

5.4.3.1 Flood Characteristics

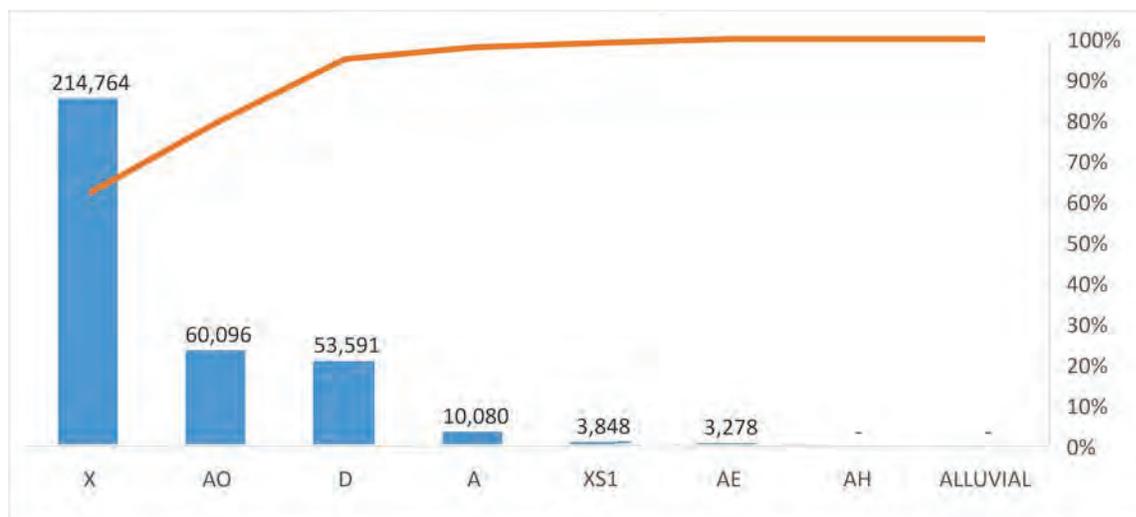
This system is distributary and braided consisting of numerous named and unnamed washes. Like its major tributaries the Black and Altar Valley Washes the floodplains like the basins they are within are very broad. These characteristics along with the massive size of the watersheds and surrounding mountains mean that flooding may occur even where it is not raining. Flash flooding may arrive expectantly and affect a broad area making access difficult if not impossible. In addition to residential areas, critical infrastructure including bridges and the Marana Waste Treatment Plant are at risk. The City of Tucson maintains two major recharge facilities for Tucson’s annual allocation of Colorado River Water near the East Branch Brawley Wash and just to the south of the East Branch confluence with the main stem Brawley Wash.



Wastewater Treatment Plant during the 2006 Flood

In 2003 the District constructed the 28-acre Marana High Plains multi-purpose effluent recharge and ecosystem restoration project utilizing Santa Cruz River effluent flows. Through staff’s continued management and optimizations actions, the project recently reached the full water appropriation permitted recharge limit of 600-acre-feet per year.

Figure 44 - Brawley Wash Federal Floodplain Designations in Acres



In addition to the 73,453 acres (114.7 square miles) of SFHA included on the chart above, there are also 513 acres of District Special Studies Floodplains and 87,082 of local sheet flood area in this watershed. Together these mapped floodplain areas are 46 percent of the total watershed area!

The Brawley Wash to the west is unconfined and braided. Special Study #31 evaluated flows in this area and estimated that 21,000 cfs of the 35,000 cfs 1% chance flood is along the west branch of the Brawley, with the remaining 14,000 cfs in the channel to the east. Sheet flooding affects a majority of this area within unincorporated Pima County (Special Study #46; 08/08/2007).



Ajo Highway Bridge during 2006 Flood, looking north

Flood and erosion risks need further evaluation on this western edge, to identify structural and non-structural means to address the ongoing sheet flooding and lack of drainage infrastructure problems. Tropical storms are the main threat to widespread flooding on the Brawley, but monsoon convective storms can also cause local flash flooding.

This system is distributary and braided consisting of numerous names and unnamed washes.

