type B is present from Craycroft Road east to the Tucson County Club area.</p>

7.0 AGUA CALIENTE WASH

❖ Overview

Agua Caliente Wash drains the southeast corner of the Santa Catalina Mountains and the northeast metropolitan area, flowing along a southwest alignment that is parallel to and east of the Mount Lemmon Highway. It drains into Tanque Verde Creek just downstream of Houghton Road.

The channel is dynamic, and assumes a semi-braided form throughout. Natural channel banks prevail except for upstream of the Tanque Verde Road bridge, where soil-cement has been constructed to direct flows under the bridge; and in isolated locations to protect individual lots. Buried erosion protection is located along the east bank, north of Fort Lowell Road, to protect the San Domingo residential subdivision. Downstream of Soldier Trail Road, larger flows break out of the channel, and the floodplain becomes broad. These overbank flows, together with a high water table in this area, support riparian vegetation. Hydro-meso riparian vegetation has been mapped from the Coronado National Forest Service boundary to Houghton Road.

Prior to the completion of the Tanque Verde Road bridge in 1994, there was no means of all-weather access across the Agua Caliente Wash. During large flow events, access routes to the triangular area north of Tanque Verde Creek and southeast of Agua Caliente Wash often became temporarily impassable.

Agua Caliente Wash has been divided into three reaches, for discussion purposes (Figure 7-1). A brief discussion of each reach is provided, and Table 5 summarizes the flood control approach.

❖ Floodplain/Land Use Description

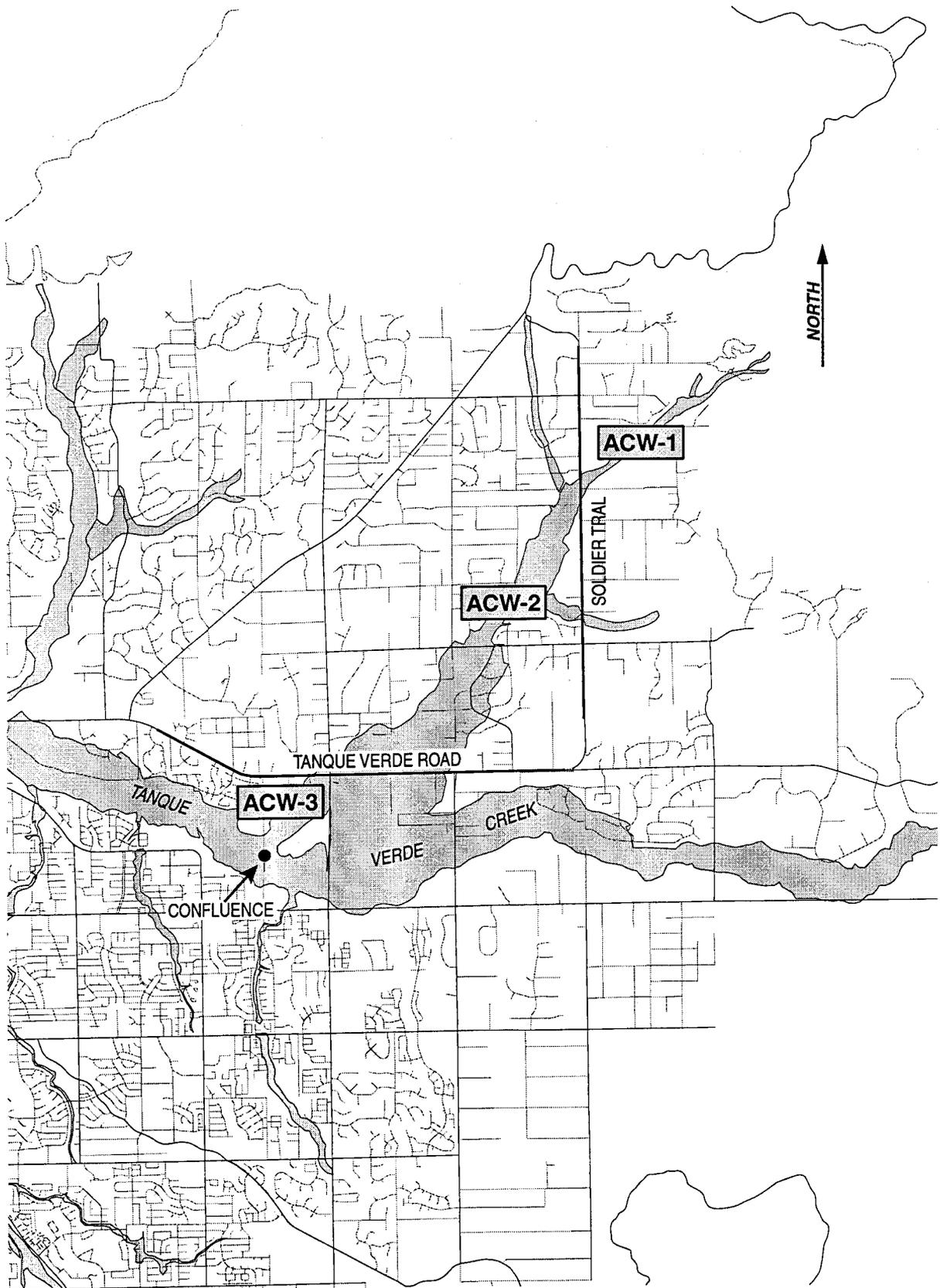
ACW-1: Coronado National Forest to Soldier Trail

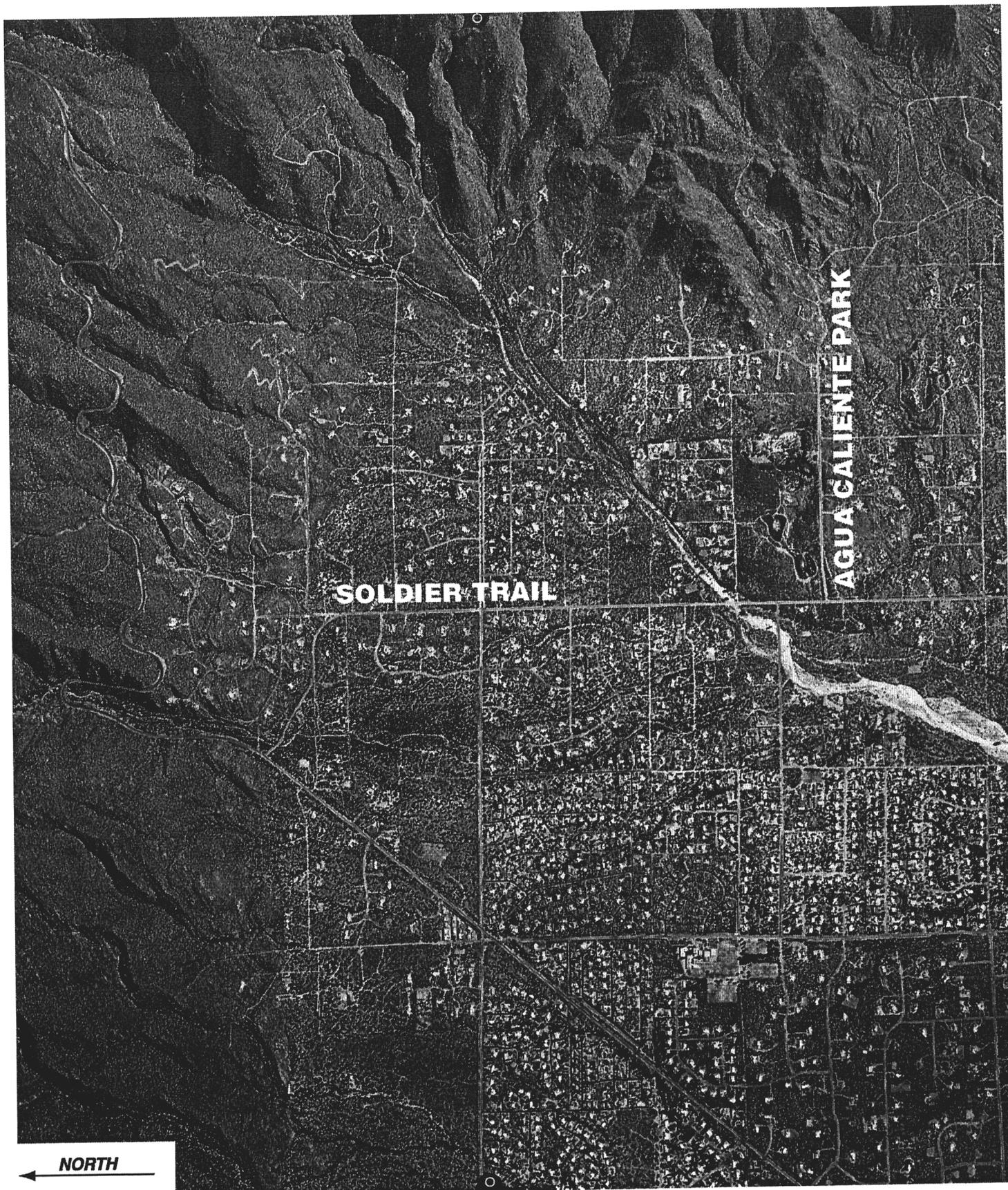
Upstream of Soldier Trail, the Agua Caliente Wash is narrow and incised, with a channel width averaging about 150 feet.. Set within a rocky area, the channel banks and bed are stable. The floodplain is narrow, with an average width of 330 feet.

This area is in the far northeast corner of the greater Tucson area, in close proximity to the Coronado National Forest. Land use consists of sparse residential development and open space areas. Agua Caliente Park is located south of the wash and upstream of Soldier Trail. Although infill development is likely to continue, because the surrounding Coronado National Forest places a natural constraint on development, and due to the rocky nature of the stream channel, this reach of the wash is likely to remain relatively unchanged.

⇒ *Representative Aerial Photo: 22 - 23*

Figure 7-1
AGUA CALIENTE WASH





ACW-2: Soldier Trail to Tanque Verde Road

This 2.7-mile reach encompasses most of the Agua Caliente Wash. The river system is highly dynamic, as evidenced by the semi-braided nature of the main flowpath, which has shifted with each major flood in the past 20 years. In contrast to the upstream reach, the channel is relatively wide and shallow, with a floodplain that spills out into the overbank areas. The average width of the floodplain is over 1500 feet, and large flows are characterized by much erosion and sediment deposition.

Land use adjacent to the wash is a mixture of open space, and sparse to moderate residential development. Downstream of Soldier Trail, open space and sparse residential development adjoins the wash. From Prince Road south to beyond Fort Lowell Road and west to Melpomene Way, moderately dense subdivisions are built closer to the channel. Several tracts have been developed as part of the Bel Air Ranch Estates subdivisions, and some of these were developed prior to the adoption of a local floodplain management ordinance. During the mid-1960's, an earthen channel was excavated along the wash south of Fort Lowell Road, to facilitate development of the Bel Air Ranch subdivision.

Until 1994, when the Department constructed a bridge across Agua Caliente Wash at Tanque Verde Road, there was no all-weather crossing of the wash. During large flows, vehicular access to the triangular area north of Tanque Verde Creek and southeast of Agua Caliente Wash became impassable. Although a bridge had been planned since the mid-1980's, it had not been constructed due to funding constraints. Following the January 1993 Floods, during which access to this area became impassable for up to three days, funds were reallocated and the bridge was constructed. As part of the bridge project, a channel was excavated, and soil-cement levees and a berm were constructed to direct flows under the bridge.

