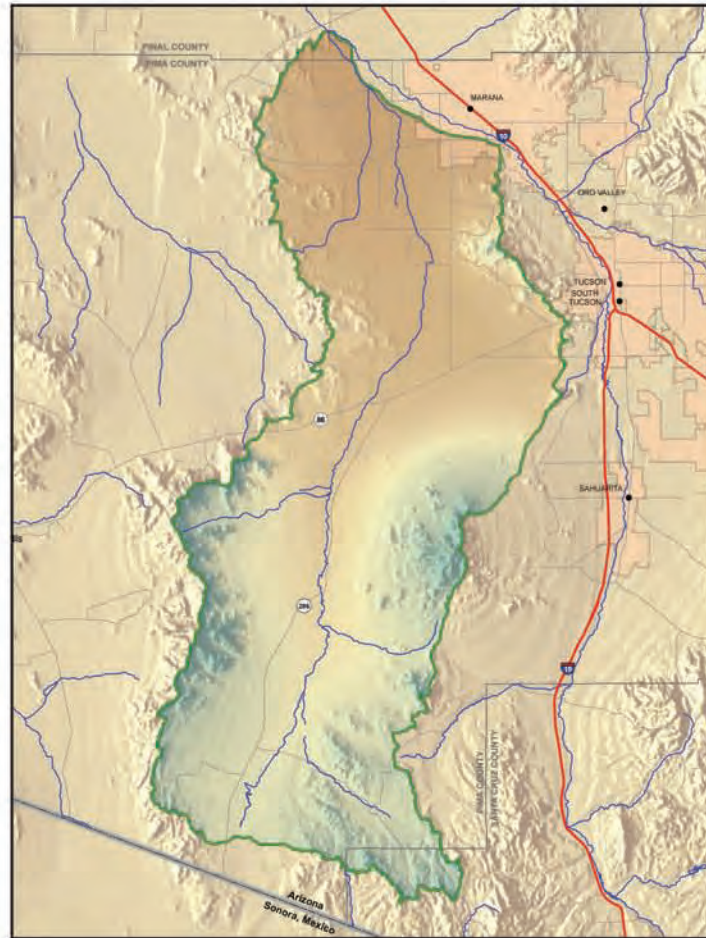


# Brawley Wash - Los Robles Wash Watershed - Arizona (Altar Wash - Brawley Wash Watershed)

## Rapid Watershed Assessment

June 2008



*Prepared by:*  
USDA Natural Resource Conservation Service – Arizona  
University of Arizona, Water Resources Research Center



The University of Arizona



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Arizona Department of Agriculture  
Arizona Department of Environmental Quality  
Arizona Department of Water Resources  
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**Brawley Wash-Los Robles Wash  
Watershed 15050304  
(Altar Wash-Brawley Wash  
Watershed)  
8-Digit Hydrologic Unit  
Rapid Watershed Assessment**

**Section 1: Introduction**

Overview of Rapid Watershed  
Assessments

A Rapid Watershed Assessment (RWA) is a concise report containing information on natural resource conditions and concerns within a designated watershed. The "rapid" part refers to a relatively short time period to develop the report as compared to a more comprehensive watershed planning effort. The "assessment" part refers to a report containing maps, tables and other information sufficient to give an overview of the watershed including physical characteristics and socioeconomic trends.

The assessments involve the collection of readily available quantitative and qualitative information to develop a watershed profile, and sufficient analysis of that information to generate an appraisal of the conservation needs of the watershed. These assessments are conducted by conservation planners, using Geographic Information System (GIS) technology. Conservation Districts and other local leaders, along with public land management agencies, are involved in the assessment process.

An RWA serves as a communication tool between the Natural Resources Conservation Service (NRCS) and partners for prioritizing conservation

work in selected watersheds. RWAs serve as a platform for conservation program delivery, provide useful information for development of NRCS and Conservation District business plans, and lay a foundation for future cooperative watershed planning.

General Description of the Brawley  
Wash-Los Robles Wash Watershed

The Brawley Wash-Los Robles Wash Watershed (also locally referred to as the Altar Wash-Brawley Wash Watershed or Altar and Avra Valleys) is located in the south-central portion of the state of Arizona. The Watershed lies west of I-19 and east of the Baboquivari Mountains, north of the U.S.-Mexico border and, south of Pinal County, except for a small section located in Pinal County (Figure 1-1).

The watershed can be defined as the area drained by the Altar Wash, Brawley Washes and Los Robles Wash to the confluence with the Santa Cruz River.

The watershed comprises 900,480 acres (1,407 square miles), and is located approximately 97% in Pima County and about 2% in Santa Cruz County and 1% in Pinal County. Forty-one percent of the land is state owned, 24% is privately owned, 11% is wildlife preserve, 10% is managed by the Bureau of Land Management, 8% is Tohono O'odham Indian Reservation, 3% is National Forest, 2% is national parks and 1% is state parks.

There are about 10,000 acres of irrigated cropland in the watershed; however, much of this cropland is being rapidly converted to urban uses and this trend is expected to continue in the

future. Important crops include alfalfa and cotton. The remaining area is primarily rangeland and urban land. Livestock use is dominated by ephemeral steer operations at the lower elevations, and cow calf operations at the higher elevations.

Major towns and cities include Arivaca and a portion of the Town of Marana. The metropolitan area of Tucson is east of, and outside, the watershed. Conservation assistance is provided through two Natural Resource Conservation Districts: Pima and Tohono O'odham. There are two U.S. Department of Agriculture (USDA) Service Centers in the area, located in Tucson and Sells.

Resource concerns in the watershed include soil erosion; rangeland site stability; rangeland hydrologic cycle; excessive runoff (causing flooding or ponding); aquifer overdraft; effect of air quality on visibility and plant health; threatened or endangered plant and animal species; noxious and invasive plants, wildfire hazard; inadequate water for fish and wildlife; habitat fragmentation; and inadequate distribution of water for domestic animals (NRCS Factsheet).

## Section 2: Physical Description

### Watershed Size

The Brawley Wash-Los Robles Wash Watershed covers approximately 1,407 square miles (900,480 acres), representing about 1.2% of the State of Arizona. The watershed has a maximum width of about 25 miles east to west, and a maximum length of about 65 miles north to south. The high point in the watershed is the Baboquivari Mountains near Baboquivari Peak at 7,257 feet, and the low point is the confluence of Brawley Wash and the Santa Cruz River at 1,847 feet.

The Brawley Wash-Los Robles Wash Watershed was delineated by the U.S. Geological Survey and has been subdivided by the NRCS into smaller watersheds or drainage areas. Each drainage area has a unique hydrologic unit code number (HUC) and a name based on the primary surface water feature within the HUC. These drainage areas can be further subdivided into even smaller watersheds as needed. The Brawley Wash-Los Robles Wash Watershed is an 8-digit HUC of 15050304 and contains the following 10-digit HUCs (Figure 2-1):

- 1505030401 Arivaca Creek
- 1505030402 Puertocito Wash
- 1505030403 Altar Wash
- 1505030404 Upper Brawley Wash
- 1505030405 Lower Brawley Wash
- 1505030406 Los Robles Wash

### Geology

The Brawley Wash-Los Robles Wash Watershed is located within Arizona's Basin and Range Province. The Basin and Range Province of southern and western Arizona is an area where the Earth's crust has been stretched and broken by numerous faults so that mountain ranges and basins (broad valleys) have formed by the vertical motion of large crustal blocks.

The Basin and Range Province was formed from 28 to 12 million years ago as the Baja California portion of the Earth's tectonic Pacific Oceanic plate began diverging from the continental plate, stretching the continental plate and forming the equivalent of stretch marks in the earth's crust, nearly parallel to the strike (direction) of the plate boundary. As the earth's crust is stretched, blocks of crust break and drop in a pattern of valley basins and high peak ranges, and is known as the Basin and Range Province within Arizona and other regions of Mexico and the western United States.

The watershed is bounded on the west by the Baboquivari Mountains, a range of block-faulted mountains that are crosscut by northwest-striking faults and shear zones that are part of a regional structural pattern. The Baboquivaris, and the closely related Quinlan Mountains to the north, are composed of Jurassic, Cretaceous, and Tertiary granite interspersed with small amounts of schist and sedimentary rocks (Goodwin, 1985). Volcanic remnants of a large caldera, the Tucson, Sierrita, and Tumacacori Mountains delineate the eastern limit of the watershed, and to the south the

Atascosa Highlands and Pajarita Mountains form a barrier that acts as the watershed’s southeastern limit. The Sierritas, which combine Paleozoic and Mesozoic sedimentary rocks with Cretaceous-aged volcanic rocks, are a valuable source of copper in the region; several open-pit mines on the east side of the range mine the large deposits of poypphony copper found there (Chronic, 1983). (Figure 2-2)

Soils

Soils within the Brawley Wash – Los Robles Wash Watershed are diverse and formed as the result of differences in climate, vegetation, geology, and physiography. Detailed soils information for the watershed is available from the Natural Resources Conservation Service (NRCS) within the following Soil Surveys: “Soil Survey of Pima County, AZ, Eastern Part”; and “Soil Survey of the Tucson – Avra Valley Area, Pima County, AZ.” Soils data and maps from these Soil Surveys can be accessed through the NRCS Web Soil Survey website: <http://websoilsurvey.nrcs.usda.gov>.

Common Resource Areas

The USDA, Natural Resources Conservation Service (NRCS) defines a Common Resource Area (CRA) as a geographical area where resource concerns, problems, or treatment needs are similar (NRCS 2006). It is considered a subdivision of an existing Major Land Resource Area (MLRA). Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area.

The Brawley Wash-Los Robles Wash Watershed is comprised of four Common Resource Areas (Figure 2-3 and Table 2-2).

*Table 2-1: Brawley Wash – Los Robles Wash Watershed Common Resource Areas*

<b>Common Resource Area Type</b>	<b>Area (sq. mi.)</b>	<b>Percent of Watershed</b>
<b>40.1 Upper Sonoran Desert</b>	<b>694</b>	<b>49%</b>
<b>40.2 Middle Sonoran Desert</b>	<b>49</b>	<b>3%</b>
<b>41.1 Chihuahuan – Sonoran Desert Shrubs</b>	<b>69</b>	<b>5%</b>
<b>41.3 Chihuahuan – Sonoran Semidesert Grasslands</b>	<b>596</b>	<b>42%</b>

Data Sources: GIS map layer “cra”. Arizona Land Information System (ALRIS 2004). Natural Resource Conservation Service (NRCS 2006)

Beginning at the lower end of the watershed, CRA 40.2 “Middle Sonoran Desert” occurs at elevations ranging from 1200 to 2000 feet. Precipitation averages 7 to 10 inches per year. Vegetation includes saguaro, palo verde, creosote bush, triangle bursage, brittlebush, prickly pear, cholla, desert saltbush, wolfberry, bush muhly, threeawns, and big galleta. The soils in the area have a hyperthermic soil temperature regime and a typic aridic soil moisture regime. The dominant soil orders are Aridisols and Entisols. Deep, stratified, coarse to fine-textured soils occur on floodplains and alluvial fans. Deep, moderately fine and fine-textured and gravelly, moderately fine-textured soils occur on fan terraces.