The table below summarizes of historic USGS gaging station records.

Table 6 – Brawley Wash Watershed USGS Gages

USGS Gaging Station	Brawley Wash near Three Points, Az 09487000	Little Brawley Wash near Three Points, AZ 09487100	Los Robles Wash near Marana, AZ 09487250
Period of Record	1940-08-14 to 2015-07-01	1962-09-26 to 1981-09-05	1962-09-26 to 1983-10-02
Watershed Area (sq. m)	776	11.90	1170
Flood-Peak of Record (cfs)	19,100	19,800	32,000
Date	10-1-1983	09-26-1962	09-26-1962
Table of Regulatory Discharge (cfs)	NA	13,800	35,000

The table below summarizes Pima County ALERT Gages.

Table 7 – Brawley Wash Watershed ALERT Streamflow Gages

Pima County Alert Gage	Brawley Wash at Three Points ID: 6423	Brawley Wash At Milewide Road ID: 6443
Location (Latitude, Longitude)	(32.0756, -111.3383)	(32.2486, -111.2444)
Period of Record	1991-09-01 to Present	2001-03-08 to Present
Watershed Area (sq. m)	785.48	247.44
Flood-Peak of Record (cfs)	14000	6047
Date	07-05-1998	07-31-2010

Table 8 – Brawley Wash Watershed ALERT Precipitation Gages

Pima County ALERT Gage	Brawley Wash at Three Points ID: 6420	Brawley Wash At Milewide Road ID: 6440	Diamond Bell Ranch - Brawley Basin ID: 6410	Hilltop Road - Brawley Basin ID: 6450	Picture Rocks Community Center - Brawley Basin ID: 6460	Tucson Water Treatment Plant - Brawley Basin ID: 6470
Location (Latitude, Longitude)	(32.0756, -111.3383)	(32.2486, -111.2444)	(31.9897, -111.2972)	(32.0436, -111.2417)	(32.3092, -111.2356)	(32.1711, -111.0872)
Period of Record	1991-09-01 to Present	1991-10-10 to Present	1989-02-27 to Present	2001-10-18 to Present	2001-10-19 to Present	2006-11-09 to Present

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

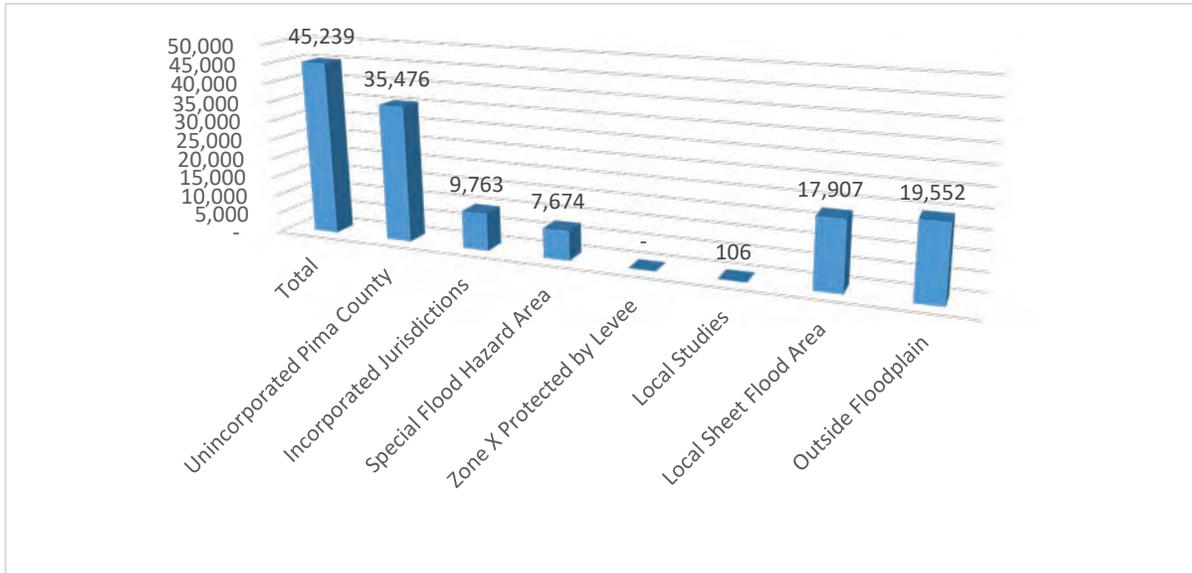
Table 9 - Brawley Wash Watershed Regulatory Discharges