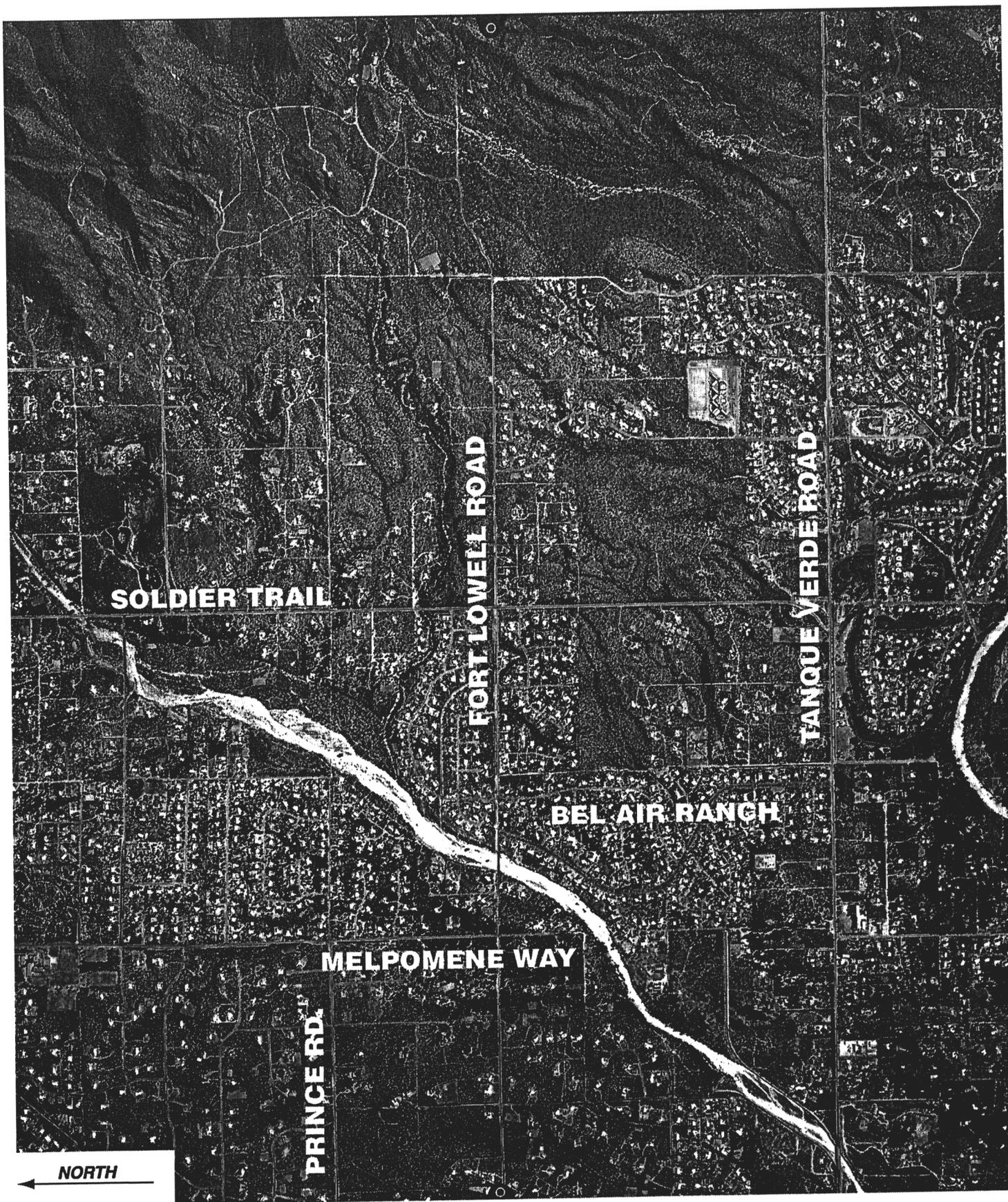
⇒ *Representative Aerial Photo: 22 - 22*

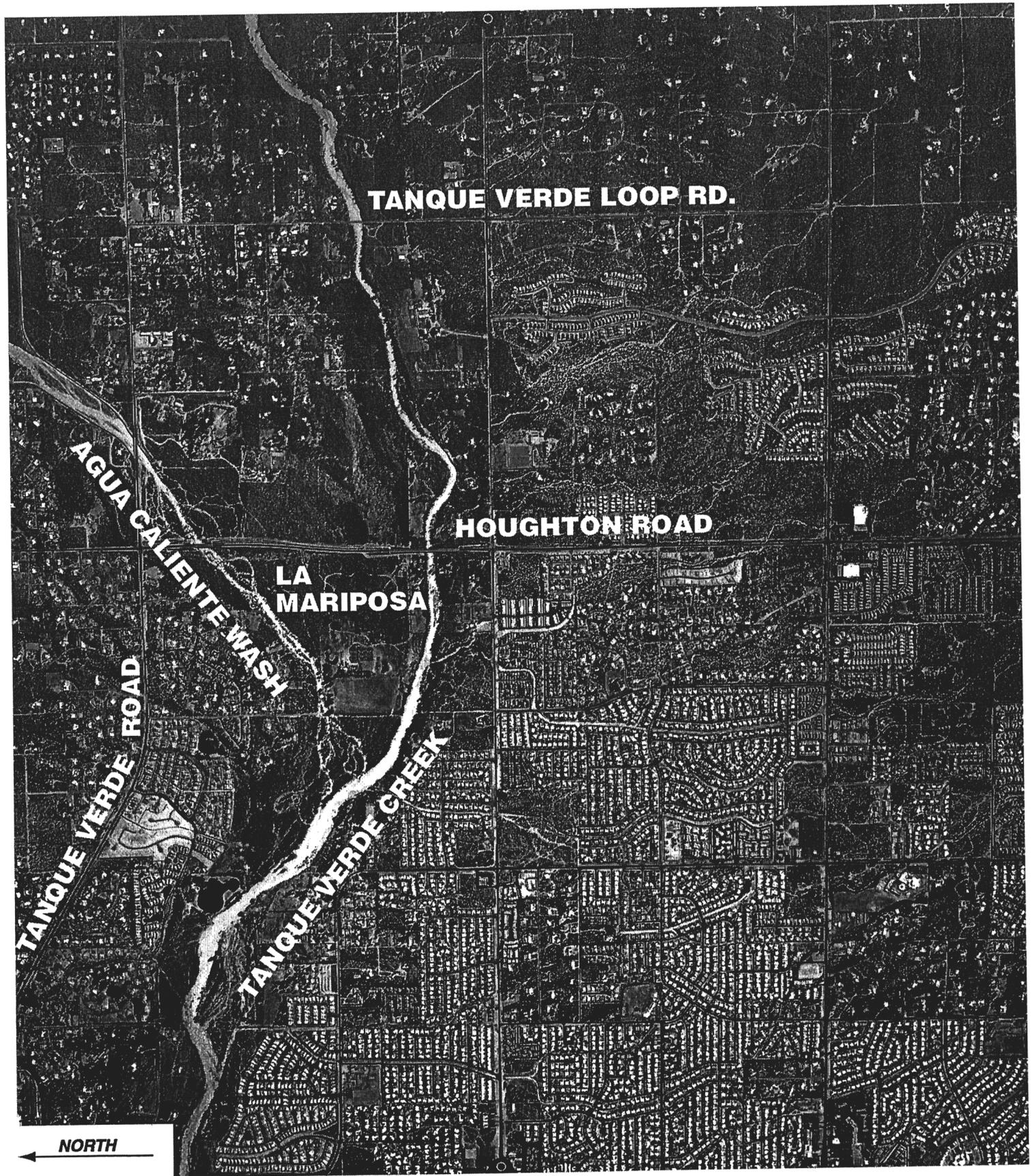
ACW-3: Tanque Verde Road to Tanque Verde Creek confluence

Downstream of Tanque Verde Road, the floodplains of Agua Caliente Wash and Tanque Verde Creek merge together to form one large floodplain that extends from the confluence upstream almost to Tanque Verde Loop Road. The channel of Agua Caliente Wash is braided and narrow, and is less well-defined than in upstream areas. During larger floods, flow breaks out of the channel, mostly to the south. The overbank areas are well-vegetated.

Due to the repeated flooding that has occurred along the south overbank of Agua Caliente Wash and the north overbank of Tanque Verde Creek, little development has occurred between the two in the vicinity of Houghton Road and continuing downstream. There is sparse residential development along the south overbank near the Tanque Verde Road bridge. The Powder Horn Ranch subdivision is located along the north overbank south of Tanque Verde Road. La Mariposa, a recreational facility that becomes inundated during larger flows, is located south of Agua Caliente Wash upstream of the Tanque Verde Creek confluence. Limited development is anticipated to the south of Agua Caliente Wash while the flood hazard remains.

⇒ *Representative Aerial Photos: 21-21*





Watercourse Reach	Status	Flood Control Approach	Notes
1. Agua Caliente Wash, Coronado National Forest to Soldier Trail	Channel banks are natural through this reach. <u>No structural improvements are planned.</u>	Maintain the natural channel and floodplain area.	The channel bed is rocky and fairly well incised upstream of Soldier Trail Road. Hydro-mesopariparian habitat has been mapped along the channel.
2. Agua Caliente Wash, Soldier Trail to Tanque Verde Road	The channel banks are mostly natural. Isolated segments of erosion protection have been constructed to protect private property. Beginning approximately half way between Prince Road and Fort Lowell, and extending to Melpomene Way, an earthen channel was excavated through the Bel Air Ranch Estates residential subdivision in the mid-1960's. Downstream of Melpomene Way, channelization and soil-cement levees were constructed in conjunction with the Tanque Verde Road bridge. A diversion structure has been proposed upstream of Tanque Verde Road.	Maintain the natural channel, to preserve overbank floodwater storage, and attenuate downstream flood peak discharges..	The Bel Air Ranch subdivisions south of Fort Lowell Road are located in a FEMA floodplain. Hydro-meso riparian habitat is present throughout the reach.
3. Agua Caliente Wash, Tanque Verde Road to Tanque Verde Creek (END AGUA CALIENTE WASH)	The channel is natural.	Maintain the natural channel and floodplain.	The La Mariposa Recreational Facility, as well as the Powder Horn Ranch subdivision, are both located along this reach. Hydro-meso riparian habitat is present throughout the reach.

8.0 SABINO CREEK

❖ Overview

Sabino Creek drains a large watershed that stretches up the Santa Catalina Mountains to Mount Lemmon, and includes a portion of the northeast greater metropolitan area. Upon exiting the mountain front, Bear Creek drains into Sabino Creek at Snyder Road, and Sabino Creek flows south in a broad, braided, floodplain, draining into Tanque Verde Creek just downstream of Tanque Verde Road. Except for the downstream-most reach, which is located partly within the City of Tucson, all of Sabino Creek is located in unincorporated Pima County.

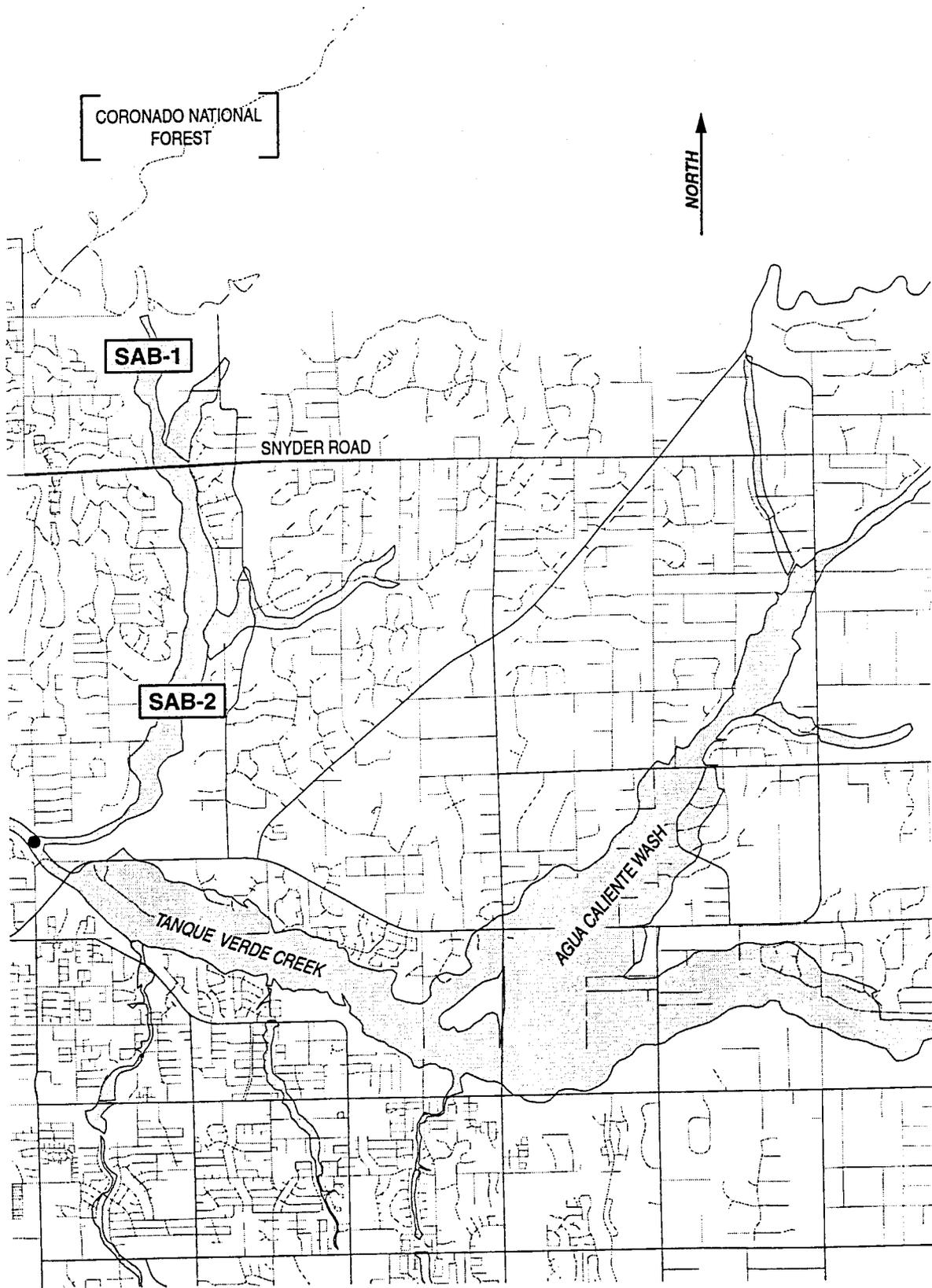
Because the channel bed and banks are rocky and well-vegetated, the channel and adjacent areas are relatively stable. Little erosion protection has been constructed, except for the soil-cement bank stabilization at the Tanque Verde Creek confluence. A few residences, all of which become isolated during major flooding, have been constructed within the center of the creek bed. Most of the floodplain is privately owned.

