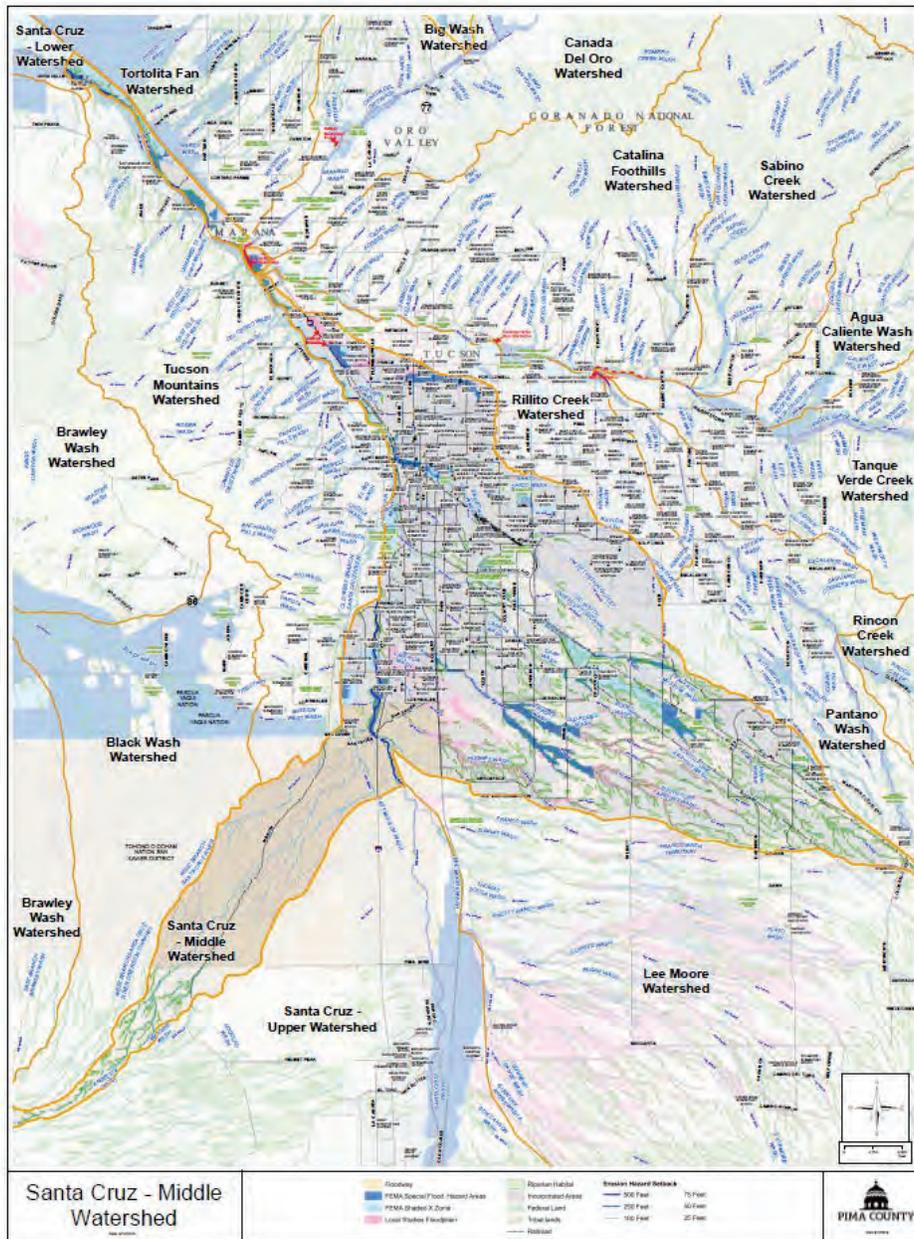


### 5.4.13 Santa Cruz River - Middle

This watershed extends southerly across the San Xavier District of the Tohono O’odham Nation along a lengthy tributary of East Mission Wash along Mission Road to the Sierrita Mountains in the southwest and the Julian Wash along the Interstate 10 Corridor to State Route 83 in the southeast. These branches coalesce along the Santa Cruz River near Valencia. Its northern terminus is Avra Valley Road. It is comprised of 107,767 acres (168.4 square miles), of which 66,005 (103 square miles) is in the City of Tucson, 2,332 in the Town of Marana and 655 in the City of South Tucson.

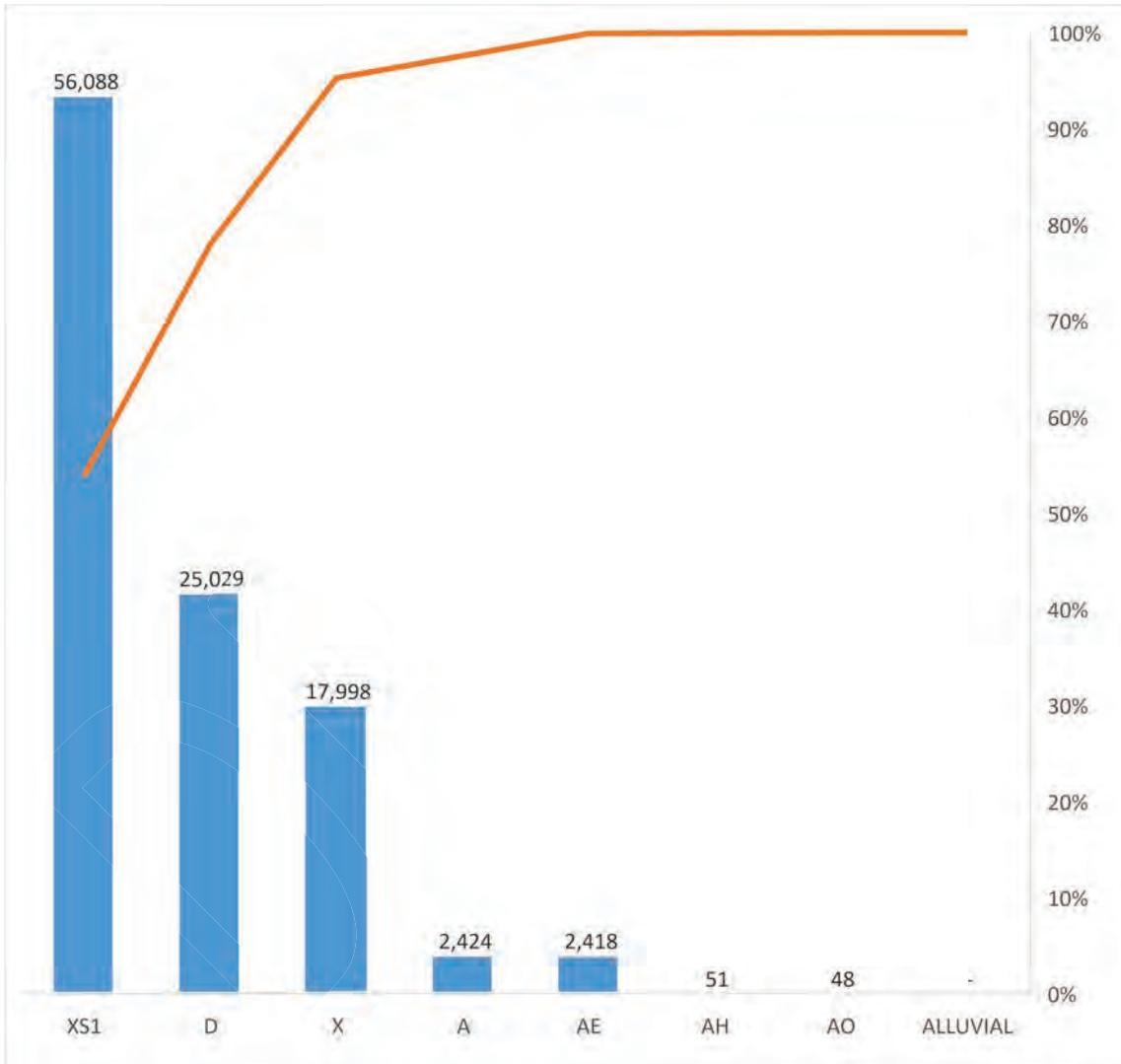
Figure 137 - Middle Santa Cruz River Watershed Map