CRA 40.1 “Upper Sonoran Desert” occurs at elevations ranging from 2000



to 3200 feet with precipitation averaging 10 to 13 inches per year. Vegetation includes saguaro, ironwood, palo verde, mesquite, range ratany, creosotebush, triangle bursage, prickly pear, cholla, wolfberry, bush muhly, threeawns, ocotillo, and globe mallow. The soils in the area have a thermic soil temperature regime and a typic aridic soil moisture regime. The dominant soil orders are Aridisols and Entisols. Deep, moderately coarse-textured to fine textured soils occur on alluvial fans and drainageways. Deep, gravelly, limy, moderately coarse to moderately fine-textured, soils occur on fan terraces. Shallow, cobbly and gravelly soils and rock outcrop occur on hills and mountains.

Moving up the watershed, CRA 41.3 “Chihuahuan – Sonoran Semidesert Grasslands” occurs at elevations ranging from 3200 to 5000 feet with precipitation averaging 12 to 16 inches per year. Vegetation includes mesquite, catclaw acacia, palo verde, range ratany, fourwing saltbush, tarbush, littleleaf sumac, sideoats grama, black grama, plains lovegrass, cane beardgrass, tobosa, threeawns, Arizona cottontop and bush muhly. The soils in the area have a thermic temperature regime and an ustic aridic soil moisture regime. The dominant soil orders are Entisols, Aridisols, and Mollisols. Deep fine-textured and gravelly, moderately coarse to moderately fine-textured soils occur on fan terraces. Shallow, cobbly and gravelly soils and rock outcrop occur on hills and mountains.

In the upper portions of the watershed occurs CRA 41.1 “Mexican Oak-Pine Forest and Oak Savannah” with  
Table 2-2: *Brawley Wash – Los Robles*

elevations ranging from 4500 to 7500 feet. Precipitation averages 16 to 30 inches. Vegetation includes Emory oak, Arizona white oak, one-seed juniper, alligator juniper, California bristlebush, skunkbush sumac, Arizona rosewood, wait-a-bit mimosa, sideoats grama, blue grama, woolly bunchgrass, plains lovegrass, squirreltail, and pinyon ricegrass. The soils in the area have a thermic to mesic temperature regime and an aridic ustic to typic ustic soil moisture regime. The dominant soil orders are Entisols and Mollisols. Shallow, cobbly and gravelly soils and rock outcrop occur on hills and mountains.

These four Common Resource Areas (40.2, 40.1, 41.3, 41.1) occur within the Basin and Range Physiographic Province which is characterized by numerous mountain ranges rising abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

### Slope Classifications

Slope, as well as soil characteristics and topography, are important when assessing the vulnerability of a watershed to erosion. Approximately 78% of the Brawley Wash – Los Robles Wash Watershed has a slope less than 15%, while 10% of the watershed has a slope greater than 15% (Table 2-2 and Figure 2-4). The Lower Brawley Wash Watershed is relatively flat, with only 4% of its area over 15% slope, and 87% less than 5% slope. The Arivaca Creek Watershed is relatively steeper, with

### Wash Watershed Slope Classifications

Watershed Name	Area (sq. mi.)	Percent Slope		
		< 5%	5-15%	>15%
Los Robles Wash 1505030406	210	83%	11%	6%
Lower Brawley Wash 1505030405	410	87%	9%	4%
Upper Brawley Wash 1505030404	149	70%	13%	17%
Altar Wash 1505030403	350	74%	11%	15%
Puertocito Wash 1505030402	149	83%	9%	7%
Arivaca Creek 1505030401	139	55%	29%	16%
Brawley Watershed	1407	78%	12%	10%

Data Sources: Derived from DEM, obtained from U.S. Geological Survey, April 8, 2003  
<http://edc.usgs.gov/geodata/>

16% of the area greater than 15% slope and 55% less than 5% slope.

### Streams, Lakes and Gaging Stations

The locations of active and inactive gaging stations, and their respective annual mean stream flow, are found in Table 2-3.1. Nearly all streams and washes in this watershed are intermittent, and therefore flows only occur during runoff periods. Altar Wash near Three Points has the largest active stream flow with 5.35 cfs. Arivaca Creek at Arivaca has the lowest active stream flow with 0.16cfs. Table 2.3.2 lists major lakes and reservoirs in the Brawley Wash – Los Robles Wash, as well as their watershed position, surface area, elevation and dam name. Arivaca Lake is the largest surface water in the

watershed with an area of about 118 acres. Figure 2-5 lists the major streams and washes and their lengths. Stream and wash lengths range from 36 miles for Brawley Wash to 2.0 miles for Bailey Wash.

The purpose of the Central Arizona Project (CAP) Canal is to transfer Colorado River water to cities and farms in central and southern Arizona. Thirty-six miles, of the total 349 mile long CAP canal, are in the watershed. In addition to the CAP, there are 31 miles of irrigation canals managed by water providers for agricultural water use.



**Table 2-3.1: USGS Brawley Wash – Los Robles Wash Watershed Stream Gages and Annual Mean Stream Flow**

USGS Gage ID	Site Name	Begin Date	End Date	Annual Mean Stream Flow (cfs)
Active Gages				
09486590	Arivaca Creek at Arivaca	05-01-2002	09-30-2006	0.16
09486800	Altar Wash near Three Points	01-11-1966	09-30-2006	5.35
09487000	Brawley Wash near Three Points	12-14-1990	09-30-2006	5.06
Inactive Gages				
09486580	Arivaca Circle at Arivaca	10-01-1995	04-30-2002	0.87
09486600	Arivaca Wash Near Arivaca	03-17-1967	09-30-1972	3.46

*\*Discontinuous years of data*

*Data Sources: GIS dataset "usgs\_gages\_utm" USGS 2007; USGS website, National Water Information System <http://waterdata.usgs.gov/nwis/>*

**Table 2-3.2: Brawley Wash – Los Robles Wash Watershed Major Lakes and Reservoirs**

Lake Name (if known)	Watershed	Surface Area (acres)	Elevation (feet above mean sea level)	Dam Name (if known)
Aguirre Lake	Puertocito Wash	51	3,455	
Arivaca Lake	Arivaca Creek	118	3,773	Arivaca Dam
BK Tank	Los Robles Wash	34	1,995	

*Data Sources: GIS data layer "Lakes", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2003 <http://www.land.state.az.us/alris/index.html>*

*Table 2-3.3: Brawley Wash – Los Robles Wash Watershed  
Major Streams and Canals Lengths*

Stream Name	Watershed	Stream Length (miles)
Alambre Wash	Upper Brawley Wash, Altar Wash	15
Altar Wash	Altar Wash	23
Arivaca Creek	Arivaca Creek	15
Arroyo del Compartidero	Puertocito Wash	7
Bailey Wash	Puertocito Wash	2
Blanco Wash	Los Robles Wash	19
Brawley Wash	Lower Brawley Wash, Upper Brawley Wash	35
Los Robles Wash	Los Robles Wash, Lower Brawley Wash	19
Penitas Wash	Altar Wash	13
Puertocito Wash	Puertocito Wash	10
Central Arizona Project (CAP) Canal	Lower Brawley Wash	36
Irrigation Canals	Altar Wash, Los Robles Wash, Lower Brawley Wash	31

*Data Sources: GIS data layer “Streams”, Arizona State Land Department, Arizona Land Resource Information System (ALRIS), October, 10, 2002.  
<http://www.land.state.az.us/alris/index.html>*

### Riparian Vegetation

The Arizona Game & Fish Department has identified and mapped riparian vegetation associated with perennial waters in response to the requirements of the state Riparian Protection Program (July 1994). This map was used to identify riparian areas in the Brawley Wash – Los Robles Wash Watershed (Figure 2-6).

Four of the ten types of riparian areas occur within the Brawley Wash – Los Robles Wash Watershed. Riparian areas encompass approximately 17,000 acres (27 sq. mi.) or less than 0.2% of the entire watershed. North American

Warm Desert Riparian Mesquite Bosque comprises about 15,397 acres, or 90% of the riparian areas. North American Warm Desert Riparian Woodland and Shrubland, and North American Warm Desert Lower Montaine Riparian Woodland and Shrubland, comprise the remaining 1,281 acres and 459 acres of the watershed, respectively (Table 2-4).

Altar Wash has the greatest amount of riparian vegetation with 7,664 acres (12 square miles). The Tanque Verde Creek/Rillito River Watershed has about 2,243 acres (4 sq. mi.) and the Los Robles Wash Watershed has only 1,923 acres (3 sq. mi.).

*Table 2-4: Brawley Wash – Los Robles Wash Watershed Riparian Vegetation (acres) by 10 Digit Watershed (Part 1 of 2).*

Riparian Vegetation Community	Los Robles Wash 1505030406	Lower Brawley Wash 1505030405	Upper Brawley Wash 1505030404	Altar Wash 1505030403	Puertocito Wash 1505030402
North American Warm Desert Lower Montaine Riparian Woodland and Shrubland	-	1	51	332	45
North American Warm Desert Riparian Woodland and Shrubland	896	97	64	185	-
North American Warm Desert Riparian Mesquite Bosque	1,027	1,747	1,806	7,147	1,493
Total Area (acres)	1,923	1,845	1,921	7,664	1,538

Data Sources: GIS data layer "newgapveg", Southwest Regional GAP Program, October 13, 2005  
<http://fws-nmcfwru.nmsu.edu/swregap/>

*Table 2-4: Brawley Wash – Los Robles Wash Watershed Riparian Vegetation (acres) by 10 Digit Watershed (Part 2 of 2).*

Riparian Vegetation Community	Arivaca Creek 1505030401	Brawley Wash – Los Robles Wash Watershed
North American Warm Desert Lower Montaine Riparian Woodland and Shrubland	29	459
North American Warm Desert Riparian Woodland and Shrubland	38	1,281
North American Warm Desert Riparian Mesquite Bosque	2,176	15,397
Total Area (acres)	2,243	17,137

Data Sources: GIS data layer "newgapveg", Southwest Regional GAP Program, October 13, 2005  
<http://fws-nmcfwru.nmsu.edu/swregap/>

## Land Cover

The Riparian Vegetation map (Figure 2-6) and Land Cover map (Figure 2-7) were created from the Southwest Regional GAP (GAP Analysis Project) land cover map (Lowry et. al, 2005). Within the Brawley Wash – Los Robles Wash Watershed, Table 2-5 identifies the Scrub/Shrub as the most common land cover type over the entire watershed, encompassing about 76% of the watershed. The next most common types are Grassland/Herbaceous (8%) and Evergreen Forest (6%).

Note: There are a total of 26 GAP vegetation categories present within the Brawley Wash-Los Robles Watershed boundary. Some of these categories occur only in small concentrations, and are not visible at the small scale in which the maps are displayed. Some of the vegetation categories were re-grouped in order to increase the legibility of the map. In collaboration with NRCS, staff were able to create a total of 14 grouped GAP vegetation categories, as shown on Table 2-5.

