Resource Management Plan
for
Tijeras Arroyo Biological Zone

City of Albuquerque
Parks and Recreation Department
Open Space Division

February 2014

Tijeras Arroyo Biological Zone (Bio-Zone) Open Space Resource Management Plan
Tijeras Arroyo Open Space Properties and Adjacent Lands

City of Albuquerque

ACKNOWLEDGEMENTS

City of Albuquerque

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Acronyms

COA- City of Albuquerque
Bio-Zone- Biological Preservation Zone
Marron- Marron and Associates, Inc.
MPOS – Major Public Open Space
RMP- Resource Management Plan
RMVS- Resource Management and Visitor Service
OSAB- Open Space Advisory Board
ORV- Off-Road Vehicles
OSD- Open Space Division
OSV- Open Space Volunteer program
TABZ- Tijeras Arroyo Biological Preservation Zone
TWV- Trail Watch Volunteer program
CIOTE- Community Interpreters of the Environment

1. EXECUTIVE SUMMARY

The City of Albuquerque (COA) is seeking to establish a biological preservation zone (Bio-Zone) within existing COA Open Space Division (OSD) managed lands, parcels owned by other agencies, and private lands adjacent to a 3.7 mile stretch of the Tijeras Arroyo (Tijeras Creek). A Bio-Zone is an area where conservation of wildlife habitat, restoration to enhance biological diversity, and the protection of all natural and cultural resources are the main functions within the zone. This zone shall restrict development within the Tijeras Arroyo floodplain and focus on managing the zone for its biology, cultural history, and natural character. This will be accomplished by either acquiring parcels within the floodplain or establishing agreements with property owners and managing the Bio-Zone according to the practices described in this plan.

The formal intention to create a Bio-Zone and Resource Management Plan (RMP) was enacted through City Council resolution, C/S R-07-278 (Appendix A), which required the City to develop a master plan for a Tijeras Arroyo bio-zone preserve that described methods of preservation, management, and restoration. An RMP for Tijeras Arroyo was recommended earlier in the COA Major Public Open Space Facility Plan.

The RMP area is located within Tijeras Canyon and Tijeras Arroyo in southeast Albuquerque, Bernalillo County, New Mexico (Figure 1). The RMP location appears on the *Tijeras, New Mexico* U.S. Geological Survey 7.5 minute quadrangle map. The COA Bio-Zone Plan area extends along Tijeras Canyon and the Tijeras Arroyo for approximately 3.7 miles from the Carñuel Interstate-40 interchange westward to the boundary of Kirtland Air Force Base. The width was determined by the arroyo's 100-year floodplain, extending to approximately 500 feet on either side of the arroyo's meander.

The Bio-Zone is dominated by the Tijeras Arroyo, also known as Tijeras Creek, one of the largest arroyos in the Albuquerque Area. This arroyo is the main waterway for most of the snow melt and rain flows from Tijeras Canyon and portions of the East Mountains. It drains over 77 square miles of land in the East Mountains and percolates a significant amount of water back into the aquifer. The Tijeras Creek is a perennial stream with surface flows east of Four Hills Blvd., transitioning into subsurface flows at the Four Hills Fault. Two documented springs occur along Tijeras Canyon and a third was located in 2007-8 that seems to be an important watering hole for wildlife.

The Bio-Zone topography drops from the foothills of the Sandia Mountains onto a broad *bajada* that slopes downward toward the Rio Grande Valley. The eastern half is dominated by woodlands, riparian forest, and scrubland. It forms a narrow but cohesive riparian forest, creating important habitat for local wildlife as well as migratory birds. The western portion features arroyo grassland species.

The greatest diversity of wildlife occurs within the eastern portion of the study area east of Four Hills Boulevard because of greater vegetation cover, access to water and food, and habitat. Now, many animals must cross through residential and industrial areas or over roadways to reach either primary or secondary resources. The preservation of a corridor allowing unimpeded crossing would benefit all species utilizing the study area.

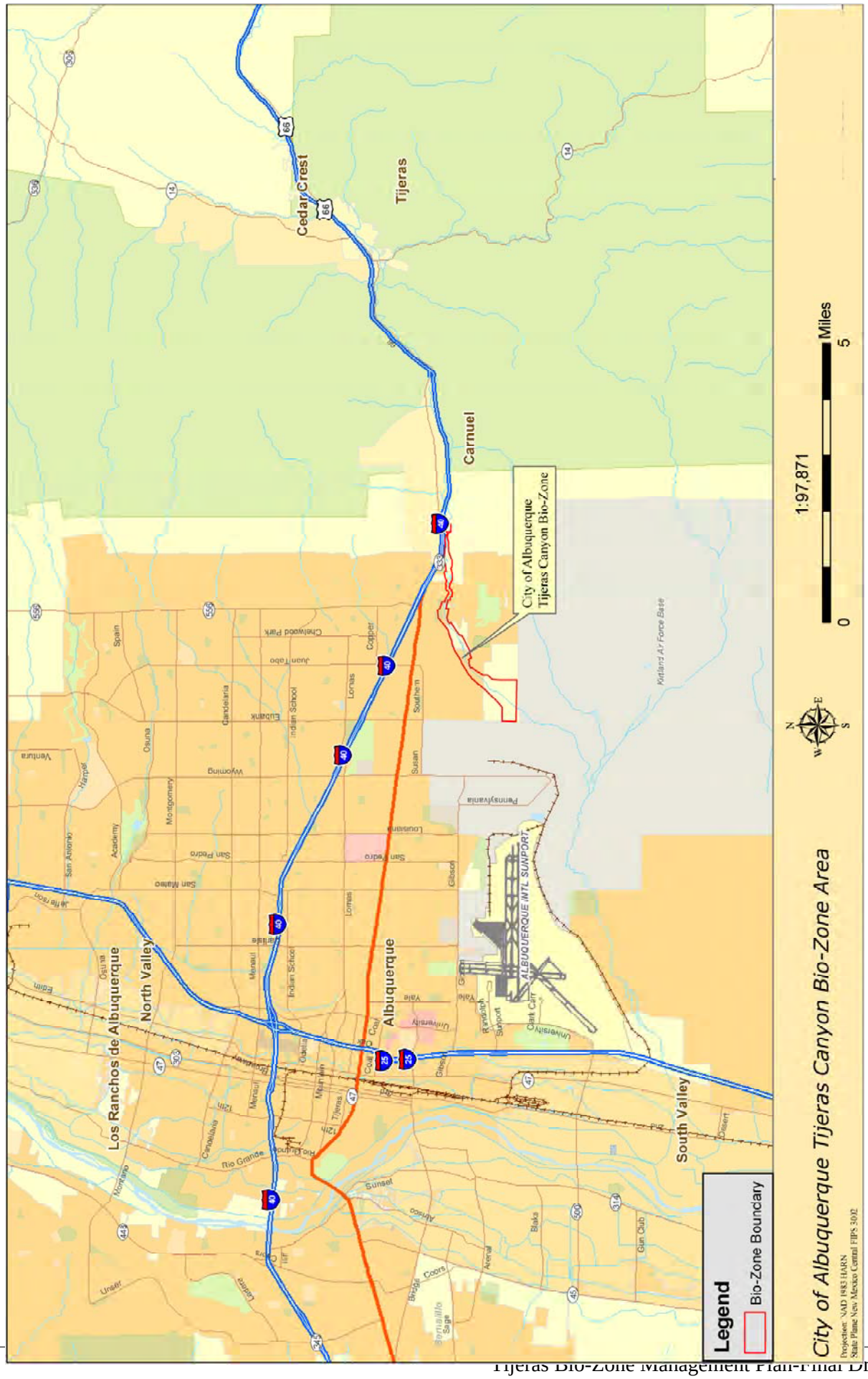

Figure 1. Regional Location Map

One of the most important means of protecting the natural character of the arroyo is by protecting the natural form of the channel. This will keep runoff in contact with the soil for a longer period of time, allowing more infiltration into the soil.[1] It also protects the banks from erosion by slowing storm flows.

1.1. Overall Goals

The main goals of this Bio-Zone Resource Management Plan (RMP) are to conserve remaining native vegetation and wildlife habitat, restore native vegetation and wildlife habitat to increase biodiversity where feasible within the study area, provide increased low-impact recreational opportunities to area residents, and protect cultural resources. Two other important aspects of this Plan are to help preserve the aquifer by allowing water to infiltrate and recharge the aquifer and minimizing, through bio-swale filtering, the amount of storm water pollutants entering the arroyo from adjacent developed areas.

The primary means of protecting the channel is by restricting development. As stated in the Facility Plan for Arroyos: "where appropriate, the entire 100-year floodplain of the arroyo shall be dedicated to or purchased by the City as Major Public Open Space." Therefore, it shall be deemed appropriate under this RMP that the current (2013) 100-year floodplain within the Tijeras Arroyo Bio-Zone (TABZ) be dedicated to or purchased by the City as Major Public Open Space. (See Figure 3**)**

Before conveying any parcel to the City of Albuquerque, private landowners shall remediate all damage to soil, water, and vegetation that has occurred as a result of erosion, littering, dumping, and off-road vehicle use. The City reserves the right to refuse any prospective conveyance that is not in good, natural condition through its ordinary reviews conducted by Real Property Division, including environmental reports.

The City also holds the right to accept, at its discretion, a property requiring clean-up or remediation in exchange from the seller for partial or whole compensation for the clean-up, by either monetary payment or an adjustment in the price of the land.

Two local consulting firms, Marron and Sites Southwest, contributed greatly to the plan through extensive field surveys and reports. Information utilized in this study was gathered from field surveys of the study area, remote sensing, and previous work done in the area. Several private parcels were not surveyed and that information is based on non-field methods and inference.

[1] Policy b of the Water Management section of the Albuquerque/Bernalillo County Comprehensive Plan states that "maximum absorption of precipitation shall be encouraged through retention of natural arroyos and other means of runoff conservation within the context of overall water resource management." Protecting the natural meanders of the arroyo is consistent with this policy.

Historically, the scrubland, forest, and woodland habitats within Tijeras Canyon abruptly transitioned to desert grassland near Tramway Boulevard. Within the last two decades, most of this habitat along the western base of the Sandia Mountains has been developed. Human-associated disturbances in and around the Plan area have created barriers and dangers for wildlife, known as "habitat fragmentation," which likely affects local and long distance movements or migrations. The human population is projected to increase along the study corridor during the next 20 years, which will likely result in further loss of wildlife and habitat if effective and permanent measures are not implemented. This RMP introduces measures to prevent further loss of wildlife and plant habitat.

For future planning, vegetation zones and wildlife habitats within the Plan area were mapped, and locations of preservation and restoration value were identified. Recommendations for preserving and improving habitat are presented. A Class I (records search) and Class II (field reconnaissance) Cultural Resource Survey were conducted by Marron and Associates, Inc. (Marron) and are summarized in section 4 of this RMP.

This RMP is intended to improve the understanding of the vegetative structures, wildlife habitat, and restoration opportunities present within the Plan area. By understanding these variables, habitats can be preserved and enhanced while an increasing human population can also thrive and benefit. The RMP also provides recommendations and implementation measures to preserve and improve vegetation, wildlife habitat and water recharge, and to locate areas for low-impact recreational use in the Tijeras Arroyo Bio-Zone.

A major management obstacle is the different ownership of the parcels in the Bio-Zone Plan area. The parcels are owned by many different private citizens and governmental agencies (See Figure 2) throughout the Plan area. Collaboration, acquisition, transfers, coordination, and possible donations between the parcel owners and COA Open Space Division will be necessary to achieve the goals and objectives of the RMP. In addition OSD must work with private landowners to ensure that development does not damage the channel or fragile habitat areas within the TABZ.

The Open Space Division has been working with the COA Planning Department to coordinate certain aspects of the East Gateway Plan Sector Development Plan with the Bio-Zone RMP. For example, Singing Arrow Park, an adjacent archaeological site, and other City-owned lands nearby could be incorporated into the OSD network to create additional opportunities for parking and trailhead access into the Bio-Zone.

1.1.1. Bio-Zone Goals

1) Conserve and restore natural resources, wildlife, and environmental features;
2) Conserve and protect cultural resources;
3) Provide opportunities for outdoor education and low-impact recreation;
4) Enhance vegetative biodiversity habitat within disclimax (disturbed) areas and the overall Bio-Zone.
5) Facilitate aquifer recharge and help filter storm water pollutants.

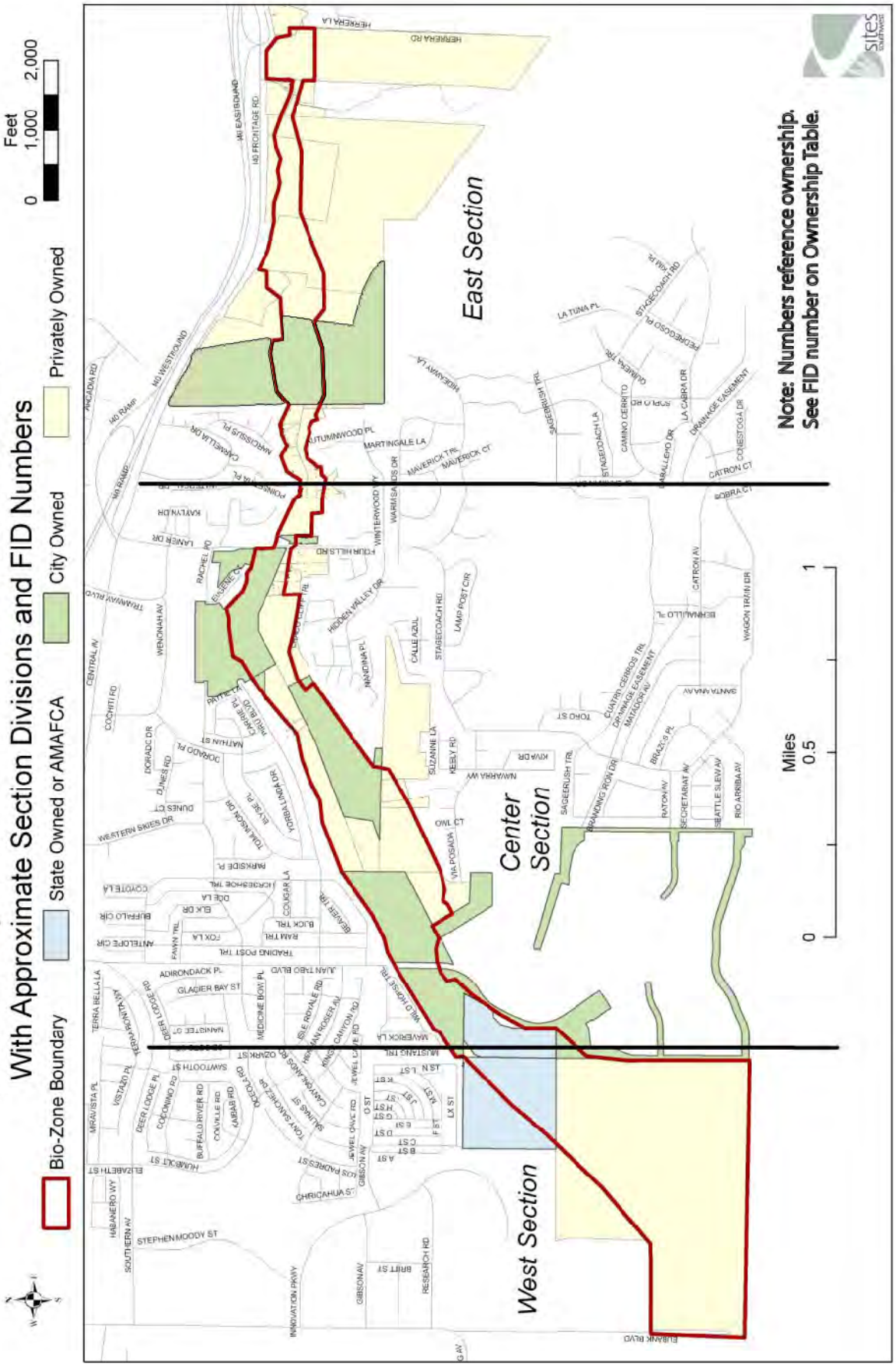

Figure 2. Ownership Categories

1.1.2. Bio-Zone Objectives

- Acquire more parcels within the Bio-Zone to incorporate into the City Major Public Open Space network. This is crucial to allow fluid management of the land as a bio-zone.
- Preserve remaining native vegetation communities;
- Restore native vegetation in needed areas;
- Improve wildlife habitat to ensure species' protection;
- Implement restoration measures, such as bio-swales, to reduce pollutants and toxins washing in from adjacent developments and storm water conveyances;
- Design and install appropriate improvements to City-owned Major Public Open Space areas– provide boundary protection, trails, signs, and other improvements that will enhance visitor experience while protecting vegetation and wildlife habitat;
- Enhance visitor access via designated trail-heads or parking areas;
- Protect sensitive cultural resources and enhance environmental quality;
- Preserve natural channel morphology;
- Develop strategies to minimize erosion, re-vegetate disturbed areas, and protect archaeological sites;
- Provide interpretive and educational opportunities to help visitors of all ages better understand natural systems, human use, and dynamic land management strategies;
- Encourage long-term stewardship of this site through Open Space Volunteer programs to assist and enhance the management and protection of the natural and cultural resources;
- Provide routine patrols by the Open Space staff to inspect site and conditions and to provide information and make contact with visitors and volunteers;
- Provide visitor safety and resource protection with the collaboration of Albuquerque Police Department (APD) Open Space officers;

1.1.3. Bio-Zone Improvements

Access. The Tijeras Arroyo currently has many "owners" and access has been characterized as both a destructive force and a very important aspect of recreation. Too many areas are accessible by vehicle, resulting in problems such as off-road vehicle trespass and illegal dumping. OSD will determine areas that are acceptable for pedestrian access and where vehicular should be prohibited. Official parking areas currently do not exist. A few options do exist for future official parking areas. Possible future sites for official parking areas include Singing Arrow Park, an area near a future fire station/commercial development (shared parking) southeast of the Juan Tabo Bridge at the Tijeras Arroyo, and an area off Four Hills Road. As housing subdivisions are being developed rapidly in the area, it will be critical to designate low-impact recreational use through designated access points for nearby residents as well as parking areas for citizens who drive to the area.

Boundary protection. As acknowledged in the City of Albuquerque Major Public Open Space Facility Plan, signs need to be posted to identify boundaries, access points and regulations. Per a meeting with the Juan Tabo Hills LLC owners, boundary protection began spring 2009 with the developer of Juan Tabo Hills by installing a gate and temporary fencing along the arroyo Open Space boundary southeast of the Juan Tabo Bridge. Once build-out completes, OSD will fence all COA OSD parcels. Areas to the west near Eubank Blvd. need access control measures installed by the appropriate owners. OSD will work with owners to accomplish this.

1.2. Bio-Zone Implementation (Report Section 9.1)

The following actions shall be implemented to reach the overall goals of this RMP. If the policies and implementation to safeguard the property are not followed, any potential restoration work is likely to fail or even be reversed. These policies and actions will help carry out existing City plans for this area, such as the *The City of Albuquerque Major Public Open Space Facility Plan* and the *Bernalillo Albuquerque Comprehensive Plan.*

The two main considerations to safeguard the Bio-Zone are 1) to establish access control and 2) to protect habitat and restoration areas. In order to safeguard the entire Bio-Zone boundary, this plan, once officially adopted, will act as a document designating the area a Biological Zone. Further protection measures should then be sought.

City Open Space Division should acquire, through purchase, donation or easement, the most sensitive sites to prohibit destruction through development. The plan prioritizes the parcels for acquisition based on resource value and development pressure. Acquisition of new MPOS lands may happen in a number of ways:

1) Fee simple transactions (purchase)
2) Transfer of development rights for plats not yet developed
3) Private donations
4) Conservation easements
5) Land swaps with other agencies

To protect the arroyo from erosion, the Open Space Division (OSD) should attempt to acquire the entire active channel. At a minimum, Open Space should work with private landowners interested in developing parcels in and around the TABZ to establish protection and conservation measures.

Implementation shall focus on three main areas of concern:

- The first is drainage, which is increasing in importance as residential development continues to surround the arroyo. Coordination with AMAFCA, Bernalillo County and private land owners will be essential to successfully manage drainage and mitigate release of pollutants and contaminants.

- Second, the persistent illegal motorized vehicle recreational activity in the arroyo threatens to further degrade habitat and vegetation and disturb and displace

wildlife as well as destabilize the slopes. Access control is critical to preserving the study area and to successfully restore the degraded land. Fencing and signing the entire boundary is critical and must be implemented. OSD will work with surrounding owners to accomplish this.

- Third, after the property boundary is protected and access is limited to only pedestrians, volunteer involvement to start implementing restoration strategies (as outlined in section 8.2) will be needed. Ongoing habitat restoration and other projects along with monitoring will be crucial to achieving success the goals and objectives outlined in this RMP.

Cultural resource protection is also one of the goals and objectives for this RMP. No specific sites shall be disclosed to the public except on guided interpretive tours only. The protection of these sites is crucial to their survival and significance of human history in the area. Archaeological clearances must be implemented by the OSD prior to any and all restoration and trail work within the City-owned Bio-Zone areas.

1.2.1. Environmental Education and Interpretation (Report Section 9.2)

Educational and interpretive themes will need to be developed or existing programs used by City staff. Due to current OS staffing, guided hikes may be conducted by trained volunteers who are members of the TWV program under the Community Interpreters of the Environment (CIOTE) volunteer program. There may also be opportunities to collaborate with other interested groups or organizations that are interested to help in interpretive tours.

1.2.2. Trail Improvements (Report Section 9.3)

City staff will attempt to have a minimum of two volunteer trail projects each year. Most trail work at TABZ will involve new trail construction and the rerouting or closure of social trails. Improvements may also consist of enhancing drainage within the trail system. Berm removal and drain dips are two ways of increasing the effectiveness of keeping water off the trails, thus slowing erosion of the trail. Rerouting steep sections of existing trails will need to be considered; new trail construction shall follow hillside contours. These improvements should mitigate erosion and provide a safe, fun, and sustainable trail system.

1.2.3. Parking Area (Report Section 9.4)

The proposed parking lot near the Juan Tabo Bridge will depend on the timing of the Juan Tabo Hills subdivision build-out. This build-out, which is to include a City- owned fire station, may take several years. When the parking area is constructed, the OSD will install appropriate signage near the trailhead and parking area. Other parking areas shall be considered for future development when and if the City can acquire more land within the Bio-Zone. Otherwise, coordination with private land owners and other agencies who own land within the Bio-Zone could provide accessibility to people who want to park and recreate throughout the TABZ.

Table 1. Implementation Table

Project	Description and/or Justification	Lead Agency
Drainage Management and Improvements	Various drainage improvements as needed to support the arroyo's main function. Monitoring of drainage outlets to ensure continued land health.	AMAFCA
Access Control	Location and installation of property fencing, Location of trailheads and parking areas, locating and installing regulatory signage to protect the land from illegal activity.	COA Parks and Recreation, Open Space Division
Land Restoration and Remediation	Restoration of wildlife habitat and land health to parcels that the City owns or is considering accepting as Open Space. Includes erosion control, trash cleanup, and re-vegetation.	TBD
Environmental Education and Interpretation	Planning and installation of interpretive signage at trailhead kiosks to increase awareness and promote environmental stewardship of the Bio-zone.	COA Parks and Recreation, Open Space Division
Trail Building and Maintenance	Design and building of natural surface trails for passive recreation.	COA Parks and Recreation, Open Space Division
Community Inclusion	Recruitment of volunteers from the neighborhood for Trailwatch and maintenance in order to promote "eyes on Open Space," community stewardship and education, and support access control and land remediation efforts.	COA Parks and Recreation, Open Space Division
Other Facility Improvements	Location and installation of restrooms and shade structures where desirable.	COA Parks and Recreation, Open Space Division

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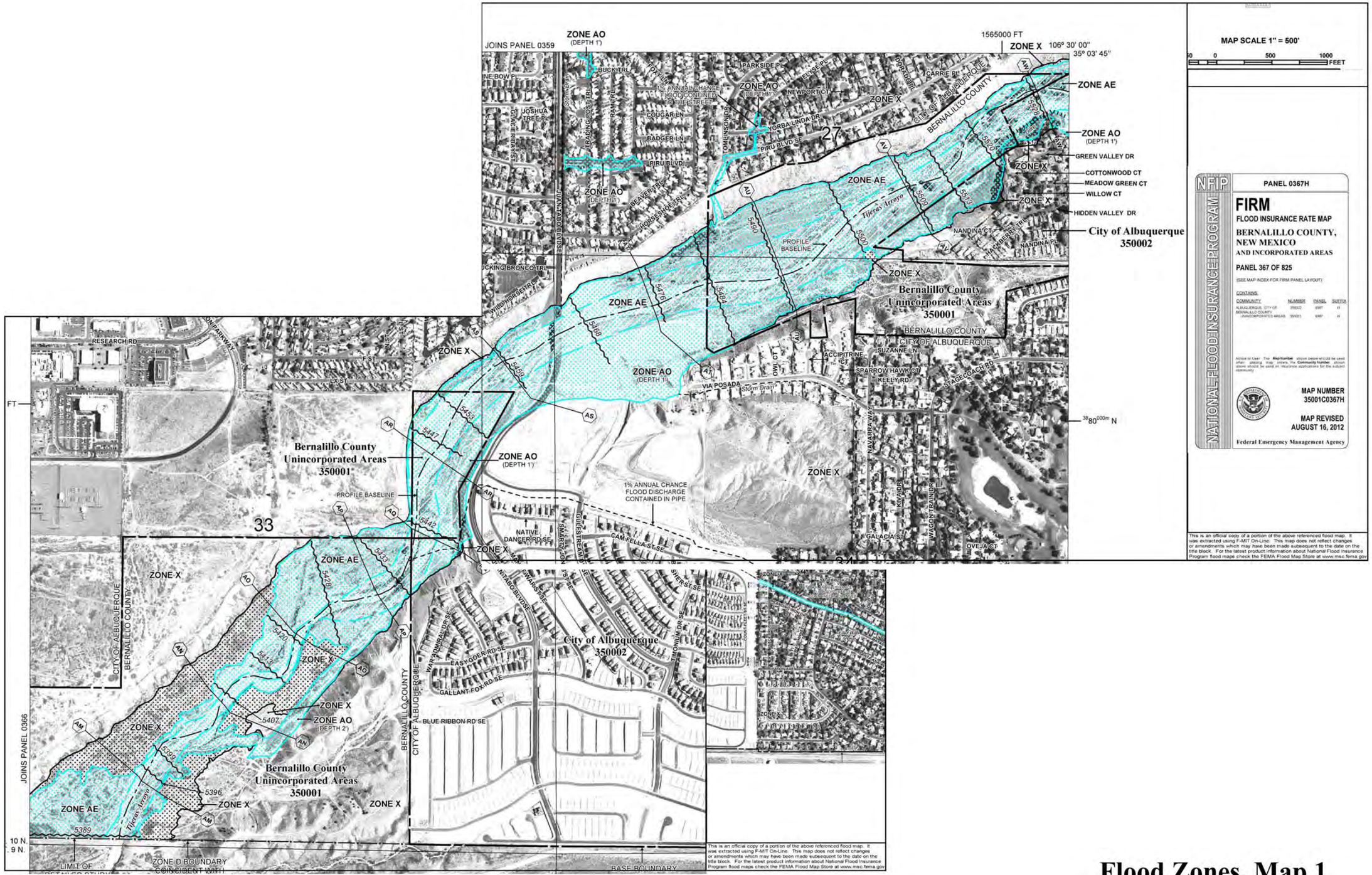
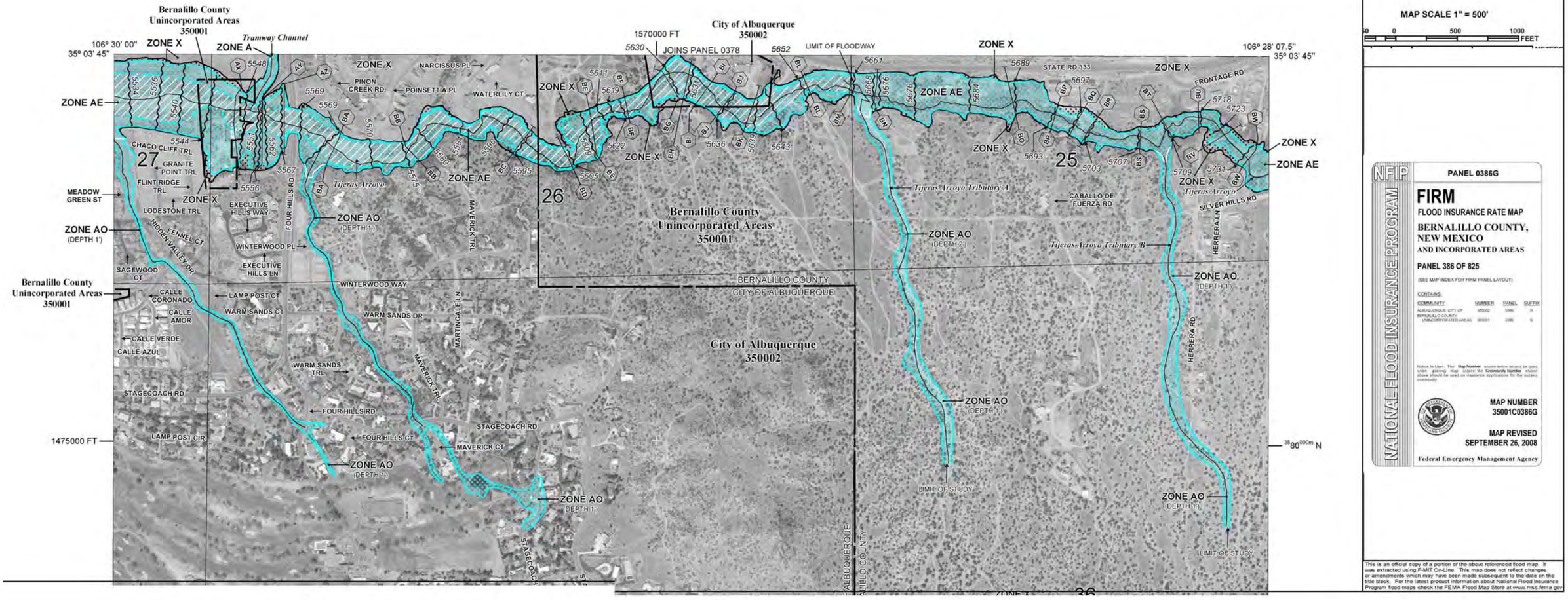
Figure 3. Flood Zones



Flood Zones, Map 1



MAP SCALE 1" = 500'

0 500 1000 FEET

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0386G

FIRM

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 386 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0386	G
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0386	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
35001C0386G

MAP REVISED
SEPTEMBER 26, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Flood Zones, Map 2

2. PLAN INTRODUCTION AND PURPOSE

The Tijeras Arroyo Biological Zone Resource Management Plan (RMP) is a working document that provides guidance for management and use of this site. The primary goal of the plan is to outline measures that will aid in the conservation of the natural and cultural resources and to identify opportunities for public recreation.