Sabino Creek is viewed by many as a natural greenbelt within the urbanized Tucson area. Much of the creek is used for open space purposes, including boarding horses and other animals, or for recreational uses. The floodplain is covered with very dense hydro-meso riparian habitat. Property owners and residents along Sabino Creek have long expressed a desire to maintain the natural, vegetated character of this verdant desert watercourse.

For discussion purposes, Sabino Creek has been divided into two reaches (Figure 8-1). A brief description of each reach follows. Table 6 indicates the District's flood control approach for Sabino Creek.

Figure 8-1

SABINO CREEK



❖ Floodplain/Land Use Description

SAB-1: Coronado National Forest to Snyder Road

In this uppermost one-mile reach south of the Coronado National Forest boundary, Bear Creek and Sabino Creek occupy a "V-shaped" densely vegetated area. The floodplain is natural, with minimal disturbance. Large lots predominate in the upper half-mile abutting the Coronado National Forest. In the lower half-mile upstream of Snyder Road, much of the land on the outer sides of the "V" has been subdivided, and moderately dense residential subdivisions have been constructed. Within the creek areas, few residences have been built, and little additional development is anticipated due to the flood hazard and lack of access during flooding.

⇒ *Representative Aerial Photo: 20 - 23*

SAB-2: Snyder Road to Tanque Verde Creek Confluence

In contrast to the largely undisturbed upstream floodplain, there has been more disturbance in the wash downstream of Snyder Road. Residences have been constructed in, and adjacent to, the floodplain, and several large, open space areas have been cleared to form pastures. Property owners have constructed roads to access their properties, and berms to redirect flows away from vulnerable areas.

Moderately dense residential subdivisions have been constructed along both sides of the creek in the uppermost half of this reach. Large lots, and sparse development, which together appear as large open space areas, adjoin the creek along the southern part of this reach. These lots may be subdivided at some time in the future, and denser development may be constructed closer to the creek, much like in the upstream part of this reach. Due to the flood hazard and accompanying access problems, little additional development is expected to occur within the floodway.

⇒ *Representative Aerial Photo: 20 - 22*



NORTH ←



SNYDER ROAD
JUST OFF MAP

TANQUE VERDE CREEK

← NORTH

20-22

8-5

Sabino Creek

Watercourse Reach	Status	Flood Control Approach	Notes
1. Sabino Creek, Coronado National Forest to Snyder Road	The channel bed and banks are natural, and the floodplain is densely vegetated. <u>No structural improvements are planned.</u>	Maintain the natural floodplain and overbank storage area, as well as the dense riparian habitat.	Mapped hydro-meso riparian habitat occupies most of the floodplain.
2. Sabino Creek, Snyder Road to Tanque Verde Creek (END SABINO CREEK)	The channel banks are natural, except for approximately 2000 feet of bank stabilization upstream of the confluence with Tanque Verde Creek. <u>No structural improvements are planned.</u>	Maintain the natural floodplain and overbank storage area, and the riparian habitat.	Mapped hydro-meso riparian habitat occupies most of the floodplain.

9.0 RINCON CREEK

❖ Overview

Rincon Creek drains a portion of the south face of the Rincon Mountains, flowing to the west, then west/northwest, ultimately draining into Pantano Wash south of the Irvington Road alignment. The Coronado National Forest lies to the east, and Saguaro National Park lies to the north of the creek.

Most of the surrounding land is undeveloped, except for a few fairly small residential subdivisions to the north and south. Several large, leveled and cleared land areas are located in the floodway, however, they haven't been cultivated in many years.

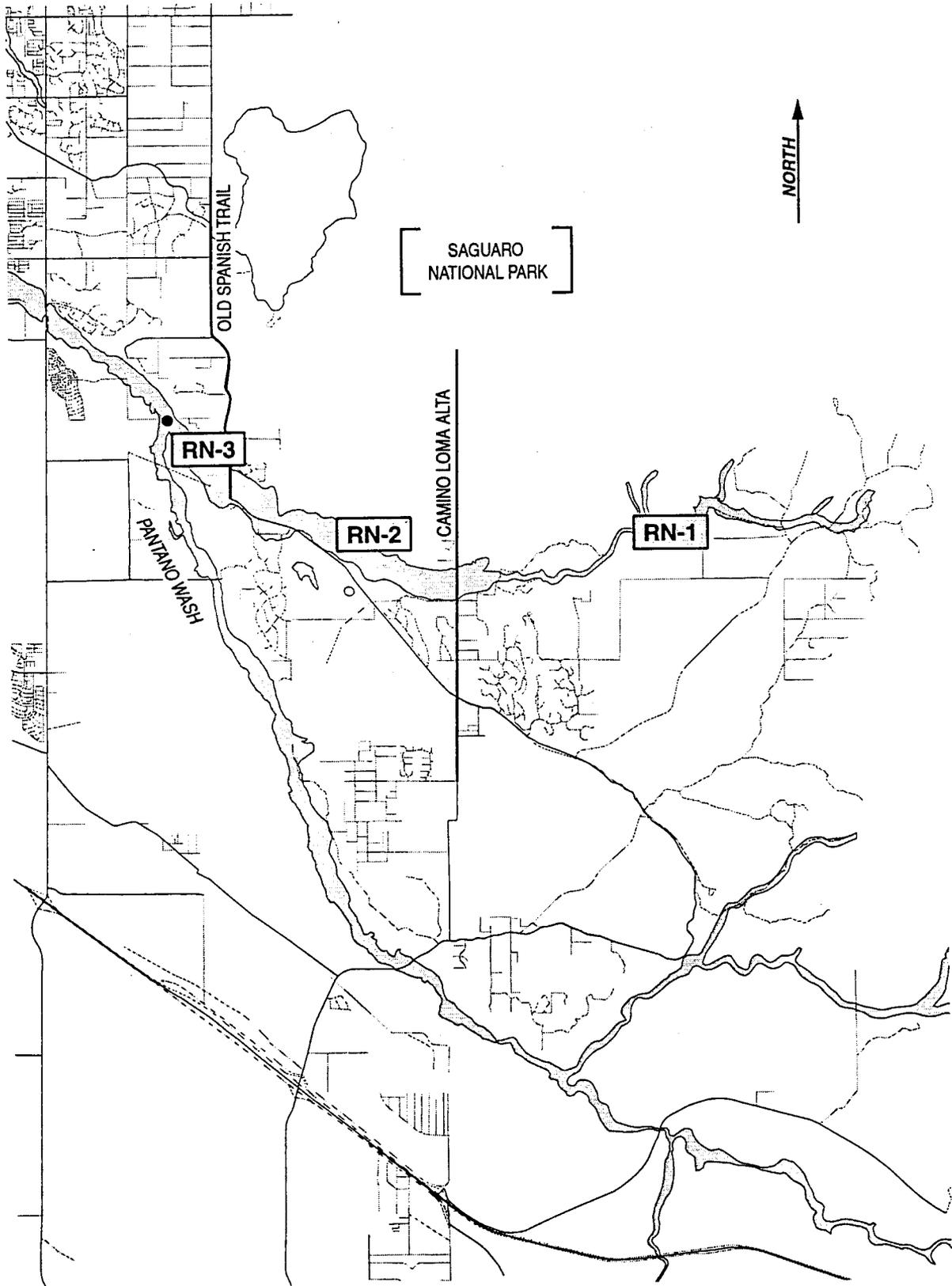
Both Old Spanish Trail and Camino Loma Alta cross Rincon Creek at grade. When large flows occur, these crossings become impassable. Consequently, most of the development is south of the creek.

The landscape is expected to change greatly over the next couple of decades, as the Rocking K Specific Plan area is developed. Beginning just west of Camino Loma Alta and extending almost to Old Spanish Trail, the Rocking K boundaries extend two miles north and south of Rincon Creek, adjoining Saguaro National Park at the northeastern Specific Plan area boundary.

For discussion purposes, Rincon Creek has been divided into three reaches (Figure 9-1). Table 7 provides a summary of the flood control approach, for each reach.

Figure 9-1

RINCON CREEK



❖ Floodplain/Land Use Description

RN-1: Coronado National Forest to Camino Loma Alta

In its upstream reaches, from the Coronado National Forest boundary until approximately one-half mile upstream of Camino Loma Alta, Rincon Creek occupies a relatively narrow (300-foot wide) floodplain, with an incised channel. Approaching Camino Loma Alta, the geologic floodplain broadens considerably, to approximately one-quarter of a mile. Mapped riparian habitat lines the floodplain.

Areas adjacent to Rincon Creek are sparsely developed, and remain natural. Although this reach may remain relatively unchanged for several years, as the Rocking K Specific Plan area to the west is developed, areas to the east are likely to experience increased development pressure.

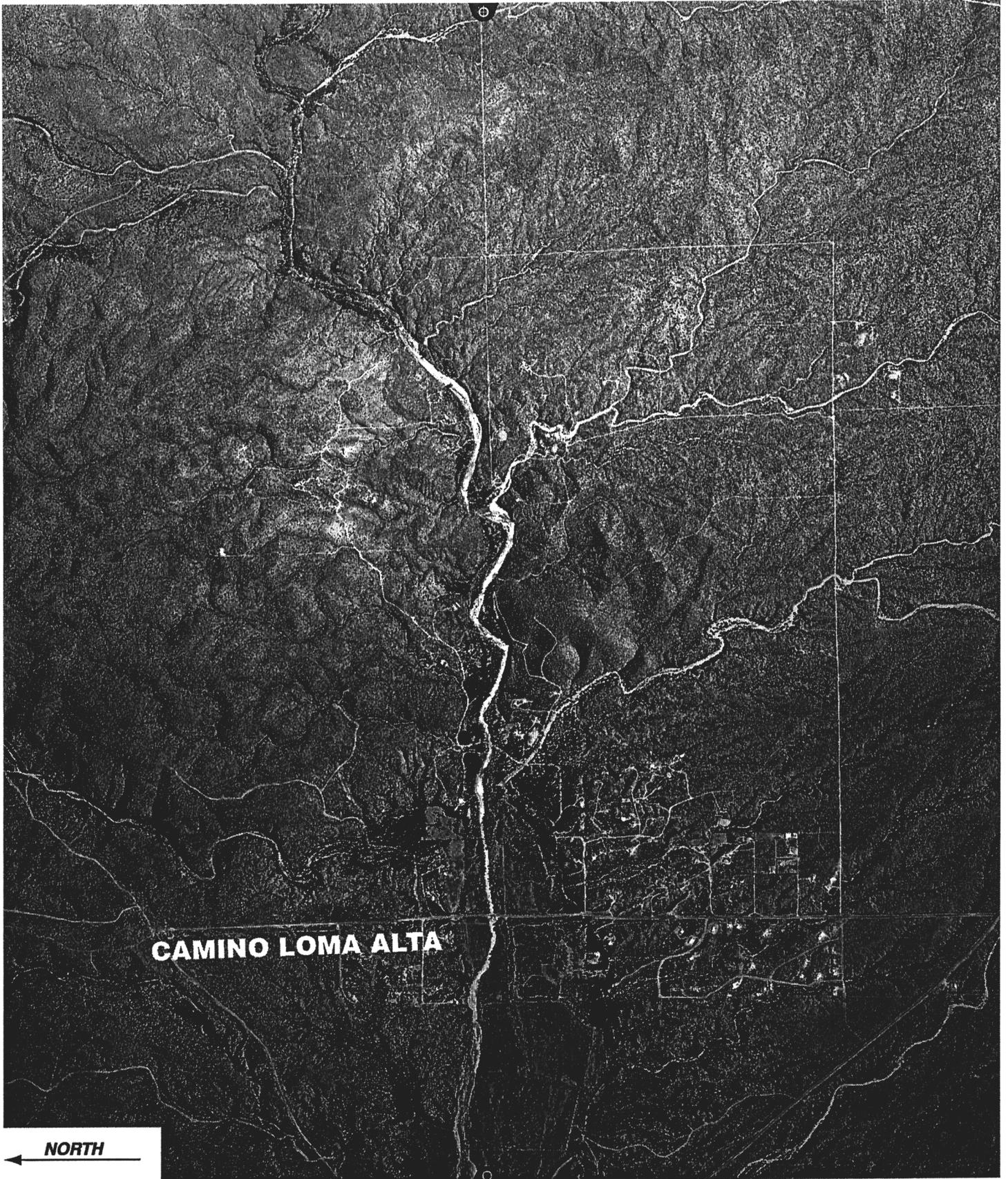
⇒ *Representative Aerial Photo: 24-17*

RN-2: Camino Loma Alta to Old Spanish Trail

As discussed in the overview, the floodplain in this reach has been disturbed by the leveling and clearing, several decades ago, of large fields for agricultural purposes. Consequently, the floodplain extends to the edges of the leveled fields throughout much of the reach. In addition to the leveling and clearing, the low-flow channel was straightened, although it is re-establishing a sinuous, meandering path within the wider floodplain area. Recent aerial photographs show that the low-flow channel currently occupies the northern part of the floodplain. Although it is likely that there was significant riparian habitat in this reach before the floodplain was disturbed, there is almost none remaining.

