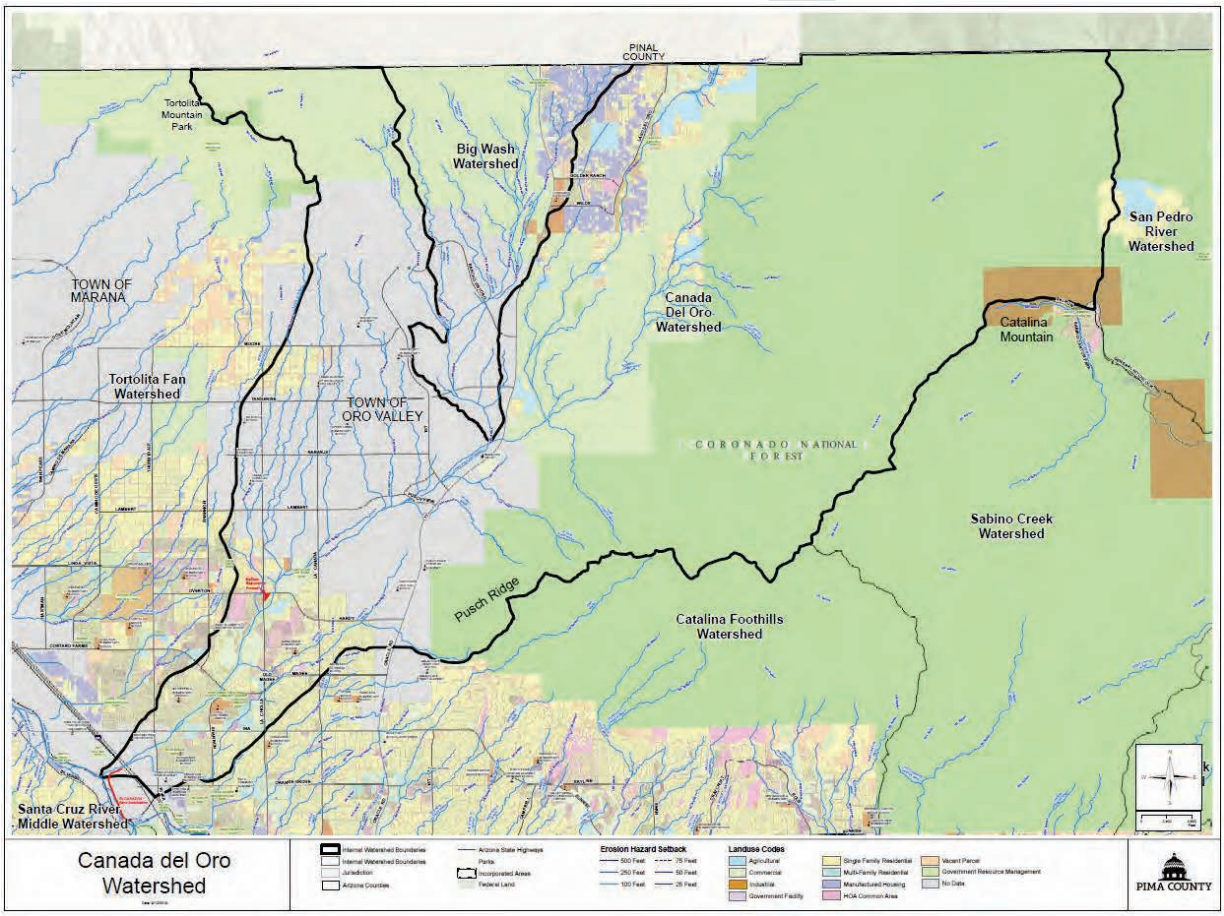
5.4.4 Canada Del Oro & Big Wash

For the purposes of this study, this watershed includes the Canada Del Oro and two of its largest tributaries the Big Wash and the Sutherland Wash. This system drains the western slopes of the Santa Catalina Mountains and the eastern slopes of the Tortolita Mountains. The Canada del Oro and Big Wash enter Pima County from Pinal County into the community of Catalina. The Canada del Oro passes under Interstate 10 and railway before its confluence with the Santa Cruz River. Within Pima County, it is comprised of 86,362 acres (134.9 square miles), of which 16,503 acres are in the Town of Oro valley and 564 acres in the Town of Marana.