### 5.4.13.1 Flood Characteristics

There are 4,942 acres of FEMA Special Flood Hazard Area. The FEMA Flood Insurance Study (FIS) indicates a peak discharge of 60,000 cfs at Congress Street near the midway point and 70,000 cfs upstream of the confluence with the Canada del Oro Wash. Interestingly it is also 70,000 downstream of the confluence at Cortaro Farms Road near the downstream terminus. The FIS drainage area is 3,503 square miles at this location.

Figure 138 - Middle Santa Cruz River SFHA in Acres



In addition to the SFHA zones included on the chart above, there are also 6,145 acres of District Special Studies Floodplains, and 682 acres of sheet flood area in this watershed. Special studies floodplains in distributary areas in the downstream reaches date to 2 decades ago. Distributary flow modeling can better assess flood hazards in these areas. The Santa Cruz River floodplain and floodway south of Los Reales Road and west of Interstate 19 within the San Xavier District of the Tohono O’odham Nation is the only tribal land that FEMA has mapped.

The table below provides a summary of historic USGS gaging station records.

Table 42 - Middle Santa Cruz River Watershed USGS Gages

USGS Gaging Station	South Fork Airport Wash near Tucson, AZ 09482350	North Fork Airport Wash near Tucson, AZ 09482370	West Branch Santa Cruz River at Tucson, AZ 09482450	Airport Wash at Tucson, AZ 09482400	Rodeo Wash at Tucson, AZ 09482410	Julian Wash at Tucson, AZ 09482420
Period of Record	1966-07-28 to 1980-09-07	1961-08-22 to 1980-09-07	1966-08-19 to 1981-07-29	1966-09-11 to 1988-07-27	1970-07-20 to 1981-07-29	1970-07-19 to 1981-03-02
Watershed Area (sq. m)	9.78	6.65	23.60	23	7.24	26.50
Flood-Peak of Record (cfs)	1890	1350	910	2900	898	1270
Date	07-08-1974	08-22-1961	09-25-1976 and 10-06-1977	10-01-1983	07-20-1970	07-19-1970

USGS Gaging Station	Pumping Wash near Vail, AZ 09482330	Railroad wash at Tucson, AZ 09482950	Tucson Arroyo at Vine Ave at Tucson, AZ 09483000	High School Wash at Tucson, AZ 09483010	Santa Cruz River at Tucson, AZ 09482500	Cemetery Wash at Tucson, AZ 09483042
Period of Record	1966-08-16 to 1981-07-25	1970-07-20 to 1983-01-29	1940-08-13 to 1981-06-25	1968-08-10 to 1983-08-16	1915-12-23 to 2015-07-28	1966-08- to 1990-07-24
Watershed Area (sq. m)	.81	2.30	8.20	.95	2222	1.17
Flood-Peak of Record (cfs)	337	1590	5000	800	52700	600
Date	07-00-1971	07-19-1971	07-22-1961	08-12-1972	10-02-1983	08-20-1968

<b>USGS Gaging Station</b>	<b>Flowing Wells Wash at Tucson, AZ 09483045</b>	<b>Santa Cruz River at Ina Road near Tucson, AZ09486490</b>	<b>Santa Cruz River at Cortaro, AZ09486500</b>
<b>Period of Record</b>	1971-08 to 1990-07-24	1991-03-01 to 1992-08-24	1940-08-14 to 2015-01-31
<b>Watershed Area (sq. m)</b>	3.53	2612.31	3503
<b>Flood-Peak of Record (cfs)</b>	1470	6360	65000
<b>Date</b>	08-23-1982	03-01-1991	10-02-1983
<b>Table of Regulatory Discharge (cfs)</b>	NA	NA	70000

The table below summarizes Pima County's ALERT Gages. The locations are from the District's Alert map.

*Table 43 - Middle Santa Cruz River ALERT Streamflow Gages*

<b>Pima County Alert Gage</b>	<b>Santa Cruz River below Canada Del Oro Wash ID: 6014</b>	<b>Santa Cruz River above Grant Road ID: 6033</b>	<b>Arroyo Chico Wash at Cherry Avenue ID: 6183</b>	<b>Arroyo Chico Wash at Randolph Park ID: 6193</b>	<b>Tucson Diversion Channel at Ajo Detention Basin ID: 6233</b>	<b>Santa Cruz River at Valencia Road ID: 6043</b>	<b>Franco Wash at Swan Road ID: 6213</b>
<b>Location (Latitude, Longitude)</b>	(32.3282, -111.0686)	(32.2468, -110.9969)	(32.2164, -110.9481)	(32.2147, -110.9183)	(32.1833, -110.9269)	(32.1342, -110.9919)	(32.0547, -110.8933)
<b>Period of Record</b>	2015-07-19 to Present	2015-07-19 to Present	2007-07-10 to Present	2007-07-10 to Present	2002-11-08 to Present	2002-05-17 to Present	2006-09-05 to Present
<b>Watershed Area (sq. m)</b>	3451.3	2207.36	7.61	1.57	14.37	2046.08	21.51
<b>Flood Peak of Record (cfs)</b>	16000	6885	1664	205	4746.8	26493	551.4
<b>Date</b>	08-09-2016	08-09-2016	07-31-2007	09-08-2014	07-31-2007	09-08-2014	08-01-2007