3. PROPERTY DESCRIPTION & EXISTING CONDITIONS

The Plan area is located within approximately 50 acres adjacent to and within Tijeras Canyon and Tijeras Arroyo for approximately 3.7 miles from the Carñuel Interstate-40 interchange westward to the boundary of Kirtland Air Force Base in southeast Albuquerque, Bernalillo County, New Mexico (Figure 1). This location appears on the *Tijeras, New Mexico* U.S. Geological Survey 7.5 minute quadrangle map.

Development within the Tijeras Arroyo area has increased over recent years, resulting in further impacts to already restricted wildlife populations and further loss of connectivity between important mountain and lowland resources. Urban infrastructure and development result in wildlife habitat loss, increased abundance of domestic predators (dogs and cats) , and loss of vegetative cover—all barriers to the movement of local wildlife. This results in increased population fragmentation, generalist species invasions, and reduced genetic diversity within plant and animal populations[2].

The human population is projected to increase along the study corridor during the next 20 years[3], which will likely result in further loss of habitat and connectivity if effective and permanent measures are not implemented.

[2] Jaeger and Fahrig 2004, Marvier et al. 2004, Trombulak and Frissell 2000, Evink et al. 1996, Bennett 1991, Saunders and Hobbs 1991, Harris 1984, Adams and Geis 1983, Oxley et al. 1974.
[3] Bureau of Business and Economic Research 2008.

1. Looking east from Juan Tabo Bridge of the TABZ. This is the central section of the area.

3.1. Topography

Topographic relief within the site begins at 5,700 feet at the east end and declines to 5,380 feet at the west end. Overall, the TABZ is not steep within the arroyo but tends to have steep and rocky side slopes at the eastern end of the zone. The western end of the Bio-Zone has steep sections leading up to housing developments, with little or no rock outcrops. See the topographic map (Figure 4).

2. Topography shows a steep and rocky eastern end of the zone (left) and a less rocky but steep section along the western end of the property (right).

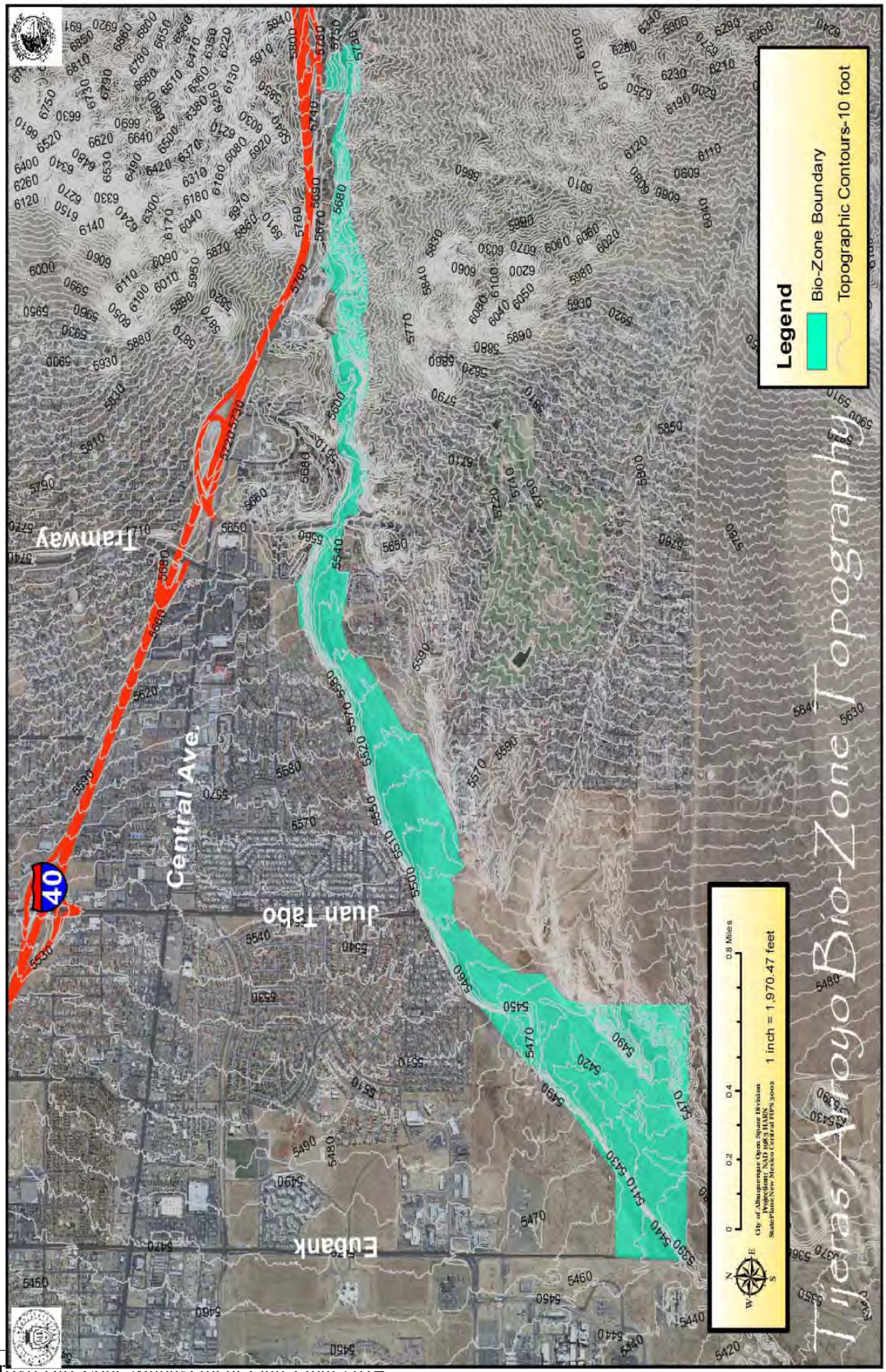


Figure 4. Topography

3.2. Soils

Area soils consist of various loams, sands, rock outcrops, and gravels (See Figure 5. Soils Map). Soil mapping units that most commonly occur within the study area are (NRCS web soils survey 2008):

(BKD) Bluepoint-Kokan association, hilly
(Te) Tesajo-Millett stony sandy loam
(ROF) Rock outcrop-Orthids complex, 40 to 80 percent slopes
(EmB) Embudo gravelly fine sandy loam, 0 to 5 percent slopes
(EtC) Embudo-Tijeras complex, 0-9 percent slopes
(MWA) Madurez-Wink Association, gentle slopes
(WeB) Wink-Embudo Complex, 0-5 percent slopes
(TgB) Tijeras gravelly fine sandy loam, 1 to 5 percent slopes
(Cu) Cut and fill land
(GA) Gila fine sandy loam

The Tijeras Arroyo Biological Zone consists of multiple soil series, each are briefly described in this section.

3.2.1. Bluepoint-Kokan Association, hilly (BKD)

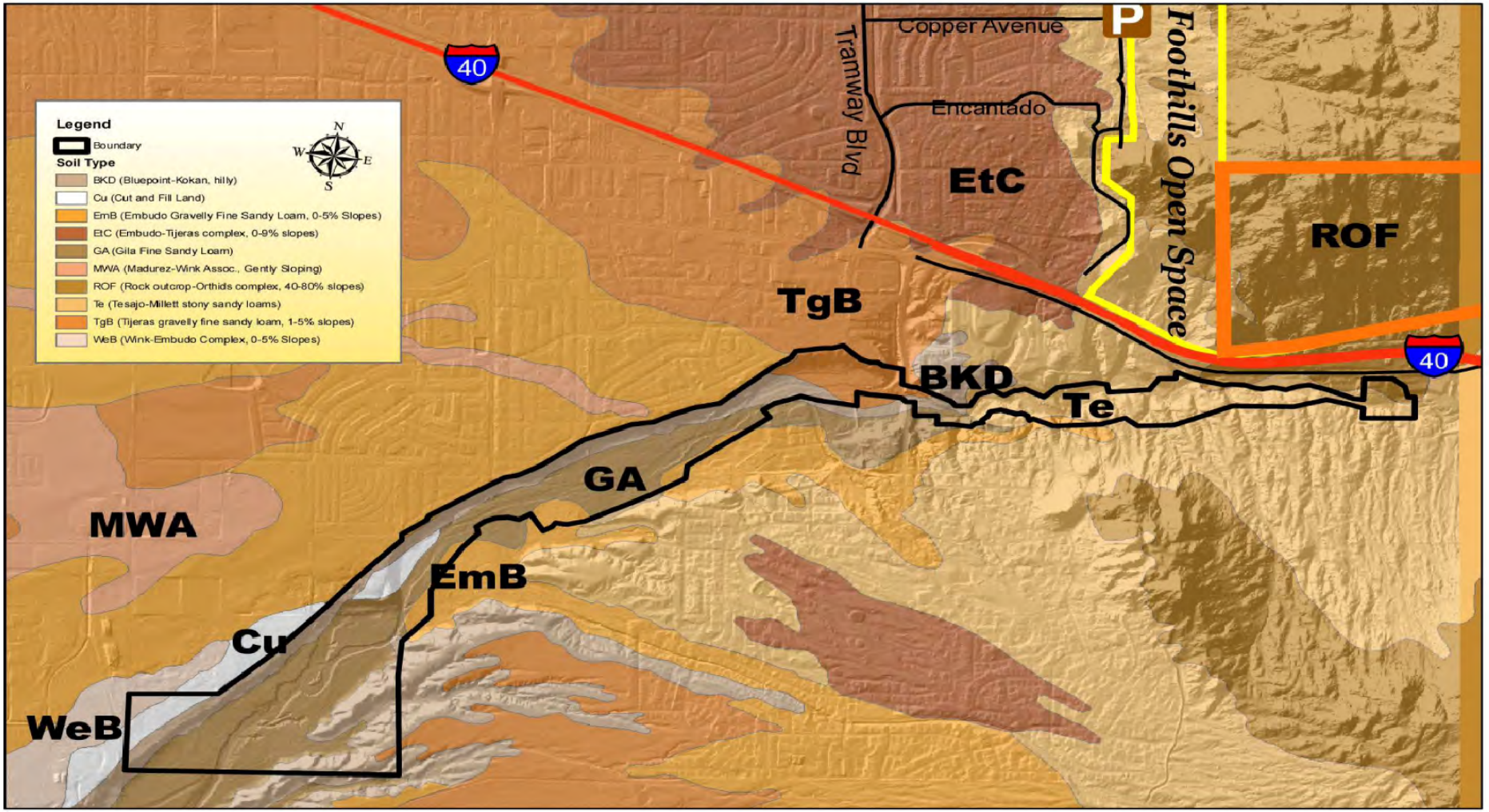
The Bluepoint-Kokan association is 50 percent Bluepoint loamy fine sand and 40 percent Kokan gravelly sand. The gently rolling Bluepoint soil is on alluvial fans between gravelly ridges of the hilly to steep Kokan soil. This series consists of deep, somewhat excessively drained soils that formed in sandy alluvial and Aeolian sediments on alluvial fans and terraces. The soil is slightly calcareous and mildly to moderately alkaline. Runoff tends to be slow and water erosion is moderate to severe. This soil association is beneficial for range, watershed, wildlife habitat, recreation, and community development.[4] This soil occurs along the western and central sections of the Bio-Zone's north slope of the Tijeras Arroyo.

3.2.2. Tesajo-Millett Stony Sandy Loam (Te)

The Tesajo series is associated by Tesajo-Millett stony sandy loam soil (Te) within the management plan area. The Te soil derives from decomposed granite rock and settles as alluvial fans on slopes ranging between 3 and 20 percent. The Te soil typically exists in elevations from 6,000 to 7,000 feet. This soil receives an average annual precipitation of 10 to 14 inches and averages 145 to 185 frost free days per year. Water runoff is medium and erosion susceptibility is moderate.[5] The eastern section of the Bio-Zone is made of nearly 100 percent Te soils with the exception of the large rock outcrops that occur on the sides of the arroyo.

[4] Bernalillo County Soil Survey, Leroy W. Hacker of the Soil Conservation Service in Cooperation with New Mexico Agricultural Experiment Station.1977. 38-39
[5] Ibid, 38-39.

Figure 5. Soils



3.2.3. Rock outcrop-Orthids complex (ROF)

The Pino series is associated by Rock outcrop-Orthids complex (ROF) with slopes of 40 to 80 percent and elevation ranges from 6,000 to 8,000 feet. The ROF complex consists of moderately deep and well drained soils which formed out of material weathered from limestone and shale on the ridges and sides of mountains. Rock outcrops occur where limestone, schist, gneiss, or granite has been exposed through geomorphic processes like uplift, faulting, wind and water erosion. The average annual precipitation is 16 to 20 inches and has 80 to 110 frost-free days. Runoff is extremely rapid due to the steep slopes and the susceptibility for soil erosion due to water and wind is moderate to high. This soil is a good use for watershed, low-impact recreation, and wildlife habitat.[6] The eastern section of the Bio-Zone boundary is dominated by steep slopes and large rock outcrops on either side of the arroyo.

3.2.4. Embudo Gravelly Fine Sandy Loam (EmB)

The Embudo Series consisting of Embudo gravelly fine sandy loam (EmB) and Embudo-Tijeras complex (EtC) are deep, well drained soils that formed in alluvium derived from decomposed granitic rocks on old alluvial fans. The Embudo Series is closely associated with the Tijeras and Wink soil series. This includes the following soils in the plan area: **Madurez-Wink Association (MWA), Wink-Embudo Complex (WeB), and the Tijeras gravelly fine sandy loam (TgB)**. Overall, these soils represent a surface layer of fine sandy loam about 4 inches thick. Below this layer is about 16 inches of gravelly sandy loam. Below this depth is stratified gravelly loamy coarse sand to approximately 60 inches deep. These soils are moderately alkaline and very permeable. The Tijeras Arroyo consists primarily of the Embudo, Madurez, and Wink soil series. These soils are suitable for use as range, watershed, wildlife habitat, and community development.[7] EmB soils can be found on the southern sides of the Tijeras Arroyo within the central to western sections of the Plan area. WeB soil is found at the western tip of the Bio-Zone, while MWA is close to the boundary but not within the actual Bio-Zone boundary. These three soils are all related and essentially composed of similar material associated with sandy arroyo beds.

3.2.5. Cut-and-Fill Land (Cu)

Cut and Fill Land (Cu) is made up of sandy loam and very gravelly sands that have been mixed by filling for residential, industrial, and business developments. Cu usually consists of Bluepoint, Kokan, and Wink soils. This soil is permeable and runoff is slow to very rapid (depending on slope) while the hazard of erosion is slight to severe. This soil is used primarily for community development and watershed.[8] This soil is mapped

[6] Ibid, 1977. 31-34.
[7] Bernalillo County Soil Survey, Leroy W. Hacker of the Soil Conservation Service in Cooperation with New Mexico Agricultural Experiment Station, 1977. 17-18, 43-44.
[8] Ibid, 1977. 17.

within an extremely disturbed section of the Bio-Zone boundary along the western north-slope. Most likely, developers and contractors building new construction near Eubank and the arroyo spread cut- and-fill sandy soil into this area. This soil also could have been deposited when the area was used as a City landfill.

3.2.6. Gila Fine Sandy Loam (GA)

The last soil series within the plan area is the Gila Series and comprises most of the Plan area. The Gila Series are deep, well drained soils that formed in recent alluvium on the flood plains along the Rio Grande and Rio Puerco. Slopes are not steep, only sloping from 0 to 2 percent. The GA has a 5 to 15 percent gravel structure and a surface layer that differs in texture. Stream-washed sand and gravel are in the channels. Runoff is slow and flooding is a hazard, while water erosion is moderate. This soil is typically used for wildlife habitat, community development, and watershed.[9] This soil resides in the central section and makes up most of the arroyo to the western lower elevations of the Bio-Zone area. Specifically, the Gila fine sandy loam (GA) makes up most of the soil within the arroyo bed.

3.2.7. Precipitation

Albuquerque, New Mexico receives approximately 8.7 inches of precipitation annually (reading taken at the Albuquerque Sunport), mostly occurring from July through October. Average maximum high temperatures reach approximately 70 degrees Fahrenheit (F). Average minimum low temperatures approach 43 degrees Fahrenheit (F). The average annual maximum temperature at the nearby Tijeras Ranger Station is 66.4 degrees Fahrenheit (F). The average low in January is 15.3 degrees F and the average high in July is 88 degrees F. Annual average precipitation is approximately 15.31 inches per year, with approximately 13.8 inches of snow contributing to the precipitation level (New Mexico Climate Summaries 2008). Data from the National Weather Service conclude that the area around the TABZ typically receives 14 inches of precipitation, of which snow fall is recorded as a liquid measure. Rainfall is usually in the form of short, intense summer rains. (See precipitation map, Figure 6)

[9] Ibid, 1977. 19.

Figure 6. Annual Precipitation

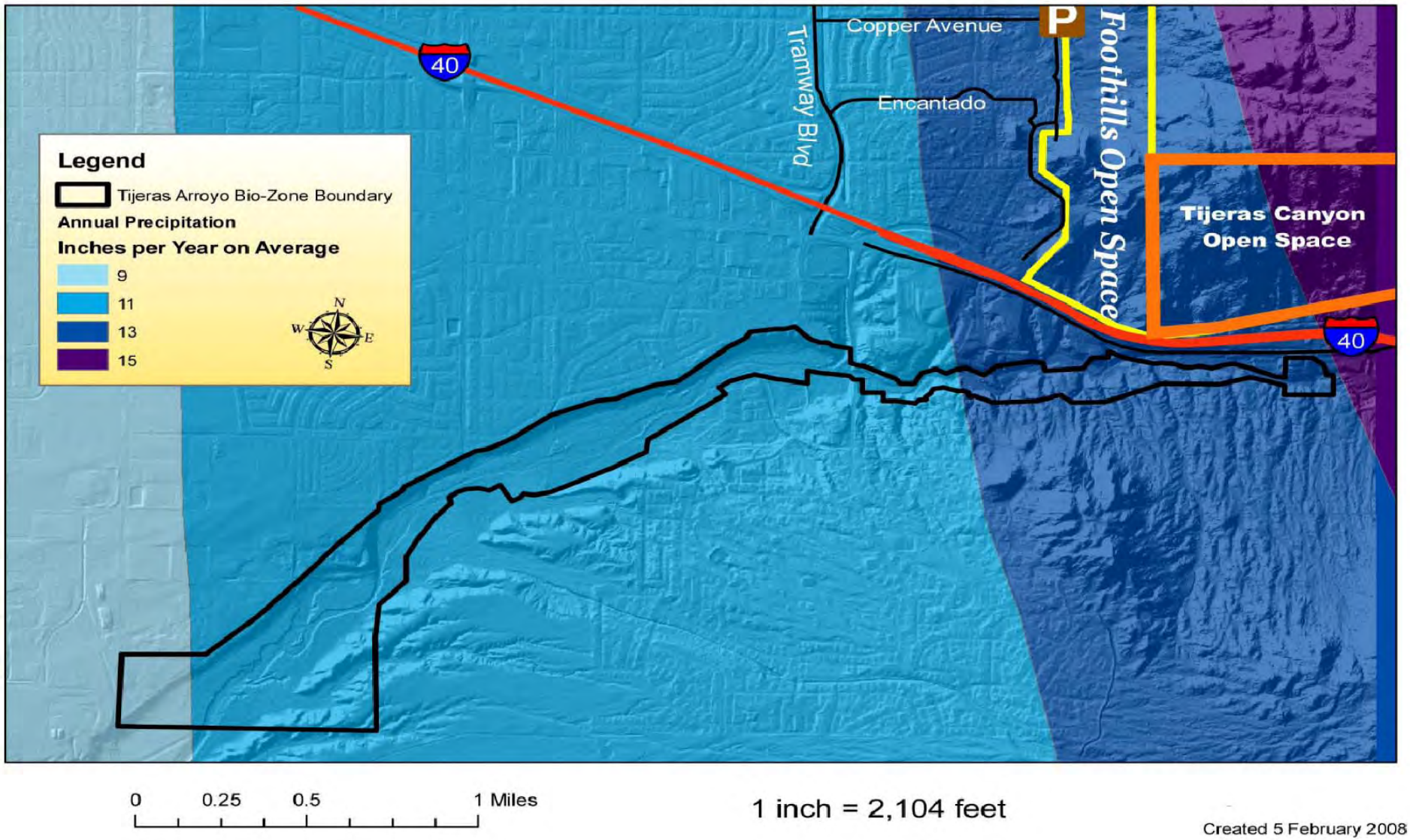


Table 1. Average Climate Data for Albuquerque

Month	30 Year Avg. Temp. (°F)	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	30 Year Avg. Precipitation (in.)
Jan	36.5	47.0	22.0	0.5
Feb	41.6	53.0	26.0	0.6
Mar	47.9	61.0	32.0	0.6
Apr	56.0	71.0	40.0	0.6
May	65.2	80.0	49.0	0.6
June	75.0	90.0	58.0	0.6
July	78.8	92.0	64.0	1.3
Aug	76.4	89.0	63.0	1.7
Sept	69.6	82.0	55.0	1.1
Oct	57.2	71.0	43.0	0.9
Nov	44.7	57.0	31.0	0.6
Dec	36.6	47.0	23.0	0.4
Year	57.2	70.0	42.2	9.4

Source: National Climatic Data Center 2006; Weather Underground 2006

3.3. Geology

The lower elevations within the western section of the TABZ consist of alluvium deposits and some cut-and-fill deposits. The alluvium deposits are the result of past and present erosional processes of the Sandia Mountains. Several arroyos have deposited this alluvial material on the lower portions of the property. The higher elevations to the east are characterized by steep-sided, boulder-strewn slopes with granite outcrops. The geologic record shows the type of rock and other material and the time period when the formations occurred. The geologic record for the plan area represents two significant occurrences. The eastern section of the Bio-Zone boundary consists of Middle Proterozoic plutonic rocks that are from New Mexico's earliest formations, symbolized as Yp. The Yp is roughly 1.6 billion years old from the Precambrian era and Proterozoic period. The western section is categorized as Piedmont alluvial deposits and is much more recent in the geologic timeline than the Yp formation. These are from the Zenozoic era and upper to middle Quaternary period (approximately 10,000-20,000 years ago (See the geologic map, Figure 7).

3.4. Hydrology

The Tijeras Arroyo Biological Zone is dominated by the Tijeras Arroyo, also known as Tijeras Creek. This is the main waterway for most of the snow melt and rain flows from Tijeras Canyon and portions of the East Mountains. The Tijeras Arroyo is one of the largest arroyos in the Albuquerque area. The arroyo drains over 77 square miles of land in the East Mountains and percolates a significant amount of water back into the aquifer. The Tijeras Creek is a perennial stream with surface flows east of Four Hills Blvd. transitioning into subsurface flows at the Four Hills Fault. There are three main hydrologic issues in this Plan area.

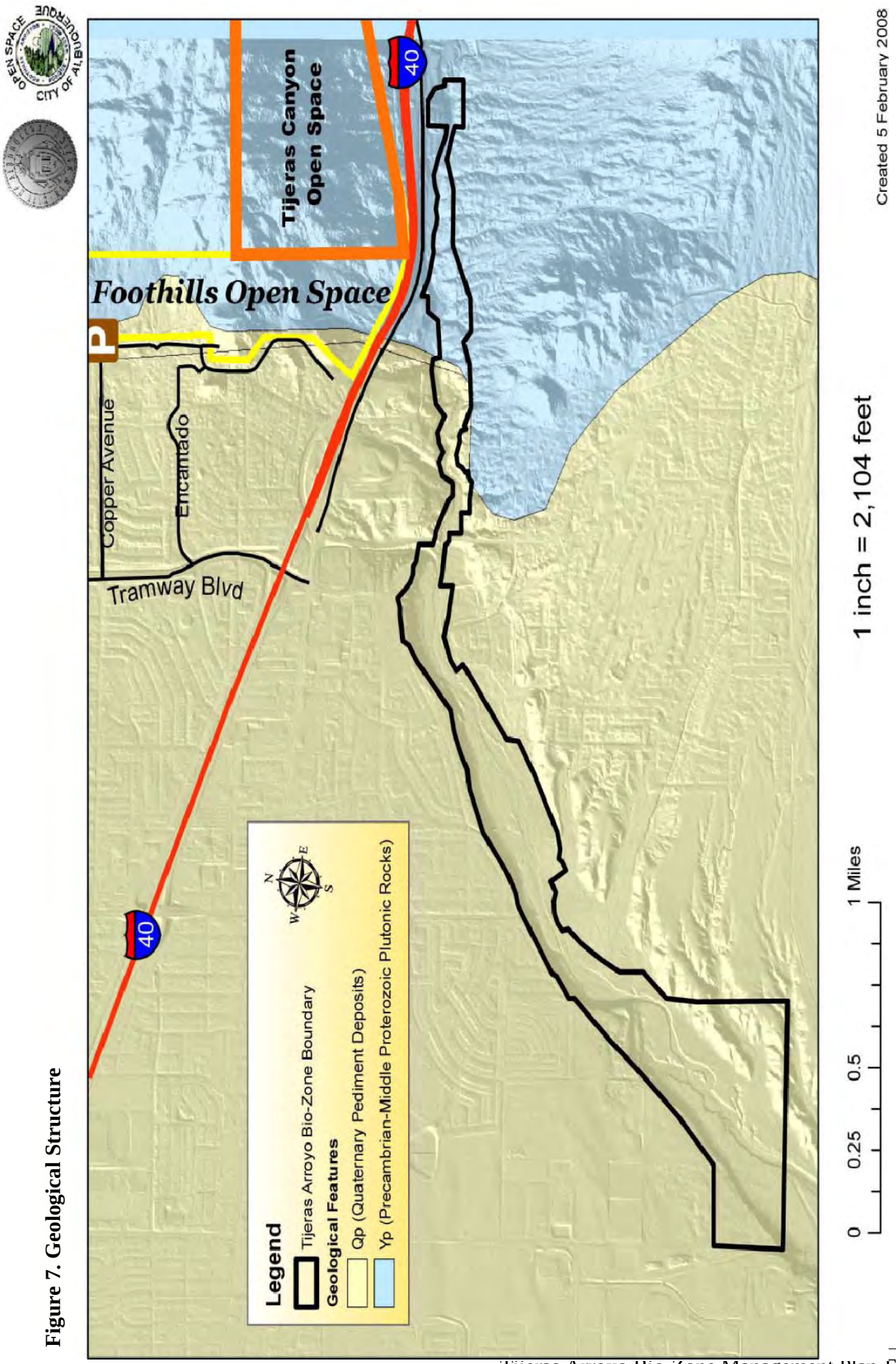


Figure 7. Geological Structure

The foremost hydrologic issue is flash flooding. Without warning, flash floods can inundate the area at extremely high rates of speed with large amounts of water. This issue is important when determining what portions of the Bio-Zone should be acquired as Major Public Open Space and what areas could be developed. Areas with the potential to flood should be considered for acquisition as MPOS. Future and potential acquisition is detailed in section 6.1 and 8.1.

The second hydrologic issue involves surface water runoff from surrounding developments and storm drains. Recommendations to reduce the contamination of pollutants within the arroyo are outlined in section 8.2.

Third, future trail development and the use of existing trails should be evaluated with the goal of minimizing soil erosion caused by water runoff. All trails should follow "sustainable" guidelines when being planned, constructed, and maintained. (See section 6.3.)

Two documented springs occur along the Tijeras Canyon (*Tijeras, New Mexico* U.S. Geological Survey 7.5 minute quadrangle map). The first appears to originate at the toe of the north slope of Tijeras Canyon just above Tijeras Creek. There does not appear to be surface discharge associated with it, but a stand of salt cedar occurs there most likely due to subsurface flows or seepage. The second spring appears to be located at the base of the north slope of the canyon just above a dam that has been constructed within the channel of Tijeras Creek.

A third spring located within the study area has not been documented. It was located during a previous survey of the Tijeras Canyon area. This spring occurs in an unnamed side canyon just south of Tijeras Canyon Frontage Road where surface water was present both in 2007 and 2008. It appears to be an important waterhole for wildlife and is located near a documented wildlife crossing point.[10] Please see the *Wetlands* section under 3.4 Plant Communities for more information.

3.5. Plant Communities

Six vegetation types occur within the study area (Vegetation Map, Figure 8) including[11]:
Arroyo Riparian;
Desert Grassland;
Lower Montane Scrub;
Juniper Savanna;
Lower Montane Riparian Forest; and

[10] Marron and Associates, Inc. 2007
[11] Dick-Peddie. 1993

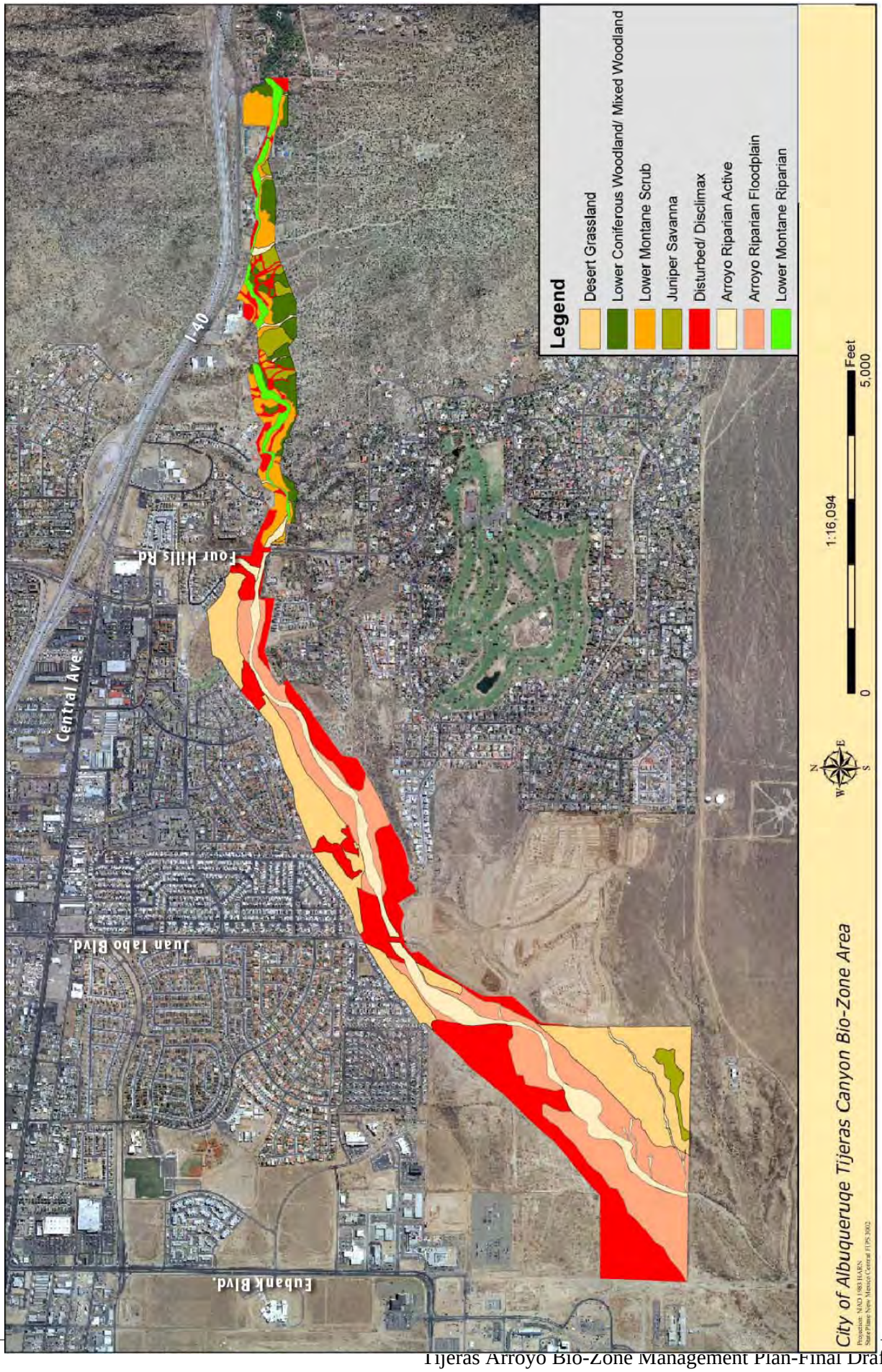


Figure 8. Vegetation

3.5.1. Lower Coniferous/Mixed Woodland

In addition to these natural climax plant communities, several disturbed areas are present that support exotic invasive or weed species. Field surveys were combined with data from previous surveys of both Tijeras Canyon and Kirtland Air Force Base to identify a total 152 vascular plant species representing 45 families that occur in the area (Appendix B).