Similar to upstream areas, this reach is sparsely developed, however, it is more developed than the upstream and downstream reaches. Residential development extends along a narrow north-south corridor from Rincon Creek to the Pantano Wash, at the downstream end of the reach. The Ranchos Pequeños subdivision is subject to overbank flooding from Rincon Creek as well as localized flooding from the south. It is anticipated that the likelihood of overbank flooding will be reduced when the Rocking K master drainage scheme is implemented.

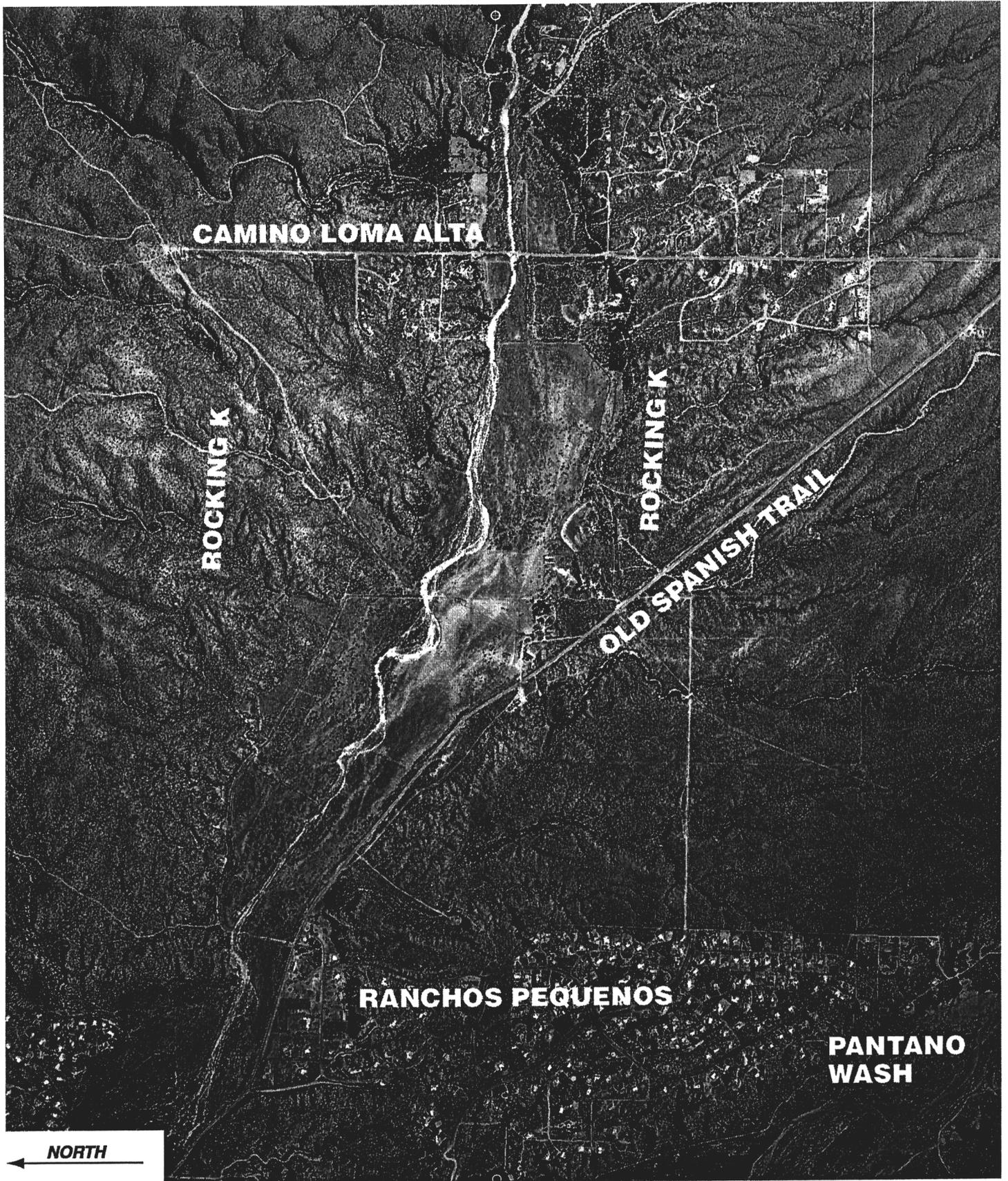
⇒ *Representative Aerial Photo: 23-17*



24-17

9-4

Rincon Creek



CAMINO LOMA ALTA

ROCKING K

ROCKING K

OLD SPANISH TRAIL

RANCHOS PEQUENOS

**PANTANO
WASH**

NORTH ←

RN-3: Old Spanish Trail to Pantano Wash

The floodplain assumes a more northwesterly alignment after the creek crosses Old Spanish Trail. As in the upstream reach, areas adjacent to the low-flow channel have been leveled and cleared for agricultural purposes, although the fields have not been cultivated in many years. The low-flow channel is narrow and sinuous, and the floodplain width is consistent with that in upstream reaches. Although the floodplain has been disturbed, it is less disturbed than the upstream reach, and xero-riparian Type B habitat is present along the length of the low-flow channel.

Of the three reaches along Rincon Creek, this is the most sparsely developed. Only a few residences are located north of the channel. As the Rocking K Specific Plan area is developed, this area will likely be subjected to increased development pressure.

⇒ *Representative Aerial Photo: 22-18*



22-18

9-7

Rincon Creek

Watercourse Reach	Status	Flood Control Approach	Notes
1. Rincon Creek, Coronado National Forest to Camino Loma Alta	The channel banks are natural. <u>No structural improvements are planned.</u>	Maintain the natural floodplain.	The creek contains mapped hydro-meso riparian habitat from the Forest Boundary to Camino Loma Alta. The existing habitat should be preserved.
2. Rincon Creek, Camino Loma Alta to Old Spanish Trail	The channel banks are natural, however, the entire floodplain was disturbed in the 1940's and 1950's, when agricultural fields were cleared. As part of the Rocking K Specific Plan, there will be encroachment into the floodplain. Current plans call for maintaining a low-flow channel within a 400-600-foot wide natural area. <u>Embankments at the edges of the natural area will be protected from erosion, and will have weirs along the top to allow the larger flows to spill over into areas outside the embankments.</u>	Largely contain the 100-year flow within a 400-600 foot-wide natural area.	Most of this reach is within the Rocking K Specific Plan area. As part of the conditions of the Specific Plan approval, a restoration plan for Rincon Creek must be approved. As of 7/00, the restoration plan is being developed.
3. Rincon Creek, Old Spanish Trail to Pantano Wash (END RINCON CREEK)	The channel banks are natural, although the floodplain was disturbed decades ago to facilitate irrigation of cultivated fields. <u>No structural improvements are planned.</u>	Maintain the natural floodplain, including overbank storage, to reduce downstream flood peak discharges.	The existing mapped habitat (xeriparian Type B) should be preserved.

10.0 BLACK WASH

❖ Overview

The Black Wash watershed, which extends south to the Sierrita Mountains and east to the Tucson Mountains, drains a predominantly rural area southwest of metropolitan Tucson. Trending southeast to northwest, the Black Wash flows into the Brawley Wash at Sandario Road, about three miles north of Snyder Hill Road. Characterized by gently sloping terrain and alluvial fan conditions extending from the Sierrita Mountains northward, sheet flooding and distributary flow conditions prevail.

Although the area is sparsely developed, there are a few small residential subdivisions within the floodplain. During major floods, most of the watershed can become sufficiently inundated to pose a threat to life and property. Due to the extensive sheet flooding and accompanying erosion and sediment deposition, access roads often become impassable. Evacuation by helicopter, such as occurred during the October 1983 Flood, may be the only avenue of escape during a major flood.

As this area is close to Tucson, yet is largely undeveloped and rural, it continues to draw people. This posed a dilemma for District staff, who were aware of the potential flood hazard, yet lacked the tools to regulate development in the most hazardous areas. Although the Federal Emergency Management Agency (FEMA) has identified a regulatory floodplain, it has not identified a floodway. Following completion of a study, the District's Board of Directors in 1991 approved the boundaries of an administrative floodway. This allowed District staff to impose the more restrictive regulations governing development in the most hazardous areas of the floodplain.

For discussion purposes, the Black Wash has been divided into two segments, with the Ajo Highway as the dividing line between the two (Figures 10-1 and 10-2). A brief description of each reach follows, as well as a summary table listing the flood control status of each reach.

❖ Floodplain/Land Use Description

BW-1: Cardinal Avenue to the Ajo Highway

The watershed divide between the West Branch of the Santa Cruz River and the Black Wash is west of Cardinal Avenue and south of Los Reales Road. Located in a Zone AO floodplain, with shallow flooding depths of one to three feet, the entire Black Wash area is in a floodplain which extends to over six miles wide in places. The first part of this reach, extending just over two miles to Vivian Road, is characterized by a relatively narrow, densely vegetated floodway averaging 350 feet in width. Downstream of Vivian Road, the floodway widens considerably, to an average of 1500 feet, and maintains this width until about a mile downstream of the Ajo Highway.