*Table 2-5: Brawley Watershed Southwest Regional GAP Analysis Project Land Cover, Percent of 10-digit Watershed (Part 1 of 2)*

Watershed					
Land Cover	Los Robles Wash 1505030406	Lower Brawley Wash 1505030405	Upper Brawley Wash 1505030404	Altar Wash 1505030403	Puertocito Wash 1505030402
Agriculture (Irrigated Cropland)	4%	6%	0.2%	-	-
Altered or Disturbed	1%	0.3%	-	-	3%
Developed High Intensity	1%	0.6%	-	-	-
Developed Low Intensity	4%	10%	1%	-	-
Emergent Herbaceous Wetland	-	-	-	0.3%	0.2%
Evergreen Forest	-	0.4%	13%	11%	6%
Grassland /Herbaceous	-	0.2%	6%	11%	25%
Open Water	-	0.1%	-	-	-
Scrub/Shrub	89%	79%	77%	74%	63%
Sparsely Vegetated/Barren	0.9%	4%	1%	1%	1%
Woody Wetland	1%	1%	2%	4%	2%
Area (Sq. mi.)	210	410	149	350	149

*Table 2-5: Brawley Watershed Southwest Regional GAP Analysis Project Land Cover, Percent of 10-digit Watershed (Part 2 of 2)*

Watershed		
Land Cover	Arivaca Creek 1505030401	Percent of Total
Agriculture	-	2%
Altered or Disturbed	-	0.5%
Developed High Intensity	-	0.3%
Developed Low Intensity	-	3%
Emergent Herbaceous Wetland	1%	0.1%
Evergreen Forest	13%	6%
Grassland /Herbaceous	16%	8%
Open Water	0.1%	-
Scrub/Shrub	66%	76%
Sparsely Vegetated/Barren	2%	2%
Woody Wetland	3%	2%
Area (Sq. mi.)	140	1408

*\*Not necessarily irrigated land.*

*Data Sources: GIS data layer "newgapveg", Southwest Regional GAP project, 2005*

*Originated by Southwest Regional GAP project: <http://fws-nmcfwru.nmsu.edu/swregap/>*

### Meteorological Stations, Precipitation and Temperature

For the years 1961-1990, the average annual precipitation for the Brawley Wash – Los Robles Wash Watershed was about 15 inches (WRCC, 2004) (Table 2-6). Puertocito Wash and Arivaca Creek Watersheds receives the most rainfall with about 19 inches of annual rain on average, while Los Robles Watershed receives the least rainfall with an average of 11

inches annually. Average Temperature for the Brawley Wash – Los Robles Wash Watershed range from 63.3°F to 70.3°F. Active meteorological stations in the watershed are located in Figure 2-8.

The Western Regional Climate Center calculates the average minimum and maximum temperatures for each month for the period of record and then takes an annual average.

*Table 2-6: Brawley Watershed Meteorological Stations, Temperature (°F) and Precipitation (in/yr) with Recent Long-term Records.*

10-digit Watershed Name	Meteorological Stations and Map ID	Temperature (°F)			Precipitation (in/yr)		
		Avg. Min.	Avg. Max.	Avg.	Avg. Min.	Avg. Max.	Weighted Average
Los Robles Wash 1505030406	Red Rock	52.8	85.1	68.9	9	13	11
Lower Brawley Wash 1505030405	Tucson 17NW	56.5	84.1	70.3	9	23	13
Upper Brawley Wash 1505030404	Anvil Ranch	48.9	83.5	66.2	13	29	17
Altar Wash 1505030403	-				13	31	17
Puertocito Wash 1505030402	Sasabe	49.3	79.1	64.2	15	23	19
Arivaca Creek 1505030401	Ruby	49.9	76.6	63.3	15	21	19
Brawley Watershed	-	-	-	-	9	31	15

*Data Sources: GIS data layer "precip\_a\_az" Water and Climate Center of the NRCS (1998); GIS data layer "NWS\_Stations" Western Regional Climate Center (WRCC), Temperature data. July 15, 2004; <http://www.wrcc.dri.edu/summary/climsmaz.htm>*

### Land Ownership/Management

There are 11 different land ownership/management entities in the Brawley Wash – Los Robles Wash Watershed (Figure 2-9 and Table 2-7). State Land is the largest category, representing about 41% of the watershed, followed by the Private Land

with about 24%, and Wildlife Preserve with about 11%. Saguaro National Park, the Bureau of Land Management, Game & Fish, Coronado National Forest, Tohono O’odham Indian Reservations and the Military hold smaller amounts of land in the watershed.



*Table 2-7: Brawley Wash – Los Robles Wash Watershed Land Ownership/Management. (Percent of each 10-digit Watershed) (part 1 of 2)*

Land Owner	Los Robles Wash 1505030406	Lower Brawley Wash 1505030405	Upper Brawley Wash 1505030404	Altar Wash 1505030503	Puertocito Wash 1505030402
BLM	38%	4%	5%	5%	1%
Bureau of Reclamation	-	1%	-	-	-
Game and Fish	--	<1%	<1%		
National Forest	-	-	-	-	2%
Indian Reservation	11%	16%	19%	0.25%	<1%
State Parks	-	4%	-	-	-
Military	-	-	-	-	-
National Parks	-	6%	-	-	-
Private Land	26%	40%	27%	13%	8%
State Land	25%	29%	49%	66%	44%
Wildlife Preserve	-	-	-	16%	45%
<i>Area (square miles)</i>	210	410	149	350	149

*Table 2-7: Brawley Watershed Land Ownership/Management. (Percent of each 10-digit Watershed) (part 2 of 2)*

Land Owner	Arivaca Creek 1505030401	Brawley Watershed
BLM	6%	10%
Bureau of Reclamation	-	<1%
Game and Fish	<1%	<1%
National Forest	30%	3%
Indian Reservation	-	8%
State Parks	-	1%
Military	-	-
National Parks	-	2%
Private Land	20%	24%
State Land	22%	41%
Wildlife Preserve	21%	11%
<i>Area (square miles)</i>	139	1,408

*Data Sources: GIS data layer "ownership", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2007*

## Land Use

The Land Use map (Figure 2-10) was created from the Southwest Regional GAP Analysis Project land cover map (Lowry et. al, 2005).

The land use condition during the early 1990's was determined using the National Land Cover Dataset (NLCD).

The NLCD classification contains 21 different land cover and use categories (USGS, NLCD Land Cover Class Definitions); however, these categories have been consolidated into five land cover types (Figure 2-10 and Table 2-8). The five groupings for the land cover categories are:

- Crop, which includes confined feeding operations; cropland and pasture; orchards, groves, vineyards, nurseries and ornamental horticulture; other agricultural land.
- Forest, includes areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than

6 meters tall); tree canopy accounts for 25-100 percent of the cover

- Water, identifies all areas of surface water, generally with less than 25% cover of vegetation/land cover
- Range, which includes herbaceous rangeland; mixed range; shrub and brush rangeland.
- Urban (high density & low density) includes residential areas; commercial and services; industrial and commercial complexes; mixed urban or built-up land; other urban or built-up land; strip mines quarries and gravel pits; transportation, communication and utilities.

The most common land cover type is Range which makes up about 94% of the watershed. Urban Low Intensity is the next most common type with about 3% of the total area.

2-8: Brawley Wash – Los Robles Wash Watershed Land Use, Percent of 10-digit Watershed

Land Cover/Location	Crop	Forest	Urban High Intensity	Urban Low Intensity	Range	Water	Area (sq.mi.)
Los Robles Wash 1505030406	4.0%	-	1.0%	4.0%	92%	<1.0%	210
Lower Brawley Wash 1505030405	6.0%	-	1.0%	10%	84%	<1.0%	410
Upper Brawley Wash 1505030404	<1.0%	<1.0%	-	1.0%	99%	-	149
Altar Wash 1505030403	-	<1.0%	-	-	>99%	<1.0%	350
Puertocito Wash 1505030402	-	<1.0%	-	-	>99%	<1.0%	149
Arivaca Creek 1505030401	-	-	-	-	>99%	<1.0%	139
Percent of Brawley Wash – Los Robles Wash Watershed	2.0%	<1.0%	<1.0%	3.0%	94%	<1.0%	1,407

Data Sources: GIS data layer “Southwest Regional GAP Program”, originated by Southwest Regional GAP program, 2005. <http://ftp.nr.usu.edu/swgap/>

Mines - Primary Ores

Table 2-9 and Figure 2-11 show the types of ores being mined in the Brawley Wash – Los Robles Wash

Watershed. The most common type of ore is gold with 94 mines (Ward, J.S. and Associates. 1973). Other common known ore types are copper, silver, lead, tungsten, manganese, and uranium.

*Table 2-9: Brawley Wash – Los Robles Wash Watershed Mines – Primary Ores*

Ore Type	Total Number of Mines
Asbestos	2
Barium	1
Beryllium	3
Copper	48
Fluorine	6
Geothermal	11
Gold	94
Iron	1
Lead	33
Lithium	1
Manganese	11
Perlite	1
Quartz Crystal	1
Rare Earth	2
Silicon	1
Silver	69
Stone	4
Tungsten	12
Uranium	11
Zeolites	1
Zinc	1

*Note: If a mine contains more than one ore, only the major ore is noted. Data Source: "mines" Arizona Land Information Service, 2006*

### Section 3: Resource Concerns

concerns can be grouped under the broad resource categories of Soil, Water, Air,

#### Introduction

Conservation Districts and other local leaders, along with NRCS and other resource management agencies, have identified priority natural resource concerns for this watershed. These

Plants, or Animals (SWAPA). Refer to Table 3-1 for a listing of priority resource concerns by land use within the Brawley Wash - Los Robles Wash Watershed.

*Table 3-1: Brawley Wash - Los Robles Wash Watershed Priority Resource Concerns by Land Use*

Resource Category	Cropland Concerns	Rangeland Concerns	Forest Concerns	Urban Concerns
Soil Erosion		Sheet & Rill Erosion		Roads & Construction Sites
Water Quality				
Water Quantity	Aquifer Depletion	Aquifer Depletion		Aquifer Depletion
Air Quality				Roads & Construction Sites
Plant Condition		Plant Productivity, Health & Vigor		
Noxious & Invasive Plants		Noxious & Invasive Plants		Noxious & Invasive Plants
Domestic Animals		Inadequate Quantities & Quality of Feed & Forage & Distribution of Water		
Species of Concern		T&E Species & Declining Species & Species of Concern		

(NRCS, 2008)

#### Soil Erosion

Soil erosion is defined as the movement of soil from water (sheet and rill or gully) or wind forces requiring treatment when soil loss tolerance levels are exceeded. Sheet and rill erosion is a concern

particularly on rangeland in areas of shallow soils and poor vegetative cover. Soil loss results in reduced water holding capacity and plant productivity. Gully erosion can be a significant problem in areas of steep slopes and deep soils. Loss of vegetative cover and down-cutting of streams contribute to gully formation. Wind erosion is

locally significant where adequate vegetative cover is not maintained.