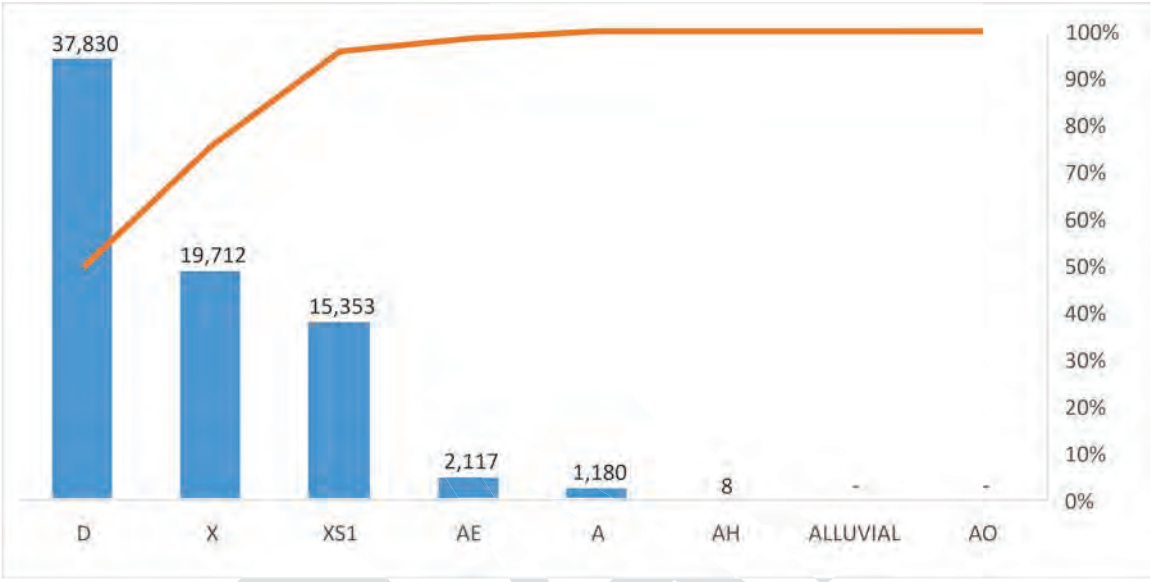
Figure 52 - Canada Del Oro Watershed Map



5.4.4.1 Flood Characteristics

In addition to the 4,758 acres of SFHA included on the chart above, there are also 1,023 acres of District Special Studies Floodplains and 5.54 acres of local sheet flood area in this watershed. Together these mapped floodplain areas are 6 percent of the total watershed area. The CDO in particular has very steep and rocky upper slopes within the Catalina Mountains and thus flash flooding is a significant concern.

Figure 53 - Canada Del Oro & Big Wash SFHA in Acres



The table below summarizes historic USGS gaging station records.

Table 10 – Canada del Oro and Big Wash Watershed USGS Gages

USGS Gaging Station	Canada Del Oro near Tucson, AZ 09486300	Canada Del Oro BLW Ina road near Tucson, 09486350
Period of Record	1959-07-21 to 1983-10-01	1992-08-07 to 2015-08-07
Watershed Area (sq. m)	250	255
Flood Peak of Record (cfs)	17000	9870
Date	07-21-1959	09-08-2014
Table of Regulatory Discharge (cfs)	NA	NA

The next table provides a summary of Pima County ALERT streamflow gages.

Table 11 - Canada del Oro and Big Wash ALERT Streamflow Gages

Pima County ALERT Gages	Canada Del Oro Wash at Golden Ranch Road (PT) ID:1103	Big Wash at Canada Del Oro Wash ID: 1274	Canada Del Oro Wash at Ina Road ID: 1203
Location (Latitude, Longitude)	(32.4784, -110.8995)	(32.413,-110.942)	(32.3355,-111.0421)
Period of Record	1999-07-01 to Present	2007-07-03 to Present	1993-01-11 to Present
Watershed Area (sq. m)	64.8	110.4	255.19
Flood Peak of Record (cfs)	2193.2	7396	19028
Date	08-09-2004	9-08-2014	07-29-2006
Table of Regulatory Discharge (cfs)	NA	NA	NA

Table 12 - Canada del Oro and Big Wash ALERT Precipitation Gages

Pima County ALERT Gages	Samaniego Peak-Canada Del Oro Basin ID: 1130	Dan Saddle-Canada del Oro Basin ID: 1140	Cargodera Canyon-Canada Del Oro Basin ID: 1070	Canada Del Oro Wash at Golder Ranch Road ID: 1100	Rancho Vistoso-Canada Del Oro Basin ID: 1260	Canada Del Oro Wash at Big Wash ID: 1270	Oro Valley Public Works-Canada Del Oro Basin ID: 1230
Location (Latitude, Longitude)	(32.4683 -110.8172)	(32.4813,-110.7491)	(32.4455,-110.8768)	(32.4783,-110.8989)	(32.45-110.9458)	(32.4125,-110.9419)	(32.3739,-110.9827)
Period of Record	2006-02-01 to Present	2005-08-23 to Present	1987-03-27 to Present	1987-01-05 to Present	2001-10-19 to Present	2007-04-05 to Present	2001-10-19 to Present

The table below provides discharge locations within the watershed. The locations are from the District's tables of regulatory discharges.