The study area drops from the foothills of the Sandia Mountains onto a broad *bajada* that slopes downward toward the Rio Grande Valley. The eastern half of the study area is dominated by woodlands, riparian forest, and scrubland and the western portion supports principally arroyo grassland species. The dominant topographic feature located within the study area is the Tijeras Arroyo. Distinct changes in vegetation occur along the length of this drainage from the foothills into the grassland. East of Four Hills Boulevard, the arroyo becomes a creek environment dominated by lower Montane Riparian Forest. The western portion near Four-Hills Boulevard has a gentle grade with a distinct active channel and broad floodplain which carry surface flows during flood events.

3.5.2. Arroyo Riparian

Arroyo Riparian vegetation occupies drainages that flow occasionally. These flows, though infrequent, can be substantial, which results in scouring the drainage bottom. The ephemeral availability of surface water within arroyos is usually insufficient to support wetland vegetation. However, distinct plant communities composed of perennial shrubs and annual species favor these arroyo habitats. Common plant species inhabiting Albuquerque area arroyos are rubber rabbitbrush (*Ericameria nauseosa*), which lines ephemeral waterways from their upland sources to the grassland habitats; Apache plume (*Fallugia paradoxa*), skunkbush sumac (*Rhus trilobata*), and brickellbush (*Brickellia* sp.).

Because of scouring, vegetative cover within channels is often less than one percent. Nearly all of this cover comes from annual species that quickly establish, mature, and seed before they are swept away by seasonal flows. Some of the most common herbaceous species observed within active arroyo channels in the Albuquerque area include hoary aster (*Machaerantha canescens*), cheet grass (*Bromus tectorum*), roughseed clammyweed (*Polanisia dodecandra*), annual sunflower (*Helianthus annuus*), Russian thistle (*Salsola tragus*) commonly known as tumble weed, and cocklebur (*Xanthium strumarium*).

3.5.3. Upper Arroyo Riparian - Active Channel

Tijeras Canyon is fed by a number of small, narrow, steeply graded arroyos that drain into the canyon from the south. They are lined by rubber rabbitbrush, Apache plume, and brickellbush. Skunkbush sumac occurs where rocky substrata line the arroyo banks. Active arroyo channels support predominantly cheet grass, roughseed clammyweed, and hoary aster. This community type is classified by Dick-Peddie (1993) as the Arroyo Riparian Apache plume Series. It occurs east of Four Hills Boulevard generally above 5,600 feet in elevation.

3.5.4. Lower Arroyo Riparian Active Channel

The portions of Tijeras Arroyo west of Four Hills Road are characterized by an incised channel flanked by a broad floodplain. The active channel is lined by rubber rabbitbrush and occasionally four-wing saltbush (*Atriplex canescens*). Apache plume occurs in some areas, but is far less abundant than in the upper channel habitats. The actual channel bottom supports hoary aster, cheet grass, annual sunflower, Russian thistle, and patches of cocklebur in low spots. Siberian elms (*Ulmus pumila*) and tree-of-heaven (*Ailanthus altissima)* occur occasionally.

3.5.5. Arroyo Riparian Floodplain

Large portions of the west end of the study area are dominated by Arroyo Riparian Floodplain vegetation. This flat floodplain environment is generally dry, but is occasionally subject to storm water surges that overtop the bank of the active channel. The soils within this habitat are finer than the active channel, and the dominant vegetation consists of a shrub community. The most common species located within this habitat is four-wing saltbush. Rubber rabbitbrush is also common in the areas adjacent to the active channel.

Broom snakeweed (*Gutierrezia sarothrae*), along with grasses such as alkali sacaton (*Sporobolus airoides*) and purple threeawn (*Aristida purpurea*) are also present. Dick-Peddie recognizes this community type as the Arroyo Riparian Desert Shrub Series usually dominated by saltbush, rubber rabbitbrush and greasewood (*Sarcobatus vermiculatus*). Much of this floodplain is affected by scouring and vehicle impacts. Consequently a variety of weedy species such as Russian thistle, and summer cypress (*Kochia scoparia*) are present.

3.5.6. Desert Grassland

Desert Grassland is a complex vegetation type that many investigators believe represents a transitional community forming the ecotonal boundary between the desert vegetation of dry lowlands and plains grassland vegetation. Many authors believe that Desert Grassland is a product or recent degradation of grassland habitats that favored the establishment of desert species in areas that were all previously grassland. Whether transitional or successional, the existing Desert Grassland communities that cover large portions of New Mexico provide important habitat for wildlife.

Desert Grassland dominates the sandy mesa top habitats above the Tijeras Arroyo drainage within the western half of the project area. Species composition varies depending upon aspect, slope, and level of disturbance. The general species composition of the Desert Grassland community within the study area fits the Shrub-Black Grama Series of the vegetation type recognized by Dick-Peddie (1993). The dominant indicator of Desert Grassland is black grama (*Bouteloua eriopoda*), which is present over much of mesa tops and slopes west of Four Hills Boulevard. Studies of this community at nearby

Sandia National Laboratory[12] found that in some areas black grama formed almost mono-specific stands where it accounted for nearly 62 percent of the foliar coverage in the entire vegetative community.

The dominant associate species within this community type on undisturbed slopes and mesa tops at the study area are blue grama (*Bouteloua gracilis*), threadleaf snakeweed (*Gutierrezia microcephala*), galleta grass (*Pleuraphis jamesii*), spike dropseed (*Sporobolus contractus*), sand dropseed (*Sporobolus cryptandrus*), four-wing saltbush and sand sage (*Artemisia filifolia*). Prickly pear (*Opuntia phaeacantha*) and small soapweed yucca (*Yucca glauca*) are also common in the area. The steep slopes along the north side of Tijeras Canyon support variations of the Desert Grassland community. These slopes appear to have been disturbed, most likely by adjacent development, and are often covered by coarse soils, gravel, and rock.

In addition to black grama, shrubby species such as four-wing saltbush appear along the toe of the slopes with galleta, small soapweed yucca, Russian thistle, summer cypress, winterfat (*Krascheninnikovia lanata*), and snakeweed are present. Associated species included prickly pear, rubber rabbitbrush, purple three-awn, lacy tansy aster (*Machaeranthera pinnatifida*), threadleaf groundsel (*Senecio flaccidus)*, Torrey joint fir (*Ephedra torreyana)*, and cheet grass.

3.5.7. Lower Montane Riparian

Montane Riparian Vegetation often occurs in the form of a closed canopy forest and is generally associated with permanent or intermittent waterways. Within the study area boundaries, Montane Riparian Vegetation occurs east of Four Hills Boulevard above 5,600 feet in elevation.

The riparian zone along the Tijeras Creek from near the Carñuel I-40 Interchange west to approximately 1,000 feet east of Four Hills Boulevard is dominated by mature cottonwood trees (*Populus deltoides* ssp. *wislizeni*) and pockets of coyote willow (*Salix exigua*) that form a scrub-shrub zone along the edge of the waterway. In some areas, invasive Siberian elms form local pockets of woodland. In addition, there are also pockets of salt cedar (*Tamarix chinensis*) and Russian olive (*Elaeagnus angustifolia*) present.

Secondary species found along the waterway include California brickellbush (*Brickellia californica*), Canada rye (*Elymus canadensis*), and Japanese brome (*Bromus japonicus*). Thin bands of obligate wetland vegetation line the edge of the waterway from Carñuel westward to approximately the 5,600 foot elevation contour level. The dominant wetland plant present within this community is watercress (*Rorippa nasturtium-aquaticum*). The edges of this portion of the creek often support bands of coyote willow and other wetland species such as Baltic rush (*Juncus balticus*), sedges (*Carex* sp.) and hydrophytic grasses.

[12] Marron and Associates, 2003

The presence of watercress, obligate aquatic species, suggests that surface water is present for protracted periods. Field observations from this study and others in the area indicate that surface water is present throughout the winter and into the spring growing season. Although exotic species are present within this riparian zone, much of the habitat is dominated by cottonwood trees, which provide important wildlife habitat.

Enclaves of riparian vegetation also occur at springs and seeps located above the Tijeras Arroyo. Local U.S. Geological Survey maps identify two springs located near to the study area (see Wildlife Habitats Map, Figure 9). One of these no longer discharges to the surface but associated wet soils support riparian vegetation such as cottonwood trees and salt cedar. An active spring located just north of the study area occurs in a side canyon that drains down into Tijeras Canyon. Furthermore, this wetland supports a perennial assemblage of obligate wetland vegetation and provides water to wildlife.

3.5.8. Lower Montane Scrub

Montane scrub vegetation often forms in areas where less moisture is available than at the surrounding vegetation zones and is often located just below woodland zones. Within the study area, this zone is generally found on slopes where woodland savanna drops into Tijeras Canyon. It also occurs on the side slopes above nearby tributary canyons. These steep, often rocky slopes, support vegetation such as wavy-leaf oak (*Quercus undulata*), shrub live oak (*Quercus turbinella*), Apache plume, sand sage, skunkbush sumac, cane cholla (*Opuntia imbricata*), black grama, broom snakeweed, and California brickellbush. Montane scrub vegetation also dominates boulder fields, rock outcrops, and cliff faces along the Tijeras Arroyo.

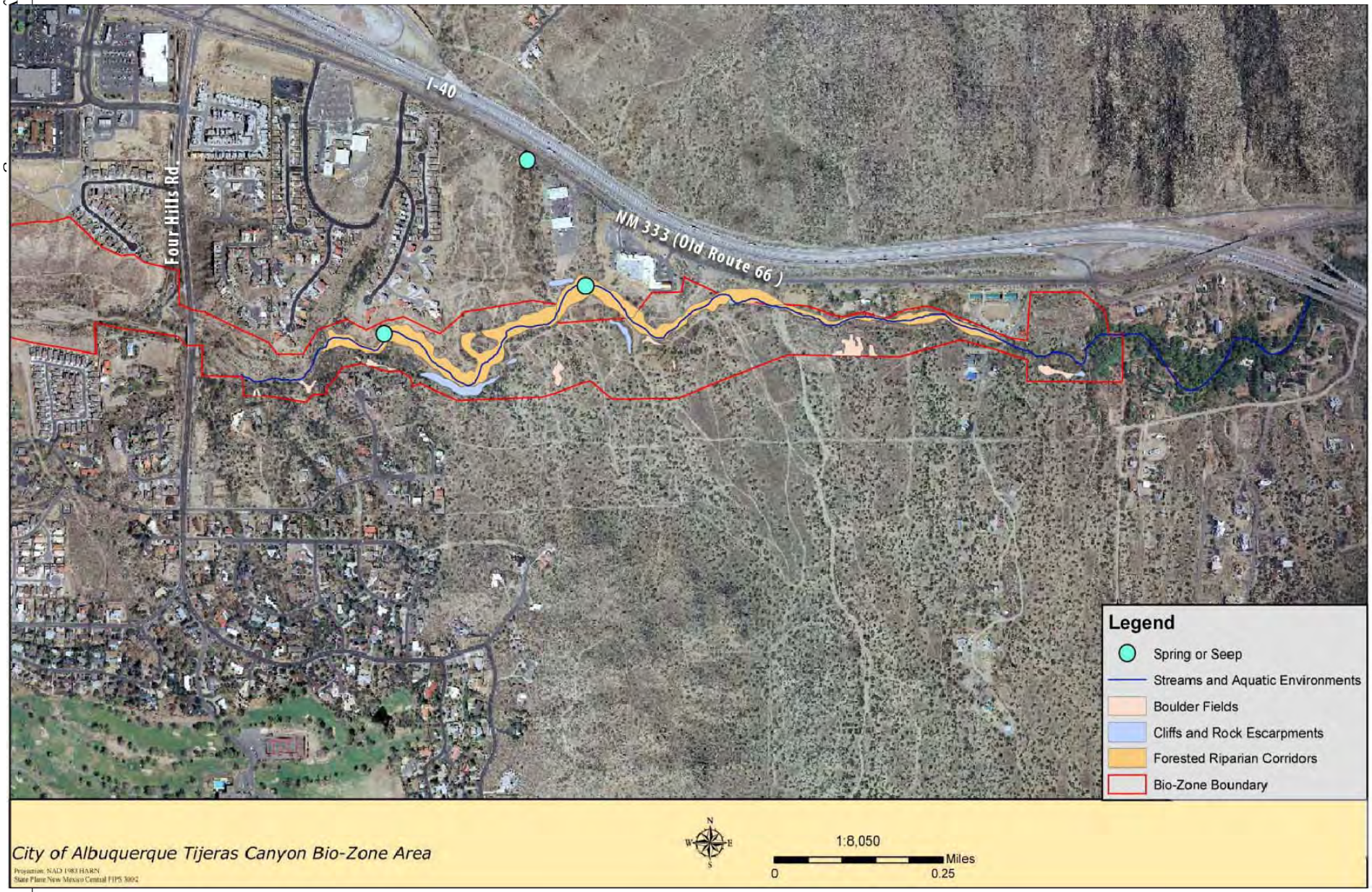
The Montane scrub zone is defined from the Montane Riparian Vegetation that occurs lower in elevation, but forms a transition area with the Lower Coniferous/Mixed Woodland Vegetation that occurs slightly higher. This transition area often supports Apache plume and shrub live oak intermixed with one-seed juniper (*Juniperus monosperma*) and herbaceous species more often associated with savanna or woodland habitats.

3.5.9. Juniper Savanna

Juniper Savanna like Desert Grassland is considered a transitional community. In New Mexico, Juniper Savanna occurs at the ecotone between woodlands and grasslands. This zone is characterized by a thinning of tree density and an increase in grass cover. Savanna occurs where there are fewer than 320 trees per hectare[13]. Within New Mexico, junipers most often persist at the lower fringe of the woodland zone. Consequently the most common savanna condition in New Mexico is Juniper Savanna. If conditions are suitable, this zone can be quite extensive. The effect is a grassland-type situation with a mosaic of trees scattered throughout.

[13] Dick-Peddie, 1993

Figure 9. Important Wildlife Habitats



Within the study area the dominant savanna tree is one-seed juniper. It is primarily confined to the areas east of Four Hills Boulevard in areas where the more densely vegetated lower Coniferous/Mixed Woodland opens onto flat-to- gently-sloping benches with thinly scattered junipers growing among grasses such as black grama, blue grama, purple three awn and shrubby species such as winterfat and cane cholla. These small pockets of Savanna occur at the transition from Coniferous/Mixed Woodland into lower Montane Scrub zones.

A small band of one-seed juniper occurs along the southwestern boundary of the study area bordering the Kirtland Air Force Base fence line. Common associate species such as galleta, purple three awn, tory ephedra, and fluff grass (*Erioneuron pulchellum*) occur there. Normally these enclaves would be too small to mention, but within the surrounding Desert Grassland biome, they form a distinct and unique vegetative group.

3.5.10. Lower Coniferous/Mixed Woodland

Generally Coniferous Woodland in New Mexico is defined by the presence of junipers and pines, while Mixed Woodland usually consists of mixtures of Piñon-Juniper and Gambel's oak. Coniferous Woodland is normally found on the lower, drier boundary of woodland vegetation types, located just above grassland and savanna regimes in elevation.

On the upper, more mesic boundary of Coniferous Woodland, the density of trees increases, often in excess of 600 trees per hectare. On the lower and drier aspects, fewer than 400 trees per hectare would be found. As the density of trees decreases, the proportion of grasses to trees usually increases. In the lower elevations or drier aspects, the proportion of grasses to trees increases such that the community can no longer be considered woodland and is characterized as savanna.

Within the study area the woodland vegetation is dominated by one-seed juniper with Piñon pine (*Pinus edulis*) represented by just a few individuals. The community in Tijeras Canyon is intermixed with small oaks. Structurally, this community can be classified as Coniferous/Mixed Woodland. Within the study area this community is located principally on the higher elevation slopes above the Tijeras Arroyo. It occurs primarily on north facing slopes, but is occasionally found on southern exposures.

3.5.11. Disclimax Vegetation (Weedy or Disturbed Conditions)

When conditions within a vegetative area are stable a distinct community will form. Such stable plant communities are termed climax vegetation. The vegetation types discussed above are considered climax communities. When stable communities are disturbed the vegetative composition often shifts so that fast-growing and opportunistic species, often referred to and considered as weeds, are favored. Many areas within the study area have been disturbed such that the climax community was reduced or removed. In some cases, such as areas adjacent to roadways, little or no vegetation cover remains.

In other cases the vegetation cover is sporadic and consists of weedy species. These areas support what is termed “disclimax vegetation”.

Disclimax communities occur east of Four Hills Boulevard principally along roadways that advanced into the woodland and scrub communities. Invasive species such as Siberian elm, Russian olive, and salt cedar also occur at several locations adjacent to Tijeras Creek. Within the western portions of the study area disclimax vegetation is more common. The construction of housing, landfills, and gravel mining operations and off-road vehicle use has resulted in the complete loss of natural vegetation in some areas. Many areas are completely devoid of vegetation and others support weedy species such as Russian thistle, summer cypress, broom snakeweed, or invasive trees such as Siberian elm and tree-of-heaven. These areas provide an immediate opportunity for habitat enhancement.

3.5.12. Wetlands

Wetlands are transitional areas located between terrestrial and aquatic systems that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation that is typically adapted for life in saturated soil conditions and are defined by three essential characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology[14].

Hydrophytic vegetation requires the presence of permanent or semi-permanent water, and includes species such as cattails and water lilies. Hydric soils are flooded at least during the growing season long enough that anaerobic conditions develop. Wetland hydrology refers to the availability of water. Wetlands require permanent or periodic inundation at least during the growing season. Wetland hydrology is the key to development of viable wetlands.

Three types of wetland hydrology exist within the study area (See Wetlands Map, Figure 10). The largest and most obvious wetland areas located within the Bio-Zone Study area are associated with seasonal flows of Tijeras Creek east of Four Hills Boulevard, which supplies sufficient water necessary to maintain obligate wetland vegetation such as coyote willow, watercress, and Baltic rush. This water originates from snow-melt in the nearby mountains as well as groundwater discharge from along the bottom of Tijeras Canyon. It forms a narrow fringe of riparian emergent and scrub-shrub wetland adjacent to much of the length of Tijeras Creek east of Four Hills Boulevard (Table 2). In addition to herbaceous and shrubby wetland indicator plants, the entire length of this portion of Tijeras Creek is lined with cottonwood trees, a facultative wetland species. The sum effect is a narrow but cohesive riparian forest creating important habitat for local wildlife as well as migratory birds.

[14] US Army Corps of Engineers, 1987

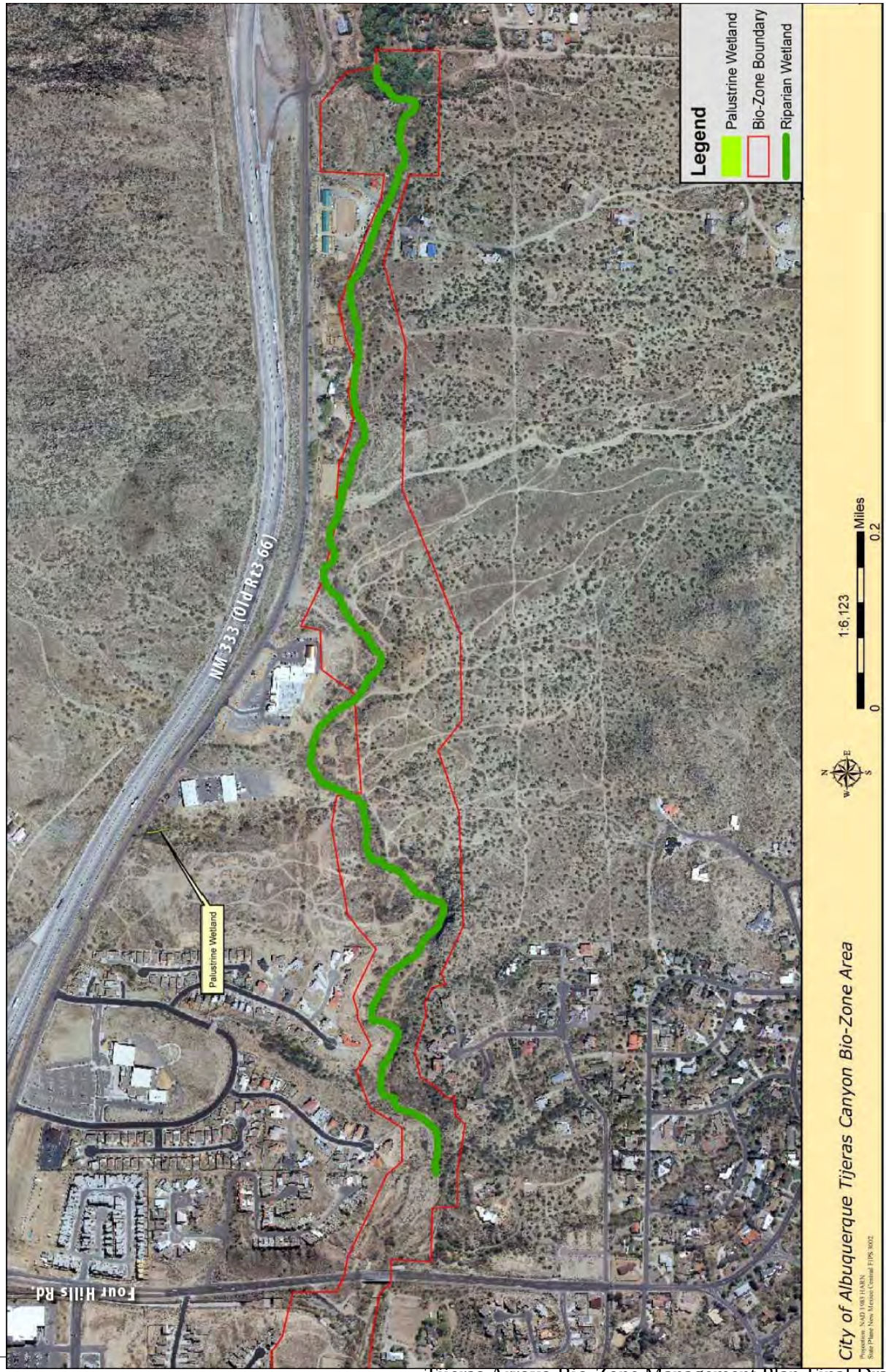


Figure 10. Wetlands

The third type of potential wetland hydrology that occurs within the study area originates with storm water surges during rain events. These ephemeral surface water flows can carry large volumes. Although such events often scour the channel and remove vegetation, they can also create low points were flows from lesser events collect. Such areas may persist more than two weeks during the growing season and can lead to the establishment of annual wetland species and small pockets of wetland within the channel. Such habitats were observed just west of Four Hills Boulevard where a drop structure in the channel bottom of Tijeras creek has created scoured pools. These areas represent potential wetlands, but did not appear to meet wetland qualification requirements during late winter of 2008.

Table 2. Wetland Locations

NAME	LOCATION
Tijeras Creek	UTM Zone 13S E364095/N3880807 NAD 83
Spring #1	UTM Zone 13S E364603/N3880936 NAD 83
Spring #2	UTM Zone 13S E364095/N3880807 NAD 83
Spring #3	UTM Zone 13S E364483/N3881196 NAD 83

3. (From left) Tijeras Creek: Wetland Area.

3.6. Wildlife Communities

The primary resources determining wildlife movements through the study area are water, forage or prey, and shelter. Secondary resources include winter ranges, breeding territories, and migration routes. In many areas, primary resources are not located adjacent to one another and daily movement is required to access them. This is particularly true of larger mammals with higher resource requirements, where a mile or more may separate resources. Development and associated infrastructure such as roadways reduce access to these features Now, many animals must cross through residential and industrial areas or over roadways to reach either primary or secondary resources. The preservation of a corridor allowing unimpeded crossing would be beneficial to all species utilizing the study area.

4. Horned Lizard and other reptiles inhabit the area.

Wildlife surveys of the study area were conducted during the late winter months when winter resident birds and non-hibernating mammals were present or active. Additional wildlife species are present during warmer months. Fifty-three vertebrates or their sign were observed within the study area.

Previous surveys of Kirtland Air Force Base and Tijeras Canyon completed during recent years were conducted during the growing season when other birds and mammals are present and reptiles and amphibians are active[15]. Species lists from these studies were

[15] Marron 2007. Sullivan and Knight, 1992

combined with the study area list to provide information regarding the probable use of the study area (Appendix D). In total 202 species observations have been documented in the general area.

Animals that occur within the study area and adjacent habitats include mule deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), coyote (*Canis latrans*), and an unidentified bat species. Guano was found but no bat species could be identified. Desert cottontail (*Sylvilagus auduboni*), black tailed jackrabbit (*Lepus californicus*), banner-tailed kangaroo rat (*Dipodomys spectabilis*), Ord's kangaroo rat (*Dipodomys merriami*), and valley pocket gopher (*Thomomys bottae*) are common within the western portions of the study area. Rock squirrel (*Spermophilus variegates*) droppings and white-throated woodrat (*Neotoma albigula*) nests were observed in the eastern portions of the study area.

Other mammals such as swift fox (*Vulpes velox*), Grey fox (*Urocyon cinereoargenteus*), mountain lion (*Felis concolor*), and bobcat (*Lynx rufus*) most likely utilize the study area but none were observed.

Birds are abundant throughout the study area. Mallards (*Anas platyrhynchos*) were observed near Tijeras Creek and both green-winged teal (*Anas crecca*) and American widgeon (*Anas americana*) were observed in a small pond adjacent to the study area just west of Four Hills Boulevard. Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), a pair of great-horned owls (*Bubo virginianus*) spotted towhee (*Pipilo maculatus*), canyon towhee (*Pipilo fuscus*), hairy woodpecker (*Picoides villosus*), ladder-back woodpecker (*Picoides scalaris*), and northern flicker (*Colaptes auratus*) were observed in the riparian forest areas in the eastern half of the study area.

An American kestrel (*Falco sparverius*) was observed in the open shrubby areas in Tijeras Canyon between Juan Tabo and Four Hills Boulevard. Eurasian collared dove (*Streptopelia decaocto*), white-winged dove (*Zenaida asiatica*), mourning dove (*Zenaida macroura*), and rock dove (*Columba livia*) as well as greater roadrunner (*Geococcyx californianus*), scaled quail (*Callipepla squamata*) and loggerhead shrike (*Lanius ludovicianus*) were observed west of Four Hills Boulevard. Horned larks (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), and scaled quail were observed on the mesa above the arroyo near the southwestern corner of the study area.

The greatest diversity of wildlife occurs within the eastern portion of the study area east of Four Hills Boulevard because of greater vegetation cover, access to water and food, and habitat.

3.6.1. Streams and Aquatic Environments

Active streams and other aquatic environments provide important habitat for both vertebrate and invertebrate animals. Birds and mammals rely on waterways and aquatic environments for water and many amphibians require water for reproduction. Tijeras Creek east of Four Hills Boulevard sustains at least seasonal flows that extend into the growing season and bird breeding season. Within the channel of the creek there are slow moving areas and pools that are suitable for use by amphibians. Currently fish do not appear to occupy Tijeras Creek but there are historic accounts that the stream once flowed on a near perennial basis and at that time supported fishes.

3.6.2. Forested Riparian Corridors

Riparian corridors develop around persistent flowing streams or rivers. These forest environments provide important wildlife habitat. Many species are residents of riparian forests and many more utilize them daily or during seasonal migrations. A well-developed forested riparian corridor extends from the eastern boundary of the Bio-Zone study area downstream to just east of Four Hills Boulevard.

3.6.3. Seeps and Springs

At least three springs occur within the study area. Two previously documented springs occur near to the riparian corridor and supplement aquatic resources available there. The third spring is surrounded by mixed woodland and scrub. It provides important habitat for wildlife, particularly during dry times of the year when water is limited and unavailable in other areas. Previous studies identified these areas as being particularly important for mule deer, and numerous mule deer tracks were observed around them during the dry season.

3.6.4. Boulder Fields

Boulder fields occur in the eastern portion of the study area and are primarily confined to the south side of Tijeras Canyon. Rocky slopes that line the steep portions of the canyon develop into fields of boulders on the gentler slopes above the canyon floor. These areas provide suitable habitat for several bats in the rock crevices, perching habitat for birds, and shelter for wood rat nests.

3.6.5. Cliffs and Rock Escarpments

Several large rock escarpments and cliff faces occur east of Four Hills Boulevard. One large cliff face occurs along the south side of Tijeras Creek. This area provides important habitat for bats and possibly nesting raptors. Bat droppings were observed in crevices at this location and a pair of great horned owls were observed in this location as well.

3.7. Wildlife Corridors, Trails, and Use Areas

3.7.1. Wildlife Corridors

Mule deer are widespread through the study area. Deer trails are common on the slopes above the roadways, and mule deer are often involved in vehicle/wildlife impacts along I-40 and the frontage road. Many of these animals move from the southern slopes of the Sandia Mountains to the water sources available in Tijeras Canyon. A crossing area of particular importance was identified during previous work in the area, which indicated that large mammals such as mule deer cross I-40 near an existing radiological facility located on the south frontage road. Numerous deer trails occur within the study area on the slopes both north and south of Tijeras Creek. These trails appear to form part of this corridor of wildlife movement along the western base of the Sandia and Manzano Mountains providing connectivity between these mountain chains.

Black bear occur in both the Sandia and Manzano mountains, and often are found in Tijeras Canyon. Several black bear road kills were documented along I-40 just east of Carñuel. Bear tracks were observed by OS staff adjacent to Tijeras Creek just east of the Four Hills Boulevard Bridge. Black bears are generally not active during the winter months when the field survey of the area was conducted, but are likely present during warmer months.

Mountain lions occur both in the Sandia and Manzano mountains, and there are documented observations of mountain lions along the interstate near the study area. Mountain lion tracks were reported from within Carñuel both on the north and south side of Tijeras Creek in the fall of 2004, and mountain lions were recently observed along the west face of the Manzano Mountains several miles south of the study area. It is likely that mountain lions utilize the eastern portions of the study area. A mountain lion and elk were observed no more than a mile east of the eastern section of the Bio-Zone. Bobcats are known to occur throughout Tijeras Canyon and it is likely that bobcats move through the eastern portions of the study area, east of Four Hills Boulevard.