Watercourse	Regulatory Discharge, cfs 1% Return Frequency	Drainage Area, sq. miles	Source of Discharge Information
Brawley Wash			
Upstream of confluence with Los Robles Wash	35,000	1,165	FEMA, Flood Insurance Study
East Branch Brawley Wash @Avra Valley Road	22,100		“ “
Little Brawley Wash USGS Gage station 09487100	13,800	11.9	USGS Water-Resources Investigation open file report 78-33 (March 1978)
Los Robles Wash Downstream of confluence with Blanco Wash	37,000	1,340	FEMA, Flood Insurance Study
Los Robles Wash @ Trico Road	35,000	1,175	“ “

5.4.3.2 Existing Development & Infrastructure Trends

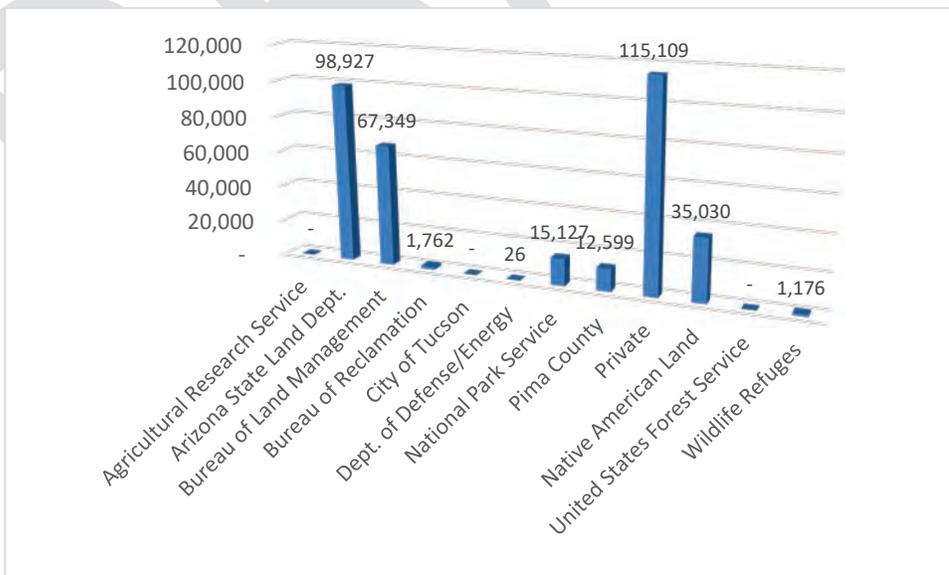
The chart below shows the distribution of residents within known floodplains, and distribution between incorporated and unincorporated areas.