Table 44 - Middle Santa Cruz River ALERT Streamflow Gages

Pima County Alert Gage	Santa Cruz River above Grant Road ID: 6030	Mission Road near Silverlake Road - Santa Cruz Basin ID: 6100	Arroyo Chico Wash at Cherry Avenue ID: 6180	Arroyo Chico Wash at Randolph Park ID: 6190	Tucson Diversion Channel at Ajo Detention Basin ID: 6230	Kino Medical - Tucson Diversion Basin (DEQ) ID: 6240	Tucson Electric Power Plant - Julian Wash Basin ID: 6260	Santa Cruz River at Valencia Road ID: 6040	Pima Air Museum - Julian Wash Basin ID: 6270
<b>Location (Latitude, Longitude)</b>	(32.2468, -110.9969)	(32.2015, -110.9934)	(32.2164, -110.9481)	(32.2147, -110.9183)	(32.1833, -110.9269)	(32.1729, -110.9261)	(32.1622, -110.8967)	(32.1342, -110.9919)	(32.1414, -110.8642)
<b>Period of Record</b>	2015-07-19 to Present	2006-09-11 to Present	2007-04-03 to Present	2007-04-05 to Present	2002-08-22 to Present	2000-10-20 to Present	2002-08-23 to Present	1989-11-14 to Present	2002-08-22 to Present

The table below summarizes regulatory discharge locations within the watershed. The locations are from the District’s Tables of Regulatory Discharges.

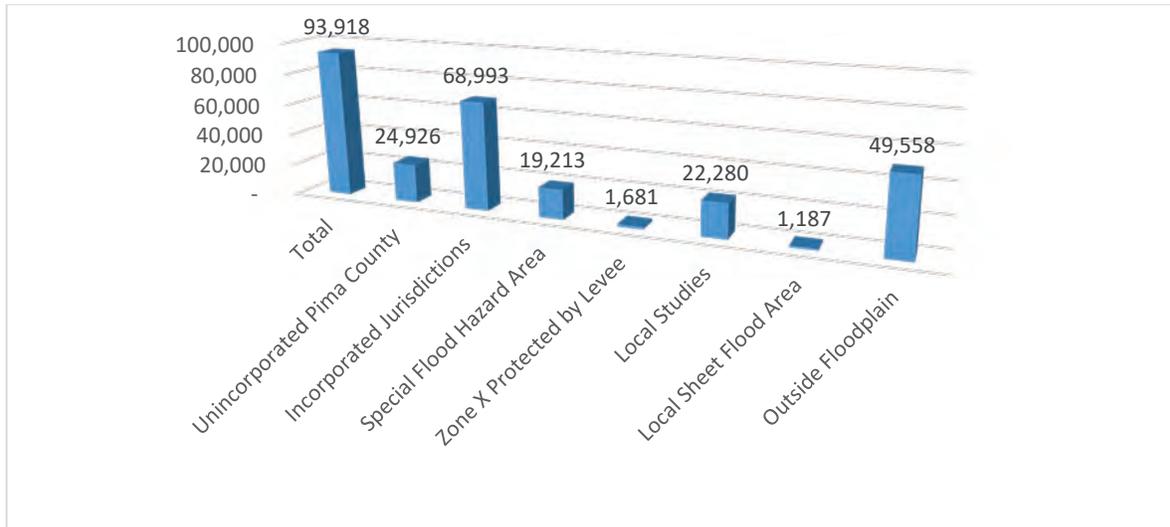
Table 45 - Middle Santa Cruz River Watershed Regulatory Discharges

Watercourse	Regulatory Discharge, cfs 1% Return Frequency	Drainage Area, sq. miles	Source of Discharge Information
Airport Wash @confluences with Santa Cruz River	8,100	23.50	FEMA, Flood insurance Study
@Cortaro Road	70,00	3503	“ “
Julian Wash	3,360	24.90	FEMA Map Revision (99-09-1084P)

### 5.4.13.2 Existing Development & Infrastructure Trends

Within the Middle Santa Cruz River watershed, the population living within all jurisdictions is 93,918 making it the most populated. The chart below shows the distribution of residents within known floodplains, and distribution between incorporated and unincorporated areas. Nearly half live in regulatory floodplains! In addition, nearly 1,700 individuals live behind a levee.

Figure 139 - Middle Santa Cruz River Watershed Population Distribution



This watershed includes the Cities of Tucson and South Tucson and includes downtown and the interstate corridors that are the urban core of the County. It also includes the community center of the San Xavier District of the Tohono O’odham Nation. As shown on the figure below, there are 67,223 acres of private lands, and 12,955 acres of State Trust lands, which is 74% of the watershed.

Figure 140 - Middle Santa Cruz River Watershed Unincorporated Pima County Land Ownership in Acres