Coyote are found throughout the study area, there were indications of east-west movement of coyotes along the drainage of Tijeras Canyon. Many coyote tracks were observed west of Four Hills Boulevard down to the southwestern boundary of the project area at Kirtland Air Force Base. A coyote den was observed by Open Space staff with fresh tracks and scat outside the den near the grove of Siberian elm within the arroyo west of Four Hills Blvd.

3.7.2. Riparian Corridors

Many of the larger mammals discussed above are wide ranging and utilize corridors that extend well outside of the riparian zone along Tijeras Creek. Many smaller mammals spend much of their time within the riparian corridor. Defined wildlife trails flank Tijeras Creek to the north and south. These indicate daily use of the area by small mammals such as skunk and raccoon and occasional use by mule deer. The woodland

that lines Tijeras Creek provides not only important foraging habitat, but also shelter for movement adjacent to human use areas.

3.7.3. Water Holes

Waterholes are important for sustaining wildlife populations during the dry seasons. Patterns of wildlife use during the warmer months appear to adjust to the availability of water. The springs that occur along the interstate and Tijeras Creek west of Carñuel are likely important sources of water for area wildlife.

3.7.4. Roost Areas

Bird and bat roost areas occur throughout the study area. Rock outcrops, cliff faces, and many of the tall trees in the eastern half of the study area provide roost habitat for birds. Cliff faces and boulder fields in the eastern portion of the project area provide roost habitat for bats. The Four Hills Boulevard and Juan Tabo Bridges also provide suitable roost habitat for many species of bats. Additionally, a small stand of elm trees located along the north side of Tijeras Canyon approximately 0.2 miles east of Juan Tabo Boulevard provides suitable roosting habitat for a wide range of birds including raptors. A raptor nest was observed within this grove of trees.

3.8. Protected Species

Species protected by federal or state agencies could occur within the study area, including many birds protected under the Migratory Bird Treaty Act. Suitable habitat for five listed species was identified within the study area. These species are: southwestern willow flycatcher, yellow-billed cuckoo, gray vireo, spotted bat, and the western burrowing owl (Figure 11).

3.8.1. Migratory Bird Use Areas and Nest Sites

The study area provides suitable roosting, nesting, and foraging habitat for a variety of migratory bird species. Three stick nests were observed within the study area. One was located within a cottonwood tree in Tijeras Canyon and two were located in elm trees near the arroyo just east of Juan Tabo Boulevard. These nests could be used by ravens or hawks. A pair of great horned owls was observed near cliffs within Tijeras Canyon, and was likely setting up a nesting territory in the area. The bridge structures at both Four Hills and Juan Tabo Boulevards provide suitable nesting habitat for cliff swallows and barn swallows. Much of the brush cover along the edge of the Tijeras Arroyo west of Four Hills Boulevard and the adjacent shrub cover on the floodplain provides nesting habitat for small songbirds such as sparrows and loggerhead shrike.

Finally, the small stand of juniper trees located at the extreme southern boundary of the study area adjacent to Kirtland Air Force Base provides suitable nesting habitat for the ferruginous hawk.

Figure 11. Protected Species Habitat

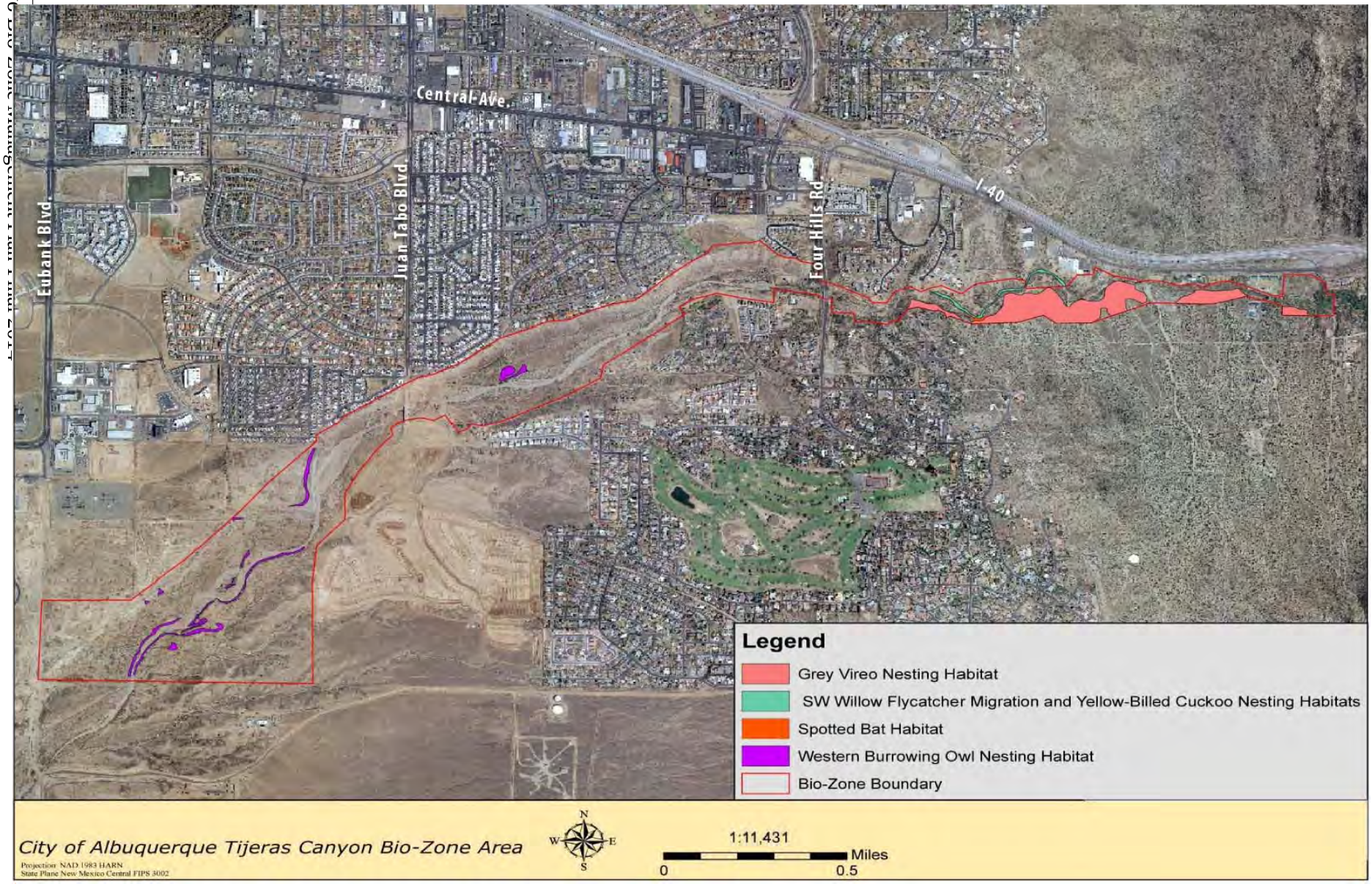


Table 3. Nest Locations

NAME	LOCATION
Great horned owls	UTM Zone 13S E386429/N3880730 NAD 83
Stick nest #1	UTM Zone 13S E346577/N3880910 NAD 83
Stick nest #2	UTM Zone 13S E362194/N3886564 NAD 83
Stick nest #3	UTM Zone 13S E362222/N3886523 NAD 83

3.8.2. Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

The southwestern willow flycatcher is protected as an endangered species by the US Fish and Wildlife Service and the State of New Mexico. The historic range of the species includes Arizona, California, Colorado, New Mexico, Texas, Utah, and Mexico. Currently, it breeds in riparian habitats from southern California to Arizona and New Mexico as well as in southern Utah, Nevada, southwestern Colorado, and west Texas.

The flycatcher is found in the United States from May until September, and winter in southern Mexico, Central America, and northern South America. It occurs statewide during spring and fall migration and breeds along several rivers including the Chama, Rio Grande, Zuni, Gila, Hondo, and San Juan. Flycatchers have also been reported to nest along streams in the western Sangre de Cristo Mountains near Taos and have been documented during migration along the Rio Grande within the Albuquerque reach of the river.

In New Mexico, the flycatcher is found in close association with dense groves of coyote willow, arrow weed, buttonbush, tamarisk, and Russian olive. These riparian shrubs often have a scattered overstory of cottonwood or box elder (*Acer negundo)*. Flycatchers nest in thickets of trees and shrubs approximately 6.5 - 23 feet in height or taller, with a densely vegetated understory from ground or water surface level to 13 feet or more in height. Surface water or saturated soil is usually present beneath or next to occupied thickets. At some nest sites, surface water may be present early in the nesting season with only damp soil present by late June or early July.

The lower Montane Riparian Forest Vegetation in the eastern portion of the study area supports coyote willow with a cottonwood overstory is considered suitable for at least spring migration habitat for this species. Since availability of water within the study area is seasonal, it is unlikely that these areas would be considered suitable nesting habitat for this species.

3.8.3. Yellow-Billed Cuckoo *(Coccyzus americanus)*

The Yellow-billed cuckoo is a federal candidate species. Yellow-billed cuckoos are late migrants, usually arriving in New Mexico in late May or June. They feed on insects, particularly tent caterpillars that can infest trees during the summer. They are usually found in lowland deciduous woodlands, willow and alder thickets, second-growth woods, deserted farmlands, and orchards. Nests are built in trees or shrubs, particularly those overgrown with vines. The nests are usually low (4–10 feet above the ground) but may be up to 35 feet above the ground. The structure is frail, with a platform up to 5 inches across built of sticks, vines, and rootlets and then lined with moss, grass, conifer needles, and catkins.

Potential nesting habitat for the yellow-billed cuckoo occurs along Tijeras Creek in the eastern portion of the study area. In particular, the portions of the creek and associated forest that occur near the springs would be desirable habitat for this species.

3.8.4. Gray Vireo (Vireo vicinor)

The gray vireo is protected as a State of New Mexico threatened species and listed as a federal species of concern. It is a small, ray bird with a faint single wing bar and faint spectacles around the eyes. It is found through much of the western United States and northern Mexico. In New Mexico, this bird normally summers west of the eastern plains from the Santa Fe area southward to Mexico. It normally occurs in open woodland, scrubland, and dry chaparral. It found in arid lands, typically in Piñon-juniper habitat with steep slopes.

The preferred breeding habitat of this species is open woodlands/shrublands with junipers as the dominant element in most areas of occurrence. In addition, oaks are part of the habitat in the southern part of the range. This vireo is an insectivore. In New Mexico, it is found during the months of April through September when insects are most abundant. Nesting gray vireos have been identified along the base of the west slope of the Manzano Mountains just south of the study area. The lower Coniferous/Mixed Woodland habitat and Juniper Savanna habitat in the eastern portion of the study area can be considered suitable habitat for this species.

3.8.5. Western Burrowing Owl (*Athene cunicularia hypugaea*)

The western burrowing owl is a federal species of concern and a protected bird-of-prey. It is a medium-sized, sandy-colored owl with long legs. This species is active by day and by night. The burrowing owl is seen most often on the ground, at or near its home burrow or perched on a lookout point such as a shrub, rock, or fence post. It inhabits bare ground near areas such as golf courses and airports; open desert dominated by yucca, cactus, and mesquite; and grassland-juniper habitat. The burrowing owl nests in abandoned rodent burrows modifying these burrows by digging and scraping with its beak, wings, and feet. They are regular breeders in New Mexico and are found in abundance in the Albuquerque area.

Although there were no burrowing owls present during surveys of the study area, the entire western portion from just west of Four Hills Boulevard south and westward to

Kirtland Air Force Base contains pockets of suitable habitat for this species. In particular, the lower half-mile of Tijeras Arroyo just north of Kirtland Air Force Base is deeply incised with steep walls dotted with burrows. Any one of these burrows would be suitable nesting habitat for the western burrowing owl.

Additionally, concrete rubble piles located along the base of the landfill that forms the western edge of the Plan area and construction debris deposited just east of the Juan Tabo Boulevard Bridge on the north side of the arroyo channel could be considered potential habitat for this species. Western burrowing owls often create nest sites within these construction debris piles.

3.8.6. Spotted Bat (Euderma maculatum)

The spotted bat is protected as a New Mexico threatened species. It is generally found in Coniferous forest or Coniferous woodland adjacent to streams or water holes, usually in the proximity of rock outcrops or cliff faces. This species has recently been discovered wintering in abandoned structures of the northeast heights of Albuquerque. Any of the cliff and rock outcrop habitats that line the south side of Tijeras Creek in the eastern half of the project area would be potential roosting habitat for the spotted bat.

4. HISTORIC AND CULTURAL RESOURCES

4.1. Site History and Culture

The eastern section of the TABZ boundary is part of the original San Miguel de Laredo Land Grant of 1763. It was commonly known as San Miguel de Carñuel. The most well known and prominent archaeological site is of a village, known as the Rancho de Carnué Site, established around 1760 near present day Carñuel.

Little is currently known about the actual founding and early history of the site. Excavation has uncovered at least seven one-room domiciles known to have been built during the initial period of European residency. The excavators also found hornos (bread ovens), refuse pits, and corrals associated with these adobe dwellings. However, the village was abandoned and the grant was annulled in 1771 after numerous attacks by "The Apaches" (who had encampments nearby).

Fifty years later, the Spanish re-attempted to colonize the Carñuel area. In 1819, the Cañon de Carñuel Land Grant was established and twenty-three families were given land in Carñuel. A church was erected and by 1850 there was close to one hundred families living in the area. The church fell to ruin and in 1898 the Santo Nino Mission Church was built. According to the Santo Nino Mission Church website, "In 1932 Father Libertine erected the large white cross on the hill across the freeway from the church. Father's idea was to encourage travelers through the canyon to stop and meditate. Prior to construction of the Interstate, a religious procession walked from the church to the cross on the hill. Carñuel celebrates a San Miguel fiesta in September, and on May 3, a Triumph of the Cross fiesta together with the fiesta of Santo Niño."[16] This large, white cross is just outside of the TABZ boundary on high ground overlooking I-40 and the Village of Carñuel. Parts of Tijeras Creek would have been used by the land grant settlers for farming.

The Tijeras Arroyo has extensive history and human use prior to the construction of the Rancho de Carnué Site. A professional Class I and Class II Cultural Resource Survey were conducted by Marron and Associates in March of 2008. A Class I survey is a search of previous identified archaeological records in the area. A Class II survey is a physical pedestrian reconnaissance "in the field" survey. The surveys were conducted as a planning tool to help the City of Albuquerque Open Space Division develop this Resource Management Plan.

The areas surveyed in the TABZ total about 4.2 kilometers (2.63 miles) long and 945 meters (3100 feet) wide at the western end and 457 meters (1500 feet) wide at the eastern

[16] Santo Nino Mission Church Website. Retrieved on 6/28/06 from http://members.aol.com/holychildparish/Carñuel.htm.

end. Some lands surveyed are owned by the City of Albuquerque, the State Land Office, the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), and private land. However, the State Land Office land and much of the private land was not surveyed due because landowners' permission was unavailable at the time.

The Class II survey focused on a 305 meter- (1,000 foot) wide corridor centered on Tijeras Creek. The survey consisted of 84.8 acres of City of Albuquerque- owned land, 115.9 acres of private land, and 15.3 acres of AMAFCA land for a total of 216 acres. No private land was surveyed east of Four Hills Road.[17]

One previously recorded site and six new archaeological sites were recorded in the project footprint. The seven archaeological sites consist of two prehistoric artifact scatters with features, two historic artifacts scatters with/without features, two historic acequias, and one site of cultural affiliation that has been undetermined.

Two of the sites are recommended as eligible for the National Register of Historic Places (NRHP) because of their prehistoric significance of occupation within the Tijeras Canyon area. Two other sites could be eligible for the NRHP for their significance relating to information about the late nineteenth and early twentieth century irrigation engineering and history of the Tijeras Canyon area.[18]

Future trail development shall not interfere with any documented archaeological site. Interpretation of one or more of the sites may be permitted in the future, but protection of the sites shall be the foremost objective.

[17] Marron and Associates, 2008.
[18] IBID, 2008.

5. Land Use

5.1. Current On-Site Activities

Current public use of the property consists primarily of hiking, dog walking, and to a lesser degree mountain biking. Allowed uses for this site include: hiking, mountain biking, dog walking (on-leash), and horseback riding. Unfortunately, due to the arroyo's accessibility there is illegal activity within the Tijeras Arroyo Bio-Zone.

The Bio-Zone east of Four Hills Road presents a nicely wooded area with a perennial stream rich with wildlife. Evidence of human activity was observed by Open Space Division staff and by consultants from Sites Southwest. Encampments with private landscaping, picnic areas, and personal belongings lying around were observed. Paintball splatters on nearby rock outcrops and trees were found.

The entire Bio-Zone has been most affected by illegal vehicular traffic scarring the land. A few vehicles have been abandoned in the arroyo, making a hike unsightly. An unauthorized BMX bicycle track was discovered near the grove of Siberian elm trees near the midsection of the Bio-Zone, and another possible BMX or motorcycle track with jumps was found in the eastern portion of the Bio-Zone. (See following pictures of existing land uses[19])

Encampments

Encampments

[19] Sites Southwest, 2008.

Hammock

Picnic Area

Landscaped Area

Paintball Splatter

Illegal Motor vehicle Tracks

Vehicle Tracks within the Tijeras Creek

Abandoned Vehicle

BMX/Motorcycle Jumps and Track

5.1.1. Structures

There are no official structures developed within the TABZ boundary. Any future structures will be limited to picnic tables, shade canopies, to lesser extent kiosks, or other non-invasive items that will improve the recreational users' experience when placed appropriately.

5.2. Trail Conditions

No official trails have been developed by the Open Space Division. The development of social trails (user-made trails) is evident within the Bio-Zone, especially within Tijeras Creek and along the embankments of the arroyo. All future development of official trails will follow sustainable trail guidelines (See section 6.4).

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6. KEY ISSUES

6.1. Future Acquisition

The key issue of the TABZ is acquisition of private and municipal (non-COA) parcels. In order to properly manage, restore, monitor, and conduct further studies within the Bio-Zone, the City must acquire control over more land parcels. The OSD can only improve and manage lands that are acquired by the COA OSD. Therefore, to properly implement the strategies and objectives outlined by this RMP, acquisition or control over key parcels is vital.

Acquisition shall be prioritized in relation to each parcel's function, significance, and importance. Acquisitions were prioritized based on a weighted score that represented the value of the resource and the amount of development pressure on each parcel The weighted score provides an objective methodology for determining which parcels are best suited for prioritizing acquisition. Each parcel was given a score of 1-5 for both resource value and the amount of pressure to develop. The two scores were added together and divided by two to reach an average overall score for each parcel.

A score of 1 is equal to either very low resource value or very low pressure to develop the parcel. A score of 2 is equal to low for both variables. A score of 3 is equal to moderate for each variable. A score of 4 is considered high for either of the variables. A score of 5 is considered very high in resource value and for development pressure.

6.1.1. Resource Value

Too score the resource value, the following were analyzed qualitatively using the biological studies conducted by the two consulting firms Sites Southwest and Marron.

- The amount or density of vegetation (disturbance)
- Types of vegetation (native or invasive)
- Amount of biodiversity of vegetation
- Water availability for both vegetation and wildlife
- Food availability for wildlife
- Wildlife cover or habitat
- The proximity of a parcel to existing COA Open Space.

The aforementioned bullets were all factors that went into scoring a parcel. For a parcel to get a score of 5, most or all of the biological factors were present. A score of 4 had several biological factors. A score of 3 had at least three of the factors listed above. A score of 2 had few to no factors listed. A score of 1 had no biological factors and was not close to MPOS. Many of the parcels east of Four Hills Blvd had a score of 4 or better due to numerous biological factors present. A low score also indicates a disclimax or

disturbed area with many invasive species present. (See Table 3 for the findings. Compare the findings on Table 3 to Figure 2, Ownership Map, to find the parcel numbers.)

6.1.2. Development Pressure

Many factors were analyzed qualitatively to score each parcel for the amount of development pressure. Such factors include:

- Existing infrastructure like roads, power lines, water lines, gas, etc..,
- Proximity to existing developments
- Privately owned parcels (more likely to be developed)
- Zoning
- Profitability
- Steepness of slopes
- Within the floodplain (hazardous)

For a parcel to get a score of 5 in regard to development pressure, the parcel must include the majority of the factors listed. A parcel receiving a score of 4 or 5 means the parcel has a high chance of being developed due to these factors. A score of 3 means a parcel would have some factors, such as infrastructure, but lack others, such as steep slopes. The chances are 50/50 for future development, meaning it could be developed but certain aspects would make development difficult. A score of 2 means the parcel is very unlikely to be developed due to certain factors like steep slopes, location within the floodplain, and no infrastructure. A score of 1 means the parcel has little to no likelihood of being developed.

6.1.3. Priority Score

All 51 parcels within the TABZ except the parcels already owned by the COA were scored for these two variables. To get a total score, the two variables were added and then averaged and rounded up if needed. (See Table Three and compare to the ownership map, Figure 2) The results in Table 4 show that the parcels with the highest scores tend to be located east of Four Hills Blvd. Parcels with an average score of 5 are considered very high priority and should be acquired first. An average score of 4 is considered high priority and should be acquired second. Properties with a score of 3 are considered moderate priority; a score of 2 is low priority; and an average score of 1 is very low priority. Acquisition should start with very high priority and end with very low priority.

Score 5= Very High Priority for Acquisition
Score 4= High Priority for Acquisition
Score 3= Moderate Priority for Acquisition
Score 2= Low Priority for Acquisition
Score 1= Very Low Priority for Acquisition

The following table and acquisition priorities should be updated every five years as conditions change.

Table 4. Tijeras Arroyo Bio-Zone Priority Acquisitions

Parcel # (Figs. 12,13)	Acres	Resource Value	Development Pressure	Priority Level
1	68.5	1	3	2 (Low)
2	12	1	2	2 (Low)
3	40.2	1	2	2 (Low)
4	85.1	N/A	N/A	In Development
5	40	1	3	2- Possible Land Swap with State (Low)
6	0.5	1	3	2 (Low)
7	16.4	3	1	Owned by AMAFCA
8	51.2	N/A	N/A	Open Space Land
9	9.5	N/A	N/A	In Development
10	13.6	3	1	2 (Low)
11	6	3	1	2 (Low)
12	17.3	3	2	3 (Moderate)
13	29.3	N/A	N/A	Open Space Land
14	1.7	3	2	3 (Moderate)
15	20.6	3	3	3 (Moderate)
16	0.4	2	1	2 (Low)
17	0.6	2	1	2 (Low)
18	0.5	3	1	2 (Low)
19	4	3	1	2 (Low)
20	1	N/A	N/A	Owned by COA
21	15.9	N/A	N/A	Owned by COA (Parks and Recreation)
22	21.4	N/A	N/A	Open Space Land
23	14	3	1	2 (Low)
24	1.9	2	3	3 (Moderate)
25	1.2	2	3	3 (Moderate)
26	2.3	2	3	3 (Moderate)
27	3	2	4	3 (Moderate)
28	1.2	N/A	N/A	Owned by COA
29	4	5	2	4 (High)
30	0.5	4	2	3 (Moderate)
31	0.9	4	2	3 (Moderate)
32	2.1	4	2	3 (Moderate)
33	15.9	4	2	3 (Moderate)
34	0.65	4	2	3 (Moderate)
35	0.64	4	2	3 (Moderate)
36	0.64	3	3	3 (Moderate)

Parcel # (Figs. 12,13)	Acres	Resource Value	Development Pressure	Priority Level
37	0.41	4	3	4 (High)
38	1.94	4	3	4 (High)
39	0.5	4	3	4 (High)
40	63.1	5	5	Open Space Land
41	22.8	4	3	4 (High)
42	9.4	4	4	4 (High)
43	37.7	5	5	5 (Very High)
44	24.7	4	4	4 (High)
45	61.8	4	4	4 (High)
46	3.16	3	4	4 (High)
47	2.2	4	4	4 (High)
48	0.5	4	4	4 (High)
49	2	4	4	4 (High)
50	63	4	5	5 (Very High)
51	3.4	5	5	5 (Very High)

Note: The following includes total acreage for each score.
Score 5= Very High Priority for Acquisition- (86.4 Acres)
Score 4= High Priority for Acquisition- (31.88 Acres)
Score 3= Moderate Priority for Acquisition- (112.5 Acres)
Score 2= Low Priority for Acquisition- (360.3 Acres)
Score 1= Very Low Priority for Acquisition- (0 Acres)

Total Parcel Acreage within and joining TABZ= 801.24
Parcel Acreage currently in development, owned by the City of Albuquerque or AMAFCA= 294.1

6.2. Protecting the Natural Character of the Land

One of the most important means of protecting the natural character of the arroyo is by protecting the natural form of the channel. This will keep runoff in contact with the soil for a longer period of time, allowing more infiltration into the soil.[20] It also protects the banks from erosion by slowing storm flows. The primary means of protecting natural channel form is by prohibiting development within the 100-year floodplain. As stated in the Facility Plan for Arroyos, where appropriate, the entire 100-year floodplain of the arroyo shall be dedicated to or purchased by the City as Major Public Open Space.

[20] Policy b of the Water Management section of the Albuquerque/Bernalillo County Comprehensive Plan states that "maximum absorption of precipitation shall be encouraged through retention of natural arroyos and other means of runoff conservation within the context of overall water resource management." Protecting the natural meanders of the arroyo is consistent with this policy.

The primary purpose of the Plan is to establish guidelines that will protect the floodplain of the Tijeras Arroyo. Therefore, it shall be deemed appropriate under this plan that the current (2013) 100-year floodplain within the Tijeras Arroyo Bio-zone be dedicated to or purchased by the City as Major Public Open Space.

Before conveying any parcel to the City of Albuquerque, private landowners shall remediate all damage to soil, water, and vegetation that has occurred as a result of erosion, dumping, and off-road vehicle use. The City reserves the right to refuse any prospective conveyance that is not in good, natural condition through its ordinary reviews conducted by Real Property Division, including environmental reports.

The City also holds the right to accept, at its discretion, a property requiring clean-up or remediation in exchange from the seller for partial or whole compensation for the clean-up, by either monetary payment or an adjustment in the price of the land.

6.2.1. Wildlife Protection

The preservation of wildlife corridors throughout Open Space properties and on U.S. Forest Service land is another important part of protecting the natural ecosystems of this fragile desert and riparian environment. Interstates, roads, and development have adverse effects on wildlife by fragmenting habitat. The Sandia and Manzano Mountains act as a corridor for wildlife migrating between the Rocky Mountains and southern New Mexico. The Tijeras Arroyo is a major thoroughfare for wildlife migrating between these mountain systems and the Rio Grande. NM Game and Fish as well as several national environmental groups identified Tijeras Canyon as the most critical wildlife crossing in New Mexico and one where mule deer, black bear, and other wildlife migrating Sandias and Manzanita Mountains have been hit by vehicles on a regular basis (FHWA 2014). In order to encourage wildlife to inhabit Open Space lands and use them as migration corridors, it is important to keep them as “natural” as possible.

Over the past several years, eight miles of electric deer fencing and five electric mats built into the roadways were constructed at various locations to guide wildlife to cross the road in designated areas where motion-detections cameras and caution lights alert motorists to slow down when wildlife are present (NM Game and Fish, 2007). Crews also enhanced existing culvert-underpasses, some of which had drop-offs at the entrances, no natural floors and approached filled with non-native vegetation unattractive to wildlife. Gabion ramps were built (rock- and dirt-filled baskets seeded with native plants) leading to the culverts, and 4-inch-high baffles attached to the bottom of each culvert to trap sediment to create a more natural floor. Volunteers from the Tijeras Canyon Safe Passage Coalition cleared the non-native vegetation in the culvert approaches. Funding came from the “I-40 GRIP” project.