Figure 45 - Brawley Wash Watershed Population Distribution



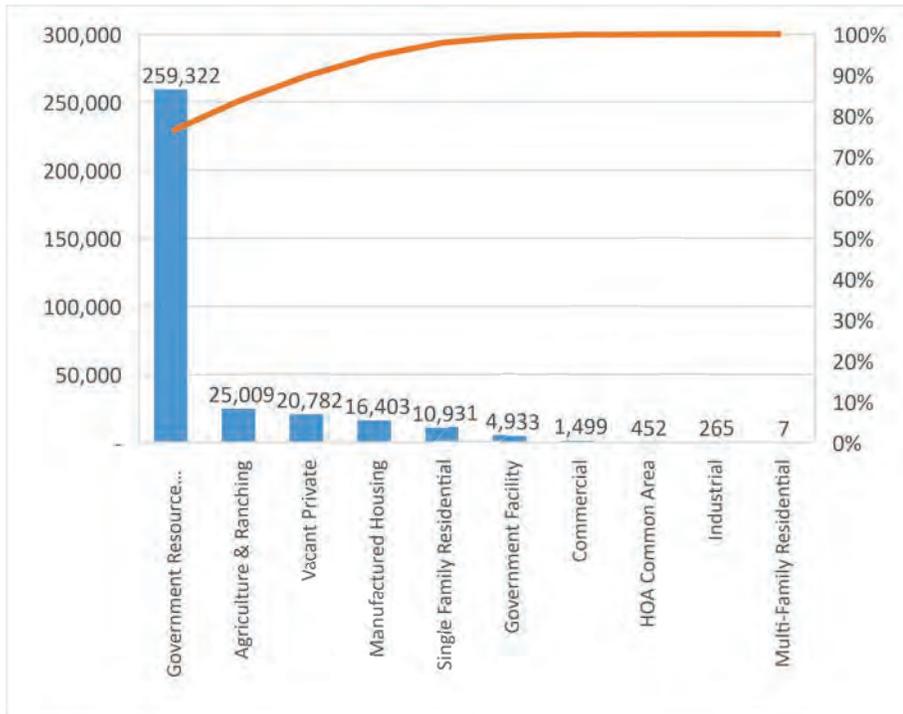
As is the case in the Black Wash watershed, this watershed contains very broad floodplains however much is available for development. While it retains a rural character, it is widely developed with large lot residential and rural commercial uses including agriculture and mining.

Figure 46 - Brawley Wash Ownership in Acres



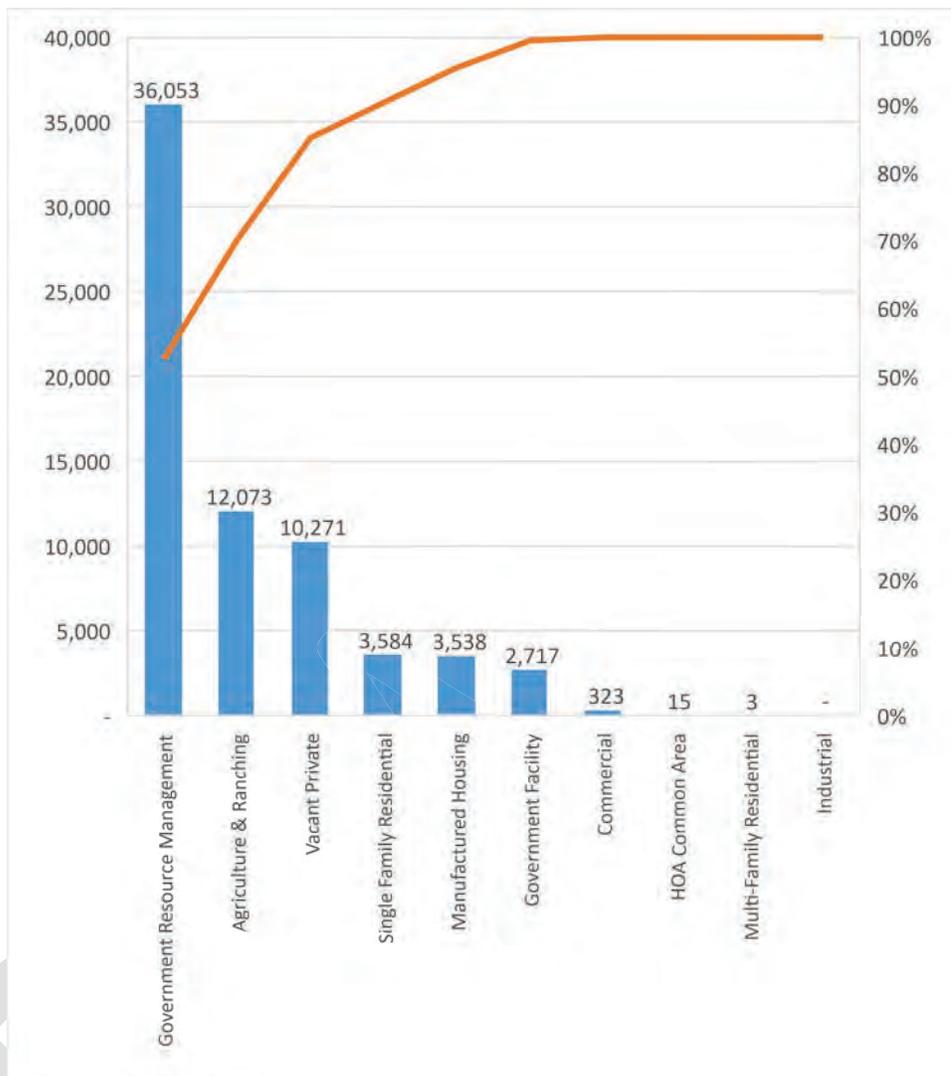
Both ownership and land use patterns provide opportunity for future growth despite floodplain constraints.