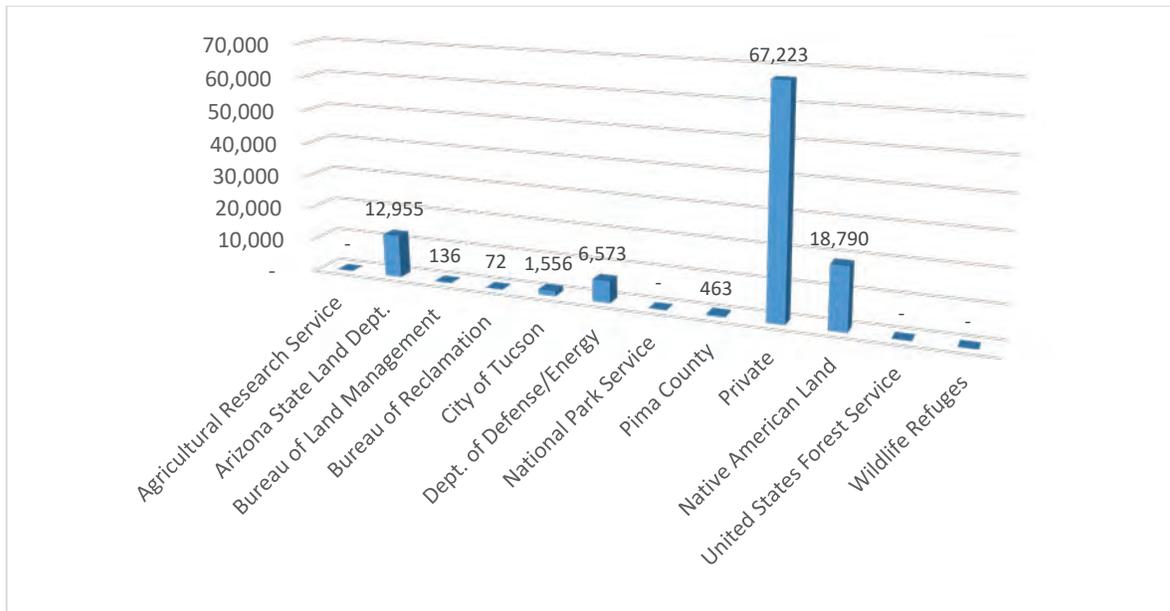
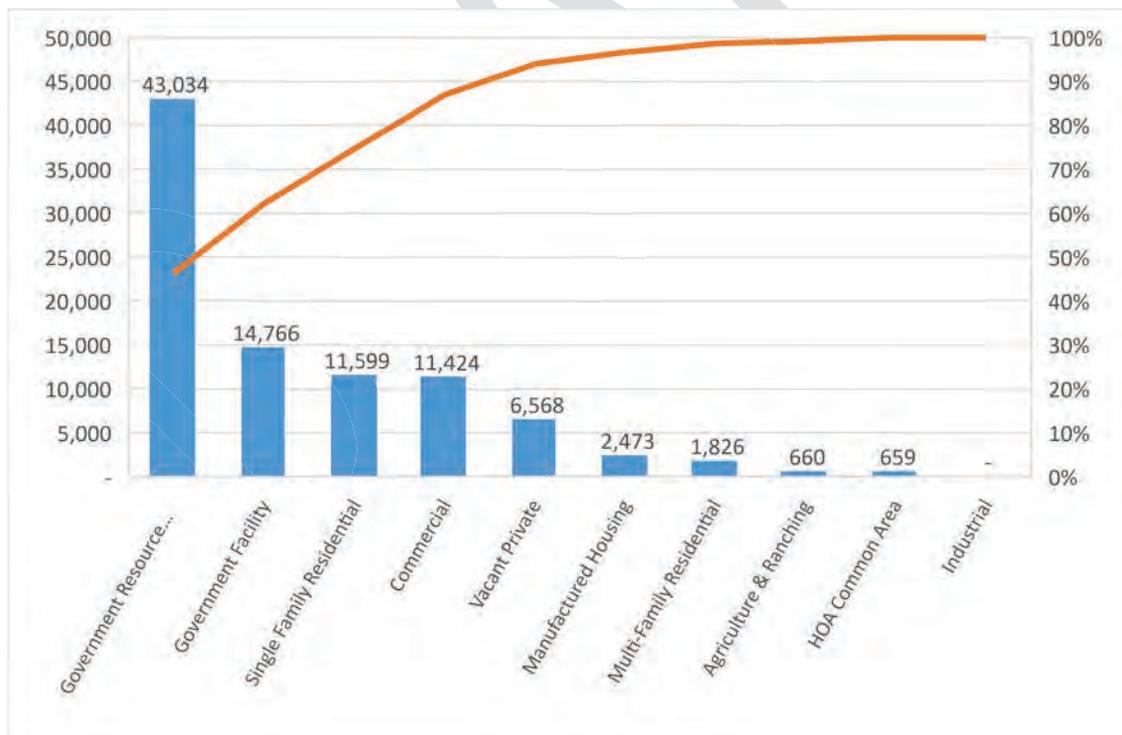


Figure 141 - Middle Santa Cruz River Watershed Land Use in Acres



With the exception of the major river floodways much of this watershed was developed without setting aside floodplains and in some cases the watercourses themselves, instead using roads as drainageways. The result has been the need for significant capital projects including installation of bank protection and grade control to prevent

erosion and channel migration in addition to culverts and storm drains. Even within the high-density transportation network of this urbanized watershed, flooded roads can create hazardous situations combined with motorist behavior and requiring annual swift water rescues and vehicle recovery.

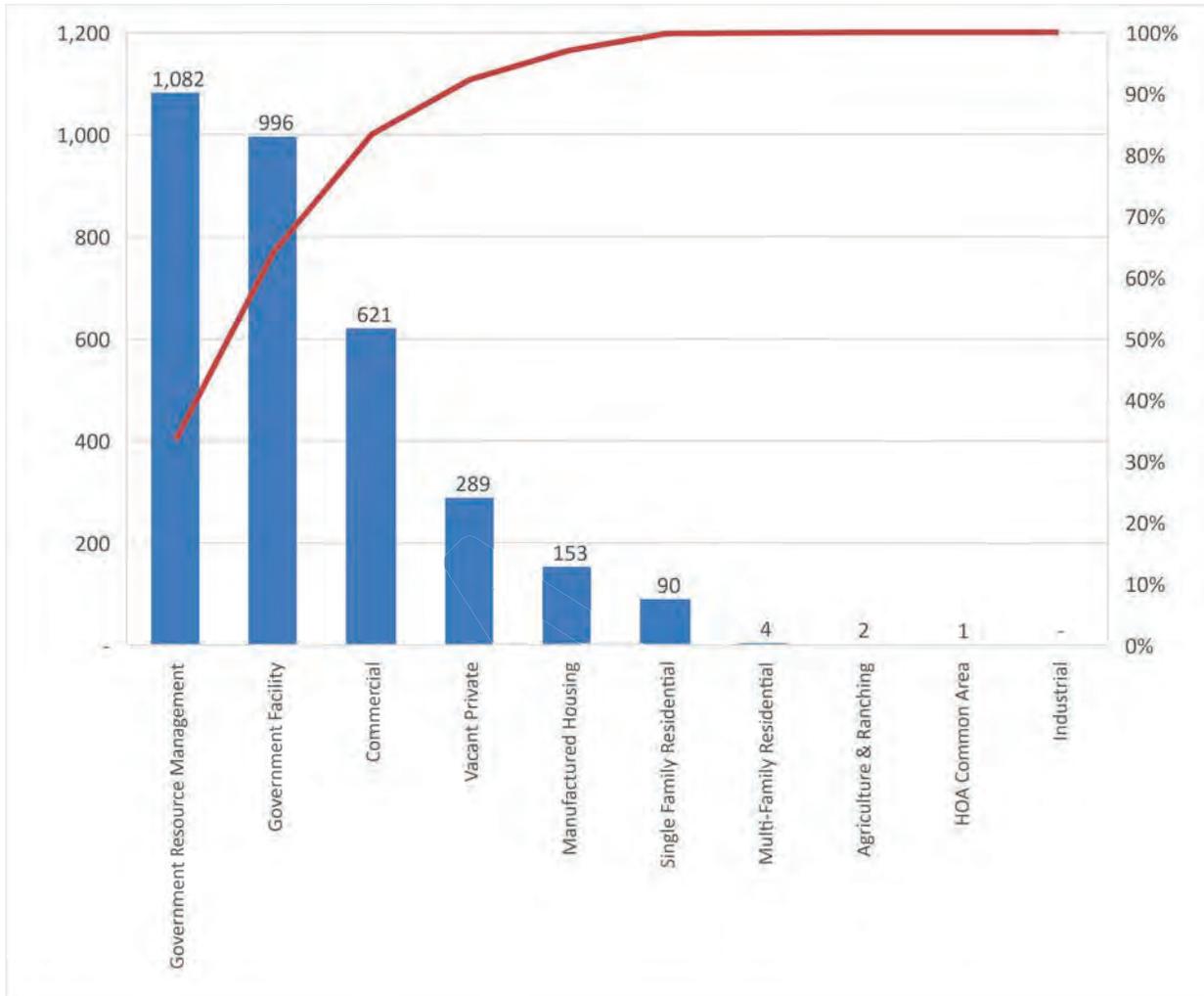
Most intense development is within the floodplain management jurisdiction of the City of Tucson or the Town of Marana. Within unincorporated Pima County, much residential development is within lots outside of platted subdivisions. The picture shows typical larger lots with no planned drainage infrastructure in distributary flow areas. The map below shows the land use and drainage patterns.