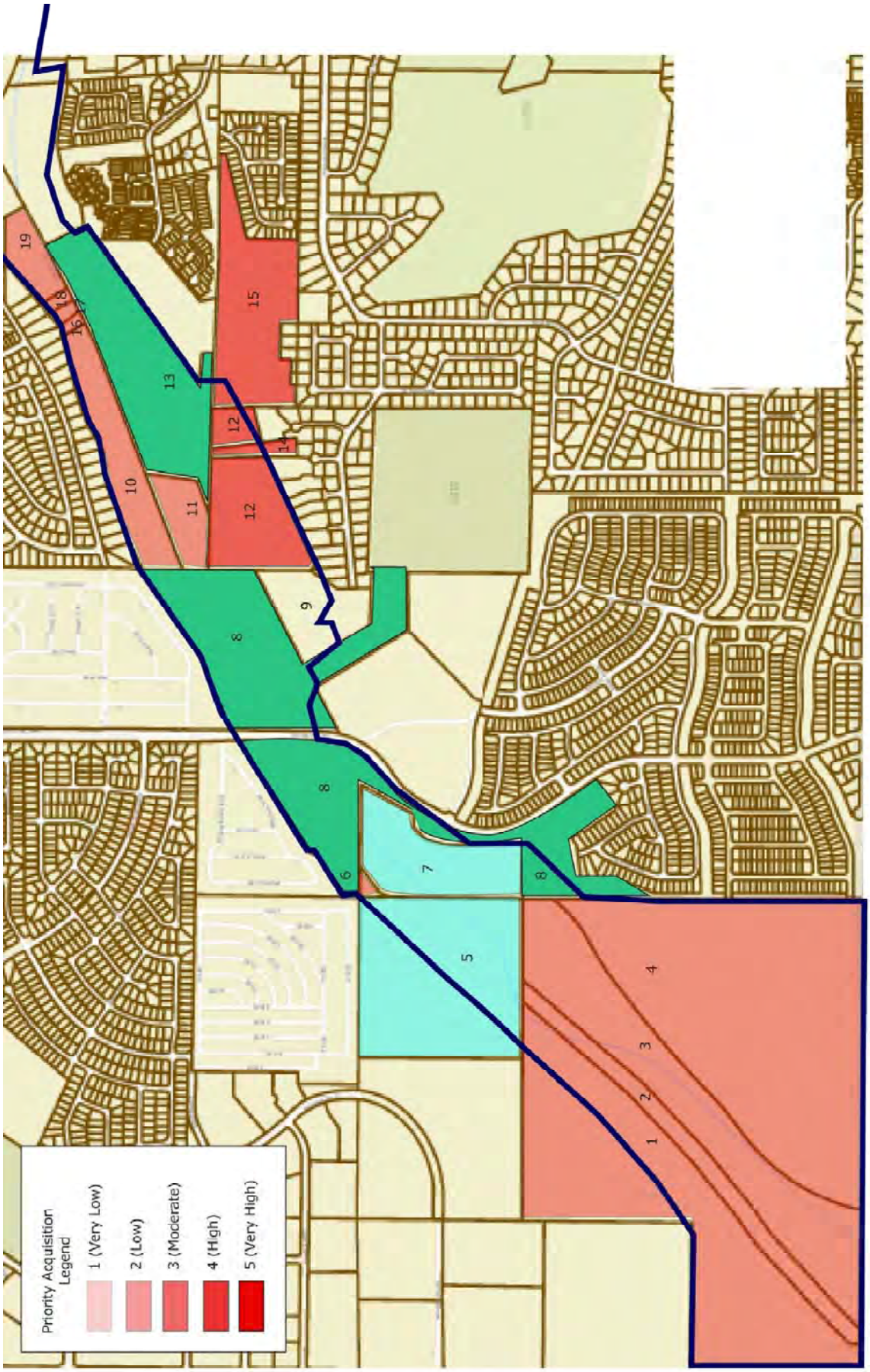

Figure 12. Ownership &Potential Acquisitions

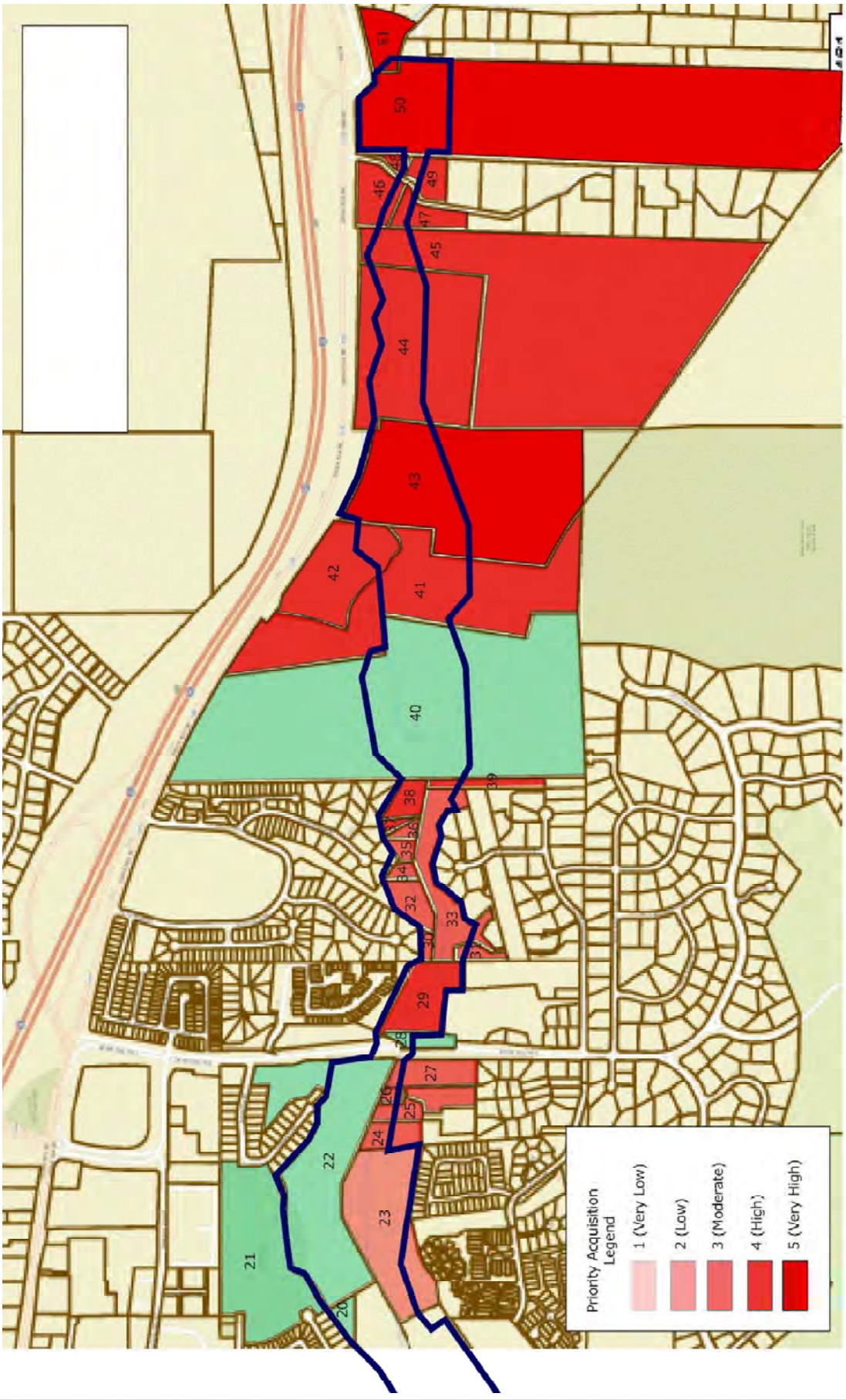

Figure 13. Ownership & Potential Acquisitions

6.3. Natural and cultural resources

A primary purpose of this RMP is to provide guidance for conserving and protecting the site's natural and cultural resources. The following are key issues regarding the management and maintenance of these resources.

- Mitigation of contaminants and pollutants caused by surface runoff, storm drain flows, and illegal dumping
- Erosion prevention caused by new development and illegal ORV use
- Re-vegetation of disturbed areas
- Up keep and management of formal trails on site
- Protection of archaeological sites and artifacts
- Protection of wildlife and plant communities
- Boundary and access protection

6.4. Trailhead Improvements

As the land around the Tijeras Arroyo develops with new homes and businesses, the need for parking and trailhead access points increases. As the Bio-Zone has numerous owners and many parcels of land within the boundary, the OSD will need to strategically place parking and access near City-owned parcels while respecting private land parcels.

The first objective is to locate the best parking and trailhead access. At least one parking lot shall be created for public access to the Bio-Zone. The proposed City fire station within the proposed Volterra Subdivision could provide a portion of its parking area for Open Space access. This would allow people to start exploring just east of the Juan Tabo Bridge. The trailhead should contain an information kiosk with a map of the Bio-Zone and an interpretive panel about the Bio-Zone's natural and cultural resources. Another trailhead area in consideration would be off Four Hills Blvd. just north of the arroyo on the west side of the road within COA jurisdiction. Currently, there is a paved driveway leading down to a landscaped area that could potentially be used as a parking lot and trailhead. More trailhead connections should be researched at the extreme east and west ends of the TABZ as well.

A trailhead near Singing Arrow Park, along the north side of the arroyo and west of Four Hills Boulevard, would also provide good access to the property. Presently there is a walk-through area from the park that leads to a steep slope going into the arroyo. A sustainable trail segment would be needed prior to putting an official trailhead and possible parking area near Singing Arrow Park.

An exciting possibility to research would be of a future connection between the Bio-Zone with a trail leading under Interstate 40 to Tijeras Canyon Major Public Open Space and the rest of the Sandia Foothills Open Space trail system.

6.5. Recreational opportunities

The City encourages low-impact recreational activities at TABZ that may include but are not limited to hiking, biking, horseback riding, as well as a variety of activities related to the study and enjoyment of nature. Improving the existing trail network to IMBA standards while retiring older, unsustainable "social" trail routes, will be a key to a successful management and maintenance program. No new trail construction segments have been identified at this point.

6.6. Trail Development and Conditions

There are many user-made trails traversing TABZ. The trails are in decent shape and may simply need periodic maintenance. Some of these may be considered "sustainable" while other segments may need to be rerouted for safety and sustainability. Most of the trails are along the embankments of the Tijeras Arroyo and are used by local residents as walking/jogging and mountain biking paths. However, some trails are along extremely steep side slopes and may need additional work to be considered safer. It is crucial to only allow sustainable trails to be officially recognized as Open Space trails. Therefore, OS staff will need to determine what can be considered official and what needs to be changed prior to installing trail signs to designate them OSD trails.

Otherwise, unauthorized "social" trail development can lead to the following problems:

- Trail incision
- Erosion and trail creep
- Surface water gullies
- Degradation to the watershed
- Negative impacts on local vegetation and wildlife habitats
- Leaching of soil nutrients
- Unsafe and dangerous trail conditions

According to the National Park Service, "sustainable trails" are those that:

- Support current and future use with minimal impact the area's natural systems;
- Produce negligible soil loss, while allowing vegetation to inhabit the area;
- Allow some vegetation to be pruned or removed for proper maintenance;
- Do not adversely affect the area's animal life
- Accommodate existing use while allowing only appropriate future use;
- Require little rerouting and minimal long-term maintenance.[21]

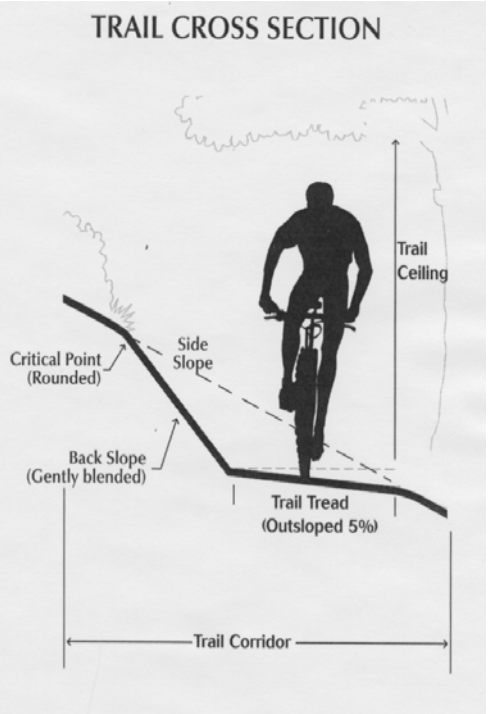

Figure 14. Sustainable Trail Design

[21] National Park Service, Rocky Mountain Region, January 1991

6.7. Sustainable Trail Design

The International Mountain Biking Association (IMBA) is an organization that started in 1988 by five mountain bike clubs in California to end the closure of mountain bike trails. They began a movement to educate the public about the benefits of recreational mountain biking and sustainable trail building. Today, the association has thousands of members and supporters from around the globe, including world champion bicyclists. According to IMBA, a sustainable trail system requires little maintenance and minimizes impacts to natural systems. There are several features that a sustainable trails system should have; some are described and illustrated below.

6.7.1. Drainage

One of the most important elements of sustainable trail design is drainage. Trails should shed water at every opportunity. Sustainable trails should never accumulate and hold water on the trail. When water concentrates and cascades down a trail it leads to unsustainable levels of erosion that both degrade the trail and the environment thus creating more trail maintenance work for Open Space staff and volunteers.

Figure 14 illustrates several important drainage features for sustainable trails.[22] The gentle, vegetated back-slope slows water down and favors infiltration rather than erosion. The trail itself is gently sloped downhill in order to continually divert water from the pathways.

If the trail passes through an extensive drainage that sheds a large amount of water or often has fast-moving flood waters, structures can be built to keep trail users safe and out of the drainage/catchment area. Keeping trail users out of the drainage also limits the amount of erosion and down-cutting in the drainage, leaving it natural and unaltered. The following pictures show examples of these structures, which may be needed when a trail crosses a large drainage.

Various structures made from natural wood and rock materials help bridge drainages.

[22] Rendering from: IMBA. Building Better Trails. Boulder, CO. 2001. Page 29 and 41.

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Figure 15 illustrates the use of the rolling grade dip to drain water from gently-sloped trails. This technique involves the creation of a small, graded dip in the trail that arches downhill. Water is diverted from the trail at the point of the dip. This prevents the pooling of water on the trail as well as the flow of water along it.

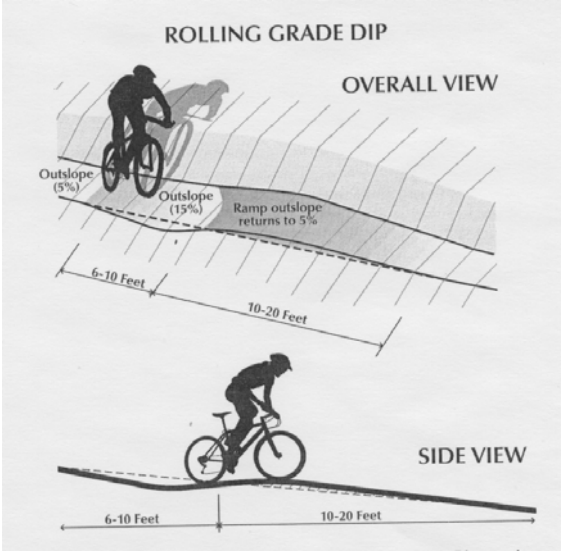

Figure 15. Graded dips prevent erosion

6.8. Limits of Acceptable Change

"Limits of Acceptable Change" is a management strategy that was originally developed to address issues within the U.S. Wilderness Preservation System. It provides a way to balance public access with resource protection. This is possible by setting *measurable standards for baseline conditions* (e.g.,the rate of damaged vegetation or erosion) and by making management decisions on the basis of such standards. If, for example, the use of a particular trail were to cause damage to surrounding vegetation beyond the set standards, then action would be taken to improve or re-route the trail in order to avoid such impacts. This system ensures that the most important values of a particular site are protected for future generations.[23] Using this system will be crucial once restoration strategies are implemented and vegetation begins to grow within disclimax communities.

6.9. Signage and Boundary Protection

Much of the boundary of the TABZ is not protected by fences or other means. The TABZ is different from most other Major Public Open Space properties because of the array of different property owners within the boundary. Collaboration with other agencies and private land owners is the only way to protect the entire Bio-Zone boundary.

The Open Space Division can fence and gate areas within the Division's parcel ownership. The Open Space Division will need to work directly with all other parcel owners to find a way to fence or otherwise protect the boundary from illegal vehicular traffic and dumping. This will be specifically important along the eastern segment of the boundary where off-road vehicle (ORV) use has been documented and along the western segment of the boundary near Eubank where recent dumping of trash has been seen. Furthermore, Sites Southwest consultants spoke with nearby residents during a field

23 McCool, Stephen F. Limits of Acceptable Change: A Framework for Managing National Protected Areas, http://www.prm.nau.edu/prm300-old/LAC_article.htm.

survey who stated that thirty to forty vehicles congregate every weekend for off-road activities in the arroyo bottom.

Agencies and property owners should collaborate to install signs to outline the TABZ boundary. Signs should be consistent throughout all parcels and ownerships documenting the area as a "Biological Preservation Zone." Types of signs to be installed include but are not limited to interpretive signs, rules and regulation signs, and boundary signs. "No motorized vehicle" signs shall also be installed around areas burdened with illegal vehicular trespass. The Open Space Division has installed some signs around the MPOS parcel near the Juan Tabo Bridge in the past.

6.10. Environmental education and interpretation

There are currently no programs being offered at the site. There are many opportunities to develop programs. Potential topics include geology, cultural history and archeology, plant communities, and wildlife talks or hikes.

6.11. Stewardship and volunteer coordination

Management of Open Space areas is enhanced by citizen participation through ongoing volunteer programs. The City has maintained an active volunteer program since 1994. Currently there are more than 200 active members of the Open Space Volunteer program (OSV) with about 750 volunteers who have gone through training. The OSV includes the Trail Watch Volunteer (TWV) program, the Adopt-an-Open Space program and other conservation projects. Scout groups, schools, and other interested organizations frequently participate in such activities.

The TWV program is the backbone of the OSD and is designed for people who already spend time in OS areas. Volunteers attend an orientation class and agree to send in regular reports on their patrols and activities. Volunteers are asked to contribute a minimum of 25 hours per year and to attend two additional training classes, educational programs, or conservation projects each year. After attending the orientation, volunteers receive an official Open Space Volunteer badge, lanyard, and iron-on patch. Once 25 hours are completed, volunteers receive a t-shirt.

Patrols are done at the convenience of the volunteer and reports are sent to a volunteer coordinator. TWVs are the 'eyes and ears' of the City and provide the 'big picture' to staff, reporting on wildlife, visitor activities, maintenance needs, suspicious activity, and other vital information occurring in the field. Volunteers may patrol on foot, by bike, or on horseback.

TWVs are also important public educators, informing visitors about the role of the City and encouraging responsible use of the resource.

An extension of the Trail Watch Volunteer program is the Adopt-an-Open Space program, formed to concentrate stewardship in a focused area. In addition to regular TWV duties, adopters must organize at least one group project per year. Some areas may require more projects within a year than other areas. City staff works with adopters to coordinate projects, supply necessary tools and materials, and provide training and supervision. At the City's expense, a sign is installed in the adopted area recognizing the group's efforts.

Conservation projects may include trash cleanup, reseeding disturbed areas, wildlife habitat improvements, the installation of interpretive signage, erosion control, trail maintenance, or new trail construction. Conservation projects are usually initiated by the volunteer group and are often a one-time project. Groups may request to work in a specific area but must be willing to work wherever the City directs them.

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7. Resource and Visitor Protection

7.1. Operations and Maintenance

The COA OSD has a construction and maintenance staff responsible for routine facility maintenance and minor construction projects. Operation staff possesses carpentry, concrete, and masonry skills. Typical duties include the operation of heavy equipment, maintenance and repair of Open Space roads and parking areas, installation and repair of fences, removal of graffiti and trash. The Operations staff is stretched thin with its present workload, but will respond to maintenance requests for all OS facilities. Requests are prioritized according to public safety issues and concerns. Maintenance staff has been to the area several times to pick up trash and debris that has been dumped in the arroyo.

7.2. Resource Management and Visitor Services

The main function of Resource Management and Visitor Service's (RMVS) is to achieve a balance between making OS areas accessible to visitors while protecting the natural and cultural resources of the land. The RMVS staff has a diverse set of responsibilities including: developing management plans, monitoring the health of the land, developing and offering interpretive information through guided hikes and school programs, developing site information including brochures and maps, recruiting and working with volunteers on trail building, maintenance or other conservation projects. The RMVS staff is also responsible for managing the Elena Gallegos Picnic Area and Boca Negra Canyon as well as the Open Space Volunteer Program.

Permanent staff members include a Program Manager, an Education Coordinator, two Associate Planners, and one Park Manager. RMVS staff relies on the help of four Park Attendants to operate the Elena Gallegos Picnic and Boca Negra Canyon Fee areas. RMVS staff will be responsible for scheduling and executing annual restoration and service learning projects with volunteers at Open Space-owned TABZ lands.

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8. MANAGEMENT OBJECTIVES AND STRATEGIES

8.1. Acquisition

8.1.1. Objective

Acquire and incorporate into the COA Major Public Open Space network as many parcels as possible that are owned privately or by various agencies to maximize ecological protection and facilitate management of the TABZ.

8.1.2. Strategies

1) Identify owners willing to sell or donate parcels of land to be acquired by the COA OSD.

2) Prioritize land acquisitions by significance of resource value and development pressure as outlined in section 6.1. Acquisition will be prioritized using the objective weighted system outlined in Table 4 and referenced on the ownership map, Figure 2. OSD should attempt to acquire the arroyo channel in its entirety.

8.2. Resource Protection and Restoration

8.2.1. Objective

Protect sensitive resources and enhance environmental quality including existing ecosystems. Develop strategies to minimize erosion, revegetate disturbed and disclimax areas, and reduce the risk of fire.

8.2.2. Strategies

1) Work with private land owners to prioritize protection areas or easements and ensure that development does not damage the channel or habitats within the TABZ.

2) Re-vegetate social trails that are not part of the formal system.

3) Monitor invasive plant species and assess potential for removal.

4) Conduct biological monitoring assessments to document habitat, wildlife, and vegetation changes.

5) Obtain archaeological clearances before beginning ground-disturbing activities, such as new trail construction.

6) Monitor resources periodically for any needed maintenance.

7) Install interpretive signs and educate users to prevent illegal activities like dumping and vehicular trespass.

8) Identify sources of runoff pollution from adjacent neighborhoods and storm drains to better locate areas for restoration measures.

Most existing habitat currently owned by the COA lacks tree cover and has been disturbed. It has less value than the wooded riparian zones. However, OSD staff and volunteers can implement restoration activities to improve these degraded areas. The following recommendations outlined by Marron and Associates are specifically designed to create wildlife and plant habitat within the dry and disturbed conditions that currently prevail in that area[24]:

- Prohibit vehicle access to the study area.
- Remove dumped materials from the study area while leaving enough material to provide habitat for the Western Burrowing Owl.
- Re-vegetate currently un-vegetated areas with native grasses, forbs, and shrubs.
- Remove exotic species such as tree-of-heaven, salt cedar, and juvenile Siberian elms.
- Currently it is not recommended that mature Siberian elms be removed, as they provide nesting habitat for raptors and other migratory birds It is recommended that the COA attempt to plant cottonwood trees where stands of mature Siberian elms are located. If cottonwoods become established, the removal of Siberian elms would be recommended.
- Increase the number of concrete runoff conveyance structures to route storm water from adjacent mesas to the Tijeras arroyo where it may be collected to provide moisture for habitat improvement activities. Modification of existing structures to provide this function is also recommended.
- Consider the installation of wells pumped by windmills along the bottom of the canyon to provide water for wildlife drinker tanks and vegetation.
- Install bat boxes under the Juan Tabo Boulevard and Four Hills Boulevard bridges as well as at the existing grove of mature elm trees just east of the Juan Tabo Boulevard Bridge, and at any wildlife water features created by the COA.
- Install raptor nest platforms at periodic intervals along the Tijeras drainage.
- Consider the creation of a wetland area at the Siberian elm grove location.

8.2.3. Habitat Protection

The most valuable habitats in terms of natural, biological, and cultural resources within the study area occur on private lands. Since these are not lands owned by the COA, no recommendations have been made with respect to specific improvements or

[24] Marron Study Report, 2008.

enhancement. However, the importance of these areas has been stated, and it is recommended that the COA consider the formation of conservation easement partnerships with willing landowners to provide for protection of these habitats.

8.2.4. Partnerships and Land-Use Agreements

Future wildlife use of the study area will depend upon the availability of habitat, resources, and access to adjacent areas. The development of land-use agreements among the COA, transportation, land and wildlife management agencies, private landowners, and conservation groups that address these issues and provide solutions to emerging problems is recommended.

Specifically, the Tijeras Arroyo Corridor Plan (draft stage-1990) made clear that drainage issues would govern arroyo treatment options and that these issues would not be resolved through the corridor planning process. The Major Open Space Facility Plan recommends that the Open Space Division and the Planning Department work with the responsible drainage authorities to incorporate open space, trail and park concerns into drainage management plans (the AMAFCA drainage management plan for Tijeras Arroyo was adopted in 1981). It is believed that this approach would be more effective in fulfilling the policies of the Facility Plan for Arroyos. See Appendix E for more specific information on other adopted and relevant plans governing the Tijeras Arroyo.

Land-use or conservation easement partnerships would allow for the protection of important resources such as riparian forest areas, springs, wetlands, and wildlife corridors that are currently beyond the jurisdiction of the Open Space Division.

8.2.5. Eastern Section

The eastern section of the Bio-Zone contains the most diverse habitat in terms of vegetation and species, therefore warranting solid preservation and enhancement measures. One strategy would be acquisition of the various privately-owned lands within the boundary area. Moreover, conservation easements, as mentioned before, could potentially provide the desired protection of this critical area and its resources. Also, obtaining ownership of the tributary reach north of the Tijeras Creek is advisable due to one of the three springs/seeps being located there. Securing this portion of the eastern section by acquisition would help to assure control of the totality of the upper riparian corridor and associated stream and aquatic environment as well as two of the three springs/seeps.

8.2.6. Central Section

The central section comprises the most City-owned parcels and presents opportunities for a variety of mitigation and protection measures. These include:

- Erosion mitigation
- Water slowing and retention strategies to promote infiltration and facilitate restoration of vegetation and associated habitat areas.
- Steep slopes stabilization in conjunction with other erosion control measures.

- Access control measures to protect existing resources from further damage by motor vehicles and foot traffic while facilitating successful revegetation and habitat establishment.

8.2.7. Western Section

This section is mainly privately owned. There is existing juniper savanna vegetation cover that ideally should be conserved and protected as it is a slow growing vegetation class which is hard to replace quickly. A long-term strategy could be to enhance the juniper savanna area with denser stands of juniper trees and lush grass cover. The natural, meandering course of the channel is critical for land health and should not be altered.

To preserve and promote use of this habitat, human traffic should be kept a minimum of 100 yards away from the noted areas.

This section contains narrow bands of potential Western Burrowing Owl habitat where an old landfill dumping site exists. This former landfill area could potentially contain hazardous materials which could be exposed by erosion. Future research into hazardous waste is recommended, as well as slope and erosion control. (See potential restoration opportunity maps, Figure 16-Figure 19.)

8.2.8. Specific Restoration Strategies

The following are specific strategies for extending the habitat-rich ecosystem observed in the eastern section to the central and western sections of the study area. (See the Contrast of Existing Habitat and Disturbed Disclimax Areas Map, Figure 20).

The specific restoration opportunities have been classified into three types:[25]

1) Biologically Sensitive Areas- contain protected species habitat and the important wildlife habitats as reported by Marron and Associates; these areas may be considered for potential preserves in which recreational activities are restricted.

2) Potential Primary Preserve- includes the riparian areas, wildlife corridors and migratory bird use areas, grasslands, and boulder fields. These are areas in which low impact activities may be allowed.

3) The Disturbed Disclimax Areas- refer to the degraded areas, largely in the central and western sections. These areas have been stripped of vegetation and have been subjected to dumping, off-road vehicle use and are currently being surrounded by residential development. These areas can be considered as having both the greatest need and the highest potential for restoration. (See the Restoration Opportunities Maps on the following pages).

[25] Sites Southwest Study Report, 2008.

Figure 16. Restoration Opportunities

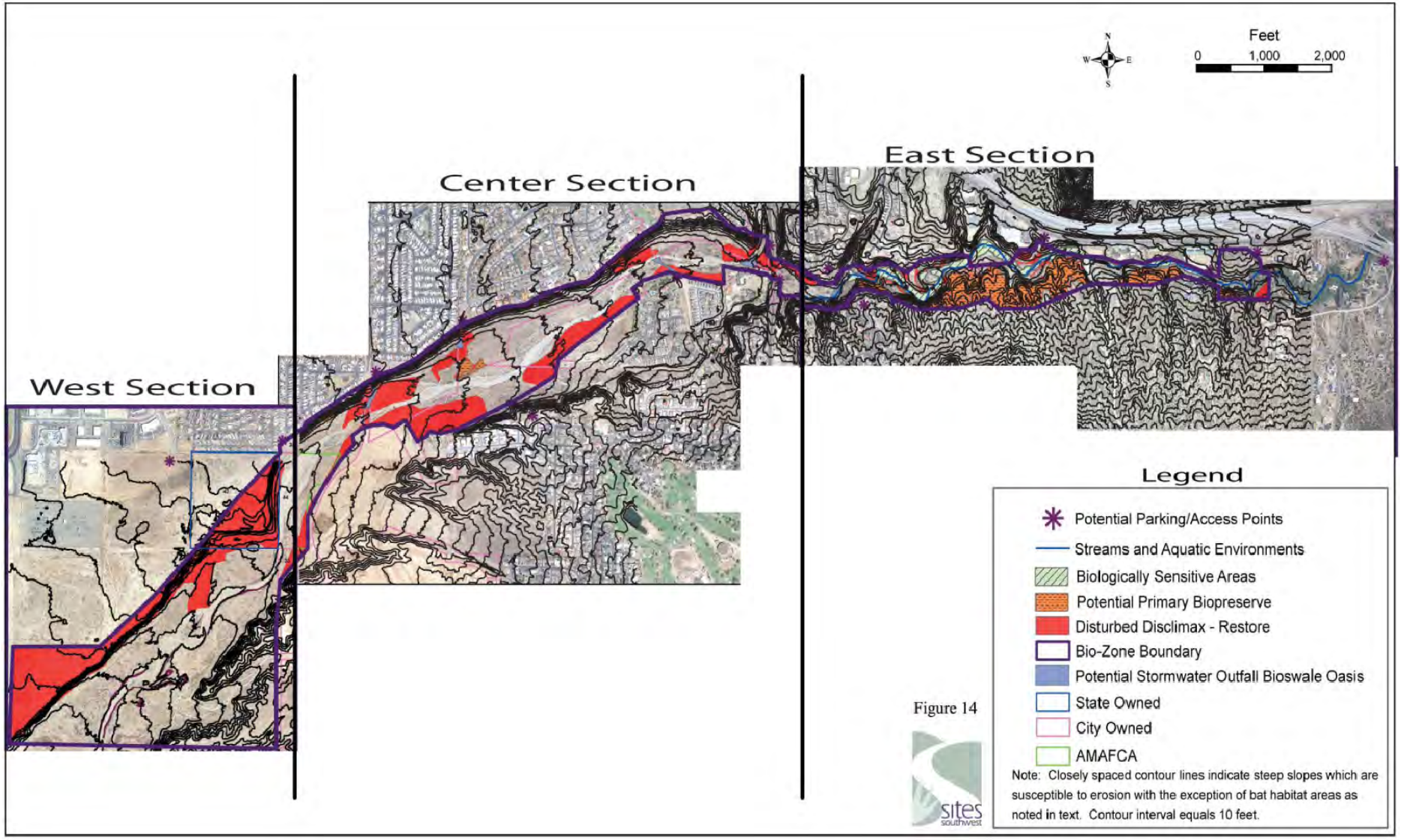


Figure 17. Restoration Opportunities (East Section)

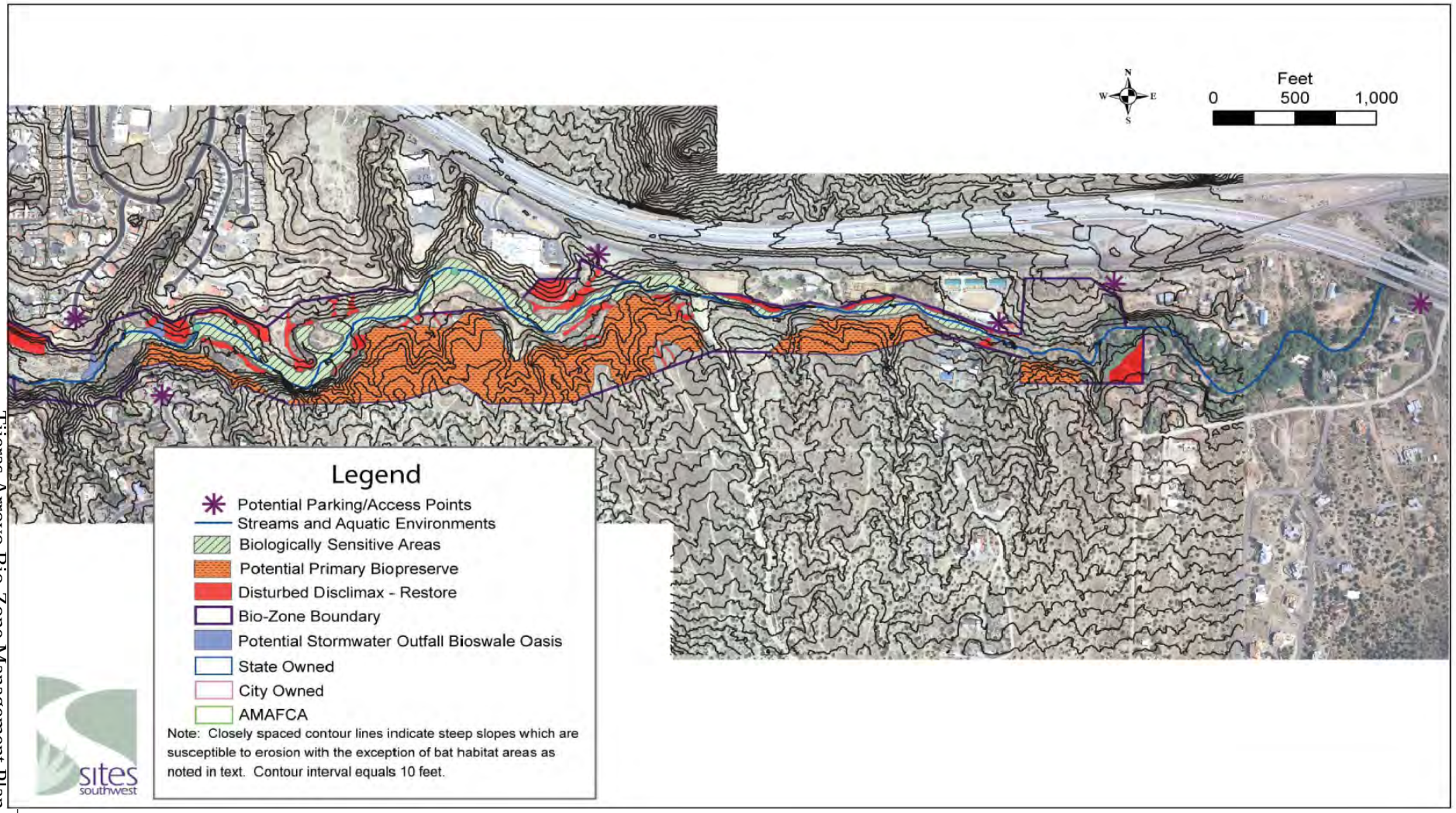


Figure 18. Restoration Opportunities (Central Section)