Headcutting of the Santa Cruz River in the far northern portion of the watershed will become a major concern when it reaches Los Robles Wash and causes loss of archaeological sites in the northern Los Robles Archaeological District.

Conservation practices applied to address this resource concern are generally those that help improve vegetative cover, stabilize sites, and control water flows. Practices may include critical area planting, deferred grazing, grade stabilization structures, herbaceous wind barriers, prescribed grazing, range planting, stream channel stabilization, tree and shrub establishment, water and sediment control basins, water spreading, windbreak establishment, and wildlife upland habitat management.

### Water Quality

The Arizona Department of Environmental Quality (ADEQ) assesses surface water quality to identify which surface waters are impaired or attaining designed uses and to prioritize future monitoring. Strategies must be implemented on impaired waters to reduce pollutant loadings so that surface water quality standards will be met, unless impairment is *solely* due to natural conditions.

Once a surface water has been identified as impaired, activities in the watershed that might contribute further loadings of the pollutant are not allowed. Agencies and individuals planning future projects in the watershed must be sure

that activities will not further degrade these impaired waters and are encouraged through grants to implement strategies to reduce loading. One of the first steps is the development of a Total Maximum Daily Load (TMDL) analysis to empirically determine the load reduction needed to meet standards.

The draft 2006 Status of Ambient Surface Water Quality in Arizona indicates that very little monitoring has been completed in Brawley Wash Watershed. This is due to very little perennial or even intermittent flows in this watershed. However, one lake in this watershed has been listed as impaired:

Arivaca Lake, a 118 acre reservoir in the Arivaca Creek Sub-watershed (HUC 150530401), is listed as impaired due to mercury in fish tissue. A TMDL was completed in 1999. The primary sources of mercury appear to be atmospheric deposition and natural deposition from local substrates. Atmospheric deposition is thought to be coming from other countries and is therefore not readily controllable. A fish consumption advisory is in place to warn the public concern risks associated with eating these contaminated fish (Figure 3-1).

Although some data was collected at a few other sites in this watershed, there was insufficient data to assess any other lake or stream in the draft 2006 assessment report.



## Water Quantity

In the Brawley Wash-Los Robles Wash Watershed (also known as the Avra Valley Subbasin), Altar Wash originates in the southern portion and flows northward to become Brawley Wash. Brawley Wash flows to the north and northwest through Avra Valley to its confluence with the Santa Cruz River. A portion of Arivaca Wash in the southwest portion of the watershed is perennial (ADWR, 1999).

Water quantity is a resource concern whenever water supplies are inadequate to meet the needs for agricultural or domestic uses. Conservation practices applied to address this resource concern on irrigated cropland are generally those that improve the quantity and efficient distribution of water. Practices may include irrigation land leveling, irrigation system, irrigation water conveyance (ditch or pipeline), irrigation water management, and structure for water control.

## Air Quality

The Rillito Area in the northern part of the Brawley Wash-Los Robles Watershed is classified by the Arizona Department of Environmental Quality as a PM-10 nonattainment area (ADEQ, 2008) (Figure 3-2). Emission sources include the Arizona Portland Cement Company, construction, unstabilized river banks, agriculture, unpaved roads and unstabilized road shoulders.

Air quality is a resource concern whenever human activities contribute significantly to airborne sediment and smoke, resulting in property damage and health problems. Conservation

practices applied to address this resource concern are generally those that reduce wind erosion and smoke. Practices may include atmospheric resource quality management, critical area planting, heavy use area protection, road closures and treatments, and windbreak establishment.

## Environmental Sites

There are no environmental Superfund or Water Quality Assurance Revolving Fund (WQARF) cleanup sites located within the watershed (Figure 3-3). However, in the Tucson area, about five miles east of the watershed, there are three WQARF sites and one EPA Superfund site.

## Plant Condition

Plant condition is a resource concern whenever plants do not manufacture sufficient food to continue the growth cycle or to reproduce. Plant condition is frequently a concern where proper grazing management is not being applied.

Conservation practices applied to address this resource concern are generally those that maintain or improve the health, photosynthetic capability, rooting and reproductive capability of vegetation. Practices may include brush management, critical area planting, deferred grazing, fencing, herbaceous wind barriers, nutrient management, pest management, prescribed grazing, prescribed burning, range planting, recreation area improvement, wildlife upland habitat management, and windbreak establishment.

## Noxious and Invasive Plants

Noxious and invasive plants are a resource concern whenever these species cause unsuitable grazing conditions for livestock or wildlife and due to their potential to out-compete native species which are generally preferred for wildlife habitat value. Increases in noxious and invasive plants can result from poor grazing management, drought, motorized off-road travel, road paving and other causes.

Conservation practices applied to address this resource concern are generally those that control the establishment or reduce the population of noxious and invasive plant species. Practices may include brush management, deferred grazing, fencing, forest stand improvement, pest management, prescribed burning, prescribed grazing, and wildlife upland habitat management.

## Bark Beetle, Drought and Wildfire

Arizona has been in an extended drought since 1996. Most areas of the state continue to experience record low winter precipitation and snowpack, above-average temperatures, and low soil moisture. These conditions have led to high vegetation stress, high fire potential, below-normal streamflow, decreasing water supplies and deteriorating range and pasture conditions. Although in more forested regions of the state these conditions have led to Bark Beetle infestation, this has not been observed in the Brawley Wash – Los Robles Wash Watershed (adapted from Arizona Drought Preparedness Annual Report, 2006).

The Climate Assessment for the Southwest (CLIMAS) website ([www.ispe.arizona.edu/climas](http://www.ispe.arizona.edu/climas)) and ADWR Statewide Drought Program website ([www.azwater.gov/dwr/drought](http://www.azwater.gov/dwr/drought)) provide information on Arizona's drought status. The area of Arizona that encompasses the Brawley Wash - Los Robles Wash Watershed has received less than 50% of average annual precipitation, placing it in moderate drought status. The long-term drought status is severe.

## Domestic Animal Concerns

Domestic animal concerns occur whenever the quantity and quality of food are not adequate to meet the nutritional requirements of animals, or adequate quantity or distribution of water is not provided. This is frequently a concern on rangeland when changes in species composition resulting from poor grazing management and drought can reduce the availability of suitable forage. This is also a concern where stock water is not evenly distributed resulting in poor grazing management.

Conservation practices applied to address this resource concern are generally those that maintain or improve the quantity, quality, and diversity of forage available for animals, reduce the concentration of animals at existing water sources, and insure adequate quantity and reliability of water for the management of domestic animals. Practices may include brush management, deferred grazing, fencing, pest management, prescribed burning, prescribed grazing, pipelines, ponds, range planting, water spreading, wells,

spring development, watering facility, and wildlife upland habitat management.

Species of Concern

There are 55 threatened and endangered species listed for Arizona (U. S. Fish and Wildlife Service website). In 1990 Arizona voters created the Heritage Fund, designating up to \$10 million per year from lottery ticket sales for the conservation and protection of the state’s wildlife and natural areas. The Heritage Fund allowed for the creation of the Heritage Data Management System (HDMS)

which identifies elements of concern in Arizona and consolidates information about their status and distribution throughout the state. (Arizona Game & Fish website, 2006)

The Brawley Wash-Los Robles Wash Watershed contains 8 species that are either listed, species of concern, or candidate species, under the U.S. Endangered Species Act (Table 3-2). Of the eight species listed in the watershed, six of the species are designated as being in imminent jeopardy of extinction.

*Table 3-2: Brawley Wash-Los Robles Wash Watershed Species of Concern and Endangered Species Classifications and Observations<sup>(1)</sup>*

Common Name	Species Name	USESA (2)	USFS (3)	STATE (4)
Chiricahua Leopard Frog	Rana chiricahuensis	LT	S	WSC
Gila Topminnow	Poeciliopsis occidentalis	LE		WSC
Jaguar	Panthera onca	LE	S	WSC
Kearney’s Blue Star	Amsonia kearneyana	LE		HS
Masked Bobwhite	Colinus virginianus ridgwayi	LE		WSC
Nichol Turk’s Haed Cactus	Echinocactus horonthalonius var.	LE		HS
Pima Pineapple Cactus	Coryphantha scheeri var.	LE		HS
Western Yellow-billed Cuckoo	Coccyzus americanus occidentalis	C	S	WSC

Data Sources: Arizona Land Information System (ALRIS), Natural Resource Conservation Service (NRCS).

Note: Status Definitions as Listed by Arizona Game and Fish Department, November 26, 2006 [http://www.gf.state.az.us/w\\_c/edits/hdms\\_status\\_definitions.shtml](http://www.gf.state.az.us/w_c/edits/hdms_status_definitions.shtml)

**(1) Proposed for Listing: (USEA) Federal U.S. Status**  
 ESA Endangered Species Act (1973 as amended)  
 US Department of Interior, Fish and Wildlife Service

**(2) Listed:**  
 LE Listed Endangered: imminent jeopardy of extinction.  
 LT Listed Threatened: imminent jeopardy of becoming Endangered.

Candidate (Notice of Review: 1999):  
 C Candidate. Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed

rules have not yet been issued because such actions are precluded at present by other listing activity.

**(3) USFS US Forest Service** (1999 Animals, 1999 Plants)

US Department of Agriculture, Forest Service, Region 3

S Sensitive: those taxa occurring on National Forests in Arizona which are considered sensitive by the Regional Forester.

**(4) State Status**

NPL Arizona Native Plant Law (1993)

Arizona Department of Agriculture

HS Highly Safeguarded: no collection allowed.

WSC Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Arizona Game and Fish Department's listing of Wildlife of Special Concern in Arizona (WSCA, in prep).

Resource Concern Summary

The Brawley Wash Watershed is a mosaic of federal, state, tribal and private lands where livestock grazing, agriculture and recreation are the primary land uses. The southern portion of the watershed is primarily managed by the U.S. Forest Service and U.S Fish and Wildlife Service. The northern portion of the watershed is a mixture of state and private lands. Livestock grazing is the primary land use activity on the private and state lands. The watershed is located near the cities of Tucson and Marana and the southern half of the watershed has seen significant development over the last decade.

Several important natural areas are located in the watershed. The Saguaro National Park West and the Tucson Mountain Park are located in the lower portion of the watershed. A portion of Ironwood Forest National Monument is located within the watershed. The world famous Arizona-Sonora Desert Museum is located in the watershed near Saguaro National Park West. Old Tucson, an old movie studio and tourist

attraction is also located in this area. This area is heavily used for recreation by both Tucson residents and tourists.

The Buenos Aires National Wildlife Refuge is located in the upper portion of the watershed. The Buenos Aires NWR is one of the largest wildlife refuges in the United States and is a reintroduction location for the endangered masked bobwhite quail (*Colinus virginianus ridgwayi*). Arivaca Creek and Arivaca Cienega, located on the refuge, are valuable birding areas in southern Arizona and support a local ecotourism economy in the town of Arivaca. Other species of concern found in the watershed include Chiricahua leopard frog (*Rana chiricahuensis*), Gila topminnow (*Poeciliopsis occidentalis*), jaguar (*Panthera onca*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Kearney's blue star (*Amsonia kearneyana*), Nichol's Turk's head cactus (*Echinocactus horizonthalonius var.*), and Pima pineapple cactus (*Coryphantha scheeri var.*).