Figure 47 - Brawley Wash Land Use in Acres



Future land use may depend upon decisions made by the State Land Department and Arizona Department of Transportation. The envisioned Interstate Highway (I-11) would intensify development pressure and large players have begun to emerge including Monsanto. However, is unlikely to occur in the next five years. It is interesting to note however that this is where groundwater recharge is occurring to balance the drawdown within the adjacent Tucson hydrogeological basin. A fact, which may increase the attractiveness of the area significantly, as supplies dwindle and development pressure mounts. The Central Arizona Project (CAP) canal can cause flow diversions in portions of the watershed draining to the East Branch, as would any new linear infrastructure.

Figure 48 - Brawley Wash Floodplain Land Use in Acres



The broad floodplain has historically attracted agriculture and while much converted to rural residential uses, the area is increasingly urbanized and large segments of the population exposed to flood risk. As with the Black Wash watershed, the extent of manufactured housing within the floodplain is notable.

Along the western edge of the sub basin, where development occurred without consistent drainage infrastructure drainage and sheet flow conditions, flows on unpaved roads produce further down cutting, which in turn results in more flow along the roadway. This process of flow capture results in degradation of the local flow conditions. The land use map below also shows these patterns.

5.4.3.3 Riparian Habitat and Natural Areas

As shown on the bar chart below, there are 15,088 acres of Pima County Regulated Riparian Habitat in this watershed and 21,508 acres of IRA. There are also 107,796 preserved acres in this watershed, including 9,539 in regulatory floodplain.

The rich habitat in this watershed supports wildlife and facilitates beneficial natural floodplain function. Preservation of natural floodplain function is important in this watershed to reduce channelization, which disrupts habitat and can lead to extensive maintenance requirements due to sedimentation.

Figure 50 - Brawley Wash Watershed Riparian Habitat in Acres



The riparian areas are classified into two primary plant communities, Sonoran Desertscrub biome (BLP #154.1) and Sonoran Riparian Deciduous Forest and Woodland Biome, Mesquite Series (BLP #224.52) (Harris, 2001). The xeroriparian habitat falls into the former, while the mesoriparian habitat falls into the latter. The Sonoran Desertscrub can be further divided into the Arizona Upland Subdivision, which is characterized by a diverse assemblage of cacti, trees and shrubs, and the Lower Colorado River Valley Subdivision, which is primarily characterized by creosotebush (*Larrea tridentata*) and bursage (*Ambrosia deltoidea*). Both plant communities are found in this watershed.



Sonoran Desertscrub Subdivision on the left and Lower Colorado River Valley Subdivision on the right

The Sonoran Desertscrub Subdivision is further classified as desert riparian shrub or xeroriparian along the washes. This vegetation community contains similar tree and shrub species found in upland sites such as paloverde, velvet mesquite, and ironwood, although certain shrub species, such as canyon ragweed (*Ambrosia ambrosioides*) and cheesebush (*Ambrosia salsola*) are more prevalent.



The Brawley Wash at 3-points (left), unnamed xeroriparian wash (center), xeroriparian understory vegetation (right)

The Sonoran Riparian Deciduous Forest and Woodland Biome, Mesquite Series, is an open to fairly dense drought-deciduous woodland dominated by velvet mesquite (*Prosopis velutina*). Understory vegetation is characterized by shrubs such as wolfberry (*Lycium sp.*), snakeweed (*Gutierrezia sp.*), burroweed (*Isocoma tenuisecta*), whitethorn acacia (*Vachellia constricta*) and catclaw acacia (*Senegalia greggii*) and native grasses, vines and annuals.