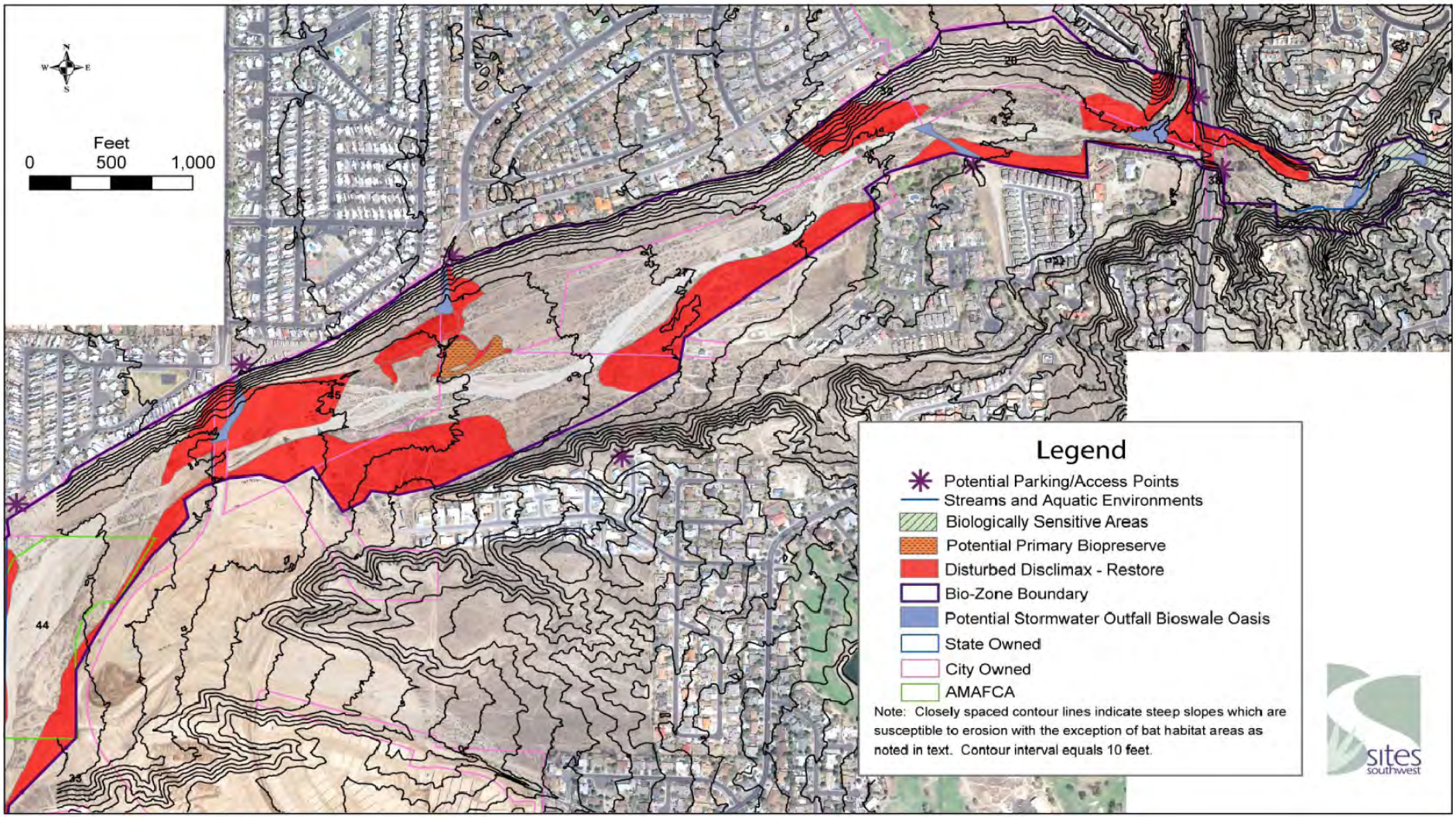


Figure 19. Restoration Opportunities (West Section)

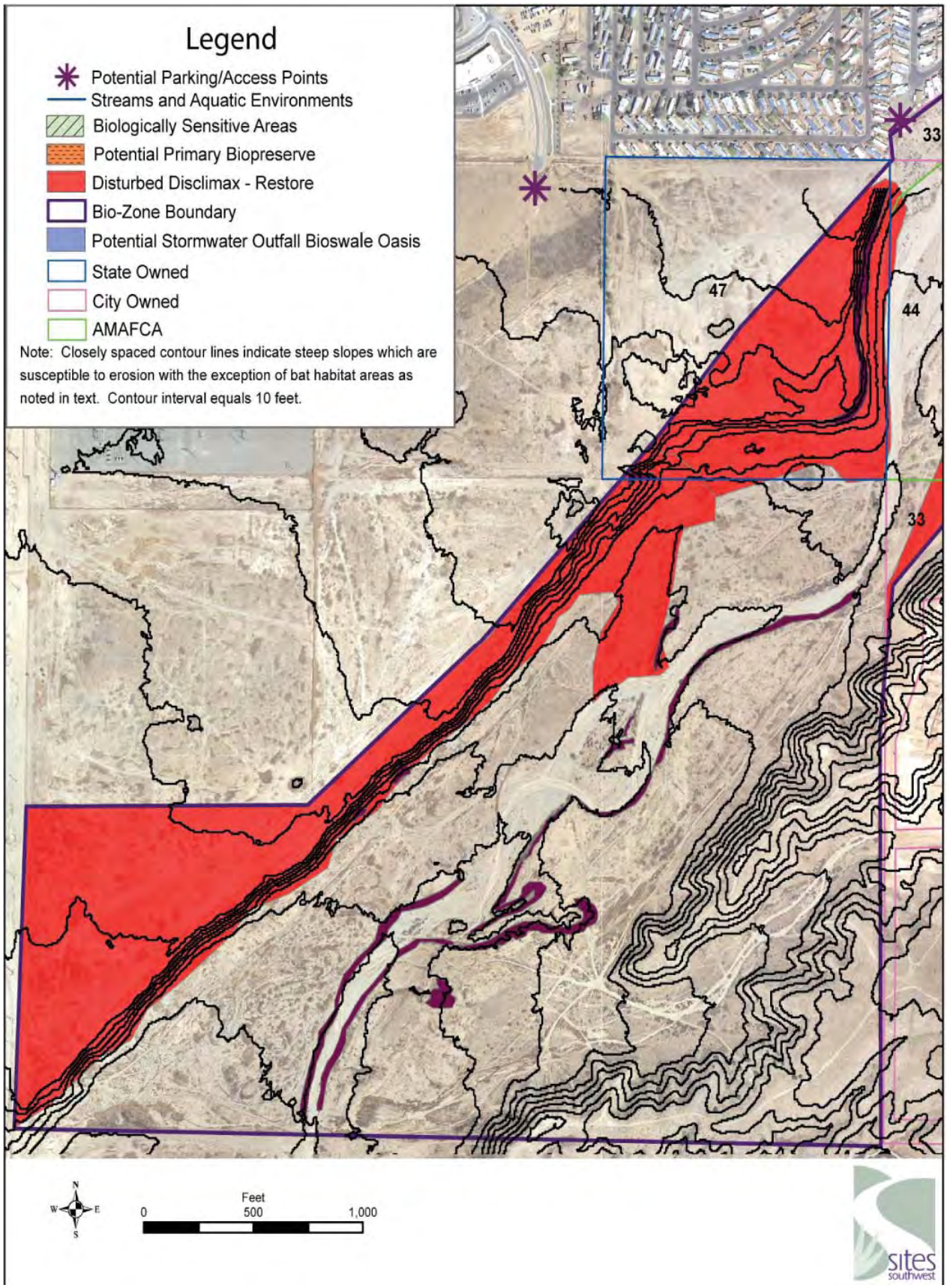
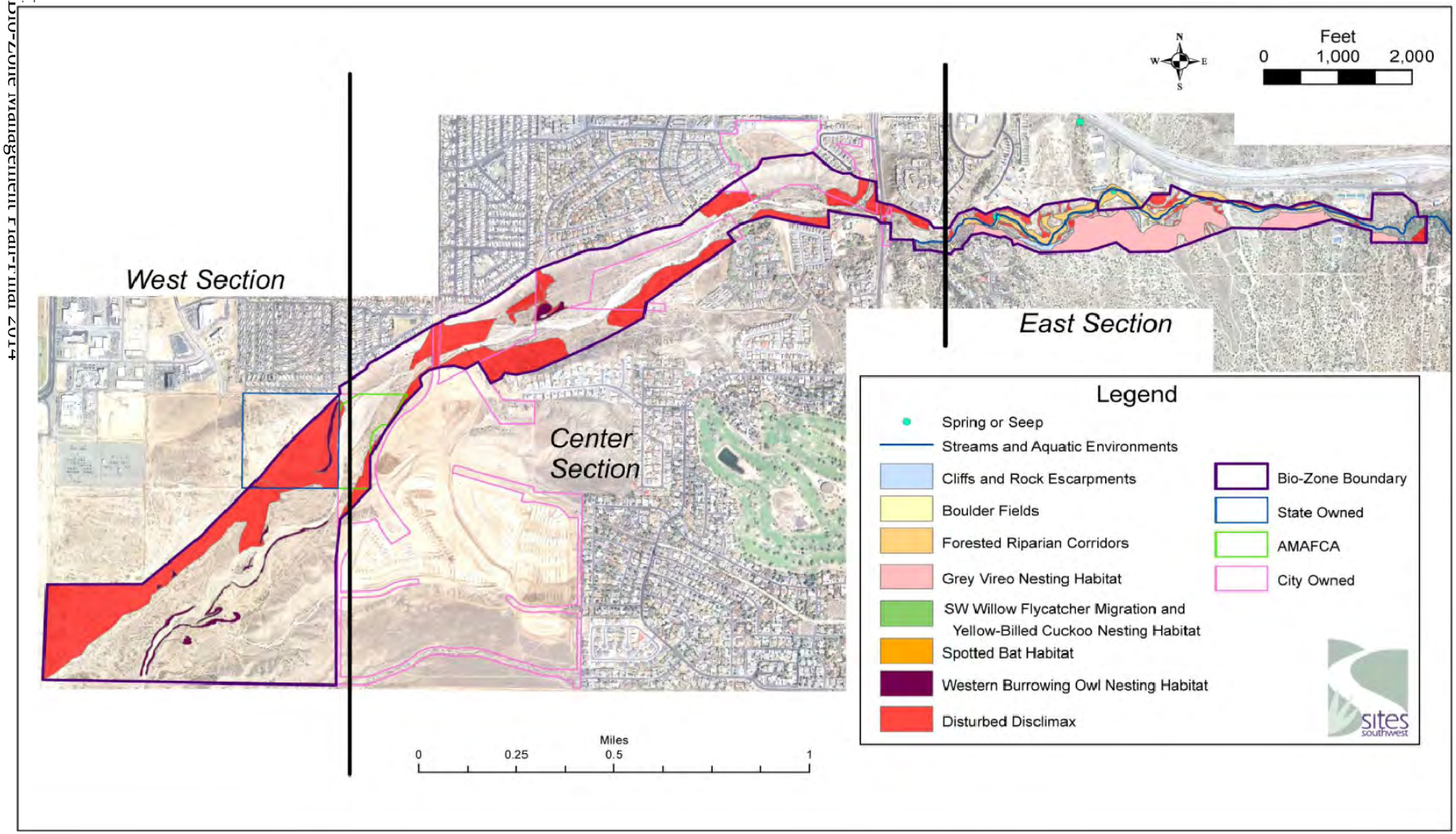


Figure 20. Contrast of Existing Habitat and Disturbed Disclimax Areas



A critical part of restoration is to revegetate sparsely or non-vegetated areas with native plant species. Only re-seeding or overseeding, planting, establishing and managing native plants can reverse the trends of poor to non-existent habitat, excessive erosion and dominance by non-native species. Restoring the native plant palette is essential to improving wildlife habitat.

Restoration strategies, in order to be successful at establishing revegetation, must be site-specific. Several factors are critical in the determining which strategy to use and where to use it. The microclimate at a particular location (solar aspect, soil, slope, available moisture), existing vegetation, the plants species, and whether the plants should be installed as seeds, tube plants or larger specimens, are among the main considerations. Reclamation seeding should be applied wherever restoration planting occurs. Riparian, Montane, Woodland, Juniper Savanna and Shrub Thicket areas may also receive pole plantings of trees and bare root, container, or plug plantings of shrubs.[26]

8.2.9. Removal of Noxious Materials

Noxious and hazardous materials and debris should be removed as a first-line restoration strategy. Trash and construction debris have been dumped in the arroyo for decades. There are several methods recommended for dealing with these, depending upon their nature. In some cases, as with some of the piles of construction debris; they could be allowed to remain after some clearing of potentially dangerous substances or materials because they have potential as nesting sites for the Western Burrowing Owl, a protected species. Moreover, it is possible that some of the dumped material—concrete chunks in particular could be reused as elements of erosion control strategies or as seating. Other materials will need to be removed prior to revegetation and reseeding.

Removal of non-native and noxious weedy invasive species such as Siberian elm and tamarisk is noted as a potential future strategy once revegetation with native species is successfully established and of sufficient magnitude to offset loss of current habitat provided by the non-native species.

8.2.10. Seeding (Re-seeding and overseeding)

Seeding is one of the least expensive methods of restoration. Seeding includes re-seeding of areas that have been denuded of vegetation, while overseeding refers to application of seeds in areas that have existing plants. Specific seed mixtures should be developed for the target area undergoing restoration. Typical seed mixtures for the Tijeras Arroyo Bio-Zone would consist of available native grasses and forbs seed that would provide food, nesting habitat and shelter or roosting potential. Re-seeding methods to be considered are broadcasting, crimp and drill or hydro-mulching, and land imprinting, a no-till method for seeding. A thin layer (1/2”) of small (1/2”-1”) fractured gravel much over seeded

[26] IBID, 2008.

areas has also produced successful establishment, particularly in overseeding installations.

Other than the use of hydrophilic amendments, no irrigation will be applied, making the timing of reclamation seeding critical to the establishment of the vegetative cover. It should be performed during the annual spring and summer rainy seasons, typically April through May and July through September, although the specific time will vary with the microclimate of the target area. A suggested grassland seed mix that could be planted throughout the area is detailed in Appendix C.

8.2.11. Planting Strategies *(Revegetation)*

Bare root, container or plug planting with native shrubs, such as Apache plume (Fallugia paradoxa), four wing saltbush (Atriplex canescens), chamisa (Chrysothamnus nauseosus), false indigo (Amorpha fruticosa) skunkbush Sumac (Rhus trilobata), and in wetter areas, coyote willow (Salix exigua), black willow (Salix nigra var. gooddingii), golden currant (Ribes aureum), and Seepwillow (Baccharis salicifolia) will be an important strategy for establishing woody plants. Again, specific plant species should be appropriate for the target vegetation zones as designated by Marron and Associates.[27]

Planting methods are:

- **Bare-root planting** - planting a plant directly in the ground without a root-ball.
- **Container planting** - planting small plants in small containers.
- **Plug planting** - planting small seedlings with a soil or growth medium. The juvenile plants will be planted as bare root with hydrophilic amendments (such as Dri-Water™) and additional restoration devices such as straw or log wattles and/or wicks. Hydrophilic amendment refers to containers filled with water-absorbing gel particles that absorb water and then slowly release it to plants over time. Containers of gel are placed around the root zone of the plant at the time of planting and watered well. Replacements or refills of the containers may be necessary once or twice per growing season during the time of establishment (generally two years). Coyote willows can also be planted directly in wet areas as **live sticks**.

[27] Sites Southwest Study Report, 2008.

Native Tree and Shrub Plantings with Dri-Water™ and Log Wattles

Pole planting- Native trees, such as the Valley Cottonwood (Populus deltoids ssp. Wislizenii) can be planted by using pole planting. This technique is most frequently used in the restoration of riparian areas and may be appropriate for areas with a high water table as well as r the larger storm water outfall, or bioswale oases, discussed below. Branches of cottonwoods, called whips, 10 feet to 15 feet in length, are slipped into holes that have been augured through the soil to the water table. Little maintenance is required beyond taking precautions to protect the young trees from beavers. Installation of Dri-Water™ in large diameter perforated PVC near the root zone may be necessary to establish pole plantings in certain areas. The Open Space Division has been pole planting "whips" of black willow and cottonwood in the bosque for many years.

A potential overall restoration strategy is to re-vegetate the arroyo with shrubs and juvenile trees to re-create the missing native canopy and understory of forest woodland and riparian areas with native shrub thickets in open areas. At the same time, spaces (gaps) should be left between restored areas to create edge conditions. Preferences for thicket size and gaps are species-specific for many birds and mammals; providing a variety of sizes in thickets and the gaps will best meet the needs of a wide variety of wildlife.

Maintenance and adaptive management will be important to the long-term success of the re-vegetated areas. It will require ongoing removal of non-native and invasive species. In re-vegetated areas, plants that die will be replaced if appropriate. For best results, the hydrophilic amendments on shrubs and trees will have to be refilled or replaced throughout the first two growing seasons, and maybe longer in extreme drought conditions.

8.2.12. Outfall Bioswales

Albuquerque's storm water management system in areas adjacent to the study area is designed to convey storm water runoff directly to the Tijeras Creek arroyo and on to the Rio Grande. In most locations, this runoff enters the bosque prior to outfalling into the river. Water from municipal storm water outfalls is generally of low quality as storm water systems drain developed areas and contain high levels of automotive pollutants and debris, while irrigation return flows contain agricultural contaminants (e.g., fertilizers and pesticides).

Additional problems associated with these storm water systems are that the typically high velocities associated with their discharge increase the erosion potential and the large amount of trash deposited in the vicinity of the outfalls. Bioswales and debris catchment devices and energy dissipation methods at outfall sites could help correct some of these issues (See Figure 22).[28]

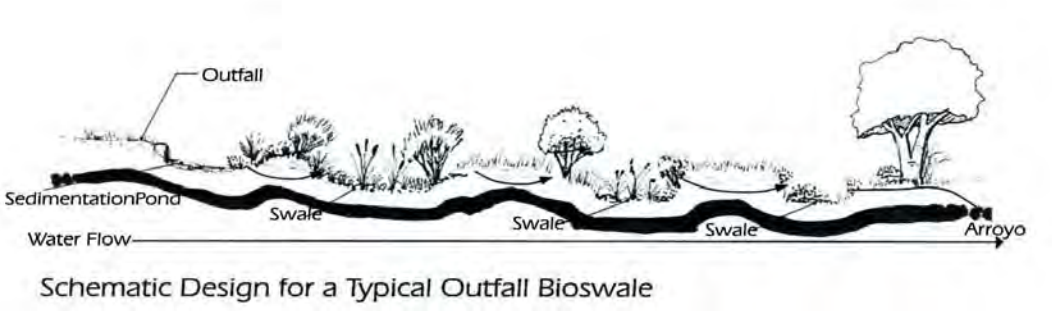


Figure 21. Outfall Bioswale

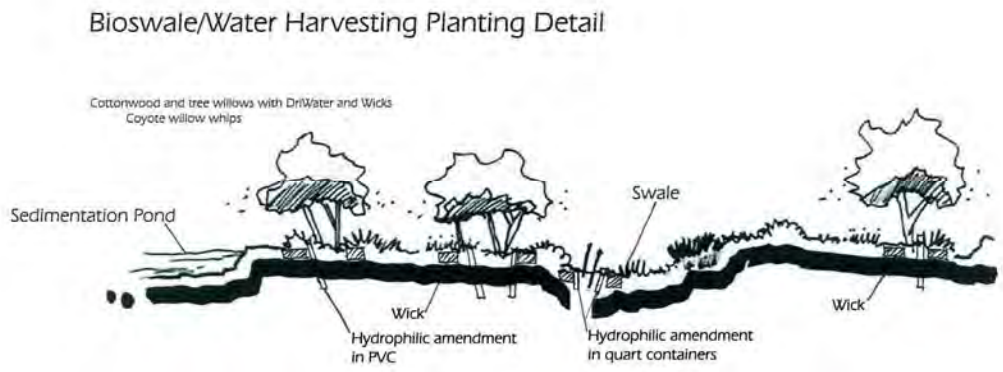


Figure 22. Water Harvesting Bioswale

[28] Sites Southwest Study Report, 2008.

Simple modifications to the existing outfalls could provide several benefits. Figure 21 Outfall Bioswale, provides a conceptual design of a typical outfall bioswale. The general concept of an outfall bioswale is to divert the low flows from the outfall into a newly constructed swale area. It is commonly accepted that the majority of the pollutants and trash from these systems is contained in the "first flush," or the first 0.25 inches of runoff. The conceptual design includes a sedimentation pond to collect the bulk of the debris, sediment and pollutants exiting the system during these low flows combined with a series of swales to help address the issues discussed above.

The swales would be planted with mesic plants and those well adapted to ephemeral conditions to promote biological activity. Screening or debris catchment devices, either directly on the outlet of the pipes or a "dam" within the sedimentation pond, could be designed to remove the trash and help the sediment drop out. The configuration presented in the figure also allows for dissipation of the energy and associated erosive potential associated with higher flows.

Additional erosion protection could be included on a site-specific basis, if needed for the existing flow paths. These measures would also serve to emulate some of the well-known benefits of wetlands by removing the contaminants through both biological and hydraulic means (settling) and providing a diverse habitat.[29]

Shrub Thickets (at Bioswale Oases)

The potential habitat value can be increased by developing the outfall bioswale as a shrub thicket. Shrub thickets provide food and shelter as well as both core and edge habitats that are preferred by a wide variety of wildlife species. In upland areas, the shrub thicket features would consist mostly of wavy leaf oak (Quercus undulata), live scrub oak (Quercus turbinella), Apache plume (Fallugia paradoxa), sand sage, skunkbush sumac (Rhus trilobata) and California brickellbush plants; other plants would be utilized depending on the specific configuration of the site. In wetter areas, a suggested plant community would be: coyote willow (Salix exigua), golden currant (Ribes aureum), Seepwillow (Baccharis salicifolia) with skunkbush sumac (Rhus trilobata) on the upper edges.[30]

[29] Sites Southwest Study Report, 2008.
[30] IBID, 2008.

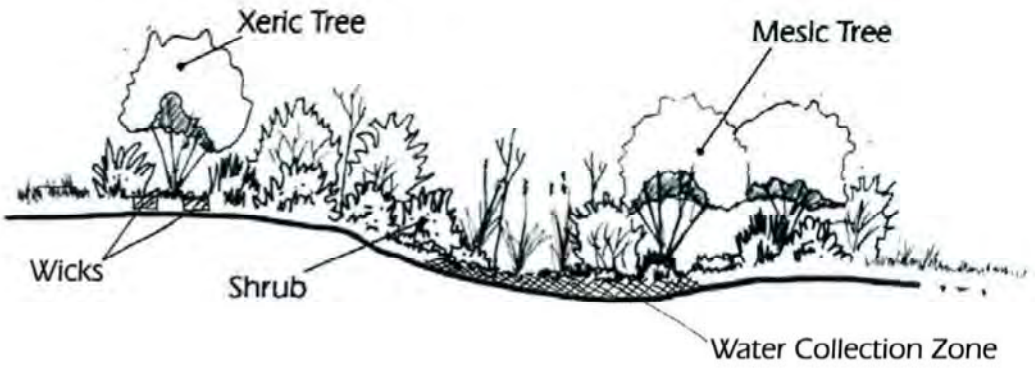


Figure 23. Shrub Thicket Bioswale

8.2.13. Slope Stabilization and Erosion Control

The study area has some very steep slopes as illustrated by the 10 foot contour lines shown in Figure 4. Combined with highly erodible soils, there is an opportunity to employ re-vegetation and other strategies that help stabilize slopes. The areas of greatest concern are in the center and western sections where the vegetation is sparse and the erosion is most significant. However, there are several other locations that would also benefit from slope stabilization, especially near the outfalls from the large commercial industrial sites in the east section.

There are a couple steep areas in the eastern section along the south side of the Tijeras Creek that are actually rock cliffs and are prime bat habitat as shown on the Protected Species Habitat Map (Figure 11). Because this area is solid rock and prime habitat, no slope stabilization will be needed.

A range of slope stabilization and erosion control measures should be implemented to slow or prevent further adverse impacts to vegetation, habitat and water quality. Some of these potential measures include check dams within the stream bed and ephemeral water flow channels, the aforementioned outfall bioswales, and the use of boulders or cobble angular rock plating along arroyo side slopes (See Figure 24 and Figure 25).

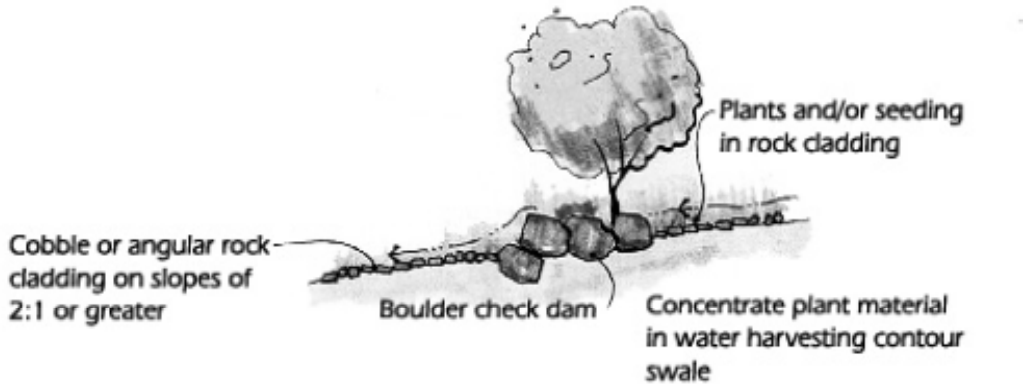


Figure 24. Slope Stabilization and Erosion Control Measures

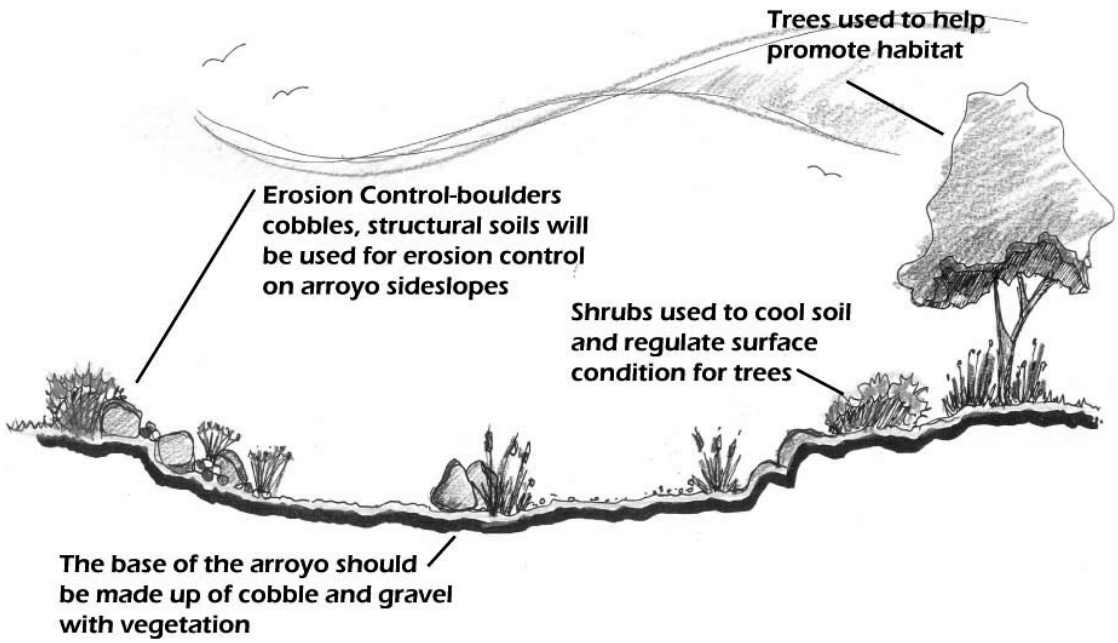


Figure 25. Slope Stabilization and Erosion Control Measures

The placement of angular rock, (approximately 12” x 18” x 6”) close together on steep slopes—known as rock plating—is a very effective method of slope stabilization. Additional slope stabilization strategies such as check dams made of boulders and/or concrete chunks found on site with tube pack plantings combined with seeding as shown

in Figure 26, Figure 27, Figure 28 could be utilized to assist in slowing or preventing further erosion of slopes in the study area.[31]

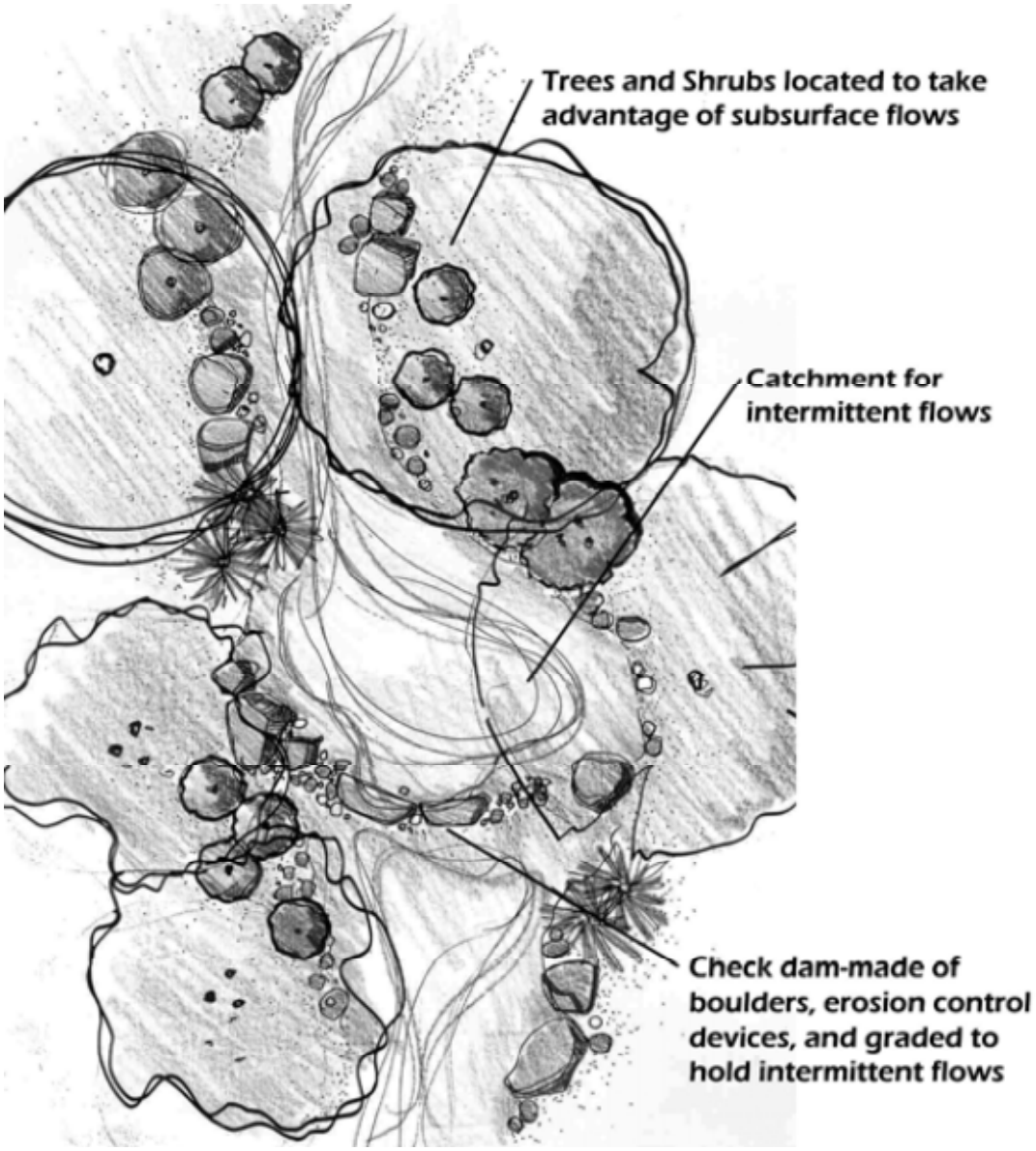


Figure 26. Slope Stabilization and Erosion Control Measures

[31] Sites Southwest Study Report, 2008.