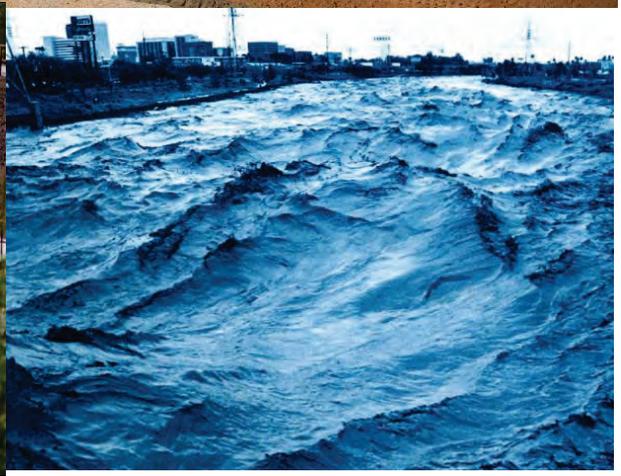
The following chart shows the land use mix within floodplains in this watershed.

Figure 143 - Middle Santa Cruz River Floodplain Land Use



As noted above both major transportation corridors serving Tucson; Interstates 10 and 19, and the railway parallel the river and explains the relatively higher percentage occupied by commercial and industrial sectors as well as multi-family housing.

In historic times, significant entrenchment occurred along the Santa Cruz from San Xavier road to the confluence of the Rillito, which has acted as a pivot point. Most of this reach is urbanized on both sides and bank protected. Through the most northern part of the reach from Cushing Street to Grant Road, where the older structures are, the channel is more encroached and constrained. A levee exists on the eastern bank about ½ mile upstream of Grant Rd and extends about a mile downstream of Grant into the downstream reach.



*Bank Protection Construction, Low and High Flow*

**5.4.13.3 Riparian Habitat and Natural Areas**

There is 3,640 acres of Pima County Regulated Riparian Habitat and 1,908 acres of IRA within this watershed. There are also 211 preserved acres in this watershed, 143 of which is in regulatory floodplain. Jurisdictions involved have preserved little herein with the exception of urban parks and the river corridor itself.