Table 13 - Canada del Oro and Big Wash Regulatory Discharges

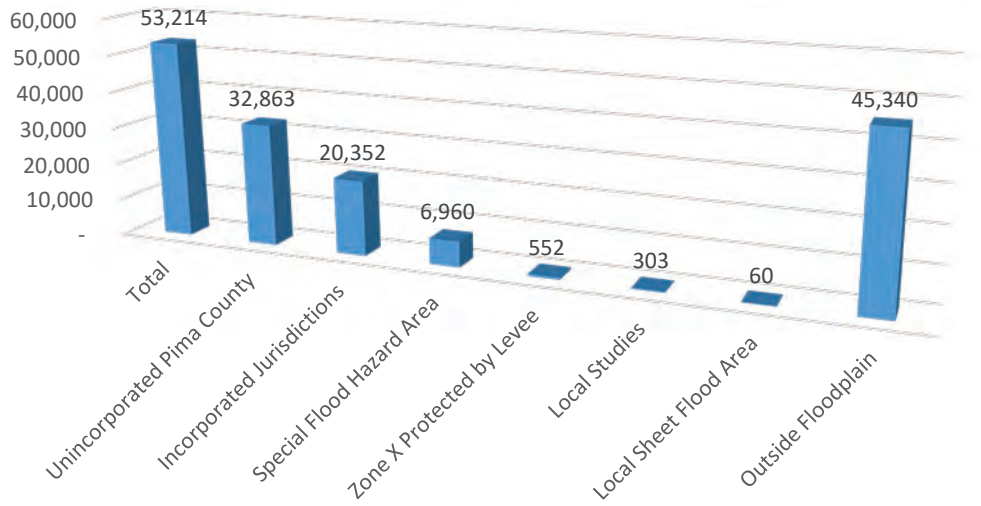
Watercourse		Regulatory Discharge, cfs 1% Return Frequency	Drainage Area, sq. miles	Source of Discharge Information
Canada Del Oro Wash				
@ Confluence with Santa Cruz river		22,400	256	FEMA Conditional Map Revision (08-09-0112R)
@Overton Road		22,100	250	" "
Above Confluence with big Wash		15,000	115	" "
Above Confluence with Southernland Wash		11,900	75.90	" "
@Pinal County Line		9,600	47	" "
Big Wash				
Upstream of confluence with Canada Del Oro Wash		18,300	110	FEMA, Flood Insurance Study
Upstream of Confluence with Honey Bee Wash		16,900	89.90	" "

These records indicate that floods in the Canada Del Oro can occur from all three of the three primary flood mechanisms that occur in Pima County, convective storms, tropical storms and frontal storms. While not apparent in the record rain on snow events could occur in this watershed when frontal storms produce rain on existing winter snow.

5.4.4.2 Existing Development & Infrastructure Trends

The chart below shows the distribution of residents within known floodplains, and distribution between incorporated and unincorporated areas. While the 13% of the population living in floodplains is not remarkable, there are also 552 people living behind a levee.

Figure 54 - Canada Del Oro & Big Wash Watershed(s) Population Distribution



As shown on the bar chart below, 44% of this watershed is within the Coronado National Forest, with nearly 37% private and another 19% of State Trust.