Sonoran Riparian Deciduous Forest and Woodland Biome, Mesquite Series (left), Mesquite Series understory vegetation (right)

The District manages 3,666 acres of open space lands in the Brawley Wash watershed. The District acquired these lands through the Floodprone Land Acquisition Program (FLAP) primarily. The majority lie within floodprone areas, with some upland areas included as part of a larger parcel. The District inspects these lands triennially to inventory infrastructure (if present), natural resources and identify threats. A few unique plant species that have been found during inspections include Tumamoc globeberry (*Tumamoca macdougalii*), Thornber fishhook cactus (*Mammillaria thornberi*), and nightblooming cereus (*Peniocereus greggii*).



Tumamoc globeberry (left) and a fruiting nightblooming cereus (right).

The Brawley wash serves as an important wildlife corridor and provides habitat for native wildlife. It is common to see large herds of mule deer, javalina, jackrabbits, and coyote. Less common species include the secretive badger, bobcat, desert iguana, Crested Caracara, and Swainson’s hawk. The riparian habitat corridors provide an important source of food, shelter, and protection from predators for a number of other reptile, amphibian, bird, and mammal species.



Badger tracks (left), desert iguana (center), and gophersnake (right).

Distributary flow areas in the Brawley Wash contain unique ephemeral water features located in both the floodplain overbank and in channel. These features fill with water during flood events and due to the deposition of fine sediments, hold water for a period afterwards, providing a water source for wildlife.



In-channel ephemeral water (left) and floodplain overbank ephemeral water (right)

In addition to supporting abundant vegetation and wildlife, there is evidence of prehistoric people throughout the watershed.



Painted pot sherd (left) and a lithic artifact (right)

Over the years, the watershed has been impacted by human development, the primary impact being flow diversions. Historic agricultural activities bermed large areas for farming, redirecting natural flow to create areas of dense vegetation on the upstream side of berms, and areas of vegetation die-off on the downstream side. This paired with diversions due to roads, development, and drought has resulted in wash channelization, creating a disconnection between the main channel and floodplain overbank. This “disconnect” results in vegetation die-off and soil erosion. Wash channelization becomes more severe moving downstream in the watershed, with channel depths exceeding 15 feet or more near Silverbell Road.



Upper watershed near 3-points (left), middle watershed (middle), and lower watershed (right)

In areas where wash channelization has occurred, the floodplain overbank continues to be vegetatively productive. Spring and summer annual plants respond to rainfall, creating pockets, or sometime a carpet of vegetation across the landscape, and desiccate quickly once freezing temperatures or the heat of summer arrives. These ephemeral plant communities provide an important source of food for insects, and by relation, native bird species and other insectivores.



Pockets of native annuals grow in shallow depressions following the summer rains.

Other human actions that threaten natural and cultural resources in the watershed include land disturbance caused by encroachment by neighboring property owners, cattle grazing, invasive species, illegal dumping, OHV use, shooting, and woodcutting. As resources allow, the District actively manages these threats through placement of fencing, signage, and enforcement when needed. Additionally, the District has been actively removing damaged interior fences and filling in open pipes along the City of Tucson fencelines, when time allows.



Buffelgrass (left), cattle grazing (middle), and soil erosion (right)



Encroachment (left), illegal dumping (middle), and mesquite die-off (right)



OHV damaging native vegetation (left), saguaro damaged by a shotgun blast (middle), and illegal woodcutting (right)