Figure 10-1
BLACK WASH

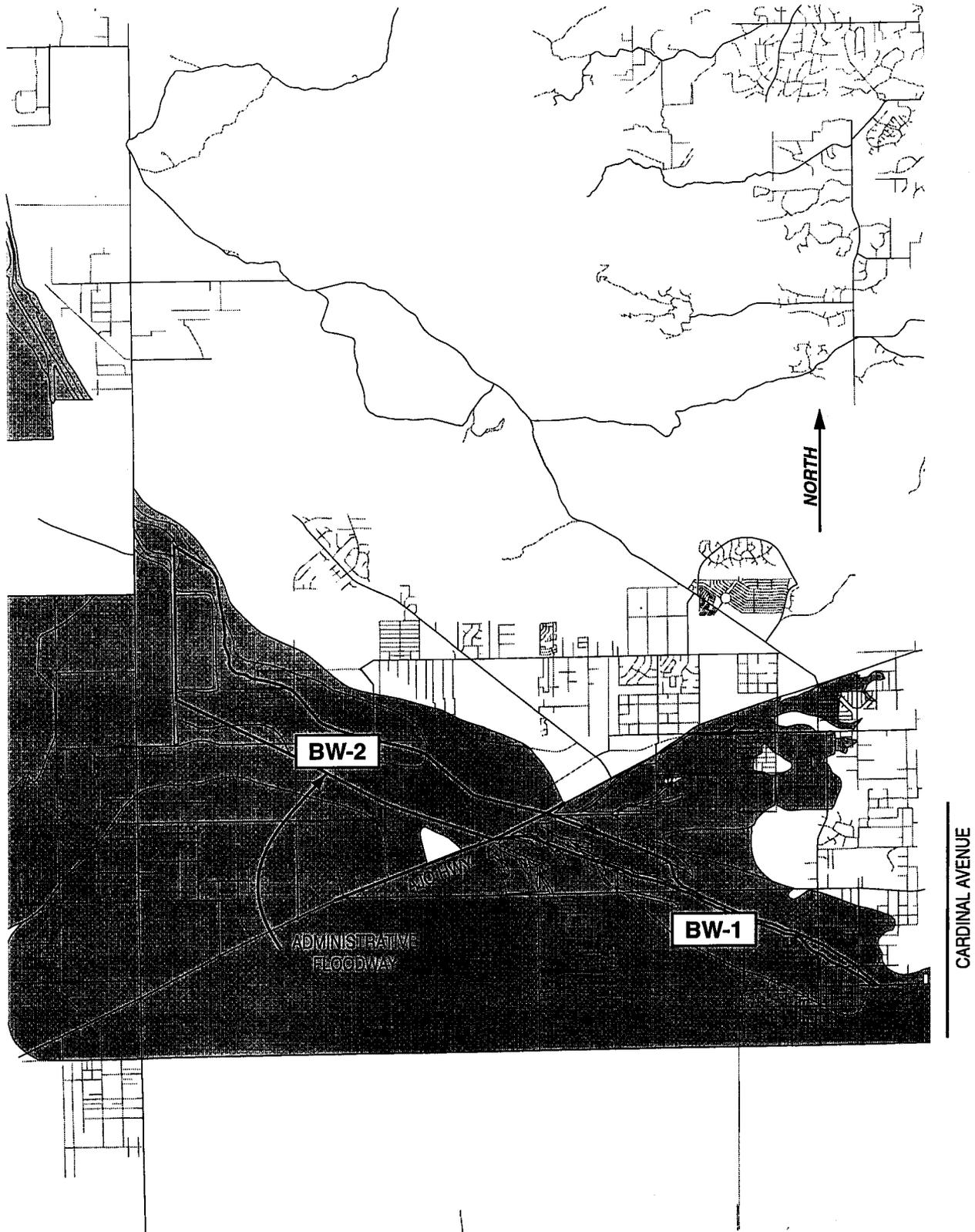
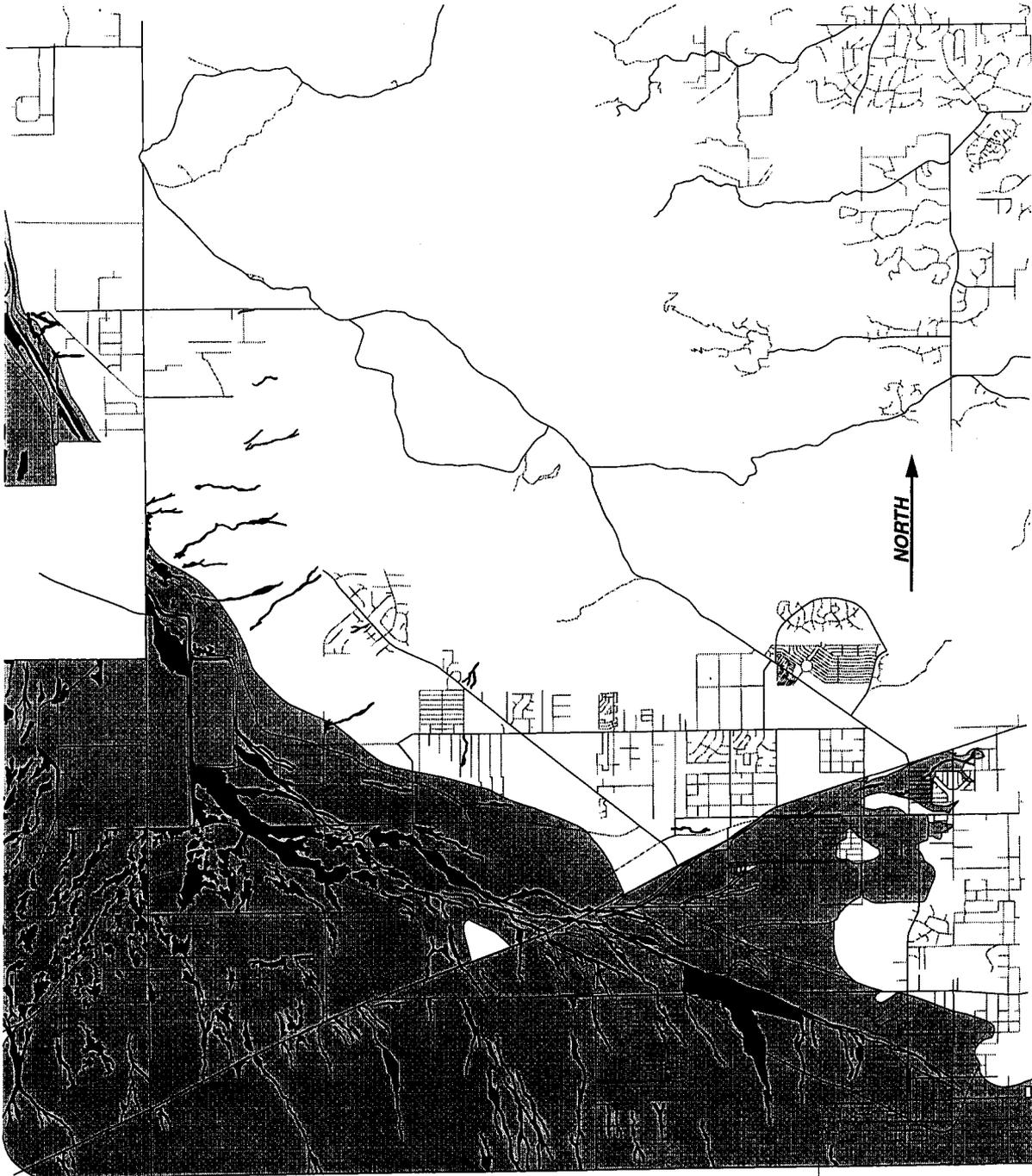


Figure 10-2
BLACK WASH



*Dark areas show locations of mapped riparian vegetation.

Most of the watershed is vacant and undeveloped. There is residential development in or near the floodway in three places: 1) downstream of Cardinal Avenue, 2) near Camino Verde (Branding Iron Mobile Home Park), and 3) southeast of the intersection of Valencia and Valhalla Roads. Residents of all three areas have reported nuisance drainage and sediment deposition problems, and impassable roadways, during flood events.

The District has emphasized nonstructural flood control along the entire length of the Black Wash. Several properties in the administrative floodway have been acquired as part of the District's Floodprone Land Acquisition Program, and acquisition in this area continues.

⇒ Representative aerial photos: 12-17 and 11-18

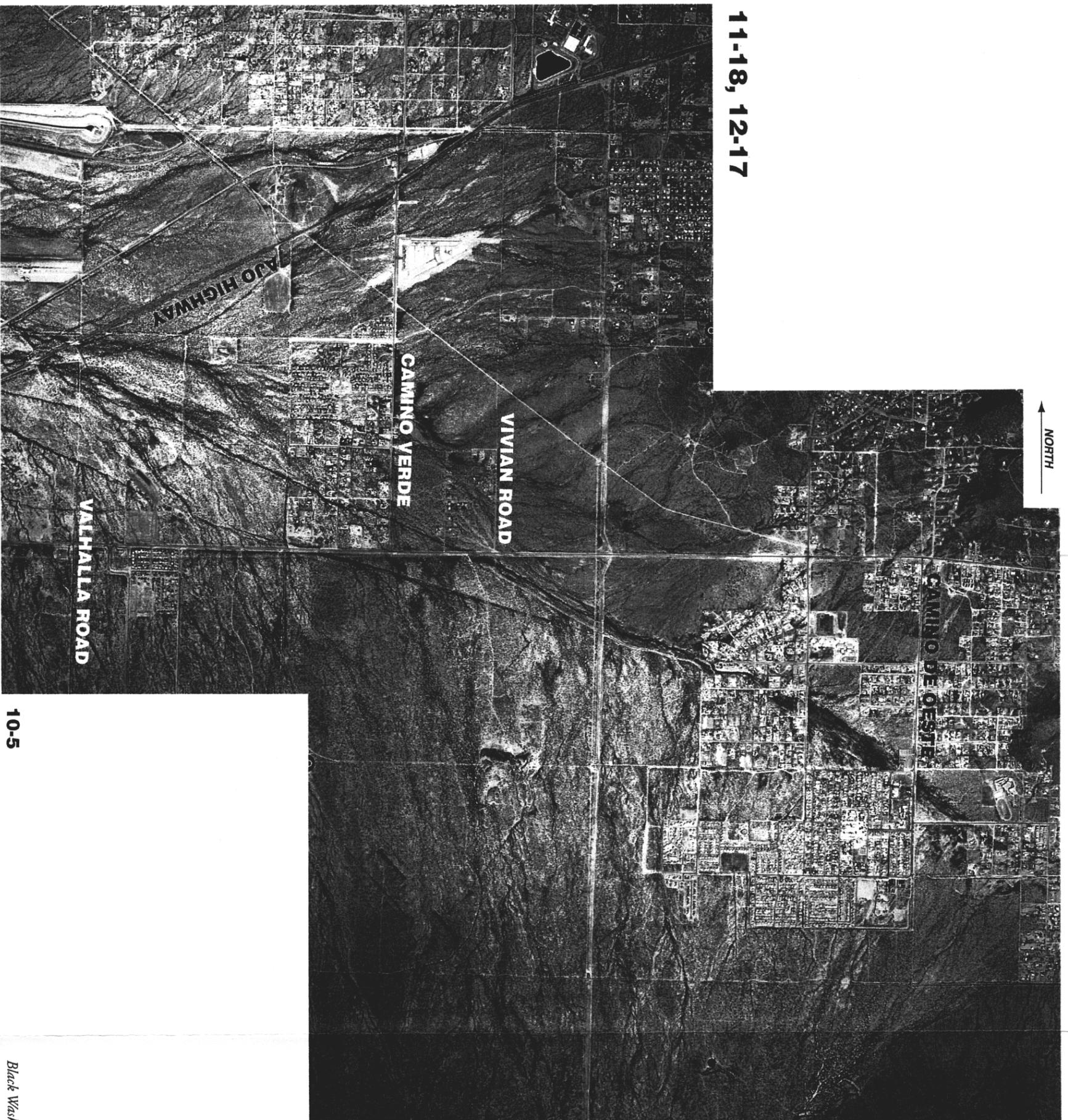
BW-2: Ajo Highway to Sandario Road

Downstream of the Ajo Highway, the administrative floodway widens considerably, from 1500 feet to almost two miles near Sandario Road, where the administrative floodway ends. At Sandario Road, the alignment of the wash changes from a west/northwest trend to a more northerly trend, as the Black Wash joins up with the Brawley Wash.

Most of the land in this reach is vacant and undeveloped. Two industrial facilities, Ryan Airfield and the Snyder Hill Road Wastewater Treatment Plant, are located in this area. A closed landfill lies adjacent to Ryan Airfield. Large agricultural fields are located near Sandario Road and Ryan Airfield.

As in the upstream reach, several parcels have been acquired in this area as part of the Floodprone Land Acquisition Program. Earthen berms and perimeter channels have been constructed around Ryan Airfield and the Snyder Road Wastewater Treatment Plant to reduce flood damage.

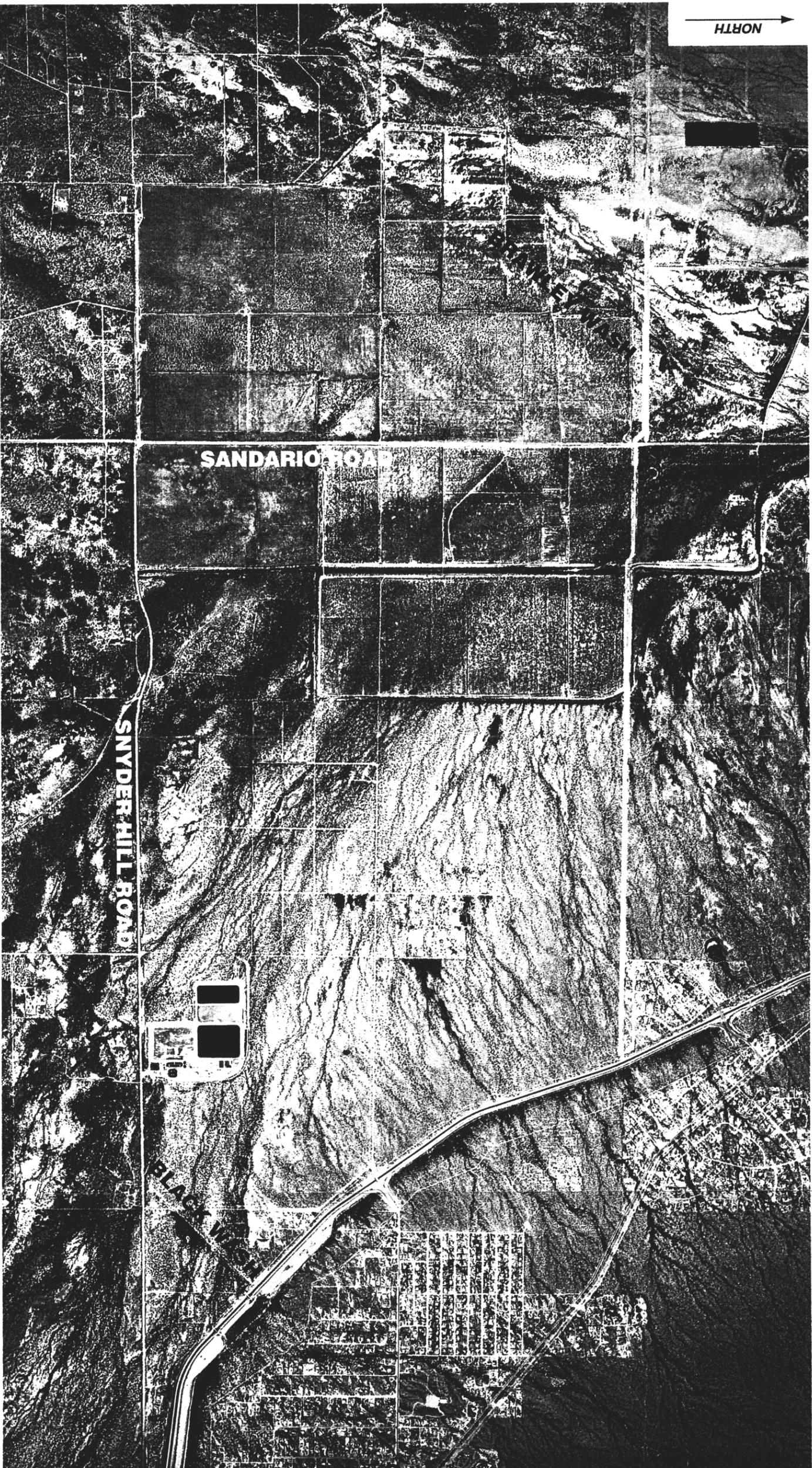
⇒ Representative aerial photos: 9-19 and 8-19