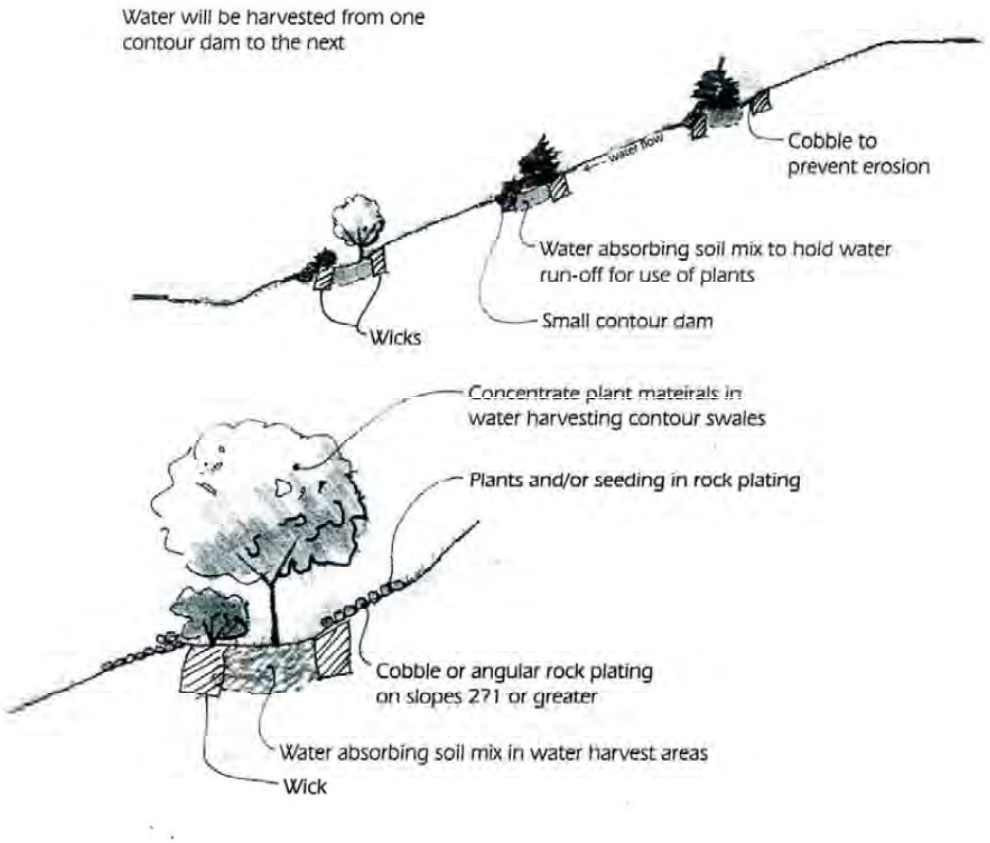


Figure 27. Slope Stabilization and Erosion Control Measures

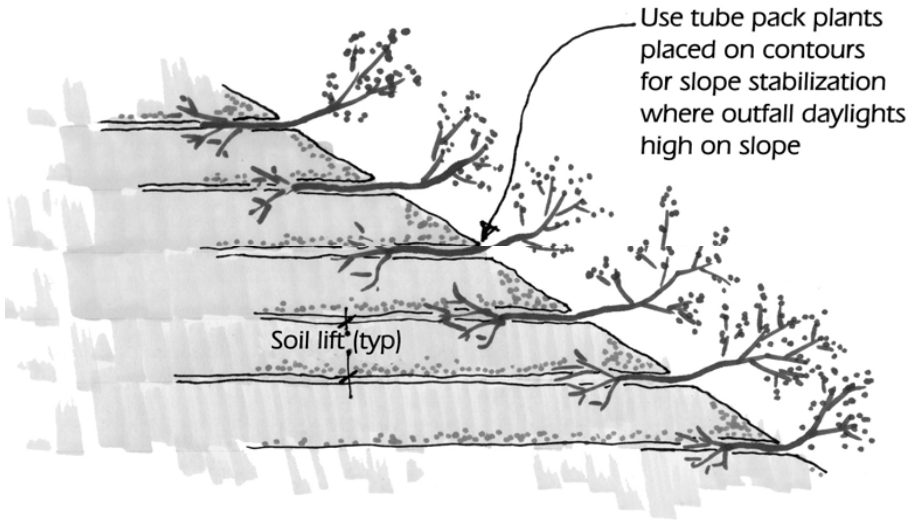


Figure 28. Slope Stabilization and Erosion Control Measures

8.2.14. Additional Restoration Strategies

Interpretive and recreational enhancements could facilitate long-term restoration in three ways:

1) Channel recreation use to a formal designated trail system, thereby reducing the impact of recreational users elsewhere in the Bio-Zone area.

2) Create a series of designated access routes and various trail types throughout the central and western sections of the Bio-Zone that will reduce damage through controlled access and use. Ensure the Albuquerque Police Department's Open Space Unit monitors the area and issues citations to violators.

3) Create interpretive resources for educating members of the public about the Bio-Zone, the restoration process and its stewardship.

4) Expand the Open Space staff to help take on more restoration projects, and increase the budget to help purchase restoration materials

8.3. Property Improvements

8.3.1. Objective

Design and install appropriate site improvements—provide boundary protection, trails, and other improvements that will enhance visitor experience and support site management while maintaining the natural undeveloped character of the property.

8.3.2. Strategies

1) Develop formal parking, trailheads, signage, and sustainable trails

2) Create and maintain an active volunteer program to help with conservation projects within TABZ.

8.4. Visitor Access and Information

8.4.1. Objective

Enhance visitor access and help orient new visitors to the property.

8.4.2. Strategies

1) Install a trailhead kiosk at any official OS parking area and at neighborhood access points displaying the site map, the formal trail system, Open Space activities, rules and regulations, emergency contact information, and special events. The best future parking area will be at the Monachos and Juan Tabo Blvd/Tijeras Arroyo. Another possible parking site may be off Four Hills Blvd. at

the Tijeras Arroyo. Ownership will have to be researched prior to trailhead and parking development.

2) Post International Mountain Biking Association (IMBA) Rules of the Trail. Develop additional signage and programs to encourage good trail use ethics, suich as : “leave no trace”.

3) Install trail markers and directional signs.

4) Install a detailed trails map at trailheads.

8.5. Trails

8.5.1. Objective

Improve trail management and maintenance to minimize erosion and deter the development of social trails.

8.5.2. Strategies

1) Complete a trail assessment map with Global Positioning Systems (GPS) and Geographical Information Systems (GIS) that identifies sustainable and non-sustainable trails within TABZ.
2) Prioritize trail maintenance activities by:
3) Improving existing trails with the construction of drain dips and other erosion control techniques (See section 6.3)
4) Closing and re-vegetating older unsustainable trail sections as new trail sections are constructed3) Develop a non-motorized, shared-use loop trail system within the property.
5) Adopt and implement IMBA trail design, construction, and maintenance standards.
6) Install trail markers and directional signs.
7) Emphasize closure of “social” trails.

8.6. Shared Uses

8.6.1. Objective

Safely accommodate shared uses by supporting diverse recreational activities (such as hiking, mountain biking, and equine uses) and educational activities, while minimizing user conflicts and safety hazards.

8.6.2. Strategies

1) Expand Trail Watch Volunteer and Adopt-an-Open Space programs.

2) Encourage multiple-use with the appropriate signage.

3) Expand the Resource Management and Visitor Services section to allow for regular park attendant patrols.

4) Post" Rules of the Trail" signs at TABZ trailheads.

8.7. Educational Opportunities

8.7.1. Objective

Provide educational opportunities at the site to help visitors of all ages better understand what makes this property and other Open Space areas worth conserving.

8.7.2. Strategies

1) Promote diverse educational opportunities open to a variety of Open Space users.

2) Offer guided hikes with a focus on natural and cultural resource issues (e.g. wildflowers, birding, and geology).

3) Install interpretive signage that informs users of each of the bio-zones. The interpretive information could include for each zone: a map and a summary of the ecology.

8.8. Stewardship and Volunteer Programs

A key management component of OS properties is volunteer recruitment and stewardship organization. Open Space volunteers are recruited through the existing Trail Watch Volunteer (TWV) program. TWV's are asked to indicate which areas of OS they usually use. This information can be used to create a database of active volunteers for all OS properties that can then be used to help organize stewardship projects for individual properties like the Tijeras Arroyo Biological Zone. This database can also be used to notify volunteers of annual meetings to discuss future work plans and to recognize achievements.

8.8.1. Objective:

To recruit, organize, and utilize individuals and groups to assist and enhance the management and protection of the natural and cultural resources of the TABZ property.

8.8.2. Strategies:

1) Continue recruiting stewards through the TWV program.

2) Hire an Open Space Volunteer Coordinator to serve as the point of contact for stewards.

3) OSD staff will work with stewardship groups to coordinate projects, supply necessary tools and materials, and provide training and supervision.

4) Convene annual TWV meetings to discuss progress, plan work projects, discuss needs, and recognize achievements.

8.8.3. Objective:

To provide clear communication and timely support of volunteer initiatives at OS properties to help establish long-term commitments from volunteers.

8.8.4. Strategies:

1) Develop annual work plans identifying staff, equipment, and budget.

2) Keep in direct contact with volunteers to help TWV's stay motivated about stewardship of Open Space properties.

8.8.5. Objective:

Develop long-term stewardship projects that significantly improve OS properties and provide benefits to neighbors and adjacent landowners.

8.8.6. Strategies:

1) Develop management partnerships and funding strategies that address long-term stewardship needs.

2) Encourage Open Space representatives to attend annual neighborhood association meetings to mediate with adjacent landowners and all interested stakeholders to promote collaboration, discussion, and resolution of issues.

3) Address and resolve internal roadblocks that may diminish the City's capacity to support volunteers.

4) Provide ongoing training opportunities for volunteers on a variety of topics such as trail building and maintenance, plant identification, and the handling of emergency situations.

5) Use OSD's Land Health Assessment protocol to monitor changes over time in general land health.

8.9. Facilities Maintenance

8.9.1. Objective:

New TABZ facilities and infrastructure will be maintained and repaired as necessary to mitigate impacts from visitor use, and annual maintenance of facilities shall be incorporated into the facility maintenance schedule.

8.9.2. Strategies:

1) Plan facilities to minimize maintenance needs.

2) Construct facilities with materials that are resistant to weather and vandalism.

3) Train Open Space Volunteers in routine maintenance, land health assessments and facility inspections whenever possible.

4) Incorporate maintenance and upkeep costs of new OS facilities into the OSD's annual operating budget.

8.10. Resource Management and Visitor Services

8.10.1. Objective:

Effectively manage and protect the resource through visitor services functions such as visitor contact, volunteer coordination, environmental education programs, and interpretive information.

8.10.2. Strategies:

1) Recruit new volunteers through visitor contact and information postings.

2) Coordinate volunteer/stewardship projects.

3) Offer guided hikes on a variety of topics relating to the property.

4) Develop interpretive information for the property to be used in signage, school programs or brochures, and on the Open Space website.

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9. Implementation

9.1. Biological Zone Natural and Cultural Resource Protection and Enhancement

Many restoration strategies were outlined in this RMP to achieve the goals introduced in the Executive Summary, which include:

- Conserving natural resources, wildlife, and environmental features;
- Conserving and protecting cultural resources;
- Providing opportunities for outdoor education and low-impact recreation;
- Enhancing vegetative biodiversity habitat within disclimax areas and the overall Bio-Zone.
- Implementing measures to reduce pollutants and contaminants from adjacent developments and storm water drainages.
- Working with private landowners to ensure that development does not threaten the integrity of the TABZ.

The following considerations shall be implemented to reach the overall goals of this RMP. If the policies and implementation to safeguard the property are not followed, any potential restoration work is likely to not work or even be reversed. The two main considerations to safeguard the Bio-Zone are 1) to establish access control and 2) to protect habitat and restoration areas. In order to safeguard the entire Bio-Zone boundary, this plan should act, once officially adopted, as a document designating the area a Biological Zone and further protection measures should be sought.

City Open Space Division should aquire, through purchase, donation or easement, the most sensitive sites to prohibit destruction through development.
Acquisition of new MPOS lands may happen in a number of ways:

1) Through fee simple transactions
2) Transfer of development rights for plats not yet developed.
3) Private donations
4) Conservation easements
5) Land swaps with other agencies

To protect the arroyo from erosion, Open Space should attempt to acquire the entire active channel. At the very least, Open Space should work with private landowners interested in developing parcels in and around the TABZ to establish protection and conservation measures.

These policies and actions will help carry out existing City plans for this area, such as the City of Albuquerque Major Public Open Space Facility Plan and the Bernalillo County-City of Albuquerque Comprehensive Plan.

9.2. Implementation shall focus on three main areas of concern.

1) The first is dealing with drainage which is increasing in importance as residential development continues to surround the arroyo. Coordination with AMAFCA, Bernalillo County and private land owners will be essential to successful management of drainage and the mitigation of pollutants and contaminants.

2) Second, the persistent illegal motorized vehicle recreational activity in the arroyo threatens to further degrade habitat, vegetation and disturb and displace wildlife as well as destabilizing the slopes. Access control is critical to preserving the study area and to the successful restoration of the degraded land. Fencing and signing the entire boundary will be crucial and must be implemented.

3) Third, after the property boundary is protected and access is limited to only pedestrians, volunteer involvement to start implementing restoration strategies (as outlined in section 8.2 will be needed. Ongoing habitat restoration and other projects along with monitoring will be crucial to the success of the goals and objectives outlined in this RMP.

Cultural resource protection is also one of the goals and objectives for this RMP. No specific sites shall be disclosed to the public except on guided interpretive tours only. The protection of these sites is crucial to their survival and significance of human history in the area. Archaeological clearances must be implemented by the OSD prior to any and all restoration and trail work within the City owned Bio-Zone areas.

9.3. Environmental Education and Interpretation

Educational and interpretive themes will need to be developed or existing programs used by City staff. Due to current OS staffing, guided hikes may be conducted by trained volunteers who are members of the TWV program under the Community Interpreters of the Environment (CIOTE) volunteer program. There may also be opportunities to collaborate with other interested groups or organizations that are interested to help in interpretive tours.

9.4. Trail Improvements

City staff will attempt to have a minimum of two volunteer trail projects each year. Most trail work at TABZ will involve new trail construction and the rerouting or closure of social trails. Improvements may also consist of enhancing drainage within the trail system. Berm removal and drain dips are two ways of increasing the effectiveness of keeping water off the trails, thus slowing erosion of the trail. Rerouting steep sections of existing trails will need to be considered and new trail construction shall follow hillside contours. These improvements should mitigate erosion and provide a safe, fun, and sustainable trail system.

9.5. Parking Area

The proposed parking lot near the Juan Tabo Bridge will depend on the timing of the Juan Tabo Hills subdivision build-out. This build-out, which is to include a City owned fire station, may take several years. When the parking area is constructed, the OSD will install appropriate signage near the trailhead and parking area. Other parking areas shall be considered for future development when and if the City can acquire more land within the Bio-Zone. Otherwise, coordination with private land owners and other agencies who own land within the Bio-Zone could provide accessibility to people who want to park and recreate throughout the TABZ.

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11. Annotated Bibliography

11.1. Rank I Comprehensive Plan

Albuquerque/Bernalillo County Comprehensive Plan, August 1988. Updated 2013.
The Comprehensive Plan contains goals and policies for all development in Bernalillo County and a land use framework for the entire urban area. The Comprehensive Plan defines the MPOS Network and sets goals for protection and preservation of natural and archeological resources, with specific language promoting educational, recreational, and cultural amenities within the Open Space Network. (See Appendix A)

11.2. Rank II Area and Facility Plans

Bernalillo County. The Bernalillo County Parks, Open Space, Trails Master Plan (POST), October 2003.
This Master Plan identifies new capital projects and improvements to existing facilities for the Bernalillo County Parks and Recreation Department (BCPR) through 2010. The document acts as an overall framework for future growth of and enhancements to facilities managed by the BCPR Department. The organizing principle of the master plan is **P**arks, **O**pen **S**pace, and **T**rails (**POST**), which strives to link all public recreational facilities and properties to each other and to residential and commercial areas, seen as a holistic approach to recreational facility development.

City of Albuquerque. Major Public Open Space Facility Plan. January 1999.
This Facility Plan establishes guidelines and policies for implementing the Open Space goals of the Comprehensive Plan. The MPOS Facility Plan is a part of a larger planning effort for all recreational resources in the City. The plan identifies seven types of Major Public Open Space based on general resource and use characteristics. (See Appendix B for a detailed account of this plan.)

City of Albuquerque, Planning Department. Facility Plan for Arroyos: Multiple Use of Albuquerque's Arroyos and Their Floodplains, February 3, 1986.
The goal of the Facility Plan for Arroyos is to create a multi-purpose network of recreational trails and open space along arroyos thereby bringing trail corridors with open space characteristics into urbanized areas of Albuquerque. This document also identifies constraints and opportunities for development, evaluates the potential of arroyos, ranks the arroyos for development, establishes policies and guidelines for development and develops an implementation program.The plan states Major Open Space Arroyos, such as Tijeras Arroyo, are to remain in a natural or semi-natural condition with native vegetation and channel stabilization consisting primarily of naturalistic treatments such as riprap and gabions. The seven policies specific to Major Open Space Arroyos as well as specific information on Tijeras Arroyo is presented in this Appendix.

11.3. Rank III Corridor Plans

Bernalillo County, Planning Department. East Mountain Area Plan. 2006.
The East Mountain Area Plan covers a large area of eastern Bernalillo County including parts of the Sandia, Manzanita and Manzano mountain ranges. Major goals and priorities are divided into three sections – Land Use, Natural Environment and Community Development – with an emphasis on preserving rural character, protecting natural resource, improving water availability and planning responsible development. This Appendix extracts this information as it applies to the Tijeras Arroyo Bio-Zone Plan.

Bernalillo County, Planning Department. Tijeras Canyon / Carñuel Plan. August 28, 2007.
This planning document examines community concerns regarding future residential growth with an emphasis on water and wastewater infrastructure. Particular detail is given to the historical significance of this area and its environmental and natural resource conditions. This Appendix extracts this information as it applies to the Tijeras Arroyo Bio-Zone Plan.

City of Albuquerque, Planning Department. East Gateway Sector Development Plan. October 2010.
This plan recommended that the City continue to acquire private lands within the Tijeras Arroyo to consolidate public ownership, provide opportunities for education and low-impact recreation, and improve and enhance habitat. It also recommended formalizing access to the arroyo at Juan Tabo Blvd. and Four Hills Road.

City of Albuquerque, Planning Department. Singing Arrow Neighborhood Plan. March 1983.
A neighborhood plan for the area bounded north and south by Central Avenue and the Tijeras Arroyo and east and west by Four Hills Road and Juan Tabo Boulevard. The plan identifies a need for a bicycle route between Singing Arrow and Kirkland Air Force base for commuting employees. The plan suggests a bikeway south of Manzano Mesa to Kirtland south of the Eubank gate. The plan advises the adoption of City-owned land next to the Carñuel Archeological Site as a neighborhood park.

City of Albuquerque, Planning Department. West Four Hills / South Eubank Planning Guidelines. July 31, 1980.
This short planning document describes rough land use and transportation guidelines for the areas surrounding the Tijeras Arroyo between Eubank Blvd. and Four Hills Road. At the time of publication this area was mostly vacant and facing significant development pressure. The document describes the Tijeras Arroyo as heavily scarred with off-road vehicles and motorcycles tracks, and that significant dumping and landfill operations occurred in the Arroyo bottom and along its northern rim.

13. Appendices

Appendix A – City Council Resolution

CITY of ALBUQUERQUE
SEVENTEENTH COUNCIL
COUNCIL BILL NO. C/S R07278
ENACTMENT NO. _____
SPONSORED BY: Don Harris

RESOLUTION
REQUIRING THE CITY TO DEVELOP A MASTER PLAN FOR A BIOZONE PRESERVE WITHIN AND ADJACENT TO THE TIJERAS ARROYO BETWEEN THE JUAN TABO BOULEVARD RIGHT OF WAY AND THE EASTERN CITY LIMIT; EXTENDING A MORATORIUM WITHIN CITY BOUNDARIES; INVITING BERNALILLO COUNTY TO CONDUCT A JOINT PLANNING EFFORT.

WHEREAS, in the book "Albuquerque's Environmental Story" the Tijeras Arroyo is described as a perennial stream that becomes subsurface at the Four Hills fault. Rock outcroppings and stands of cottonwoods along the stream bed create an open space experience unique in the City; and

WHEREAS, the United States Geological Service reports that east of the Four Hills Bridge the Tijeras Arroyo drains over 77 square miles of land and percolates a significant amount of that water into the ground just west of the bridge; and

WHEREAS, from where the Arroyo enters the City and where it enters Kirtland Air Force Base the Tijeras Arroyo is a transition/junction area for three biozones; the Lowland Mountain BioZone, the Alluvial Fan BioZone and the Short Grass Steppes BioZone. West of Four Hills Road the broad expanse of the Tijeras floodplain is over 1,000 feet. wide. East of Four Hills Road the Arroyo is lined with a mix of cottonwood trees, locust and salt cedar and mounted on grassland slopes are juniper trees; and

WHEREAS, the New Mexico Tourism Department Historic Markers Data Base identifies Tijeras Canyon as a natural route for travel between eastern New Mexico and the Rio Grande Valley since prehistoric times. Singing Arrow Preserve overlooking the Canyon was once part of the Carñuel Genizaro Community, and is on the New Mexico State List of Historical Places; and

WHEREAS, the New Mexico Department of Transportation has completed a project to provide safe passage to wildlife crossing Interstate40 in Tijeras Canyon. The Tijeras Canyon Safe Passage Coalition reports the wildlife linkage through Tijeras Canyon, which connects the Sandia and the Manzano Mountains, is one of the most important and endangered areas in the nation for wildlife passage. The habitat on either side of Interstate 40 provides homes for species such as cougar, bear, and bighorn sheep, among

many others. But, the Interstate 40 severs the two mountain ranges and creates a deadly barrier for animals; and

WHEREAS, to provide for the public's health, welfare and safety, the land use conditions of the Arroyo must be changed. Several subdivisions have developed in the bottom of the Canyon. Abandoned facilities exist in the Tijeras Arroyo Flood Plain and several government agencies have holdings within the Canyon and on the mesas overlooking the Arroyo that are not developable; and

WHEREAS, the City should set aside additional open space to provide for the protection of the riverine environment and maintain the 500-year flood plain required by the Albuquerque Metropolitan Area Flood Control Authority; and

WHEREAS, the Fiscal Year 08 Budget Resolution appropriated one hundred thousand dollars ($100,000) for a Tijeras Arroyo Management Plan and the 2007 General Obligation Bond Question designates five hundred thousand dollars ($500,000) for purchase of open space in the Tijeras Arroyo.

BE IT RESOLVED BY THE COUNCIL, THE GOVERNING BODY OF THE CITY OF ALBUQUERQUE:

Section 1. The City with the adoption of this Resolution formally invites Bernalillo County to join with the City to develop a joint City/County Tijeras BioZone Preserve Master Plan.

Section 2. The City of Albuquerque, and Bernalillo County to the extent it chooses to participate, shall commence with a Master Plan to develop a Tijeras Arroyo BioZone Preserve using the funds established for a Tijeras Arroyo Management Plan. The Plan shall identify methods for:
1) acquiring through easements the lands that make up the Tijeras Arroyo,
2) conserving and restoring the biozones within the Arroyo,
3) protecting wildlife within the Arroyo,
4) removing pollutants from the storm flows that feed into the Arroyo,
5) providing interpretive services about the Arroyo,
6) recommendations how best to manage and protect the site of the Carñuel Genizaro Community, and developing any other policies deemed necessary by the Administration.

Section 3. In the absence of a joint City/County planning effort, the City shall proceed forward with the plan, but recognizes that policies that address lands within the County are recommendations and the City has no regulatory authority over the lands within the County. The City shall, if there is not a joint planning effort, consult with the County in the development of the Master Plan.

Section 4. The City Administration and the County Administration, to the extent the County wishes to participate, are encouraged to develop the plan in concert with the University of New Mexico's Department of Biology, the School of

Architecture's Landscape Architecture Program or other graduate programs at the University of New Mexico.

Section 5. A moratorium shall be imposed until October 1st, 2008 upon all subdivision approvals for those lands within the City and set forth in Exhibit A attached to this Resolution.