Figure 144 - Middle Santa Cruz River Watershed Riparian Habitat in Acres

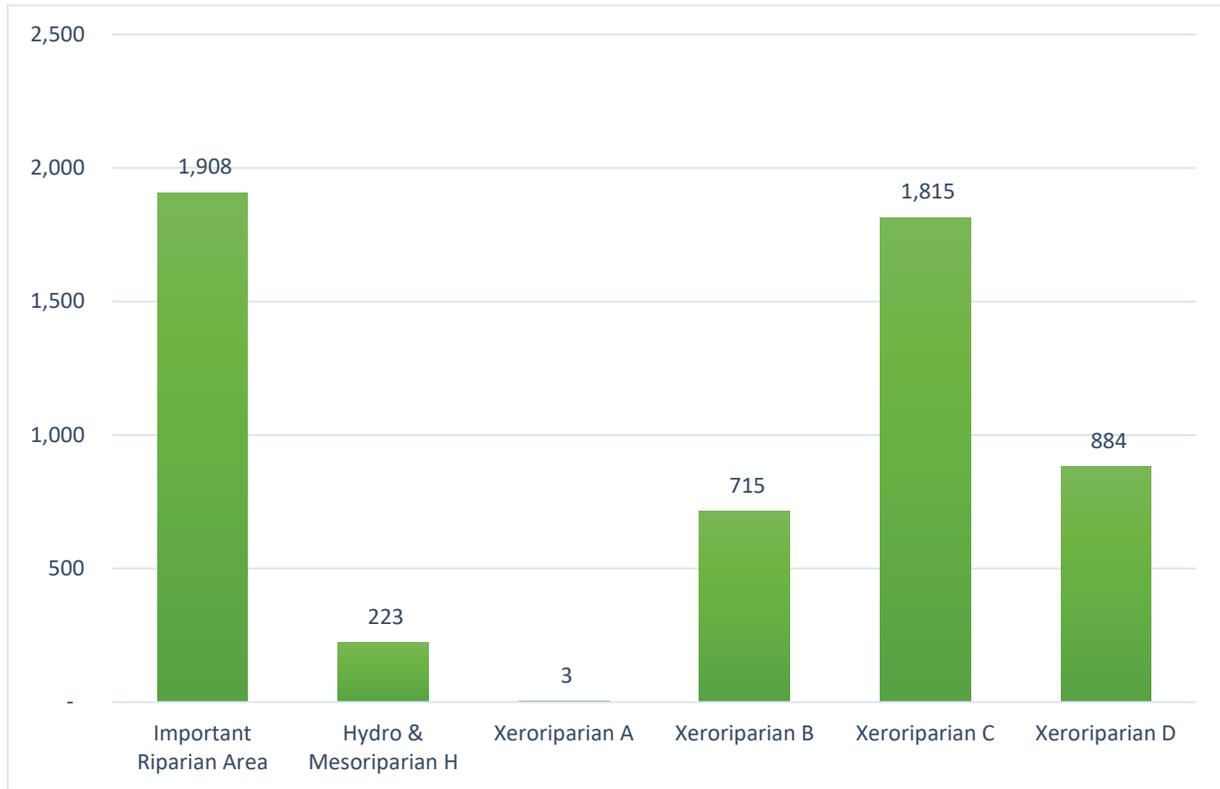


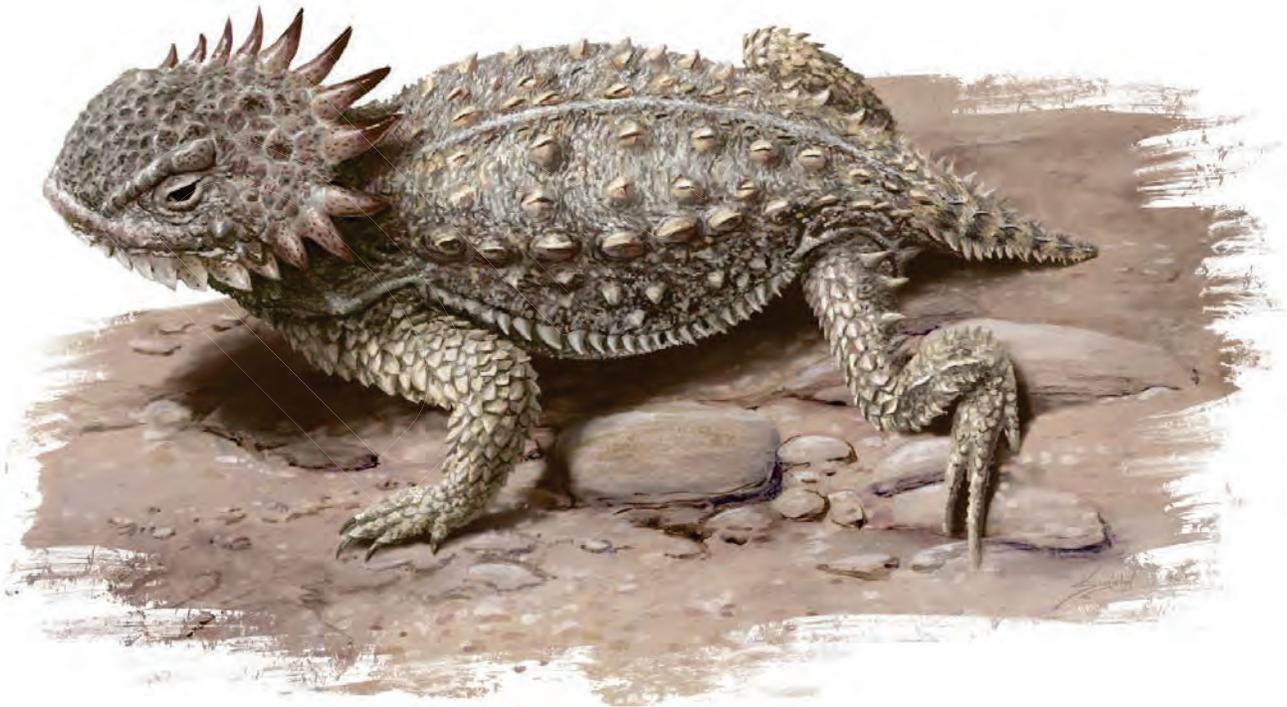
Figure 145 - Paseo de las Iglesias Multi-Purpose Restoration Project

Due to location along major transportation corridors and diverse and predominantly private land ownership, the Julian Wash remains highly infested with fire-loving buffelgrass, creating threats to both public safety and biotic diversity.

The largest habitat restoration efforts of the District in this area include the 120-acre Kino Environmental Restoration project and the 350-acre Paseo de las Iglesias along the Santa Cruz River. The former project, constructed in a pre-existing detention basin, contains a series of ponds and native vegetation plus a pumping system that both circulates stormwater within the basin and removes excess stormwater to irrigate turf at the Kino Sports Complex and surrounding landscape areas. Due to a limited urban encroachment, the Paseo de las Iglesias project takes a softer approach to major urban river management by introducing habitat restoration on the overbanks and broad terraces and relies less on bank protection. This project enhanced a pre-existing ephemeral toad-breeding habitat that supports six species of native toads.

The District completed enhancements along much of the Chuck Huckleberry Loop for ecosystem benefits, and one of the best examples of is east of Christopher Columbus Park, where water-harvesting earthworks, well timed plantings, and timely rainfall sustained revegetation without use of supplemental irrigation.

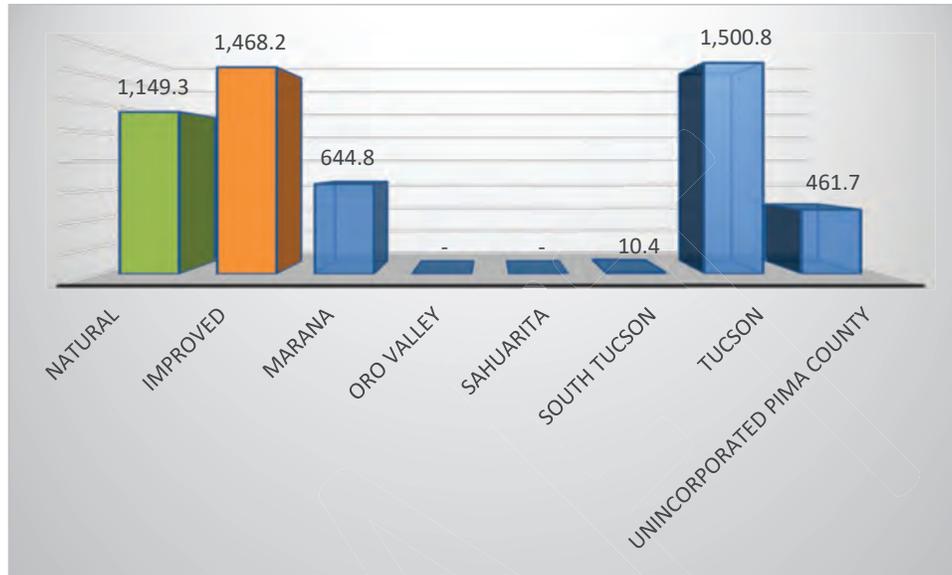
In partnership with the District, the U.S. Army Corps of Engineers constructed Tucson Drainage Area/Arroyo Chico Multi-Use Project, which included extensive environmental mitigation components. The District salvaged and relocated regal horned lizards ahead of construction, then added two ephemeral toad breeding pond and habitat amenities for returning regal horned and other native lizards.