11-18, 12-17

10-5

Black Wash



NORTH

SANDARIO ROAD

SNYDER HILL ROAD

BLACK WASH

8-19, 9-19

10-6

Black Wash

Watercourse Reach	Status	Flood Control Status	Notes
1. Black Wash, Cardinal Avenue to Ajo Highway	The channel is natural. <u>No structural improvements are planned.</u>	Preserve the natural floodplain and riparian vegetation. Enforce floodway regulations within the boundaries of the Administrative Floodway.	Xero-riparian habitat Types B and C have been mapped along the length of the floodway. A few residential areas are located in this reach, including the Branding Iron Mobile Home Park
2. Black Wash, Ajo Highway to Sandario Road (END BLACK WASH)	The channel is natural. <u>No structural improvements are planned.</u>	Preserve the natural floodplain and riparian vegetation. Enforce floodway regulations within the boundaries of the Administrative Floodway.	Xero-riparian habitat Types B and C have been mapped along the length of the floodway. Ryan Airfield and the Snyder Hill Wastewater Treatment Facility are located in this reach.

11.0 BRAWLEY WASH

❖ Overview

The Brawley Wash has a north-south trending watershed, with headwaters that begin near Sasabe, at the U.S./Mexico border. In this upstream area, the Altar Wash flows north and slightly east through the Altar Valley, towards Three Points. Near Three Points, the wash changes name and becomes the Brawley Wash. Watershed boundaries include the Roskrige Mountains on the west, and the Tucson Mountains on the east. From Three Points, the Brawley flows northeast, then turns and flows northwest, then north, for several miles, west of the Tucson urban area, to where it joins with the Blanco Wash to form Los Robles Wash. This report will focus on the Brawley Wash between Three Points and Los Robles Wash.

Although there are a few well-defined channels and flowpaths, the Brawley is characterized by an extensive floodplain where sheetflow occurs across large corridors. Braided and distributary flowpaths appear as heavily-vegetated areas on the aerial photo. Due to the broad areas that may be covered by water during flooding, as well as the large quantities of sediment that may be deposited on roadways, vehicular travel across the valley often becomes restricted until flow subsides, and the sediment is removed. Similar to the Black Wash area, should anyone need to be evacuated during flooding, helicopters may be needed.

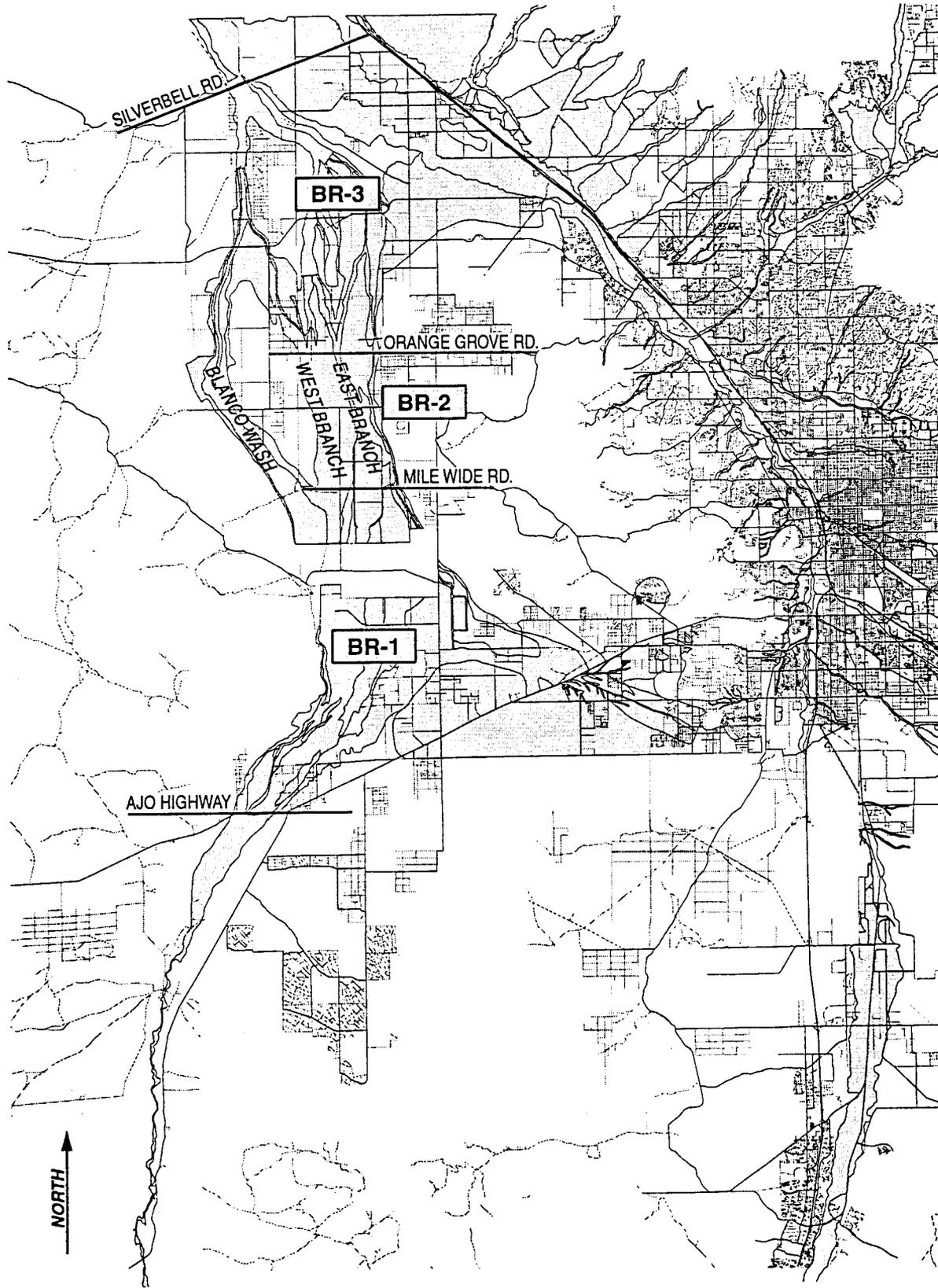
Fortunately, from a flood hazard perspective, the Brawley Wash watershed consists of mostly vacant, undeveloped land. Agriculture is the largest land use. Most of the cleared fields have not been farmed for a while, however, there are some actively cultivated fields at the north end of the watershed, upstream of Los Robles Wash. Near Three Points, there is limited, sparse residential development, and a few, scattered residences are located throughout the floodplain. Land has been subdivided into large lots in some areas. Further downstream, near where the Brawley and Blanco Washes join to form Los Robles Wash, several residential subdivisions have been constructed between the two washes. However, on the whole, there is very limited residential development throughout the Brawley Wash area. In recent years, the District has been receiving more request for permits to develop property in the Brawley Wash floodplain.

The District is in much the same predicament as it was with the Black Wash: although FEMA has identified a regulatory floodplain, no floodway has been defined. Consequently, there is currently no mechanism by which staff can impose the stricter floodway regulations. In June 1999, a study was completed that identified primary flood corridors within the Brawley Wash area. The Floodplain Management Section is currently requiring an engineering analysis to demonstrate that there is a safe, buildable area, in accordance with the current Floodplain and Erosion Hazard Management Ordinance, for development proposed within an identified primary flood corridor, where the FEMA maps and other supporting documentation indicates there could be substantial flood hazard.

For discussion purposes, the Brawley Wash has been divided into three reaches (Figure 11-1). Table 9 Lists the flood control strategy for each reach. A brief discussion of the Brawley Wash reaches follows.

Figure 11-1

BRAWLEY WASH



❖ Floodplain/Land Use Description

BR-1: Ajo Highway to Mile Wide Road

For the first six miles downstream of the Ajo Highway, a single, well-defined channel can be identified. It trends to the northeast, then turns sharply to the north just before the six-mile marker, or upstream of the Snyder Hill Road alignment. Although a main channel is visible, the river system has an overall braided appearance, with several heavily-vegetated flowpaths. The floodplain is broad, averaging just under two miles wide, and overbank flooding occurs in a corridor that is parallel to the main channel. The main channel is located along the western side of this corridor.

Where this well-defined channel ends, near the Snyder Hill Road alignment, the floodplain becomes much broader, expanding to the east to cover a width of four miles. When viewed on an aerial photograph, the flowpath is distributary, with large areas that are heavily vegetated. The overall alignment of the floodplain changes from northeast to north.

Between Snyder Hill Road and Mile Wide Road, three bifurcations of the main flowpath can be identified. One trends to the east, towards Sandario Road, where the Black Wash flows into the Brawley Wash a few miles upstream of Mile Wide Road. The middle path trends to the north; and the western-most flowpath also trends north. In addition, there is some breakout flow to the north/northwest. The two eastern-most flowpaths join just north of Mile Wide Road.

Most of the land within the floodplain is vacant and undeveloped. As might be expected, there are a few small, mostly low density residential subdivisions near the Ajo Highway. A few small, sparsely developed residential areas are also located between the Ajo Highway and Donaldson Ranch Road, along the eastern side of the floodplain. Some agricultural fields are present, mostly near Mile Wide Road. Due to the flood hazard, the broad extent of the floodplain and the difficulty in accessing this area by a standard motorized vehicle, it is likely that this area will remain rural and sparsely developed. On occasion, however, applications for floodplain use permits to develop in the floodplain are received. Scattered thin bands of mapped xero-riparian Types B and C habitat are present throughout the reach.

Much of the land area in this reach falls within a primary flood corridor as identified in a recent study (SLA, June 1999). The District plans to use the information from this study to better determine which areas can be developed in accordance with current regulations.