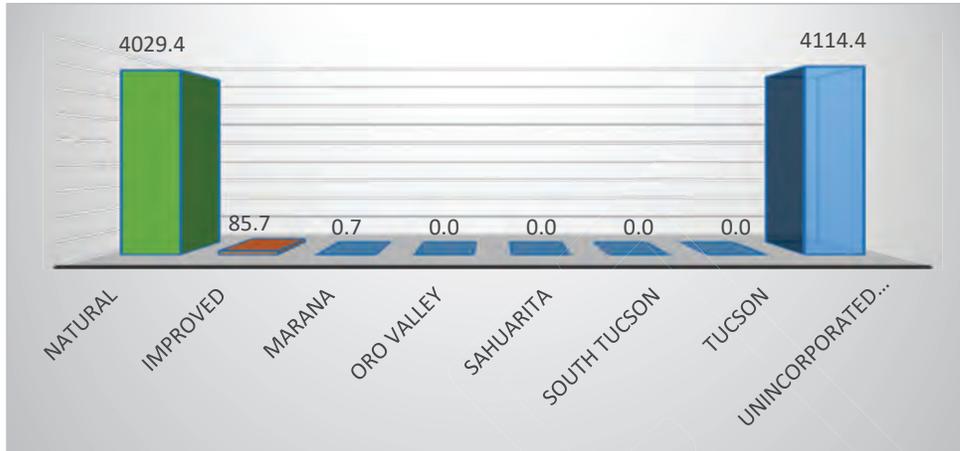
This watershed provides multiple opportunities to implement restoration and land stewardship projects.

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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 51 - Brawley Wash Drainageway Acreage



In this watershed, there are 3,751 acres of improved drainageways and 3,569 acres that are designated open space.

Downstream of Highway 86 near ALERT gauge 6423, the channel cannot convey large flows and becomes distributary. Based on a recent (9/13/14) flow event, an old channel, flowing to the east-northeast approximately 1.25 miles downstream of 6423, begins to breakout at less than 3,340 cfs (approximate stage: 6.5 ft.). The September, 2013 event moved through the Quinlan Trail area and spread as far northeast as the residential area north of Snyder Hill and Marstellar Roads. Subsequently the District has identified this as a potential area for acquiring parcels from impacted and willing sellers under the FLAP program.

This channel also flowed in the 2005 event and affected a number of residential structures in the Quinlan Trail area and downstream areas. Moderate flows may affect the Milewide Road area, Manville Road area, and the Avra Valley Road area. Due to the character of the downstream channels, travel times will be long. This area is also subject to sheet flooding that stream gauges may not register. Moderate flows at Milewide Road (6443) may affect at-grade crossings at Manville Road. Streamflow at 6423 of 2,000 cfs may indicate channel breakouts downstream. Additional at-grade crossings include those at Milewide and Manville Roads. At this streamflow, senior staff makes the decision whether or not to contact OEM. At this streamflow, ALERT staff contacts the Pima County Department of Transportation as they have responsibility for closing flooded roads, removing debris, and inspecting for damages to roadside swales, dips sections, culverts, and bridges.

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

- The trigger discharge for the breakout from the east bank of Brawley Wash north of Ajo Highway and Quinlin Trail is not known. The trigger is only known to be lower than 11,800 cfs (official USGS discharge for August 14, 2005 event per USGS Publication, Water Data Report AZ-05-1 Titled: Water Resources Data, Arizona Water Year 2005.) (T15S R10E Sec. 28) <GIS Point ID: BRW-DAT-001>

Frequently Flooded Structures and Properties Subject to Damage

- Hazardous conditions exist at the location of a break-out flow from the Brawley Wash north of Ajo Highway and Quinlin Trail. Properties at least as far south as 16474 W Quinlin Trail (208-62-002G) and as far north as 16375 W. Hermans Road (208-57-004K) are affected by this flow. The northern properties have been subject to permit denials. The breakout occurs at flows below 11,800 cfs (official USGS discharge for August 14, 2005 event per USGS Publication, Water Data Report AZ-05-1 Titled: Water Resources Data, Arizona Water Year 2005.) (T15S R10E Sec. 27) <GIS Point ID: BRW-FSP-001>
- A site-built structure on 16310 W. Honeysuckle View (208-63-0330) was built at grade without a permit. This structure was originally built as a single-family residence and has been converted to a non-habitable structure by the new owner. It is expected to get flooded during the base flood and during smaller events. (T15S R10E Sec. 34) <GIS Point ID: BRW-FSP-002>
- The area around Honeysuckle Farm Trail is subject to potential break-out flow from the Brawley Wash as well as the large wash to the east. Both washes have levees containing flow that are not designed to withstand the base flood. (T15S R10E Sec. 34) <GIS Point ID: BRW-FSP-003>
- A number of washes converge on an area just north of Los Reales Road west of Marstellar Road, creating potentially hazardous conditions. (T15S R11E Sec. 17) <GIS Point ID: BRW-FSP-004>
- Several properties near 15350 W Avra Valley Road (208-24-012H) are between the West Branch of the Brawley Wash and an agricultural levee. Depths of flow are expected to exceed three feet with high DV2 values. (T12S R10E Sec. 11) <GIS Point ID: BRW-FSP-005>
- Homes in the Avra Vista subdivision have experienced erosion of fill pads. Structures