Figure 55 - Canada Del Oro & Big Wash Watershed Ownership in Acres

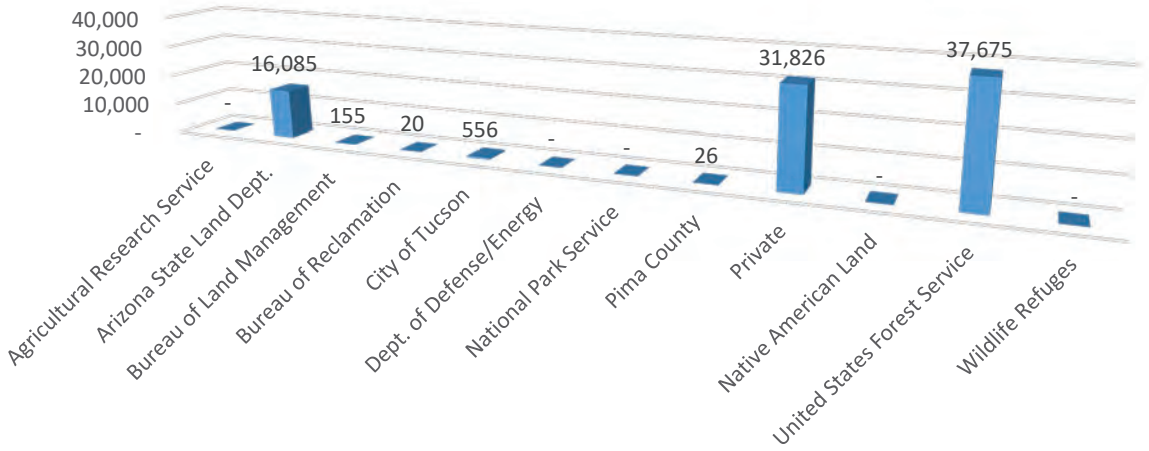


Figure 56 - Canada Del Oro & Big Wash