⇒ *Representative aerial photos: 5-16, 6&7-18, 6&7-21*

BR-2: Mile Wide Road to Orange Grove Road Alignment

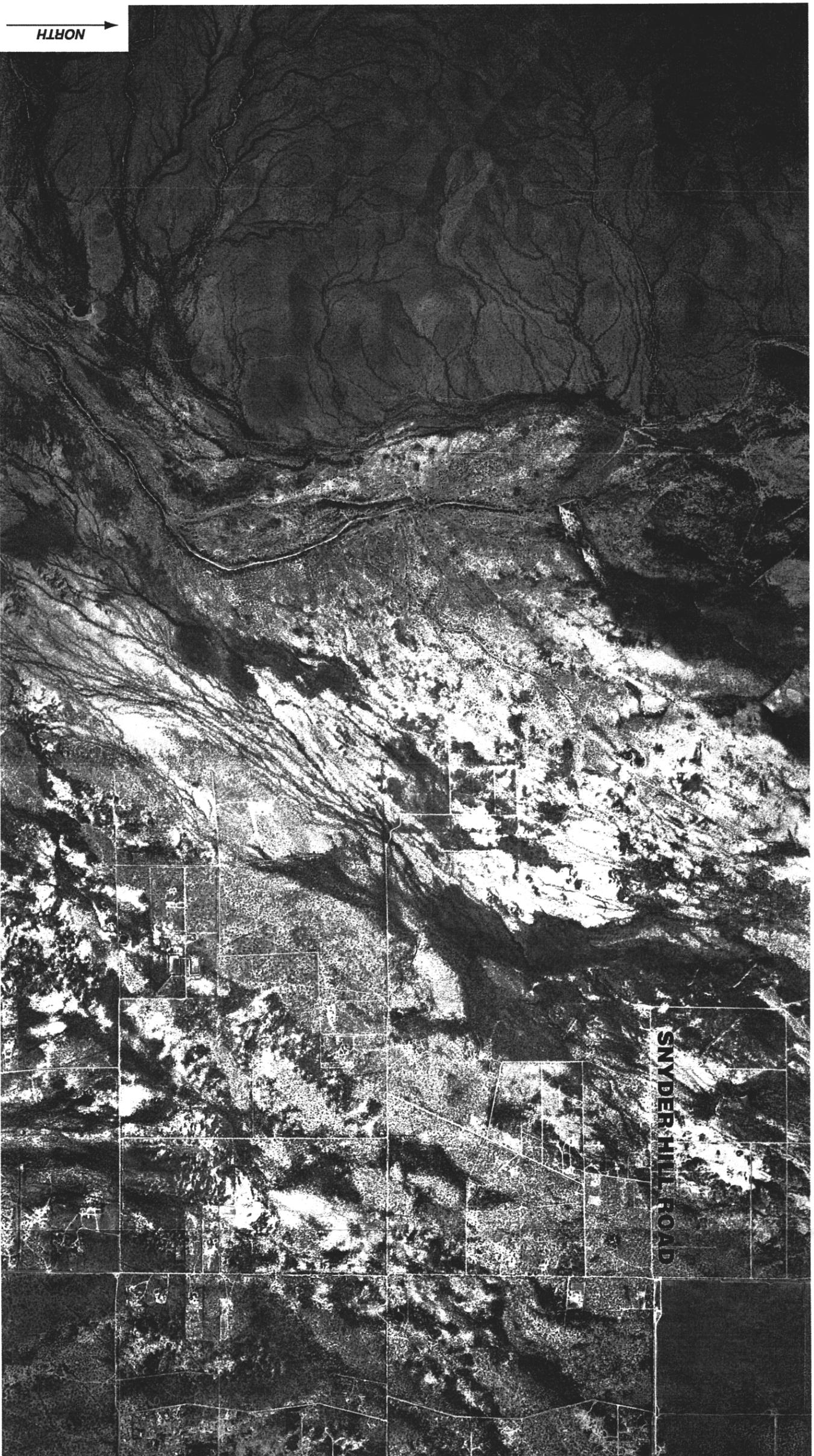
Immediately downstream of Mile Wide Road, the east and middle flowpaths join to form a braided channel system that trends to the northwest. The western-most flowpath merges with this system a couple of miles downstream of Mile Wide Road, and the flowpath assumes a more northerly trend. Shortly after all the flowpaths merge, they bifurcate, forming the East and West Branches of the Brawley Wash. This bifurcation occurs just upstream of the Orange Grove Road alignment.



5-16

11-4

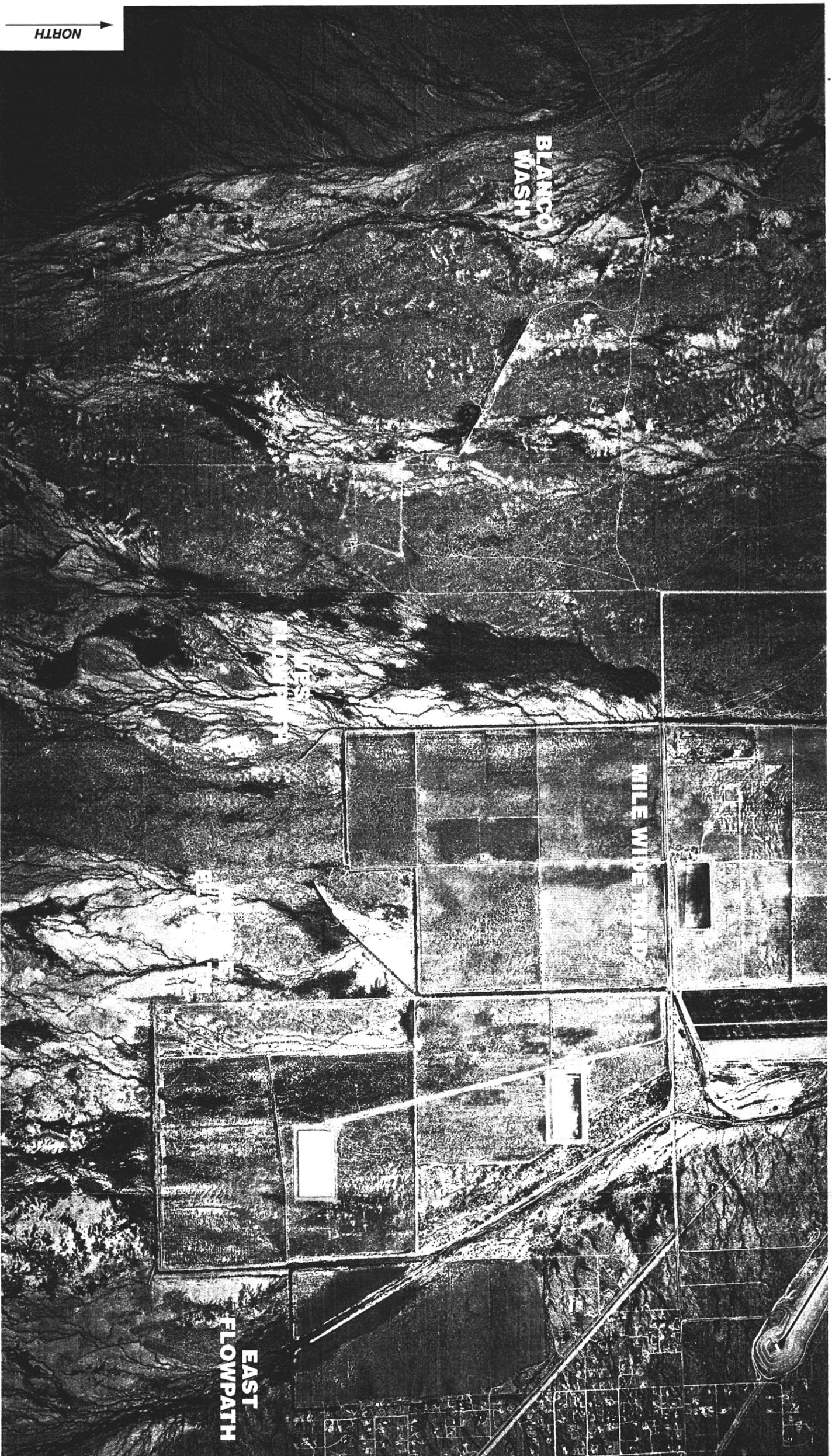
Brawley Wash



6-18, 7-18

11-5

Brawley Wash



6-21, 7-21

11-6

Brawley Wash

The floodplain in this area is broad, with an average width of approximately three miles. Agricultural fields are spread across much of the floodplain, however, few are currently cultivated. A few isolated residences are present. Access across this area during flooding is difficult at best. Little development is expected due to the high flood hazard. Scattered thin bands of mapped xero-riparian Types B and C habitat are present throughout the reach.

At the upstream end of this reach, two primary flood corridors have been identified in a recent study. These two merge to form a single primary flood corridor, which, after a relatively short distance, divides into two primary flood corridors upstream of the Orange Grove Road alignment.

⇒ *Representative aerial photos: 6&7-22, 6&7-23*

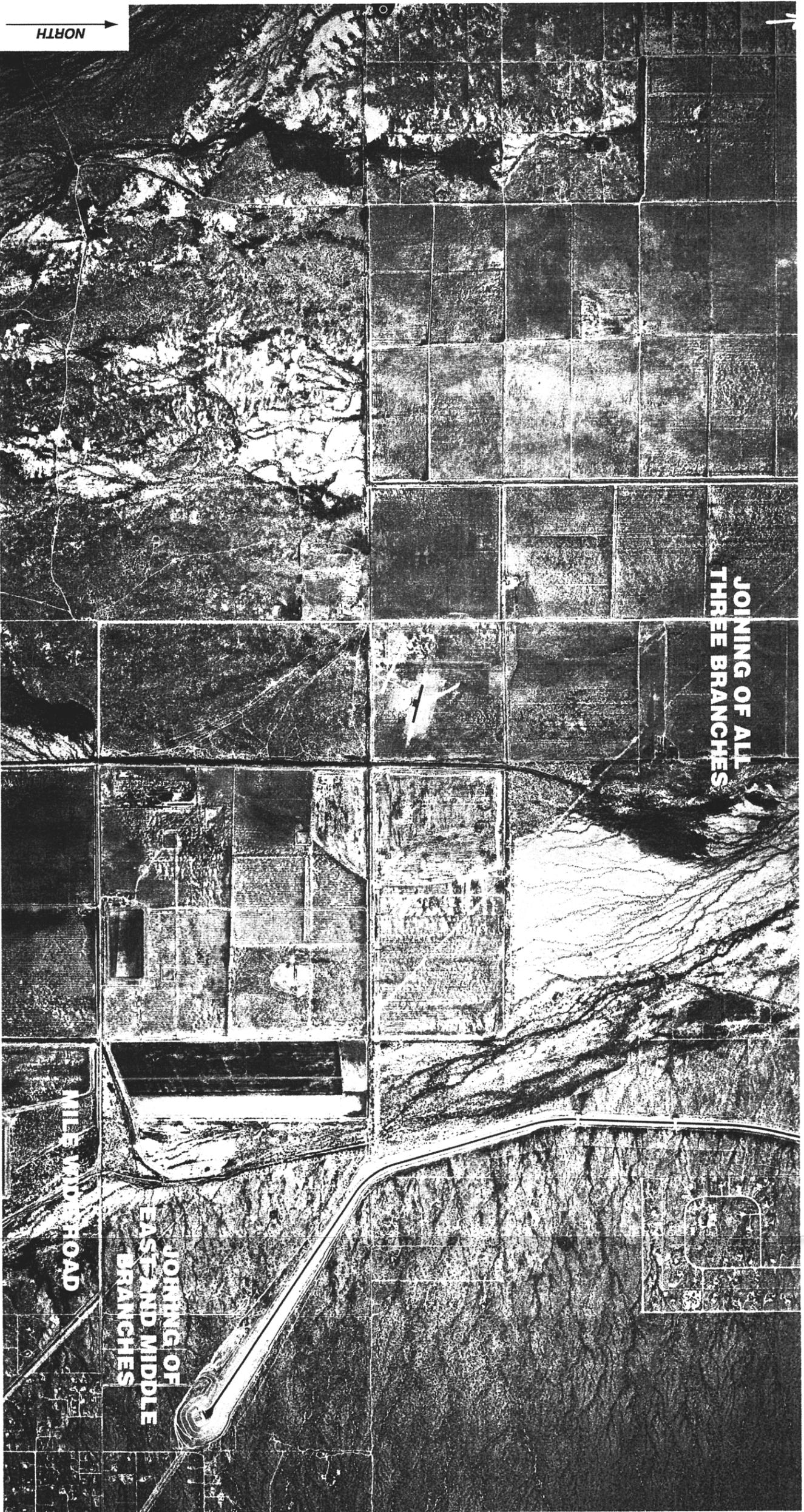
BR-3: Orange Grove Road Alignment to Los Robles Wash

The East and West Branches form two distinct flowpaths throughout the first eight miles of this approximately eleven-mile reach, joining together at the Trico Road alignment to form a single channel. The floodplain is wide, extending three to four miles across in places. A couple of islands areas between the East and West Branches are outside of the mapped floodplain. Downstream of Trico Road, the wash continues as a single channel, trending northwest towards the crossing at Silverbell Road, where the Brawley joins up with the Blanco Wash to form Los Robles Wash.

Large land areas in the southern half of this reach have been subdivided, mostly into 20-acre parcels. Residential development is sparse. Similar to upstream areas, access across the Brawley during flooding becomes difficult at best. Several agricultural fields, many under cultivation, are located in the northern part of this reach, upstream of Trico Road. Channels and berms have been constructed to direct low flows around the fields.

Almost three miles downstream of Trico Road, the Brawley joins up with the Blanco Wash to form Los Robles Wash. Several residential subdivisions have been constructed between the two washes. Scattered thin bands of mapped xero-riparian habitat, Types A, B and C, are present throughout the reach. Three primary flood corridors have been identified in a recent study.