#### 5.4.13.4 Historic Floodplain Management Approach

The figure below shows the split between natural and improved drainageways, and how many acres the District is responsible for in each jurisdiction.

Figure 146 - Middle Santa Cruz River Drainageway Acreage



In upper, more urbanized reaches, following the floods of 1983, the district embarked on a major program of bank protection to prohibit lateral migration of the riverbed. Currently most of this reach has been bank protected. However, as mentioned above in the more recent projects, wherever possible a wider floodplain maintained to facilitate habitat restoration as well as reduction of encroachment, and bank protection height. While the District is responsible for the Santa Cruz throughout Pima County, much of this watershed is within the City of Tucson.

In places, the bank protection is also a certified levee. The Grant Road Levee is upstream and downstream of Grant Road along the east embankment of the Santa Cruz River. The levee has flap gates.

The Mission West Levee is a CMU concrete reinforced floodwall south of the Mission West Subdivision.

The Roger Road Sewage Treatment Plant Levee is a soil cement levee along the east embankment of the Santa Cruz River upstream and downstream of the Roger Road Sewage Treatment Plant. There are flap gates. The effluent spillway and associated plunge pool should be included in inspections. Agua Nueva Water Reclamation Facility replaced Roger Road, and discharge quality improvements have changed river dynamics.

In order to prevent tributary flooding behind the levee in frequent minor events, where there are flap gates, the district must monitor aggradation and remove it regularly to allow gates to open.

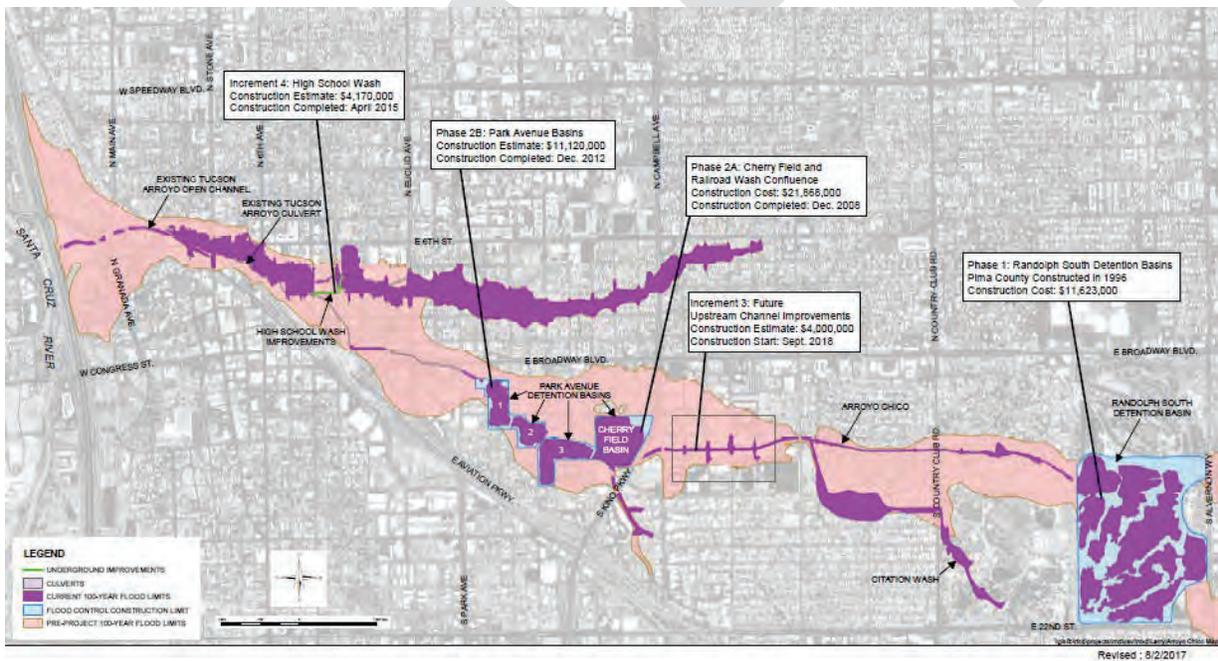
The US Army Corps of Engineers constructed the Tucson Diversion Channel Levee was constructed in the early 1960's. It lies north of Golf links Road north of the Davis-Monthan Air Force Base.

In addition to these levees and bank protection, there are several dams within this watershed.

The Ajo Detention Basin is a flood control reservoir on the Tucson Diversion Channel north of Ajo Way and upstream of the Julian Wash confluence. The dam structure is an earthen berm with a concrete inlet and outlet. The pump system is not part of the flood control function but serves as a water-harvesting component of the basin.

Pima County Regional Flood Control District and the City of Tucson in cooperation with the U.S. Army Corps of Engineers (ACOE) constructed a multi-phase flood control, environmental restoration and recreation project called the Tucson Drainage Area/Arroyo Chico Multi-Use Project. The project area encompasses approximately 4.8 miles of the Tucson Arroyo/Arroyo Chico Wash from Alvernon Way to its confluence with the Santa Cruz River near St. Mary Road. The phases of the project are:

- Phase 1, Randolph South Detention Basins, which were completed in April 1996 by the Pima County Regional Flood Control District and the City of Tucson
- Phase 2A, Cherry Field Detention Basin, which was completed in December 2008 by the ACOE; and
- Phase 2B, Park Avenue Detention Basin Complex, which the ACOE completed in December 2012.
- Increment 3 (Upstream Channel Improvements) is to be redesigned to provide channel capacity and ecosystem mitigation, and is anticipated to go to construction in September 2018.
- Increment 4 (High School Wash Storm Drain) was completed April 2015.