Erosion and sedimentation are major problems in the watershed. Brawley Wash started to incise in the early 1900's and today is a large entrenched channel. Tributaries to Brawley Wash are also entrenching due to increased channel gradients resulting from channel incisions. Erosion control protections have been proposed in the area. Arivaca Lake on the headwaters of Arivaca Creek is listed by the Arizona Department of Environmental Quality as impaired due to metals.

The watershed will see continued development due to population growth in Tucson and Marana. Local flooding and continued channel degradation are likely without the implementation of progressive watershed management practices.

Local leaders have identified watershed health as a priority concern for the Brawley Wash - Los Robles Wash Watershed (Pima County, 2000). This includes both the upland areas of the watershed and the riparian or stream course areas. The condition of the

upland areas is integral to hydrologic function, such that when precipitation falls on the land its disposition is affected by the soil and vegetation, which in turn are affected by land uses, both historical and current. The amount of the precipitation which immediately runs off the land surface, and that which infiltrates into the soil to either be used for plant growth or to recharge ground water, is dependent on this critical interface.

The main concern in the Watershed is rapidly expanding urbanization of cropland and increased recreational use of public lands, resulting in impacts to vegetation and soil surfaces which may affect hydrologic function and result in accelerated erosion. The desert and semi-desert ecosystems have developed in a climatic regime of wide fluctuations of precipitation, ranging from drought to flood. Human uses superimposed on that climatic regime can tend to exacerbate or ameliorate their effects on soils, vegetation and wildlife.

### Conservation Progress/Status

Conservation progress for the previous five years in the Brawley Wash-Los Robles Wash Watershed has focused on addressing the following primary resource concerns:

- ✓ Soil Condition – Organic Matter Depletion
- ✓ Soil Erosion – Sheet and Rill Erosion
- ✓ Water Quantity – Inefficient Water Use on Irrigated Land
- ✓ Plant Condition – Productivity, Health and Vigor
- ✓ Domestic Animals – Inadequate Quantities and Quality of Feed and Forage

The following table presents conservation accomplishments in this watershed during fiscal years (FY) 2003 through 2007, according to the NRCS Progress Reporting System.

*Table 3-3: Brawley Wash-Low Robles Wash Watershed Conservation Treatment Applied*

Brawley Wash-Los Robles Wash Watershed (15050304) Conservation Treatment Applied	FY03-07 TOTAL
Conservation Crop Rotation (328) (acres)	1,599
Fence (382) (feet)	123,187
Irrigation Land Leveling (464) (acres)	176
Irrigation Water Conveyance, Ditch and Canal Lining, (428) (feet)	2,319
Irrigation Water Conveyance, Pipeline, Underground, Plastic (430) (feet)	3,470
Irrigation Water Management (449) (acres)	1,956
Nutrient Management (590) (acres)	1,430
Pest Management (595) (acres)	1,771
Pipeline (516) (feet)	28,628
Prescribed Grazing (528) (acres)	182,092
Residue Management, Seasonal (344) (acres)	2,016
Upland Wildlife Habitat Management (645) (acres)	25,119



## **Section 4: Census, Social and Agricultural Data**

This section discusses the human component of the watershed and the pressure on natural resources caused by humans and by population change.

### Population Density, 1990

Census block statistics for 1990 were compiled from information prepared by Geo-Lytics (Geo-Lytics, 1998). These data were linked with census block data and used to create a density map (Figure 4-1) through a normalization process using a grid of 7 km squares. This process involves calculating density per census block and intersecting it with the grid, which is then used to calculate the number of people and thus density per grid square.

Table 4-1 shows the tabulated minimum, maximum and mean number of people per square mile in 1990 for the watershed. In 1990, the mean population density for the entire watershed was about 19 people per square mile. Lower Brawley Wash Watershed had the highest population mean with about 51 people per square mile, and a maximum of 2,470 people per square mile. Altar Wash Watershed had the lowest density with a mean of only about 0.5 people per square mile.

### Population Density, 2000

The Census Block 2000 statistics data were downloaded from the Environmental Systems Research Institute (ESRI) website (ESRI Data Products, 2003) and are shown in Table 4-2.

A population density map (Figure 4-2) was created from these data. The mean population density in 2000 was about 29 people per square mile. Lower Brawley Wash Watershed had the highest mean population density (78 people/sq. mi.) and the highest maximum population density, (2,643 people/sq.mi).

### Population Density Change, 1990-2000

The 1990 and 2000 population density maps were used to create a population density change map. The resulting map and table (Figure 4-3 and Table 4-3) show population increase or decrease over the ten year time frame. Overall, mean population density increased by about 10 people per square mile during this ten-year time period. Lower Brawley Wash Watershed had the largest increase in mean population at 27 people per square mile.

**Table 4-1: Brawley Wash – Los Robles Wash Watershed 1990 Population Density (people/square mile)**

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Los Robles Wash 1505030406	210	0	651	14
Lower Brawley Wash 1505030405	410	0	2,470	51
Upper Brawley Wash 1505030404	149	0	53	3
Altar Wash 1505030403	350	0	8	0.5
Puertocito Wash 1505030402	149	0	10	0.4
Arivaca Creek 1505030401	139	0	73	4
Total Brawley Wash – Los Robles Wash Watershed	1,408	0	2,470	19

*Note: Adjacent watersheds may share a grid square. Data Sources: Census block statistics for 1990 were compiled from a CD prepared by Geo-Lytics (GeoLytics, Inc. 1998. Census 1990. Census CD + Maps. Release 3.0.) New Mexico Resource Geographic Information (RGIS 2007).*

**Table 4-2: Brawley Wash – Los Robles Wash Watershed 2000 Population Density (people/square mile)**

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Los Robles Wash 1505030406	210	0	975	24
Lower Brawley Wash 1505030405	410	0	2,643	78
Upper Brawley Wash 1505030404	149	0	204	5
Altar Wash 1505030403	350	0	11	0.3
Puertocito Wash 1505030402	149	0	1	0.2
Arivaca Creek 1505030401	139	0	96	5
Total Brawley Wash – Los Robles Wash Watershed	1,408	0	2,643	29

*Note: Adjacent watersheds may share a grid square. Data Sources: Census block statistics for 1990 were compiled from a CD prepared by Geo-Lytics (GeoLytics, Inc. 1998. Census 1990. Census CD + Maps. Release 3.0.) New Mexico Resource Geographic Information (RGIS 2007).*

*Table 4-3: Brawley Wash – Los Robles Wash Watershed Population Density Change 1990 – 2000 (people/square mile)*

10-digit Watershed Name	Area (sq. miles)	Population Density Change (people/sq.mi.)		
		Min	Max	Mean
Los Robles Wash 1505030406	210	-60	646	10
Lower Brawley Wash 1505030405	410	-79	761	27
Upper Brawley Wash 1505030404	149	-46	152	3
Altar Wash 1505030403	350	-7	11	-0.2
Puertocito Wash 1505030402	149	-10	0.6	-0.2
Arivaca Creek 1505030401	139	-15	71	1
Total Brawley Wash – Los Robles Wash Watershed	1,408	-79	761	10

*Note: Adjacent watersheds may share a grid square. Data Sources: Derived from data from the GIS data used for tables 4-1 and 4-2.*

### Housing Density, 2000 and 2030

The Watershed Housing Density Map for the year 2000 and projections for the year 2030 were created with data developed by David M. Theobald (Theobald, 2005). Theobald developed a nationwide housing density model that incorporates a thorough way to account for land-use change beyond the “urban fringe.”

Exurban regions are the “urban fringe”, or areas outside suburban areas, having population densities greater than 0.68 – 16.18 ha (1.68 – 40 acres) per unit. Theobald stresses that exurban areas are increasing at a much faster rate than urban sprawl, are consuming much more land, and are having a greater impact on ecological health, habitat fragmentation and other resource concerns.

Theobald estimates that the exurban density class has increased at a much faster rate than the urban/suburban density classes. Theobald’s model

forecasts that this trend will continue and may even accelerate by 2030. This indicates that development patterns are shifting more towards exurban, lower density, housing units, and are thereby consuming more land. He suggests that exurban development has more overall effect on natural resources because of the larger footprint and disturbance zone, a higher percent of impervious surfaces, and higher pollution because of more vehicle miles traveled to work and shopping.

Figure 4-4 and Table 4-4, Brawley Wash-Robles Wash Watershed Housing Density for 2000, identifies that about 63% of housing is located in “undeveloped private” areas, about 27% is located in “rural” areas and 9% located in “exurban”. Figure 4-5 and Table 4-5, Brawley Wash-Robles Wash Watershed Housing Density for 2030, projects “undeveloped private” areas being reduced to about 5% of the watershed, “rural” decreasing to 7%, and exurban increasing to 82%.

**Table 4-4: Brawley Wash – Los Robles Wash Watershed Housing Density 2000 (Percent of Watershed) (Part 1 of 2).**

Housing Density	Los Robles Wash 1505030406	Lower Brawley Wash 1505030405	Upper Brawley Wash 1505030404	Altar Wash 1505030403	Puertocito Wash 1505030402
Undeveloped Private	70%	72%	72%	59%	54%
Rural	26%	10%	25%	41%	46%
Exurban	4%	16%	4%	0.2%	-
Suburban	-	1.1%	>0.00%	>0.00%	-
Urban	0.01%	0.3%	-	-	-

Source: Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. *Ecology and Society* 10(1): 32. [online] URL: <http://www.ecologyandsociety.org/vol10/iss1/art32/>

**Table 4-4: Brawley Wash – Los Robles Wash Watershed Housing Density 2000 (Percent of Watershed) (Part 2 of 2).**

Housing Density	Arivaca Creek 1505030401	Brawley Wash – Los Robles Wash Watershed	Brawley Wash – Los Robles Wash Watershed (sq. miles)
Undeveloped Private	32%	63%	181
Rural	38%	27%	77
Exurban	29%	9%	27
Suburban	0.06%	0.3%	1
Urban	0.06%	0.07%	0.2

Source: Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. *Ecology and Society* 10(1): 32. [online] URL: <http://www.ecologyandsociety.org/vol10/iss1/art32/>

**Table 4-5: Brawley Wash – Los Robles Wash Watershed Housing Density 2030 (Percent of Watershed) (Part 1 of 2).**

Housing Density	Los Robles Wash 1505030406	Lower Brawley Wash 1505030405	Upper Brawley Wash 1505030404	Altar Wash 1505030403	Puertocito Wash 1505030402
Undeveloped Private	3%	4%	4%	9%	7%
Rural	15%	1%	1%	11%	19%
Exurban	81%	80%	91%	80%	74%
Suburban	0.6%	4%	0.1%	0.02%	-
Urban	0.3%	11%	3%	-	-

Source: Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. *Ecology and Society* 10(1): 32. [online] URL: <http://www.ecologyandsociety.org/vol10/iss1/art32/>

*Table 4-5: Brawley Wash – Los Robles Wash Watershed Housing Density 2030 (Percent of Watershed) (Part 2 of 2).*

Housing Density	Arivaca Creek 1505030401	Brawley Wash – Los Robles Wash Watershed	Brawley Wash – Los Robles Wash Watershed (sq. miles)
Undeveloped Private	6%	5%	15
Rural	9%	7%	19
Exurban	76%	82%	236
Suburban	6%	2%	5
Urban	3%	4%	12

Source: Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. *Ecology and Society* 10(1): 32. [online] URL: <http://www.ecologyandsociety.org/vol10/iss1/art32/>

## Brawley Wash-Robles Wash Watershed Agricultural Statistics

Arizona is known as one of the most productive and efficient agricultural regions in the world, with beauty that also provides the food and fiber to sustain life in the desert. Arizona is also one of the most diverse agricultural producing states in the nation, producing more than 160 varieties of vegetables, livestock, field crops and nursery stock. The climate, natural resources, agribusiness infrastructure and farm heritage help make agriculture a \$9.2 billion dollar industry employing more than 72,000 individuals.