were supposed to be constructed on fill pads with engineered erosion protection, but most were permitted by DSD without this requirement. (T12S R10E Sec. 15) <GIS Point ID: BRW-FSP-006>

- Millstone Manor #6 has frequent flooding problems. (T14S R12E Sec. 30) <GIS Point ID: BRW-FSP-007>
- The Blue Aloe Street area flooded in 2013 when a 3,340 cfs (measured at Ajo Highway) flow broke out of the Brawley Wash and moved northeast, per USGS Water Data Report 2013. (T14S R11E Sec. 32 and T15S R11E Sec. 05) <GIS Point ID: BRW-FSP-008>

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Infrastructure

- The drainageways within Tucson West Ranchettes, Book 32 Page 099, are county maintained. They are not specifically dedicated to the District. (T15S R11E Sec. 09) <GIS Point ID: BRW-INF-001>
- The detention basin in Camino Verde Estates at the intersection of Camino Verde Road and Copper Leaf Road has overtopped during large storm events, such as 8/2/2016, though it was not damaged by this event. (T15S R12E Sec. 03) <GIS Point ID: BRW-INF-002>

Safety Concerns

- Fuller Road is subject to flooding from tributary flows coming into the Brawley Wash from the west. (T15S R10E Sec. 32). <GIS Point ID: BRW-SAF-001>
- A break-out flow from the Brawley Wash north of Ajo Highway and Quinlin Trail has the potential to create highly hazardous conditions on properties to the east of the main channel. The trigger for the breakout is not known, but is lower than 11,800 cfs (official USGS discharge for August 14, 2005 event per USGS Publication, Water Data Report AZ-05-1 Titled: Water Resources Data, Arizona Water Year 2005.) (T15S R10E Sec. 28) <GIS Point ID: BRW-SAF-002>
- The levee on Buckelew Farms on the east bank of Brawley Wash north of Ajo Highway is not designed to withstand the base flood and may fail to contain the flood. The base flood may overtop the levee. (T15S R10E Sec. 33) <GIS Point ID: BRW-SAF-003>
- Berms along Kay Linn Dr. between Deaver Rd. and Camino Verde has been known to cause flooding problems. (T14S R12E Sec. 34) <GIS Point ID: BRW-SAF-004>
- Snyder Hill Rd. washes out west of Desert Sunrise Tr. (T14S R11E Sec. 36) <GIS Point ID: BRW-SAF-005>
- Hazardous conditions exist where the Black Wash crosses Sandario Road. (T14S R11E Sec. 22) <BRW-SAF-006>
- There are numerous at-grade crossings on Kinney Road near Saguaro National Park West. The Kings Canyon crossing was heavily damaged in a 2006 event. (T14S R11E Sec. 01) <BRW-SAF-007>
- Most of the Brawley Wash area is subject to flooding and may become difficult or impossible to access during major events. Utmost caution should be observed when proceeding into this area before or during a flood crest. <BRW-SAF-008>

5.4.3.6 Floodplain Management

Future needs identified by District staff include:

- Need to update historic floodplain information and to conduct studies to identify flood risks in areas that the District has not studied.
- FLAP
- Non-permitted construction and planning, private roads and easement drainages and associated flow path capture
- Access