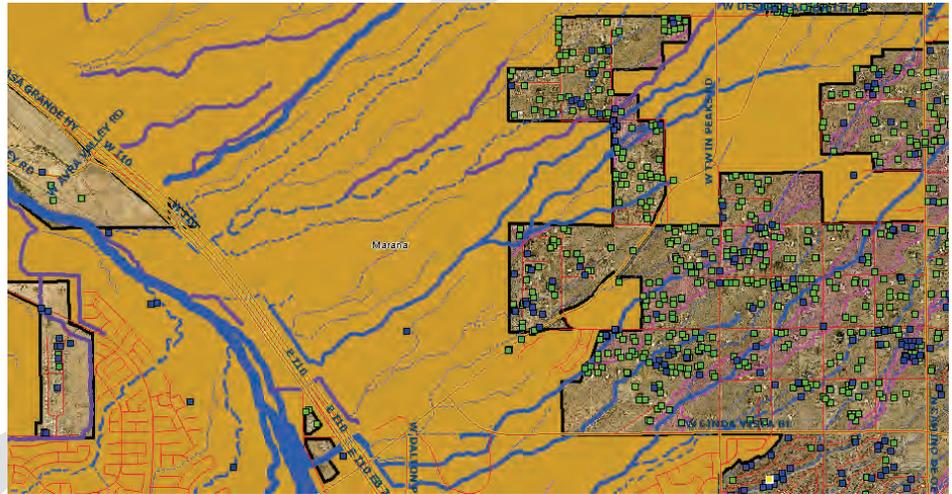
Park Avenue Basin #1- This is the first flood control reservoir on Arroyo Chico upstream of Broadway Boulevard. The basin has two sub-basins, earthen embankments, with buried Gabion mattresses, and security grates at storm drain inlets.

Park Avenue Basin #2- This is the second flood control reservoir on Arroyo Chico upstream of Broadway Boulevard. The basin has earthen embankments, with buried Gabion mattresses and security grates at storm drain inlets.

Park Avenue Basin # 3- This is the third flood control reservoir on Arroyo Chico upstream of Broadway Boulevard. The basin has earthen embankments -with Gabion mattresses (buried), security grates at storm drain inlets. Highland Avenue is a component of the earthen embankment and spillway.

Cherry Field Basin- This flood control reservoir is located at the confluence of the Railroad Wash and Arroyo Chico. It includes the drainage infrastructure for the Railroad Wash. It consists of a floodwall, an earthen embankment-with Gabion mattresses (buried), CMU retaining wall along the west side next to Cherry Avenue , manual gates, spillway (concrete bleaches south of the ball fields) , and security grates at storm drain inlets. County maintenance staff must manually operate gates to drain stored floodwaters.

In the downstream less urbanized reaches of the watershed, infrastructure is limited. The MapGuide excerpt below shows typical residential development without planned infrastructure. The green squares mark the locations of individual floodplain use permits. When project-scale or regional infrastructure is has been put in place by the District of private developers, flood hazards have been defined and mitigated during project development by the District, and it is not necessary to issue numerous individual permits.



The District has classified the Santa Cruz River as a major watercourse for regulatory and planning purposes.

Please see the Lower Santa Cruz River watershed chapter for a complete discussion of ALERT gauges and notification levels for this watershed.

#### 5.4.13.5 Needs – Capital Improvement

For each watershed; monitoring, frequently flooded structures and properties subject to damage, exposed infrastructure, and safety concerns have been described in full detail in the District’s Flood Response Field Manual (April 2019). Each of the areas so identified have addresses and geodetic coordinates associated with them and District personnel have them mapped in the Geographic Information System used. For planning purposes, specific items of concern follow; the complete report is in Appendix D.

##### Data Gathering Needs

- No site-specific issues identified.

##### Frequently Flooded Structures and Properties Subject to Damage

- The Casas Arroyo subdivision is located on the outside of a bend in the Santa Cruz River and may experience flooding and erosion problems. (T13S R12E Sec. 01) <GIS Point ID: SCM-FSP-001>
- Tetakusim Road and Settler Avenue (T15S R13E Sec. 19) <GIS Point ID: SCM-FSP-002>
- The homes in the vicinity of Oriole Circle and Mayes Place are some of the most frequently flooded structures in Pima County. Water in structures up to 18 inches deep due to Valencia Wash. (T15S R13E Sec. 09) <GIS Point ID: SCM-FSP-003>
- Homes have been known to flood south of Irvington Rd. and east of San Joaquin Ave. (T15S R13E Sec. 04) <GIS Point ID: SCM-FSP-004>
- Wyoming Wash in the vicinity of Irvington Rd. and La Cholla Blvd. flows approximately 300 feet wide (across Sindle Pl, to the north) T15S R13E Sec. 03) <GIS Point ID: SCM- FSP-005>

##### Infrastructure

- The Ina Road bridge gets shut down when flow is approximately 4-5 feet, equivalent to roughly the 25 year event, approximately 20,000 cfs. This issue is in the Town of Marana. (T13S R12E Sec. 01) <GIS Point ID: SCM-INF-001>
- The storm grate on the west side of Westover Ave. between Drexel Rd. and Canada St. has been subject to getting plugged up and causing flooding on nearby properties. A 2006 fix should improve the grate, but it’s worth following up on. (T15S R13E Sec. 04) <GIS Point ID: SCM-INF-002>
- The channel of the Santa Cruz West Branch is largely earthen and is heavily eroded in certain areas, such as where Dakota Wash enters the West Branch east of Mission Rd. and south of Irvington Rd. (T15S R13E Sec. 03) <GIS Point ID: SCM-INF-003>
- The floodwall for Mission West II subdivision is on private, individual lots and may not be properly maintained. (T15S R13E Sec. 20) <GIS Point ID: SCM-INF-004>
- The earthen embankment near the NW corner of San Xavier Estates is overtopped during the base flood. (T15S R13E Sec. 20) <GIS Point ID: SCM-INF-005>
- Santa Cruz River: 6700 N Silverbell Road (214-03-0400) is subject to channel bank migration. Based on the Sunset Road Bridge Study it is suspected that the bulk of the vegetation will be

removed at 21,800 cfs. That vegetation is at the toe of the cut-slope and at a gentle outside meander. The home at 6700 N Silverbell Road is less than 100 feet from what will be a 30-foot cut-slope. (T13S R12E Sec. 01) <GIS Point ID: SCM-INF-006>

- Santa Cruz River: 6730 N Silver Ridge Road (214-03-0430) is subject to channel bank migration. Based on the Sunset Road Bridge Study it is suspected that the bulk of the vegetation will be removed at 21,800 cfs. That vegetation is at the toe of the cut-slope and at a gentle outside meander. The home at 6730 N Silver Ridge Road is less than 150 feet from what will be a 30-foot cut-slope. (T13S R12E Sec. 01) <GIS Point ID: SCM-INF-007>

#### Safety Concerns

- No site-specific issues identified.

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### 5.4.13.6 Floodplain Management

Future needs identified by District staff include:

- Vegetation Management
- Homeless Camps
- Lot splits where west bank protection lacking near Casas Arroyo
- Sunset Road Bridge remapping - done
- Gravel pits
- Agua Dulce Coordination
- Interjurisdictional Maintenance Coordination
- Aggradation/degradation