According to the United States Department of Agriculture's, 2002 Census, there are more than 7,000 farms and ranches, seventy-eight percent of which are owned by individuals or families. The total farmland in Arizona is comprised of more than 26,000,000 acres with irrigated crops on 1,280,000 acres and pasture for animals on 23,680,000.

Brawley Wash-Robles Wash Watershed is comprised of considerable grazing land for many livestock operations, a significant number of apiary (honey bee) operations, a mixed variety of crops, including cotton and alfalfa, several recreational equestrian facilities, a few equestrian breeding and training facilities, a number of dairy facilities, variety of vegetable growing operations, a few nursery facilities, miscellaneous plantings of fruit trees, including apples and peaches (Brill, 2008).

Most farms in the Brawley Wash-Robles Wash Watershed are fairly small.

Eighty-four percent of all farms in the watershed are less than 1,000 acres in size, and 54% are less than 50 acres (Table 4-6 and Figure 4-6). Of the 100 farms that have pasture and rangeland, 43% have 100 or more acres (Table 4-7 and Figure 4-7). Of the 413 farms that harvest crops, 83% are 49 acres or less in size (Table 4-8 and Figure 4-8).

The NASS (National Agricultural Statistics Service, United States Department of Agriculture) has farm data by zip code. We used the U.S. Census Bureau ZIP Census Tabulation Areas (ZCTA) to generate maps. A typical 5-digit ZCTA (there are 3-digit ZCTAs as well) is typically nearly identical to a 5-digit U.S. Postal Service ZIP code, but there are some distinctions. Unlike ZIP codes, ZCTA areas are spatially complete and they are easier to map. The Bureau created special `XX ZCTAs (ZCTAs with a valid 3-digit ZIP but with "XX" as last two characters of the code) which represent large unpopulated areas where it made no sense to assign a census block to an actual ZIP code. Similarly, HH ZCTAs represent large bodies of water within a 3-digit zip area. There is typically no population in either an XX or HH ZCTA.

Data is withheld by NASS for categories with one to four farms. This is to protect the identity of individual farmers. Farm counts for these zip codes are included in the "State Total" category. Some categories only contained stars instead of numbers. Each star was counted as one farm. But because each star could represent as many as 4 farms, each number on the tables are actually greater than or equal to the number listed. In some cases this results in

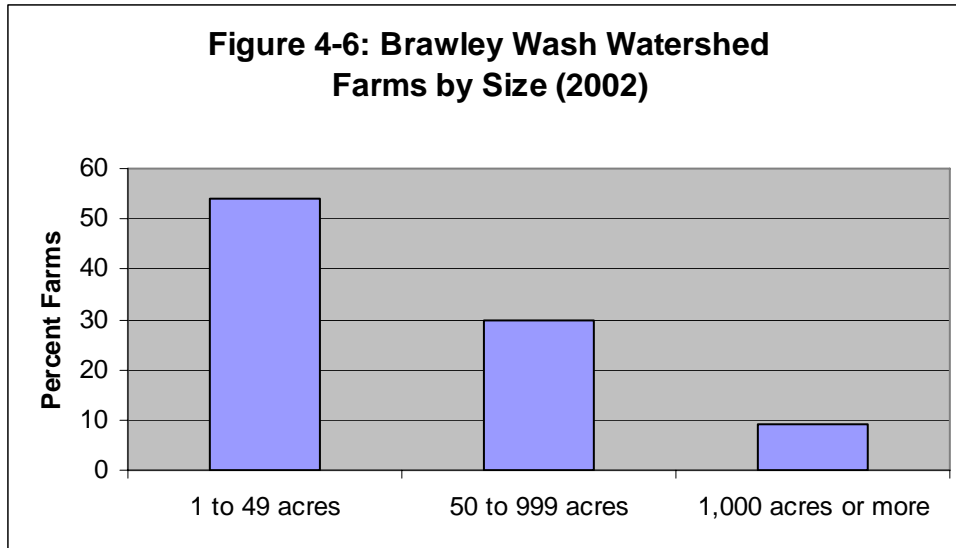


percentages that add up to more or less than 100 percent.

Tables include data from zip codes both contained within the watershed and zip codes crossing watershed boundaries. It is important to note that the figures in the tables include significant agricultural areas adjacent to but outside of the

watershed area along the Santa Cruz and the San Pedro Rivers and other nearby drainages.

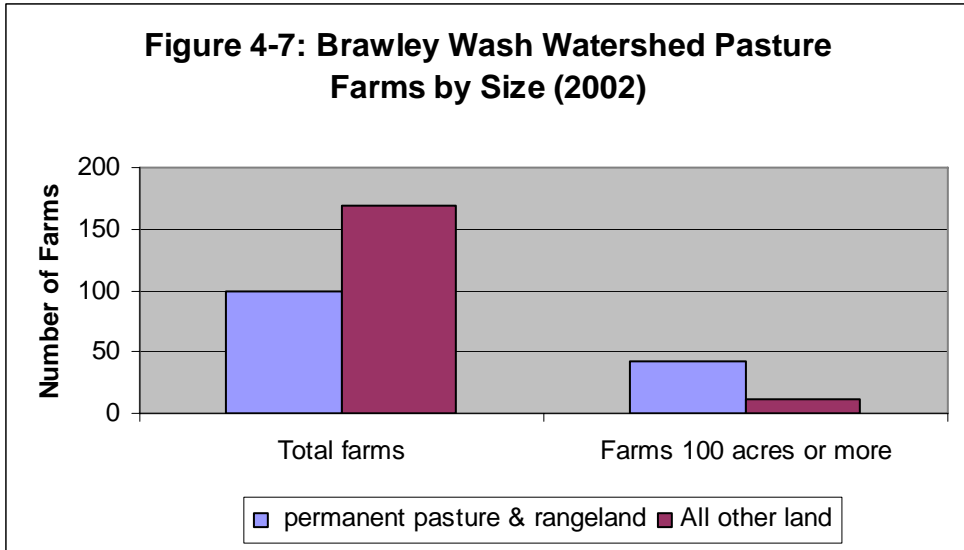
NASS assumes that when no agricultural information exists for a zip code, no agricultural activity takes place within that area.



*Table 4-6: Brawley Wash-Robles Wash Watershed Farms by Size*

All farms	1 to 49 acres	50 to 999 acres	>1000 acres
523	54%	30%	9%

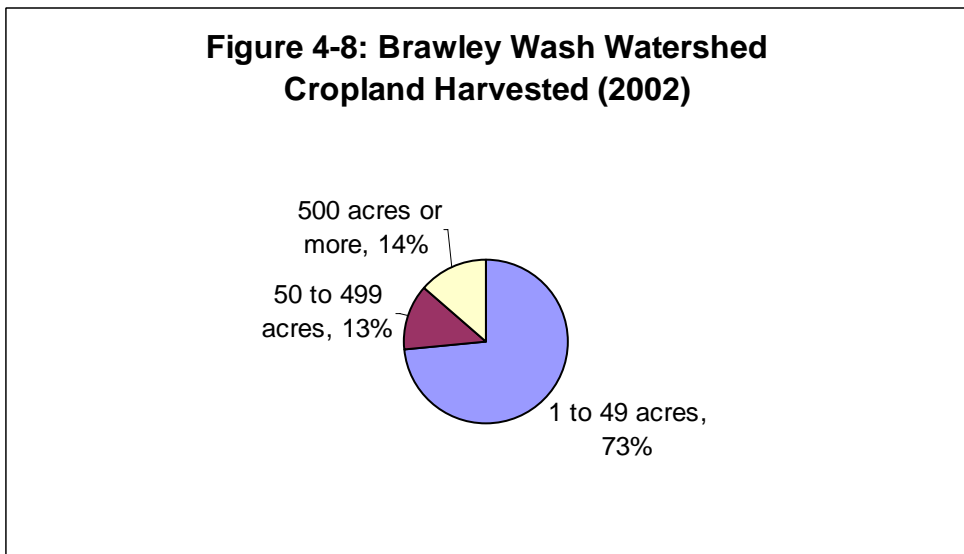
NASS defines a "farm" as an operation with at least \$1000 in agricultural sales from agriculture. Percents rounded. Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)



*Table 4-7: Brawley Wash-Robles Wash Watershed Pasture and Rangeland (2002)*

Category	Total farms	Farms 100 acres or more
Permanent pasture and rangeland	100	43%
All other land	169	11%

*Grazing lands are the USDA Pastureland, as defined by NASS, includes cropland used only for pasture or grazing, woodland pastured, and other pastureland and rangeland. Percents rounded. Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*



*Table 4-8: Brawley Wash-Robles Wash Watershed Cropland Harvested*

Total farms	1 to 49 acres	50 to 999 acres	>1000 acres
80	75%	13%	14%

*According to the NASS, "harvested cropland" includes all land from which crops were harvested including: cut hay; all land in orchards; citrus groves; and, nursery and greenhouse crops. Land from which two or more crops were harvested was counted only once even though there was more than one use of that land. Percents rounded. Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*

## Section 5: Resource Assessment Tables

The following Resource Assessment Tables summarize current and desired future natural resource conditions for the Brawley Wash – Los Robles Wash Watershed. The tables present information on benchmark and future conservation systems and practices, qualitative effects on primary resource concerns, and estimated costs for conservation implementation. Conservation District board members, NRCS conservationists, and other people familiar with conservation work in the watershed were consulted for estimating current and future natural resource conditions.

The tables show three levels of conservation treatment (Baseline, Progressive, Resource Management System) for each of the major land uses (range and urban) within the watershed. **Baseline** is defined as a low level of conservation adoption with landowners who are typically not participating in conservation programs. There are, however, a few practices that have been commonly adopted by all landowners in this watershed. **Progressive** is defined as an intermediate level of conservation adoption with landowners who are actively participating in conservation programs and have adopted several practices but not satisfied all of the

Quality Criteria in the NRCS Field Office Technical Guide. **Resource Management System (RMS)** is defined as a complete system of conservation practices that addresses all of the Soil, Water, Air, Plant, and Animal (SWAPA) resource concerns typically seen for this land use in this watershed.