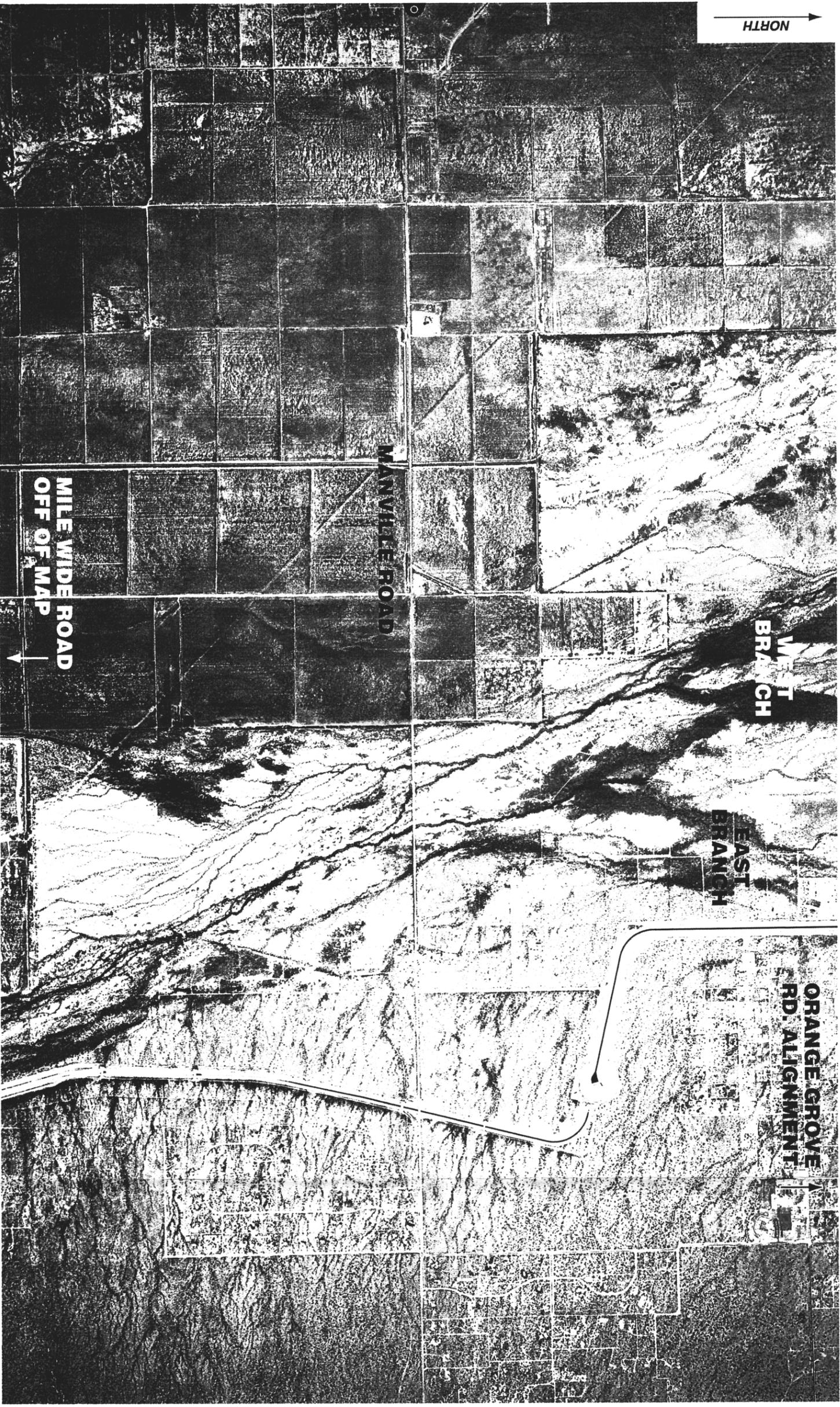
⇒ *Representative aerial photos: 6 & 7-24, 6-26, 6-27 & 6-28, and 5-28 & 5-29*



6-22, 7-22

11-8

Brawley Wash



6-23, 7-23

11-9

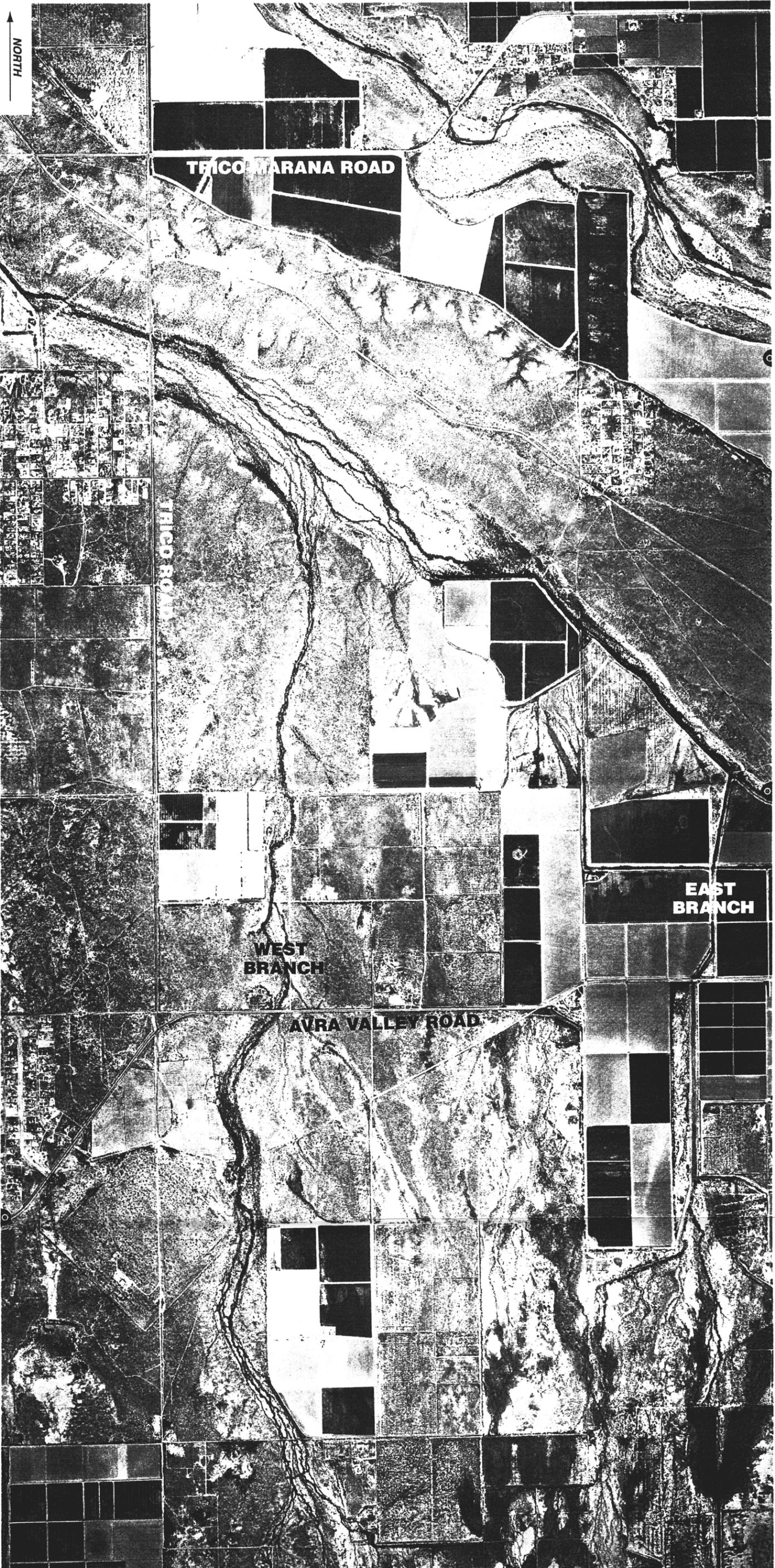
Brawley Wash



6-24, 7-24

11-10

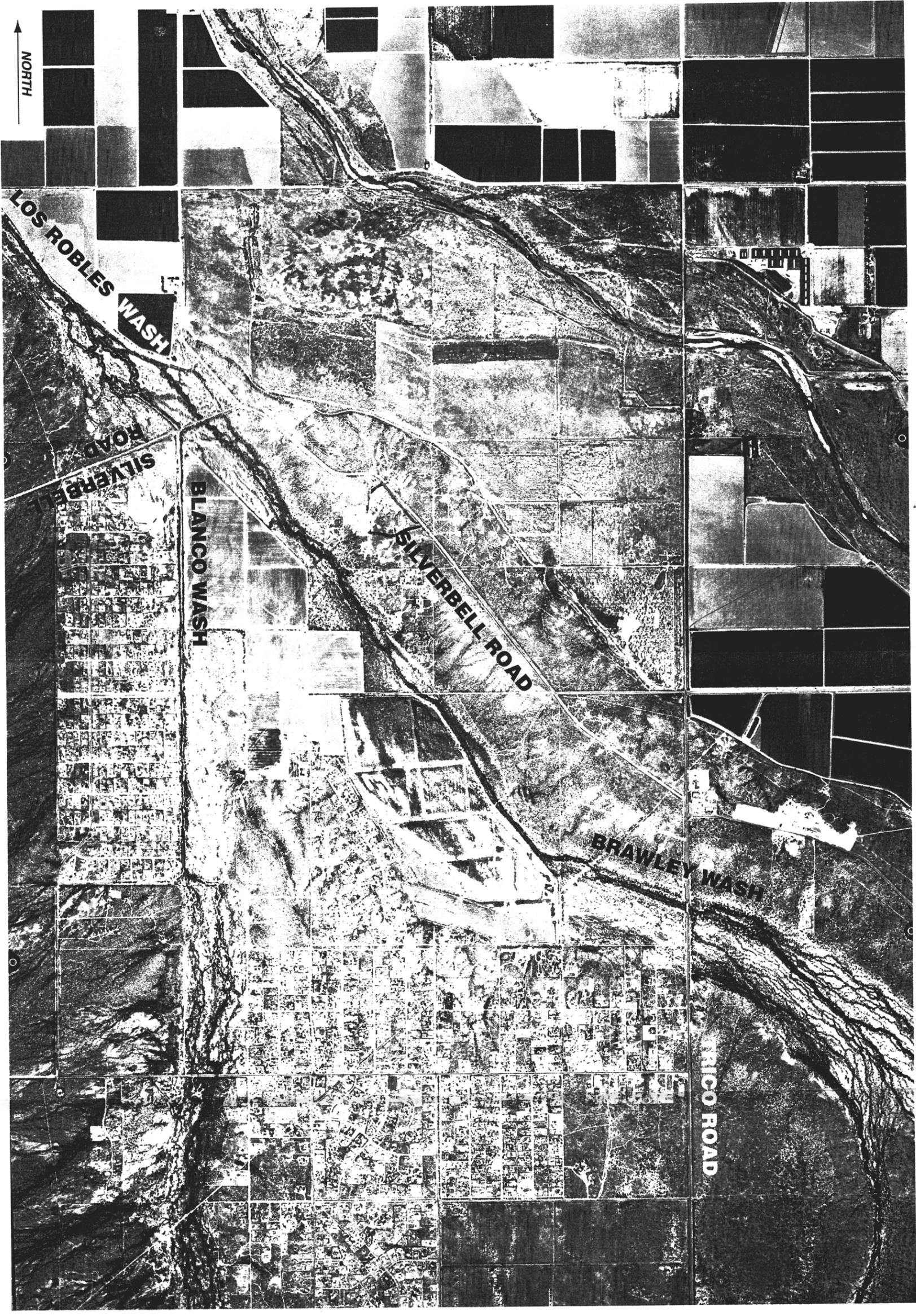
Brawley Wash



6-26, 6-27, 6-28

11-11

Brawley Wash



5-28, 5-29

11-12

Brawley Wash

Watercourse Reach	Status	Flood Control Approach	Notes
1. Brawley Wash, Ajo Highway to Mile Wide Road	The natural braided channel pattern extends across a broad floodplain. <u>No structural improvements are planned.</u>	Preserve the natural floodplain and riparian vegetation.	The Tohono O'Odham Indian Nation is located within this reach. Scattered thin bands of mapped xero-riparian Type B and C vegetation are present.
2. Brawley Wash, Mile Wide Road to Orange Grove Road alignment	The natural braided channel pattern extends across a broad floodplain. <u>No structural improvements are planned.</u>	Preserve the natural floodplain and riparian vegetation.	The Brawley Wash bifurcates into the East and West Branches upstream of the Orange Grove Road alignment. Scattered thin bands of mapped xero-riparian Type B and C vegetation are present.
3. Brawley Wash, Orange Grove Road alignment to confluence with Blanco Wash at Silverbell Road (END BRAWLEY WASH)	The natural braided channel pattern extends across a broad floodplain. <u>No structural improvements are planned.</u>	Preserve the natural floodplain and riparian vegetation.	The East and West Branches are well-defined throughout most of this reach. The two join at Trico Road to form one single channel. Further downstream, the Brawley and Blanco Washes join at Silverbell Road to become Los Robles Wash. There are several residential subdivisions between the Brawley and Blanco Washes upstream of the confluence at Los Robles Wash. Scattered thin bands of mapped xero-riparian Type A, B and C vegetation are present.