Watershed Land Use in Acres

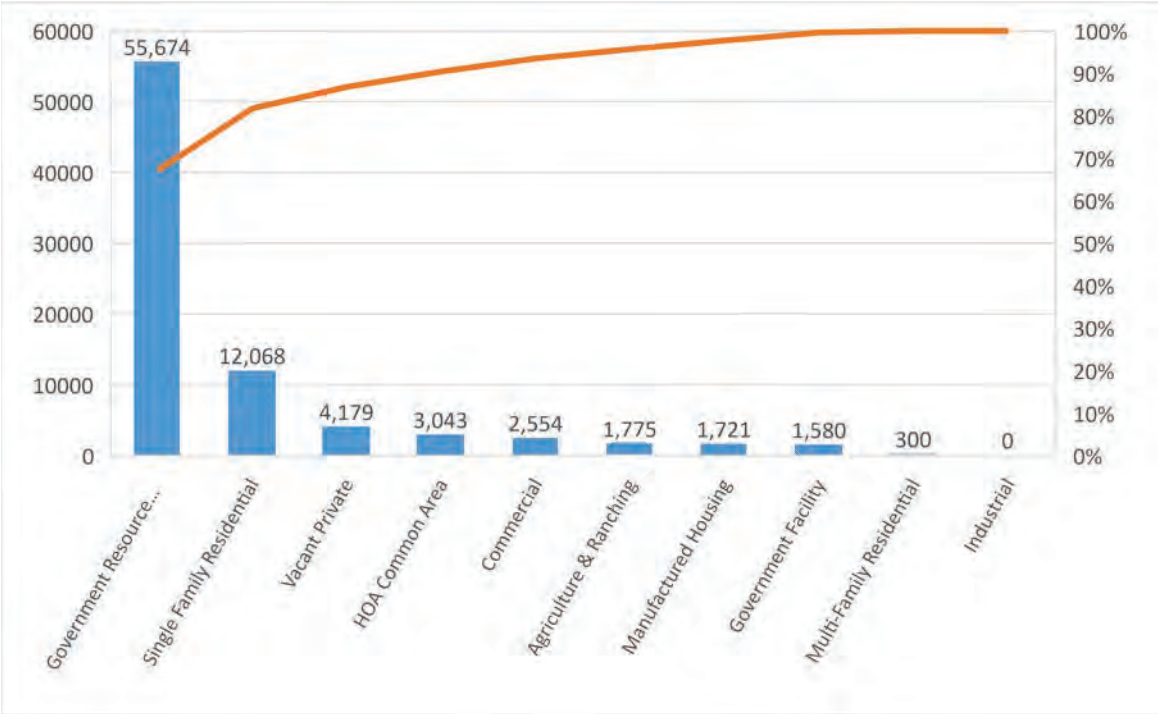
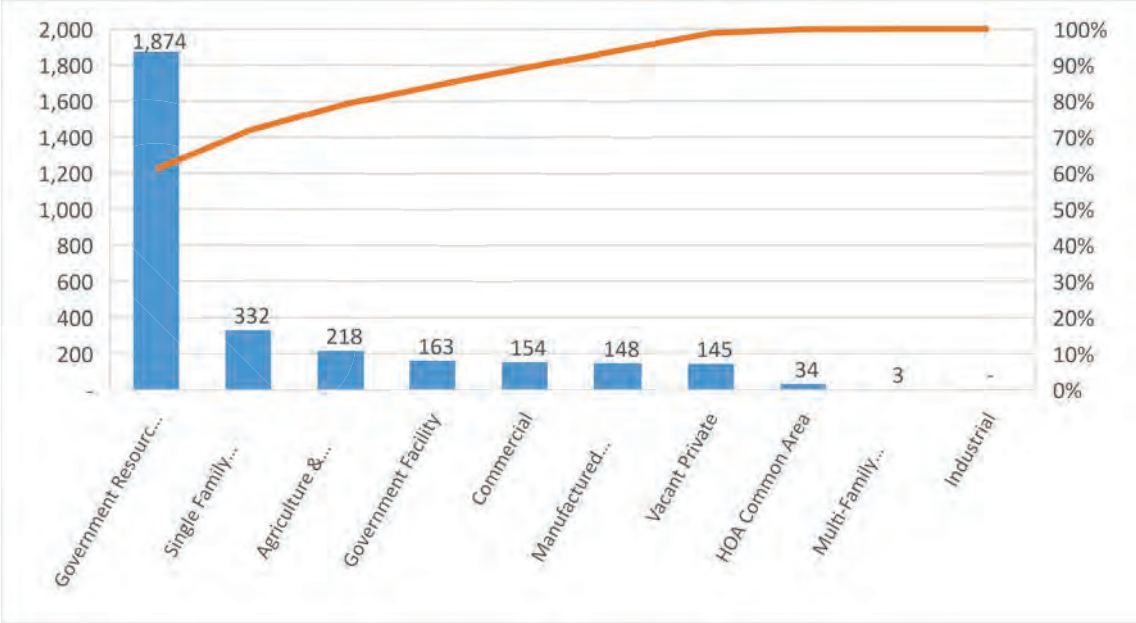
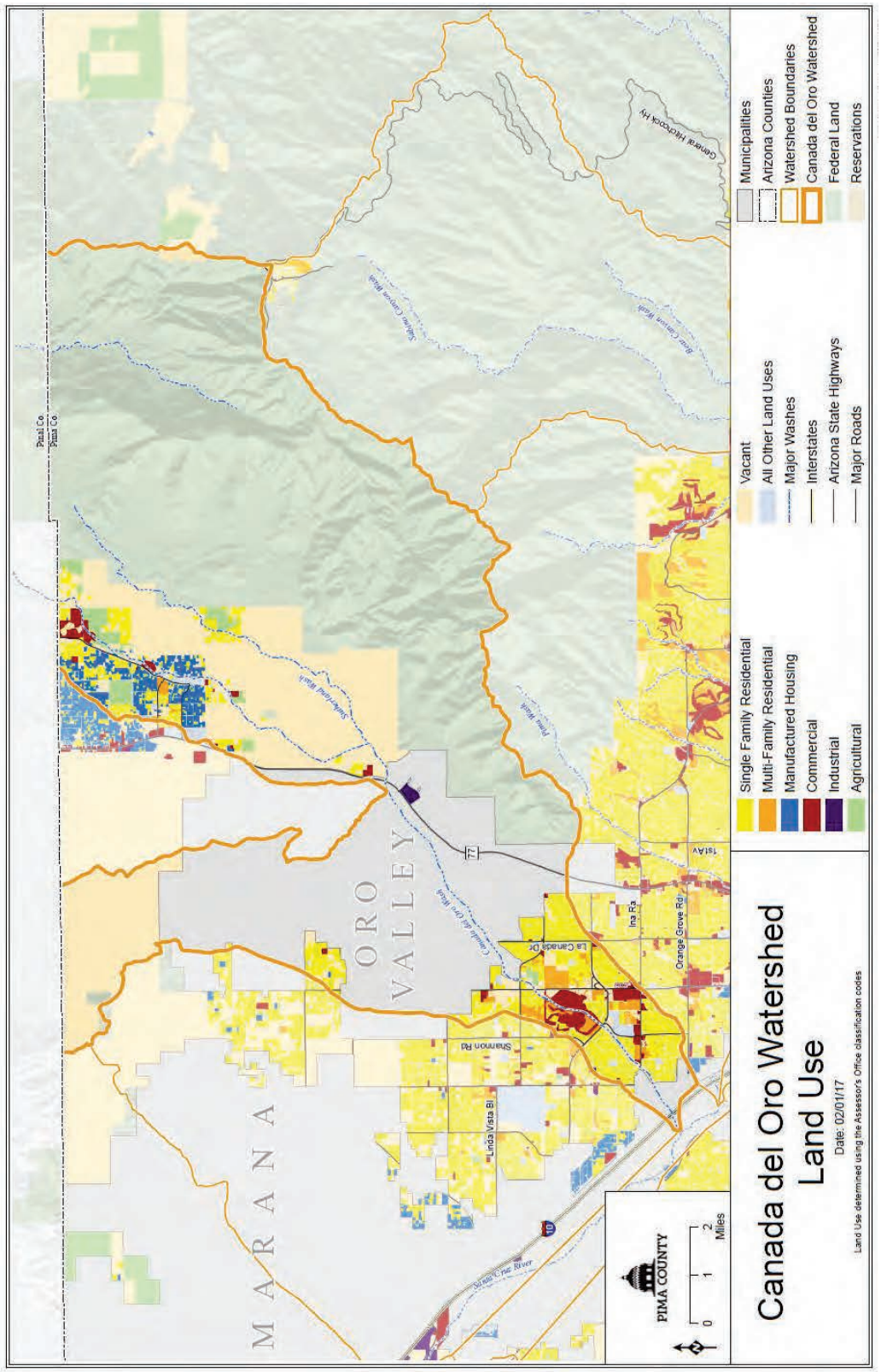