For each land use, the results of the assessment are presented in two parts. Part 1 (Assessment Information) summarizes the conservation practices at each treatment level and the quantities of practices for current benchmark conditions and projected future conditions. Part 1 also displays the four primary resource concerns, along with individual practice effects and an overall Systems Rating (ranging from a low of 1 to a high of 5) indicating the effectiveness of the conservation system used at each treatment level. Part 2 (Conservation Cost Table) summarizes the installation, management, and related costs by conservation practice and treatment level for the projected future conditions by federal and private share of the costs. Part 2 also displays the benchmark and future conservation conditions status bars.

Credit goes to NRCS in Oregon for development of the template for these Resource Assessment Tables.

WATERSHED NAME & CODE		BRAWLEY WASH - LOS ROBLES WASH - 15050304			LANDUSE ACRES		10,000	
LANDUSE TYPE		CROP			TYPICAL UNIT SIZE ACRES		500	
ASSESSMENT INFORMATION								
Conservation Systems by Treatment Level	Benchmark Conditions	Future Conditions			RESOURCE CONCERNS			
		Existing Unchanged Units	New Treatment Units	Total Units	Soil Condition – Organic Matter Depletion	Water Quantity – Inefficient Water Use on Irrigated Land	Water Quality – Excessive Nutrients and Organics in Groundwater	Plant Condition – Productivity, Health and Vigor
<b>Baseline</b>								
Irrigation Land Leveling (ac.) 464	750	375	0	375	1	5	3	1
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	6,000	3,000	0	3,000	1	5	3	1
Irrigation Water Conveyance, Pipeline (ft.) 430	3,000	1,500	0	1,500	1	5	3	1
<b>Total Acreage at Baseline</b>	<b>3,000</b>	<b>1,500</b>	<b>0</b>	<b>1,500</b>				
<b>System Rating -&gt;</b>								
<b>Progressive</b>								
Conservation Crop Rotation (ac.) 328	2,500	1,875	375	2,250	3	5	4	4
Irrigation Land Leveling (ac.) 464	2,500	2,063	188	2,250	5	1	3	5
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	20,000	16,500	1,500	18,000	1	5	3	1
Irrigation Water Conveyance, Pipeline (ft.) 430	10,000	8,250	750	9,000	1	5	3	1
Irrigation Water Management (ac.) 449	2,500	1,875	375	2,250	1	5	5	3
<b>Total Acreage at Progressive Level</b>	<b>5,000</b>	<b>3,750</b>	<b>750</b>	<b>4,500</b>				
<b>System Rating -&gt;</b>								
<b>RMS</b>								
Conservation Crop Rotation (ac.) 328	2,000	2,625	1,375	4,000	4	5	5	5
Irrigation Land Leveling (ac.) 464	2,000	2,813	1,188	4,000	5	1	3	5
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	20,000	26,500	13,500	40,000	1	5	3	1
Irrigation Water Conveyance, Pipeline (ft.) 430	8,000	11,250	4,750	16,000	1	5	3	1
Irrigation Water Management (ac.) 449	2,000	2,625	1,375	4,000	1	5	5	3
Nutrient Management (ac.) 590	2,000	2,000	2,000	4,000	1	1	5	5
Pest Management (ac.) 595	2,000	2,000	2,000	4,000	1	1	3	3
Residue Management, Seasonal (ac.) 344	2,000	2,000	2,000	4,000	5	1	3	5
<b>Total Acreage at RMS Level</b>	<b>2,000</b>	<b>2,000</b>	<b>2,000</b>	<b>4,000</b>				

WATERSHED NAME & CODE		BRAWLEY WASH - LOS ROBLES WASH - 15050304				LANDUSE ACRES		10,000	
LANDUSE TYPE		CROP				TYPICAL UNIT SIZE ACRES		500	
CONSERVATION COST TABLE		CALCULATED PARTICIPATION				PRIVATE		34%	
Conservation Systems by Treatment Level		FUTURE		FEDERAL		PRIVATE		Annual O & M + Mgt Costs	Total Present Value Cost
		New Treatment Units	Installation Cost - 50%	Management Cost - 3 yrs - 100%	Technical Assistance - 20%	Installation Cost - 50%	Annual O & M + Mgt Costs - 100%		
<b>Progressive</b>									
Conservation Crop Rotation (ac.) 328		375	\$0	\$11,250	\$2,250	\$12,274	\$0	\$3,750	\$5,773
Irrigation Land Leveling (ac.) 464		188	\$93,750	\$0	\$18,750	\$112,500	\$93,750	\$5,625	\$117,445
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428		1,500	\$6,000	\$0	\$1,200	\$7,200	\$6,000	\$240	\$7,011
Irrigation Water Conveyance, Pipeline (ft.) 430		750	\$3,750	\$0	\$750	\$4,500	\$3,750	\$150	\$4,382
Irrigation Water Management (ac.) 449		375	\$0	\$11,250	\$2,250	\$12,274	\$0	\$3,750	\$5,773
<b>Subtotal</b>		<b>750</b>	<b>\$103,500</b>	<b>\$22,500</b>	<b>\$25,200</b>	<b>\$148,748</b>	<b>\$103,500</b>	<b>\$13,515</b>	<b>\$140,383</b>
<b>RMS</b>									
Conservation Crop Rotation (ac.) 328		1,375	\$0	\$41,250	\$8,250	\$45,004	\$0	\$13,750	\$21,166
Irrigation Land Leveling (ac.) 464		1,188	\$593,750	\$0	\$118,750	\$712,500	\$593,750	\$35,625	\$743,815
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428		13,500	\$4,000	\$0	\$10,800	\$64,800	\$54,000	\$2,160	\$63,099
Irrigation Water Conveyance, Pipeline (ft.) 430		4,750	\$23,750	\$0	\$4,750	\$28,500	\$23,750	\$950	\$27,752
Irrigation Water Management (ac.) 449		1,375	\$0	\$41,250	\$8,250	\$45,004	\$0	\$13,750	\$21,166
Nutrient Management (ac.) 590		2,000	\$0	\$60,000	\$12,000	\$65,460	\$0	\$20,000	\$30,787
Pest Management (ac.) 595		2,000	\$0	\$60,000	\$12,000	\$65,460	\$0	\$20,000	\$30,787
Residue Management, Seasonal (ac.) 344		2,000	\$0	\$36,000	\$7,200	\$39,276	\$0	\$12,000	\$18,472
<b>Subtotal</b>		<b>2,000</b>	<b>\$671,500</b>	<b>\$238,500</b>	<b>\$182,000</b>	<b>\$1,066,004</b>	<b>\$671,500</b>	<b>\$118,235</b>	<b>\$957,044</b>
<b>Grand Total</b>		<b>2,750</b>	<b>\$775,000</b>	<b>\$261,000</b>	<b>\$207,200</b>	<b>\$1,214,752</b>	<b>\$775,000</b>	<b>\$131,750</b>	<b>\$1,097,427</b>

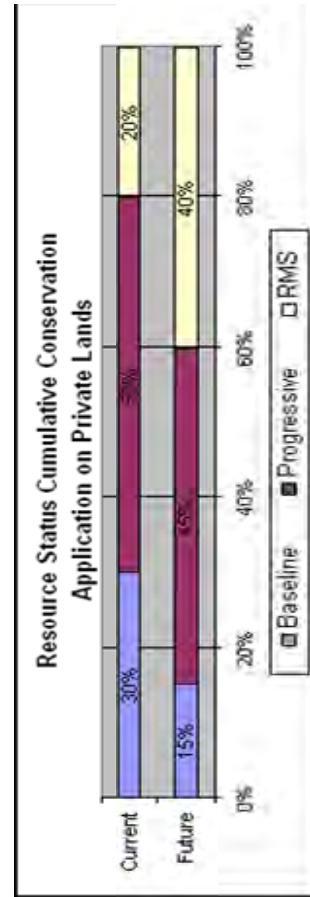


Chart Refers To	
Landuse Type	CROP
Calculated Participation Rate	34%

Average PV Costs per Ac		
System	Federal	Private
Prog	\$198.33	\$187.18
RMS	\$533.00	\$478.52

WATERSHED NAME & CODE		BRAWLEY WASH - LOS ROBLES WASH - 15050304			LANDUSE ACRES		838,000	
LANDUSE TYPE		RANGE			TYPICAL UNIT SIZE ACRES		50,000	
ASSESSMENT INFORMATION		RANGE			CALCULATED PARTICIPATION			
Conservation Systems by Treatment Level	Benchmark Conditions	Future Conditions			RESOURCE CONCERNS			
		Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water	Plant Condition – Productivity, Health and Vigor
<b>Baseline</b>		<b>System Rating -&gt;</b>			<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>
Fence (ft.) 382	8,380	4,190	0	4,190	3	3	3	5
Pipeline (ft.) 516	8,380	4,190	0	4,190	3	3	3	5
<b>Total Acreage at Baseline</b>	<b>83,800</b>	<b>41,900</b>	<b>0</b>	<b>41,900</b>				
<b>Progressive</b>		<b>System Rating -&gt;</b>			<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>
Fence (ft.) 382	251,400	190,645	8,380	199,025	3	3	3	5
Pipeline (ft.) 516	251,400	190,645	8,380	199,025	3	3	3	5
Prescribed Grazing (ac.) 528	251,400	188,550	10,475	199,025	5	5	5	5
<b>Total Acreage at Progressive Level</b>	<b>502,800</b>	<b>377,100</b>	<b>20,950</b>	<b>398,050</b>				
<b>RMS</b>		<b>System Rating -&gt;</b>			<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>
Fence (ft.) 382	251,400	316,345	81,705	398,050	3	3	3	5
Pipeline (ft.) 516	251,400	316,345	81,705	398,050	3	3	3	5
Prescribed Grazing (ac.) 528	251,400	314,250	83,800	398,050	5	5	5	5
Upland Wildlife Habitat Management (ac.) 645	25,140	25,140	14,665	39,805	5	5	5	3
<b>Total Acreage at RMS Level</b>	<b>251,400</b>	<b>251,400</b>	<b>146,650</b>	<b>398,050</b>				