Figure 57 - Canada Del Oro & Big Wash Floodplain Land Use in Acres



While a casual drive down Oracle Road suggests the land uses are predominately residential, commercial and recreational, within the floodplains ranching and other agricultural uses still exist. The map below depicts these land-use patterns.

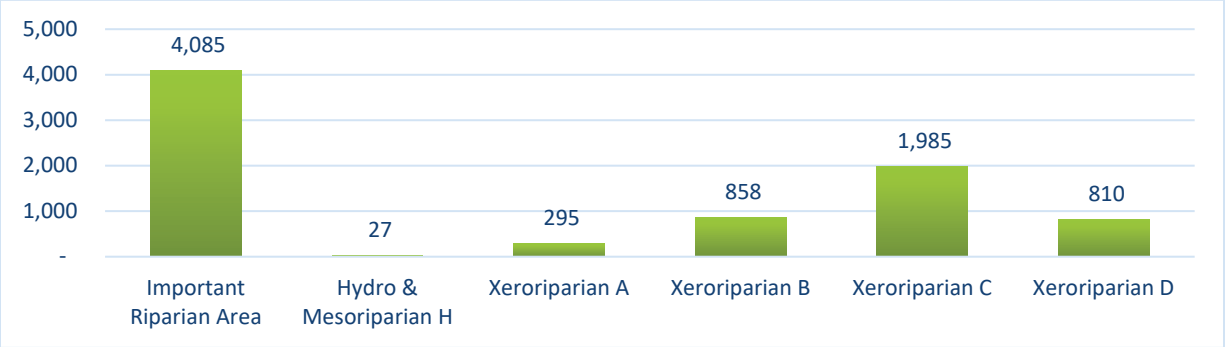
Figure 58 - CDO Land Use Map



5.4.3.3 Riparian Habitat and Natural Areas

As shown on the bar chart below, there are 3,976 acres of Pima County Regulated Riparian Habitat in this watershed. There are also 45,974 preserved acres in this watershed, including 1,977 in regulatory floodplain.

Figure 59 - Canada Del Oro & Big Wash Riparian Habitat in Acres



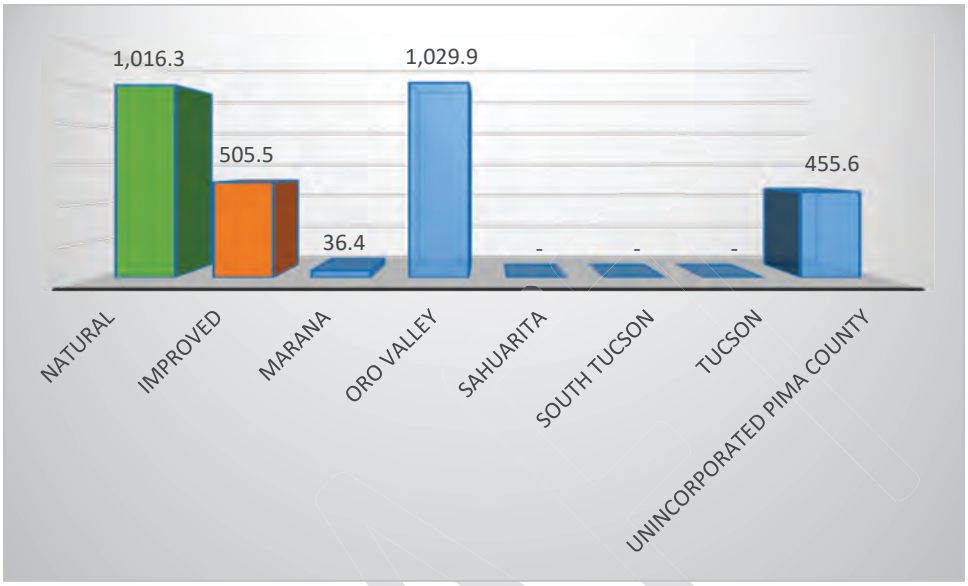
It contains some of the most significant riparian areas within the county providing both unique and rare habitat types as well as connectivity between the Catalina and Tortolita Mountains. In fact a major wildlife overpass has been completed recently connecting Catalina State Park and the National Forest on the east to county ranch preserves in the Tortolita Mountains on the west side of Oracle Highway. Recent roadway improvements including grading and widening have made this critical.

The District assisted with design and management, and recently assumed ownership of a private mitigation restoration in Big Wash. The project successfully utilized Low Impact Development techniques in funneling rooftop nod parking stormwater into the restoration project, enabling rapid recovery of mesquite bosque in a former agricultural field.

5.4.3.4 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.

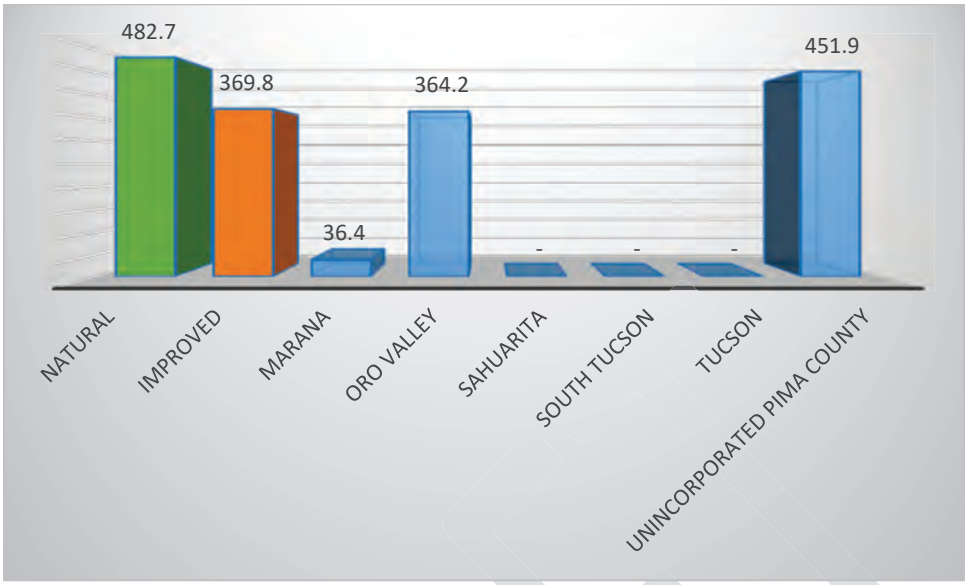
Figure 60 – Canada del Oro & Big Wash Drainageway Acreage



The CDO is a major watercourse that originates in National Forest, passes through unincorporated Pima County into Oro Valley, and then back into the County near the confluence with the Santa Cruz River. Because of this interjurisdictional coordination is an important component of a successful mitigation program. Bank protection and use of acquisition has been the focal point of management in this area especially since growth, wildfires and associated debris movement have been significant.

Exposed Bank Protection Toe

Figure 61 - Canada Del Oro Improved vs. Open Space Drainageways in Acres



In this watershed, there are 1,406 acres of improved drainageways and 800 acres that are designated open space. There is also 45,130 acres of preserved open space that together with the drainageways shown on the figure above makes up only 61% of the watershed.

Following catastrophic forest fires in the National Forest headwaters of the Canada del Oro the District and the Town of Oro Valley began acquiring floodprone and damaged properties. This management approach was appropriate hear as grandfathered non-conforming developments existed within the geologic floodplain near the mountain canyons. Doing so has certainly helped prevent repetitive losses.

Downstream within the commercialized and more densely developed residential areas bank protection projects have complemented the development of linear parks known locally as the Loop. This consists of an interconnected set of river paths for walkers, biking and equestrians with additional park amenities including recreation, education and riparian restoration projects.

The Big Wash Levee is a soil cement levee upstream of Tangerine Road along the eastern side of the Big Wash floodplain and west of the Oro Valley Hospital. Additional freeboard was added to the levee because of the hospital, a Critical Facility and because the Big Wash is in a conservation easement.

The Canada Del Oro Wash Levee is along the left embankment (looking downstream) of the Canada Del Oro Wash from Oracle Highway downstream to La Canada Drive. This is a soil cement levee.

The Canyon Shadows Levee is a soil cement levee south of the Canyon Shadows subdivision along the north embankment of the Canada Del Oro Wash Downstream of La Canada Drive.

The Rams Canyon Levee is a soil cement levee along the south embankment of the Canada Del Oro Wash upstream of the Oracle Highway.