WATERSHED NAME & CODE		BRAWLEY WASH - LOS ROBLES WASH - 15050304				LANDUSE ACRES		838,000
LANDUSE TYPE		RANGE				TYPICAL UNIT SIZE ACRES		50,000
CONSERVATION COST TABLE								
CONSERVATION SYSTEMS BY TREATMENT LEVEL		FUTURE		FEDERAL		PRIVATE		29%
	New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
<b>Progressive</b>								
Fence (ft.) 382	8,380	\$12,570	\$0	\$2,514	\$15,084	\$12,570	\$503	\$14,688
Pipeline (ft.) 516	8,380	\$33,520	\$0	\$6,704	\$40,224	\$33,520	\$1,341	\$39,168
Prescribed Grazing (ac.) 528	10,475	\$7,856	\$0	\$1,571	\$9,428	\$7,856	\$0	\$7,856
<b>Subtotal</b>	<b>20,950</b>	<b>\$53,946</b>	<b>\$0</b>	<b>\$10,789</b>	<b>\$64,736</b>	<b>\$53,946</b>	<b>\$1,844</b>	<b>\$61,712</b>
<b>RMS</b>								
Fence (ft.) 382	81,705	\$122,558	\$0	\$24,512	\$147,069	\$122,558	\$4,902	\$143,208
Pipeline (ft.) 516	81,705	\$326,820	\$0	\$65,364	\$392,184	\$326,820	\$13,073	\$381,887
Prescribed Grazing (ac.) 528	83,800	\$62,850	\$0	\$12,570	\$75,420	\$62,850	\$0	\$62,850
Upland Wildlife Habitat Management (ac.) 645	14,665	\$0	\$57,194	\$11,439	\$62,398	\$0	\$19,065	\$29,347
<b>Subtotal</b>	<b>146,650</b>	<b>\$512,228</b>	<b>\$57,194</b>	<b>\$113,884</b>	<b>\$677,071</b>	<b>\$512,228</b>	<b>\$37,040</b>	<b>\$617,292</b>
<b>Grand Total</b>	<b>167,600</b>	<b>\$566,174</b>	<b>\$57,194</b>	<b>\$124,673</b>	<b>\$741,807</b>	<b>\$566,174</b>	<b>\$38,883</b>	<b>\$679,004</b>

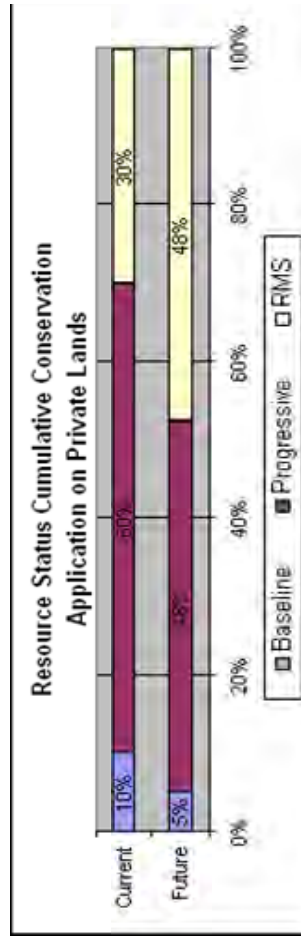


Chart Refers To	
Landuse Type	RANGE
Calculated Participation Rate	29%

Average PV Costs per Ac		
System	Federal	Private
Prog	\$3.09	\$2.95
RMS	\$4.62	\$4.21

WATERSHED NAME & CODE		BRAWLEY WASH - LOS ROBLES WASH - 15050304			LANDUSE ACRES		33,000
LANDUSE TYPE		URBAN			TYPICAL UNIT SIZE ACRES		10
ASSESSMENT INFORMATION					CALCULATED PARTICIPATION		10%
Conservation Systems by Treatment Level	Benchmark Conditions	Future Conditions			RESOURCE CONCERNS		
		Existing Unchanged Units	New Treatment Units	Total Units	Soil Condition – Organic Matter Depletion	Water Quantity – Inefficient Water Use on Irrigated Land	Water Quality – Excessive Nutrients and Organics in Groundwater
<b>Baseline</b>							
No Conservation Practices being applied at this level							
		0	0	0	0	0	0
	<b>Total Acreage at Baseline</b>	<b>29,700</b>	<b>26,730</b>	<b>0</b>	<b>26,730</b>		
<b>System Rating -&gt;</b>							
<b>Progressive</b>							
	Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	82,500	74,250	74,250	148,500	0	2
	Irrigation Water Conveyance, Pipeline (ft.) 430	82,500	74,250	74,250	148,500	1	3
	<b>Total Acreage at Progressive Level</b>	<b>3,300</b>	<b>2,970</b>	<b>2,970</b>	<b>5,940</b>	<b>1</b>	<b>3</b>
<b>System Rating -&gt;</b>							
<b>RMS</b>							
	Irrigation Land Leveling (ac.) 464	0	0	330	330	1	5
	Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	0	8,250	8,250	16,500	1	3
	Irrigation Water Conveyance, Pipeline (ft.) 430	0	8,250	8,250	16,500	1	3
	Irrigation Water Management (ac.) 449	0	0	330	330	1	5
	Nutrient Management (ac.) 590	0	0	330	330	1	5
	Pest Management (ac.) 595	0	0	330	330	1	3
	<b>Total Acreage at RMS Level</b>	<b>0</b>	<b>0</b>	<b>330</b>	<b>330</b>	<b>1</b>	<b>3</b>



WATERSHED NAME & CODE		BRAWLEY WASH - LOS ROBLES WASH - 15050304				LANDUSE ACRES		33,000	
LANDUSE TYPE		URBAN				TYPICAL UNIT SIZE ACRES		10	
CONSERVATION COST TABLE		CALCULATED PARTICIPATION				10%			
Conservation Systems by Treatment Level	FUTURE	New Treatment Units	FEDERAL		PRIVATE		Total Present Value Cost	Annual O & M + Mgt Costs	Total Present Value Cost
			Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Installation Cost 50%			
<b>Progressive</b>									
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	74,250		\$0	\$59,400	\$297,000	\$356,400	\$297,000	\$11,880	\$347,043
Irrigation Water Conveyance, Pipeline (ft.) 430	74,250		\$0	\$74,250	\$371,250	\$445,500	\$371,250	\$14,850	\$433,804
<b>Subtotal</b>	<b>2,970</b>		<b>\$0</b>	<b>\$133,650</b>	<b>\$668,250</b>	<b>\$801,900</b>	<b>\$668,250</b>	<b>\$26,730</b>	<b>\$780,846</b>
<b>RMS</b>									
Irrigation Land Leveling (ac.) 464	330		\$0	\$33,000	\$165,000	\$198,000	\$165,000	\$9,900	\$206,702
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428	8,250		\$0	\$6,600	\$33,000	\$39,600	\$33,000	\$1,320	\$38,560
Irrigation Water Conveyance, Pipeline (ft.) 430	8,250		\$0	\$8,250	\$41,250	\$49,500	\$41,250	\$1,650	\$48,200
Irrigation Water Management (ac.) 449	330		\$9,900	\$1,980	\$0	\$10,801	\$0	\$3,300	\$5,080
Nutrient Management (ac.) 590	330		\$9,900	\$1,980	\$0	\$10,801	\$0	\$3,300	\$5,080
Pest Management (ac.) 595	330		\$9,900	\$1,980	\$0	\$10,801	\$0	\$3,300	\$5,080
<b>Subtotal</b>	<b>330</b>		<b>\$29,700</b>	<b>\$53,790</b>	<b>\$239,250</b>	<b>\$319,503</b>	<b>\$239,250</b>	<b>\$22,770</b>	<b>\$308,703</b>
<b>Grand Total</b>	<b>3,300</b>		<b>\$29,700</b>	<b>\$187,440</b>	<b>\$907,500</b>	<b>\$1,121,403</b>	<b>\$907,500</b>	<b>\$49,500</b>	<b>\$1,089,549</b>

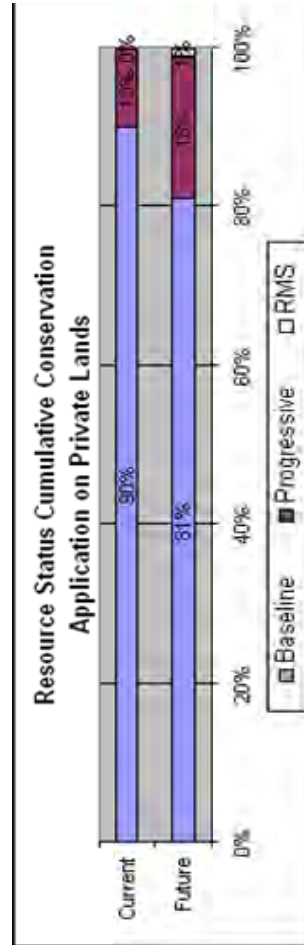


Chart Refers To	
Landuse Type	URBAN
Calculated Participation Rate	10%

Average PV Costs per Ac		
System	Federal	Private
Prog	\$270.00	\$262.91
RMS	\$968.19	\$935.46

## Section 6: References

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## GLOSSARY

<b>Drainage Basin</b>	A region or area bounded by a topographic divide and occupied by a drainage system, also known as a watershed.
<b>Drought</b>	There is no universally accepted quantitative definition of drought. Generally, the term is applied to periods of less than average precipitation over a certain period of time; nature's failure to fulfill the water wants and needs of man.
<b>Flood</b>	A flood is an overflow or inundation that comes from a river or other body of water and causes or threatens damage. It can be any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. It is also a relatively high flow as measured by either gage height or discharge quantity.
<b>Ground Water</b>	The supply of fresh and saline water found beneath the Earth's surface which is often used for supplying wells and springs. Because ground water is a major source of drinking water, there is a growing concern over areas where leaching agricultural or industrial pollutants are contaminating ground water.
<b>Soil Moisture Regimes</b>	<p><b>Aridic</b> is a soil moisture regime that has no water available for plants for more than half the cumulative time that the soil temperature at 50 cm (20 in.) below the surface is &gt;5°C (41° F.), and has no period as long as 90 consecutive days when there is water for plants while the soil temperature at 50 cm (20 in.) is continuously &gt;8°C (46°F.).</p> <p><b>Udic</b> is a soil moisture regime that is neither dry for as long as 90 cumulative days nor for as long as 60 consecutive days in the 90 days following the summer solstice at periods when the soil temperature at 50 cm (20 in.) below the surface is above 5°C (41° F.).</p> <p><b>Ustic</b> is a soil moisture regime that is intermediate between the aridic and udic regimes and common in temperate subhumid or semiarid regions, or in tropical and subtropical regions with a monsoon climate. A limited amount of water is available for plants but occurs at times when the soil temperature is optimum for plant growth.</p>
<b>Soil Orders</b>	A soil order is a group of soils in the broadest category. In the current USDA classification scheme there are 12 orders, differentiated by the presence or absence of diagnostic horizons.
<b>Soil Temperature Regimes</b>	<p><b>Hyperthermic</b> is a soil temperature regime that has mean annual soil temperatures of 22°C (72°F.) or more and &gt;5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.</p> <p><b>Thermic</b> is a soil temperature regime that has mean annual soil temperatures of 15°C (59°F.) or more but &lt;22°C (72°F.), and &gt;5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.</p>

	<p><b>Mesic</b> A soil temperature regime that has mean annual soil temperatures of 8°C (46°F.) or more but &lt;15°C (59°F.), and &gt;5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.</p>
<p><b>Surface Water</b></p>	<p>Water on the earth's surface. Lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or non-navigable, and including the beds and banks of all watercourses and bodies of surface water, that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state; except that waters in treatment systems which are authorized by state or federal law, regulation, or permit, and which are created for the purpose of waste treatment.</p>
<p><b>Watershed</b></p>	<p>The area of land that contributes surface run-off to a given point in a drainage system and delineated by topographic divides.</p>



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