Downstream of the county line that is Edwin Road, the Canada del Oro channel cannot convey large flows. Travel time from Rancho Solano (1079/1083) to Golder Ranch Road (1099/1103) is approximately 1 hour. The earliest channel breakout, near Golder Ranch Road, occurs at approximately 1,500 cfs. If breakout occurs, Lago Del Oro Parkway may be affected.

Flow registered at the stream gauges at CDO at Oracle (1273) and Big Wash at the CDO (1274) may incorporate flow from sub basins below Golder Road (including Big Wash, Sutherland Wash, Romero Canyon, etc.). Flow at these locations may affect downstream at-grade crossings. Little travel time information available. Assuming an average channel velocity of 10 fps, travel time from 1273 and 1274 to Overton Road, is approximately 45 minutes to 1 hour. Travel times change through the rainy season as the channel becomes wetted. At this streamflow, the following at-grade crossings are impacted:

- Edwin Road
- Wilds Road
- Overton Road

In 2013, the Department of Transportation completed a new bridge at a former at-grade crossing on La Cholla Boulevard downstream of the Overton Road at-grade crossing. The bridge provides safe north-south access across the CDO at a crossing, which previously detoured traffic in nearly every storm event. The bridge constitutes a significant improvement to public safety and access, especially since the Overton Road crossing closes in nearly every storm event. The Overton crossing is particularly hazardous because storms can initiate in CDO headwaters while no rainfall occurs at Overton. Flows can arrive at Overton with little warning to traffic.

At streamflow of 800 cfs at Rancho Solano, stream gauge (1079/1083) the District contacts the Pima County Department of Transportation, as is the Golder Ranch Fire Department, as flows will reach Golder Road in approximately 1 hour and 20 minutes.

At streamflow of 1,500 cfs at the Rancho Solano stream gauge, senior staff makes the decision as to whether to contact OEM.

At streamflow of 500 cfs at either sensor at CDO or Big Wash (1273/1274), the District contacts Pima County Department of Transportation, as water may affect downstream road crossings. The information on the table below also guides the Flood Threat Recognition and early Warning Dissemination process for which the District is responsible.

Table 14 - Flood Thresholds Less Than 1% Chance Flood

Flood Threshold Known to be Less Than 100 Year Discharge (1% Chance Flood)				
Gauge	Stage (ft)	Discharge (cfs)	Contact	Concern
1079/1083	5	800	Golder Ranch Fire Dept. PCDOT	Edwin/Wilds/Overton/La Cholla
1079/1083	7.1	2,000	District IMD	Overbank at Golder
1099/1103	4.2	2,000	District IMD	Overbank at Golder
1273	1.1	450	PCDOT	Overton Road
1274	1.4	300	PCDOT	Overton Road
1203	7.3	10,000	District IMD	Ina Road Bridge on the Santa Cruz

5.4.3.5 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

- 4335 E. Wilds Road. (222-35-018A) Flow breaks out of the channel in this area at around 1500-2000 cfs. (T11S R14E Sec. 15) <GIS Point ID: CDO-FSP-001>
- 4525 E. Golder Ranch Road (222-35-039D) is subject to erosion damage from a tributary to the Canada del Oro (T11S R14E Sec. 15) <GIS Point ID: CDO-FSP-002>
- 14350 N. Lago del Oro Parkway (222-47-0030), structures in the floodway. (T11S R14E Sec. 22) <GIS Point ID: CDO-FSP-003>

Infrastructure

- Carmack Wash is eroding laterally towards Shannon Road. Sediment and water overtops Shannon Road as well. (T13S R13E Sec. 04) <GIS Point ID: CDO-INF-001>
- Carmack Wash is down-cutting the channel downstream of Ina Road. (T13S R13E Sec. 04) <GIS Point ID: CDO-INF-002>

Safety Concerns

- There is an unpermitted berm in the floodway at 15900 N. Lago del Oro Parkway (222-32- 0040) that may not be designed to withstand flood forces. (T11S R14E Sec. 11) <GIS Point ID: CDO-SAF-001>
- Flow breaks out of the primary channel near Golder Ranch Road at around 1500-2000 cfs. (T11S R14E Sec. 15) <GIS Point ID: CDO-SAF-002>
- Overton Road is a dip crossing where the Canada del Oro crosses it. It can experience significant flows due to rainfall far up in the watershed. The road is frequently closed due to flow across the road. DOT Operations monitors this crossing regularly for washouts. (T12S R13E Sec. 22) <GIS Point ID: CDO-SAF-003>

5.4.3.6 Floodplain Management

Future needs identified by District staff include:

- Sediment transport and need for increased maintenance
- At grade crossing at Overton Road
- EHS development on tall steep banks
- Inter-jurisdictional Coordination
- Grade control