Appendix B – Plant Species

AGAVACEAE (Agave Family)

Yucca baccata Torr. (banana yucca)
Yucca glauca Nutt. (soapweed yucca)

ANACARDIACEAE (Cashew Family)

Rhus trilobata Nutt. (skunkbush sumac)

APIACEAE (Parsley Family)

Cymopterus acaulis (Pursh) Raf. var. *fendleri* (Gray) Goodrich (Fendler's spring parsley)

ASTERACEAE (Sunflower Family)

Acourtia nana (Gray) Reveal & King (desert holly)
Artemisia bigelovii Gray (Bigelow's sagebrush)
Artemisia filifolia Torr. (sand sagebrush)
Baccharis wrightii Gray (Wright's baccharis)
Baileya multiradiata Harvey & Gray ex Gray (desert baileya)
Brickellia californica (Torr. & A. Gray) A. Gray (California brickellbush)
Chaetopappa ericoides (Torr.) Nesom (rose heath)
Cirsium neomexicanum Gray (New Mexico thistle)
Conyza canadensis (L.) Cronq. (Canada horseweed)
Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird (rubber rabbitbrush)
Erigeron divergens Torr. & Gray (spreading fleabane)
Erigeron flagellaris Gray (trailing fleabane)
Gaillardia pinnatifida Torr. (red dome blanket flower)
Grindelia nuda Wood var. *aphanactis* (Rydb.) Nesom (gumweed)
Gutierrezia microcephala (DC.) Gray (threadleaf snakeweed)
Gutierrezia sarothrae (Pursh) Britt. & Rusby (broom snakeweed)
Helianthus annuus L (common sunflower)
Machaeranthera canescens (Pursh) Gray (hoary aster)
Machaeranthera pinnatifida (Hook.) Shinners ssp. *pinnatifida* (lacy tansy aster)
Malacothrix fendleri Gray (Fendler's desert dandelion)
Melampodium leucanthum Torr. & Gray (plains blackfoot)
Senecio flaccidus Less. var. *flaccidus (*threadleaf groundsel)
Thelesperma megapotamicum (Spreng.) Kuntze *(*Navajo tea)
Stephanomeria pauciflora (Torr.) A. Nels. (brownplume wirelettuce)
Thymophylla acerosa (DC.) Strother (pricklyleaf dogweed)
Tragopogon dubius Scop. (yellow salsify)
Xanthium strumarium L. (cocklebur)

Zinnia acerosa (DC.) Gray (desert zinnia)

ASCLEPIADAEAE (Milkweed Family)

Asclepias asperula (Dcne.) Woods. (spider milkweed)
Asclepias latifolia (Torr.) Raf. (broadleaf milkvetch)

BORAGINACEAE (Borage Family)

Cryptantha cinerea (Greene) Cronq. var. *jamesii* Cronq. (James' cryptantha)
Cryptantha crassisepala (Torr. & Gray) Greene (deer tongue)
Cryptantha fulvocanescens (S. Wats.) Payson (tawny catseye)
Lappula occidentalis (S. Wats.) Greene var. *occidentalis* (desert stickseed)

BRASSICACEAE (Mustard Family)

Descurainia incana (Bernh. ex Fisch. & C.A. Mey.) Dorn (mountain tansymustard)
Dimorphocarpa wislizeni (Engelm.) Rollins (specklepod)
Lesquerella fendleri (Gray) S. Wats. (Fendler's bladderpod)
Rorippa nasturtium-aquaticum (L.) Hayek (watercress)

CACTACEAE (Cactus Family)

Echinocereus fendleri (Engelm.) F. Seitz (pinkflower hedgehog cactus)
Escobaria vivipara (Nutt.) Buxbaum var. *arizonica* (Engelm.) D.R. Hunt (Arizona spinystar)
Opuntia clavata Engelm. (club cholla)
Opuntia cymochila Engelm. & Bigelow (grassland pricklypear)
Opuntia imbricata (Haw.) DC. (walkingstick cholla)
Opuntia macrorhiza Engelm. var. *macrorhiza* (twistspine pricklypear)
Opuntia phaeacantha Engelm. var. *phaeacantha* (tulip pricklypear)
Opuntia polyacantha Haw. (plains pricklypear)
Opuntia polyacantha Haw. var. trichophora (Engelm. & Bigelow) Coult. (hairspine pricklypear)
Sclerocactus papyracanthus (Engelm.) N.P. Taylor (paperspine fishhook cactus)

Capparaceae CAOOARACEAE (Caper Family)

Polanisia dodecandra (L.) DC. (roughseed clammyweed)

CHENOPODIACEAE (Goosefoot Family)

Atriplex canescens (Pursh) Nutt. (fourwing saltbush)
Chenopodium fremontii S. Wats. (Freemont's goosefoot)
Kochia scoparia L. (Summer cypress)
Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smit (winterfat)

Salsola tragus L. (prickly Russian thistle)

CUCURBIDACEAE (Gourd Family)

Cucurbita foetidissima Kunth (buffalogourd pumpkin)

CUPRESSACEAE (Cypress Family)

Juniperus monosperma (Engelm.) Sarg. (one-seed juniper)

CUSCUTACEAE (Dodder Family)

Cuscuta megalocarpa Rydb. (bigfruit dodder)

CYPERACEAE (Sedge Family)

Carex sp. (sedge)

ELAEAGNACEAE (Oleaster Family)

Elaeagnus angustifolia L. (Russian olive)

EPHEDRACEAE (Mormon Tea Family)

Ephedra torreyana S. Wats. (Torrey's jointfir)

EUPHORBIACEAE (Spurge Family)

Chamaesyce fendleri (Torr. & Gray) Small (Fendler's sandmat)
Chamaesyce micromera (Boiss. ex Engelm.) Woot. & Standl. (Sonoran sandmat)
Chamaesyce serpyllifolia (Pers.) Small ssp. *serpyllifolia* (thymeleaf sandmat)

FABACEAE (Bean Family)

Astragalus feensis M.E. Jones (Santa Fe milkvetch)
Astragalus lentiginosus Dougl. ex Hook. var. *diphysus* (Gray) M.E. Jones (freckled milkvetch)
Astragalus nuttallianus DC. (smallflowered milkvetch)*Caesalpinia jamesii* (Torr. & Gray) Fisher (James' holdback)
Dalea formosa Torr. (feather dalea)
Melilotus officinalis (L.) Lam. (yellow sweetclover)
Psoralidium tenuiflorum (Pursh) Rydb. (slimflower scurfpea)
Senna bauhinioides (Gray) Irwin & Barneby (twinleaf senna)

FAGACEAE (Oak Family)

Quercus turbinella Greene (Shrub live oak)
Quercus udulata (wavy-leaf oak)

FUMARIACEAE (Dutchman's Breeches Family)

Corydalis aurea Willd. (golden corydalis)

GERANIACEAE (Geranium Family)

Erodium cicutarium (L.) L'HÈr. ex Ait. (crainsbill)

HYDROPHYLLACEAE (Waterleaf Family)

Nama hispidum Gray (bristly nama)
Phacelia crenulata Torr. ex S. Wats. var. *corrugata* (A. Nels.) Brand (cleftleaf wild heiotrope)

LILIACEAE (Lily Family)

Allium macropatealum Rydb. (onion)
Nolina microcarpa Wats. (Beargrass)

LINACEAE (Flax Family)

Linum australe Heller var. *australe* (southern flax)

LOASACEAE (Loasa Family)

Cevallia sinuata Lag. (stinging serpent)
Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray (whitestem blazingstar)

MALVACEAE (Globemallow Family)

Sphaeralcea angustifolia (Cav.) G. Don (copper globemallow)
Sphaeralcea coccinea (Nutt.) Rydb. (scarlet globemallow)
Sphaeralcea fendleri Gray (Fendler's globemallow)
Sphaeralcea incana Torr. ex Gray (gray globemallow)

NYCTAGINACEAE (Four o'clock Family)

Abronia fragrans Nutt. ex Hook. (snowball sand verbena)
Allionia incarnata L. (trailing windmills)
Mirabilis multiflora (Torr.) Gray (many flowered four-o'clock)

ONAGRACEAE (Evening Primrose Family)

Calylophus hartwegii (Benth.) Raven (Hartweg's sundrops)
Gaura coccinea Nutt. ex Pursh (scarlet gaura)
Gaura mollis James (velvet weed)
Oenothera albicaulis Pursh (halfshrub sundrop)
Oenothera elata Kunth ssp. hirsutissima (Gray ex S. Wats.) W. Dietr. (Hooker's yellow primrose)
Oenothera primiveris Gray ssp. *primiveris* (desert evening-primrose)

OROBANCHACEAE (Broomrape Family)

Orobanche ludoviciana Nutt. (Louisiana broomrape)

PEDALIACEAE (Pedalium Family)

Proboscidea althaeifolia (Benth.) Dcne. (devils claw)

PINACEAE (Pine Family)

Pinus edulis Engelm. (Piñon pine)

PLANTAGINACEAE (Plantain Family)

Plantago patagonica Jacq. (woolly plantian)

POACEAE (Grass Family)

Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth (Indian ricegrass)
Aristida purpurea Nutt. (purple three awn)
Aristida purpurea Nutt. var. *longiseta* (Steud.) Vasey (red three awn)
Bouteloua barbata Lag. (sixweeks grama)
Bouteloua eriopoda (Torr.) Torr. (black grama)
Bouteloua gracilis (Willd. ex Kunth) Lag. ex Griffiths (blue grama)
Bouteloua hirsuta Lag. (hairy grama)
Bromus japonicus Thunb. ex Murr. (Japanese brome)
Bromus tectorum L. (cheet grass)
Dasyochloa pulchella (kunth) willdernow ex Rydberg (Fluff grass)
Echinochloa crus-galli (L.) Beauv. (Barnyard grass)
Elymus sp. (wild rye)
Elymus canadensis L. (Canada rye)
Elymus elymoides (Raf.) Swezey ssp. *brevifolius* (J.G. Sm.) Barkworth, comb. nov. ined. (squirreltail)
Elymus trachycaulus (Link) Gould ex Shinners (slender wheatgrass)
Eragrostis mexicana (Hornem.) Link (New Mexico lovegrass)
Erioneuron pilosum (Buckl.) Nash (hairy woolly grass)
Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth (New Mexico feathergrass)
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi (alkali grass)

Muhlenbergia porteri Scribn. ex Beal (bush muhly)
Muhlenbergia torreyi (Kunth) A.S. Hitchc. ex Bush (ring muhly)
Panicum obtusum Kunth (vine mesquite)
Pleuraphis jamesii Torr. (galleta grass)
Poa sp. (bluegrass)
Scleropogon brevifolius Phil. (burrograss)
Setaria vulpiseta (Lam.) Roemer & J.A. Schultes (plains bristlegrass)
Sorghum halepense (L.) Pers. (Johnson grass)
Sporobolus contractus A.S. Hitchc. (spike dropseed)
Sporobolus cryptandrus (Torr.) Gray (sand dropseed)
Sporobolus flexuosus (Thurb. ex Vasey) Rydb. (mesa dropseed)

POLEMONIACEAE (Phlox Family)

Gilia rigidula Benth. ssp. *acerosa* (Gray) (Wherry (bluebowls)
Gilia sinuata Dougl. ex Benth. (rosy gilia)

POLYGONACEAE (Milkwort Family)

Rumex aquaticus L. var. *fenestratus* (Greene) Dorn (Western dock)
Rumex hymenosepalus Torr. (canaigre dock)

PTERIDACEAE (Fern Family)

Cheilanthese feei T. Moore (slender lip fern)
Notholaena standleyi Maxon (Star cloak fern)

RANUNCULACEAE (Buttercup Family)

Delphinium wootonii Rydb. (Organ Mountain larkspur)

ROSACEAE (Rose Family)

Fallugia paradoxa (D. don Endl. (Apache plume)

SALICACEAE (Willow Family)

Populus deltoides Bartr. ex Marsh. ssp. *wislizeni* (S. Wats.) Eckenwalder (Rio Grande Cottonwood)
Salix exigua Nutt. (coyote willow)

SAXIFRAGACEAE (Saxifrage Family)

Fendlera rupicola Gray (Fendler bush)

SIMAROUBACEAE (Quassia Family)

Ailanthus altissima (P. Mill.) Swingle (Tree-of-heaven)

SOLANACEAE (Nightshade Family)

Datura stramonium L. (jimsonweed)
Datura wrightii Regel (sacred thorn apple)
Lycium pallidum Miers (pale wolfberry)
Solanum elaeagnifolium Cav. (silverleaf nightshade)

TAMARICACEAE (Salt Cedar Family)

Tamarix chinensis Lour (salt cedar)

ULMACEAE (Elm Family)

Ulmus pumila L. (Siberian elm)

VERBENACEAE (Vervain Family)

Verbena bracteata Lag. & Rodr. (bigbract verbena)

Appendix C – Revegetation Species

Revegetation Species Palette for Biozone Area

Achnatherum hymenoides (Indian ricegrass)
Aristida purpurea (purple threeawn)
Aristida purpurea (red threeawn)
Bouteloua barbata (sixweeks grama)
Bouteloua eriopoda (black grama)
Bouteloua gracilis (blue grama)
Bouteloua hirsuta (hairy grama)
Eragrostis mexicana (New Mexico lovegrass)
Erioneuron pilosum (hairy woollygrass)
Hesperostipa neomexicana (New Mexico feathergrass)
Muhlenbergia asperifolia (alkali grass)
Muhlenbergia porteri (bush muhly)
Muhlenbergia torreyi (ring muhly)
Panicum obtusum (vine mesquite)
Pleuraphis jamesii (gaelleta grass)
Scleropogon brevifolius (burrograss)
Sporobolus cryptandrus (sand dropseed)
Sporobolus flexuosus (mesa dropseed)
Oenothera primiveris (desert evening-primrose)
Sphaeralcea coccinea (scarlet globemallow)
Proboscidea althaeifolia (devils claw)
Astragalus feensis (Santa Fe milkvetch)
Astragalus lentiginosus diphysus (freckled milkvetch)
Astragalus nuttallianus (smallflowered milkvetch)
Caesalpinia jamesii (James' holdback)
Dalea formosa Torr. (feather dalea)
Psoralidium tenuiflorum (slimflower scurfpea)
Senna bauhinioides (twinleaf senna)
Cucurbita foetidissima (buffalogourd pumpkin)
Atriplex canescens (fourwing saltbush)
Chenopodium fremontii (Freemont’s goosefoot)
Krascheninnikovia lanata (winterfat)
Lesquerella fendleri (Fendler's bladderpod)
Acourtia nana (desert holly)
Artemisia bigelovii (Bigelow's sagebrush)
Artemisia filifolia (sand sagebrush)
Baileya multiradiata (desert baileya)
Brickellia californica (California brickellbush)
Cirsium neomexicanum (New Mexico thistle)
Ericameria nauseosa (rubber rabbitbrush)
Erigeron divergens (spreading fleabane)
Erigeron flagellaris (trailing fleabane)
Gaillardia pinnatifida (red dome blanketflower)
Grindelia nuda var. aphanactis (gumweed)
Helianthus annuus (common sunflower)
Machaeranthera canescens (hoary aster)
Machaeranthera pinnatifida (lacy tansy aster)
Malacothrix fendleri (Fendler's desertdandelion)
Melampodium leucanthum (plains blackfoot)
Senecio flaccidus var. flaccidus (threadleaf groundsel)
Tragopogon dubius (yellow salsify)
Zinnia acerosa Gray (desert zinnia)
Fallugia paradoxa (Apache plume)
Lycium pallidum (pale wolfberry)
Verbena bracteata (bigbract verbena)

Appendix D – Animal Species

* Species or their sign observed during 2008 survey by Marron

MAMMALS

Badger (Taxadia taxis)
Banner-tailed kangaroo rat *(Dipodomys spectabilis)* *****
Big-brown bat (*Eptesicus fuscus*)
Black bear (*Ursus americanus*) *****
Blacktailed jackrabbit *(lepus californicus)* *****
Bobcat (Felis rufus)
Brush mouse (Peromyscus boylii)
Coyote (Canus latrans) *****
Deer mouse (Peromyscus maniculatus)
Desert cottontail (Sylvilagus auduboni) *****
Free-tailed bat (*Tadarida brasiliensis*)
Fringed Myotis bat (*Myotis Thysanodes*)
Gray fox (Urocyon cinereoargenteus)
Gunnison's prairie dog *(Cynomys gunnisoni)*
Long-legged Myotis (*Myotis volans*)
Long-tailed weasel (*Mustela frenata*)
Merriam's kangaroo rat *(Dipodomys merriami)*
Mountain lion (*Felis concolor*)
Mule deer (Odocoileus hemionus) *****
Northern grasshopper mouse *(Onychomys leucogaste)*
Ord's kangaroo rat (Dipodomys merriami) *****
Pallid bat (Antrozous pallidus)
Piñon mouse (Peromyscus truei)
Raccoon (Procyon lotor) *****
Rock mouse (Peromyscus difficilis)
Rock pocket mouse (Perognathus intermedius)
Rock squirrel (Spermophilus variegates) *****
Silky pocket mouse (Perognathus flavuss)
Striped skunk (Mephitis mephitis) *****
Townsend's big-eared bat (*Plecotus townsendii*)
Valley pocket gopher *(Thomomys bottae)* *****
Western harvest mouse (Reithrodontomys megalotis)
White-throated woodrat *(Neotoma albigula)* *****

REPTILES

Chihuahuan spotted whiptail *(Cnemidophorus exsanguis)*
Coachwhip (Masticophis flagellum)
Collard lizard (Crotophytus collaris)
Desert grassland whiptail (*Cnemidophorus uniparens)*
Eastern fence lizard (Sceloporus undulatus)
Gopher snake or bull snake *(Pituophis melanoleucus)*
Great Plains Skink (Eumeces obsoletus)
Lesser earless lizard (Holbrookia maculata)
Little striped whiptail (Cnemidophorus inornatus)
Long-nosed leopard lizard *(Gambelia wislizenii)*
Long-nosed snake (Rhinocheilus lecontei)
Many-linked skink (Eumeces multivirganus)
Massasuaga (Sistrurus catenatus)
Plateau striped whiptail *(Cnemidophorus velos)*
Round-tailed horned lizard *(Phrynosoma modestum)*
Short-horned lizard (Phrynosoma douglassi)
Side-blotched lizard *(Uta stansburiana)*
Striped whitesnake (masticophis taeniatus)
Texas horned lizard (Phrynosoma cornutum)
Tree lizard (Urosaurus ornatus)
Western rattlesnake *(Crotalis viridis)*

AMPHIBIANS

Central Plains spade foot toad *(Scaphiopus bombifrons*
Great Plains toad (*Bufo cognatus*)
Red-spotted toad *(Bufo punctatus)*
Tiger salamander (*Ambystoma tigrinum*)
Western spadefoot toad (Scaphiopus multiplicatus)
Woodhouse toad *(Bufo woodhousei*)

BIRDS - Standardized Common Names

BITTERNS, HERONS
Great Blue Heron
AMERICAN VULTURES
    Turkey Vulture
DUCKS, GEESE, SWANS
    Snow Goose
    Canada Goose
    Mallard *****
    Green-winged Teal *****
    American wigeon *****
KITES, EAGLES, HAWKS
    Northern Harrier
    Cooper's Hawk *****
Swainson's Hawk
Red-tailed Hawk *****
Ferruginous Hawk
Golden Eagle
CARACARAS, FALCONS
    American Kestrel *****
    Merlin
    Peregrine Falcon
    Prairie Falcon
PHEASANTS, GROUSE, TURKEYS
    Wild Turkey
QUAIL
    Scaled Quail *****
CRANES
    Sandhill Crane

PLOVERS
- Killdeer

SKUAS, GULLS, TERNS, SKIMMERS
- Ring-billed Gull *****

PIGEONS, DOVES
- Rock Dove *****
- Band-tailed Pigeon
- Eurasian Collared-Dove *****
- White-winged Dove *****
- Mourning Dove *****
- Inca Dove

CUCKOOS, ROADRUNNERS, ANIS
- Greater Roadrunner *****

BARN OWLS
- Barn Owl

TYPICAL OWLS
- Great Horned Owl *****
- Burrowing Owl
- Long-eared Owl

Short-eared Owl

NIGHTHAWKS, NIGHTJARS
- Common Nighthawk
- Common Poorwill

SWIFTS
- White-throated Swift

HUMMINGBIRDS
- Black-chinned Hummingbird
- Callope Hummingbird
- Broad-tailed Hummingbird
- Rufous Hummingbird

WOODPECKERS
- Williamson's Sapsucker
- Red-naped Sapsucker
- Ladder-backed Woodpecker *****
- Downy Woodpecker
- Hairy Woodpecker *****
- Northern Flicker *****

TYRANT FLYCATHCHERS:
BECARDS
- Olive-sided Flycatcher
- Western Wood-Pewee
- Willow Flycatcher
- Hammond's Flycatcher
- Gray Flycatcher
- Dusky Flycatcher
- Cordilleran Flycatcher
- Say's Phoebe *****
- Ash-throated Flycatcher
- Cassin's Kingbird
- Western Kingbird

SHRIKES
- Loggerhead Shrike *****

VIREOS
- Gray Vireo
- Plumbeous Vireo
- Cassin's Vireo
- Warbling Vireo

JAYS, MAGPIES, CROWS
- Steller's Jay
- Western Scrub-Jay *****
- Piñon Jay
- American Crow *****
- Chihuahuan Raven
- Common Raven *****

LARKS
- Horned Lark *****

SWALLOWS
- Violet-green Swallow
- N. Rough-winged Swallow
- Cliff Swallow
- Barn Swallow

TITMICE

Mountain Chickadee *****

Juniper Titmouse

BUSHTITS
- Bushtit

NUTHATCHES
- Red-breasted Nuthatch
- White-breasted Nuthatch

CREEPERS
- Brown Creeper

WRENS
- Cactus Wren
- Rock Wren
- Canyon Wren *****
- Bewick's Wren *****
- House Wren

Winter Wren

KINGLETS
- Ruby-crowned kinglet *****

GNATCATCHERS

Blue-gray Gnatcatcher
THRUSHES
- Eastern Bluebird
- Western Bluebird *****
- Mountain Bluebird
- Townsend's Solitaire *****
- Hermit Thrush
- American Robin *****

MOCKINGBIRDS, THASHERS
- Northern Mockingbird
- Sage Thrasher
- Curve-billed Thrasher *****
- Crissal Thrasher

STARLINGS
- European Starling

WAXWING
- Cedar Waxwing

WOOD WARBLERS
- Orange-crowned Warbler
- Virginia's Warbler
- Yellow Warbler
- Yellow-rumped Warbler

Black-throated Gray Warbler
Townsend's Warbler
Pine Warbler
MacGillivray's Warbler
Wilson's Warbler
TANAGERS
- Western Tanager

SPARROWS
- Green-tailed Towhee
- Spotted Towhee *****

Canyon Towhee *****
Cassin's Sparrow
Rufous-crowned Sparrow
Chipping Sparrow
Brewer's Sparrow
Black-chinned Sparrow
Vesper Sparrow
Black-throated Sparrow
Sage Sparrow
Lark Bunting
Song Sparrow
Lincoln's Sparrow
White-crowned Sparrow *****
Dark-eyed Junco *****
McCown's Longspur
Chestnut-collared Longspur
CARDINALS, GROSBEAKS
- Black-headed Grosbeak
- Blue Grosbeak
- Lazuli Bunting

BLACKBIRDS, ORIOLES
- Eastern Meadowlark
- Western Meadowlark *****
- Great-tailed Grackle
- Brown-headed Cowbird
- Bullock's Oriole
- Scott's Oriole'

FINCHES
- Cassin's Finch
- House Finch *****

Pine Siskin *****
- Lesser Goldfinch *****
- American Goldfinch

OLD WORLD SPARROWS
- House Sparrow *****

Appendix E – Relevant Planning Documents

Albuquerque/Bernalillo County Comprehensive Plan Policies Affecting the Tijeras Arroyo Bio-Zone Study

Open Space Network – The goal is to provide visual relief from urbanization and to offer opportunities for education, recreation, cultural activities, and conservation of natural resources by setting aside Major Public Open Space, parks, trail corridors, and open areas throughout the Comprehensive Plan area.

Land Use

Policy a. Open Space lands and waters shall be acquired or regulated as appropriate to serve one or more of the following purposes:

- Conservation of natural resources and environmental features
- Provision of opportunities for outdoor education and recreation
- Shaping the urban form
- Conservation of Archeological Resources
- Provision of Trail Corridors
- Protection of the public from natural hazards

Policy b. Access to the Rio Grande, bosque and surrounding river lands should be carefully designed to provide entry to those portions suitable for recreational, scientific and educational purposes, while controlling access in other more sensitive areas to preserve the natural wildlife habitat and maintain essential watershed management and drainage functions.

Policy c. Development in or adjacent to the proposed Open Space Network shall be compatible with open space purposes.

Policy e. The Sandia Foothills where slopes exceed 10 percent shall be acquired or regulated as appropriate to protect such areas from detrimental and incompatible public and private activities.

Policy f. A multi-purpose network of open areas and trail corridors along arroyos and appropriate ditches shall be created. Trail corridors shall be acquired, regulated, or appropriately managed to protect natural features, views, drainage and other functions or to link other areas within the Open Space Network.

Policy h. Developing areas shall have neighborhood parks and open areas located to serve the population being accommodated in the developing area.

Policy i. The design of parks and other open areas shall incorporate the following criteria:

- Multi-functional use of resources and compatible facilities.
- Maintenance and landscaping appropriate to the location, function, public expectations and intensity of use.

- Integration into residential design for easy accessibility and orientation to encourage use.
- Lighting, site design, or other methods to minimize vandalism.
- Connections between other Open Space Network areas and public facilities.

Policy j. Design of neighborhood open areas should tie into other open spaces, where appropriate, to create an Open Space Network.

Community Resource Management

2. Water Management—

Policy b. Maximum absorption of rainfall shall be encouraged through use of:
Arroyo channels designed to allow infiltration of water whenever possible
Conservation devices in all new developments

6. Economic Development – The goal is to achieve steady and diversified economic development balanced with other important social, cultural, and environmental goals.

Policy d. Tourism shall be promoted

7. Education – The goal is to provide a wide variety of educational and recreational opportunities available to citizens form all cultural, age and educational groups.

Policy b. Stronger communication and planning links with area schools and educational institutions shall be established.

Policy d. Efforts should be made to integrate educational programs with the natural and cultural environments.

Policy e.Variety and flexibility in educational and recreational resources shall be encouraged through joint use of facilities.

City of Albuquerque Major Public Open Space Facility Plan

The principles of this Rank II plan establish guidelines for the implementation of MPOS Network goals contained in the Comprehensive Plan. Guidelines include policies for planning, land use decisions, management and land acquisition strategies. The analysis is divided into two sections relevant to this Study: Relevant Policies and Site Specifics.

Relevant Policies

Planning – Types of Major Public Open Space

The Major Public Open Space Facility Plan designates seven types of Major Public Open Space. Table 2-1. Open Space Types and Comprehensive Plan Purposes (p. 15-16), and Table 2-3. Permissive and Conditional Uses in Major Public Open Space (p. 23) from the MPOS Facility Plan detail the expectations and limitations of each of the seven types of Major Public Open Space. A brief description of these types is presented below.

Type 1 – Open Space Preserve (Policy A.1.B)

An area set aside for its exceptional natural, cultural or scenic value. Resources are fragile, and protection is the primary management objective, with an emphasis on protection of views, native vegetation and wildlife habitat, geological features and/or archaeological, historical, or cultural features. Development is limited to the minimum required for public safety and resource protection and enhancement. Public access is only allowed under the supervision of staff and by permit. Open Space preserves may be closed to public access to protect habitat and historic, cultural and archaeological resources. 500' buffers should be established adjacent to open space preserves, when possible, to protect the area from the impact of human use. If a buffer is not feasible, the impact of adjacent use should be mitigated.

Type 2 – Protected, Undeveloped Open Space (Policy A.1.C)

This area is defined as a significant undeveloped or conserved area with outstanding natural features or scenic qualities suitable for low impact recreational activities without substantial facilities or improvements. These areas comprise the largest proportion of the NPOS Network. Such areas shall be protected from excessive public use, with trails that can be paved or unpaved, and site protections such as fencing, signage, natural barriers, controlled use and ranger patrol. Protected, undeveloped open space should be predominately undeveloped with only those facilities needed for dispersed informal recreation, occurring at concentrated points of easy access and heavy use. Facilities will be primarily unpaved trails, with associated signage.

Type 3 – Open Space Facility (Policy A.1.D)

Land noted for its outstanding natural features and outdoor recreation opportunities. This designation allows for primary public use on pubic space lands where impacts can be mitigated. Protection of these areas should include signage, natural barriers, fencing, walls and ranger patrol.

Open Space Facilities should be located at the edges of MPOS areas in locations with access to urban streets. No new facilities shall be developed in areas with archeological sites or which are likely habitats for threatened or endangered plant or animal species. All new facilities, expansion of existing facilities and trails shall be designed to avoid these areas and to direct people away from these areas. Five classes of facilities exist within the MPOS:

Class I Facility – Developed facility containing improved parking and access
Class II Facility – Class I facility plus picnic facilities

Class III Facility – Class I facility plus picnic facilities, restrooms and trails
Class IV Facility – Class I facility plus picnic facilities, restrooms, trails and other Structures.
Class V Facility– Same as Class IV facility but with on-site staffing. Fees are collected at some Class V facilities.

Type 4 – Open Space Trail (Policy A.1.E)
Defined as a linear corridor with MPOS or linking MPOS to other facilities. These include arroyos and links. Trails are to be developed for pedestrian, equestrian and bicycling uses as appropriate and defined in adopted Rank II, Rank III, Resource Management or Master Development Plans. Interpretive trails are encouraged at accessible points of interest, particularly along major arroyos, along links between areas of cultural or historical significance, at facilities located in areas of educational value, or at the fringes of open space preserves.

Type 5 – Special Use Area (Policy A.1.F)
Includes parcels within the MPOS Network that serve a unique function in the POST Network. These facilities generally require special programming or management. Examples include Shooting Range State Park and Maloof Model Airplane Park. More specialized uses may require specific policies. These uses may be developed and managed by government and private entities other than the City of Albuquerque Open Space Division if:

- The proposed uses comply with the Extraordinary Facilities Ordinance,
- A site development plan, resource inventory and management plan are provided to the city open space division demonstrating that the proposed uses do not negatively impact adjacent Major Public Open Space,
- Limits are placed on the allowable uses in the Special Use Area, and
- Maintenance requirements and development limitations are incorporated in the lease to the outside entity.

Type 6 – Asset Lands (Policy A.1.G)
These parcels are suitable for revenue producing facilities which may or may not serve MPOS purposes. The primary value to the network is revenue potential. For zoning purposes, asset lands are not considered part of the Major Public Open Space.

Type 7 – Land Bank (Policy A.1.H)
These areas are not part of the MPOS Network and are intended for sale or trade. Land Bank areas include the Elena Gallegos Trust Lands, donations or gifts of land that are not suitable for inclusion in the MPOS Network, or which may financially benefit other property in the MPOS Program through sale, lease or trade. These lands have the potential to produce revenue for acquisition or management of other MPOS areas.

Planning Process (Policy A.2.B)
The formal planning process ensures a logical sequence from property identification to incorporation into the MPOS Network, addresses network wide and area wide concerns, and monitors use to protect MPOS resources.

- Management Planning *(Policy A.2.C)*
- Resource Management Plans should be developed for 8 specific open space areas including the Tijeras Arroyo. As a preliminary step, the Resource Management Plan requires detailed baseline studies to inventory the following:Archeological Sites; Wildlife and vegetation (particularly rare, threatened and endangered species and endangered habitats);
- Visual resources, opportunities for open space experiences; and
- Other opportunities for satisfying MPOS purposes.

The Resource Management Plan shall:

- Identify land use "carrying capacity";
- Identify access points;
- Identify facility locations, including utility and transportation corridors;
- Identify areas to be monitored and develop a monitoring and management plan;
- Establish policies for resource management, access and parking, facility management, staffing, fees, interagency cooperation and enforcement;
- Classify the parcels with the Resource Management Plan area according to MPOS type;
- Evaluate impacts and proposed development within the Major Public Open Space on adjacent areas; and
- Evaluate reasonable alternative development scheme.

Site Plan and Vegetation Management Plan *(Policy A.2.E)*
Site specific plans for development and landscaping shall be prepared for any improvement constructed in Major Pubic Open Space. Any improvements which are not permissive according to 2-3 shall be reviewed and approved by the Open Space Advisory Board prior to submittal to the EPC. The site plan review shall include approval of measures to mitigate impacts of construction and facility use. The mitigation plan shall identify methods of minimizing the impacts of construction and human use, including restoration of natural resources and environmental features. The plan should also identify conditions to be noted during ongoing monitoring which could eventually need more intensive management (i.e. re-vegetation, closing areas to public use, species inventory, re-vegetation methods, etc.)

Land Use (Policy B.1.A – B.1.F)
This section includes policies appropriating land use to be consistent with MPOS type. In most areas, a variety of users must be accommodated. For this reason facility design and public education regarding user etiquette and sharing of trails are emphasized as a means of mitigating conflicts. Preferred trail locations in the Open Space Trail type are to be identified in Resource Management Plans, Master Development Plans, and site development plans. Interpretive trails are designated as appropriate for points of interest,

particularly along major arroyos, along links between areas of cultural or historical significance, at facilities located in areas of educational value, or at the fringes of open space preserves *(per Policy B.1.E).*

Access and Parking (Policy B.2.G – B.2.I)
Access and parking areas is a major concern to adjacent neighborhoods. Each MPOS area should be independently evaluated given its uses and type to ensure an adequate supply of parking. Degree of access to each type should be addressed in associated plans, where motorized vehicular access by other than emergency and maintenance vehicles shall be prohibited unless specifically allowed by permit. Access for persons with disabilities and equitable geographic distribution of access points are important considerations in facility design.

Trails (Policy B.2.J – B.2.L)
Interpretive trails were suggested in public comments, including self guided trails. Signage should be unobtrusive, while informative and accessible. Trails should include wheelchair accessible trails at different challenge levels. Multiple uses of trails are encouraged, but in some areas designated trails may be developed to minimize resource damage. Public information regarding trail etiquette shall be provided at manned facilities.

Resource Management (Policy C.6.A – C.6.G)
This section outlines resource protection and enhancement objectives. These include resource inventory, impact evaluations, re-vegetation programs, carrying capacity studies and view shed protection, among others. Natural processes including natural plant succession and wildlife migration occurring prior to urbanization are given great weight in this section. Resource Management Plans should provide the framework for ongoing management in specific areas. A Resource Management plan for the Sandia Foothills should include the following:

- Watershed/Wildlife Study, including analysis of slopes, soils and drainage patterns;
- Threatened and endangered species survey;
- Erosion control plan;
- A general archeological clearance;
- Consideration of Native American concerns;
- Topographic mapping of trail location corridors at a scale of 1”=200’;
- Mapping of general trail locations by type of trail with the identified corridors;
- General design concepts for the trail system, including appropriate materials, grade restrictions and typical cross-sections of pedestrian/ hiking trails, equestrian trails, wheelchair accessible trails, mountain biking trails, equestrian trails, joint use trails and parking areas;
- Mitigation plan to demonstrate how construction will take place, revegetation required and informal trails to be closed;

- A plan for use of fire in managing vegetation, including coordination with the National Forest Service management policies for the Sandia Mountain Wilderness.

Management Policies (Policy D.1A – D.4)

Erosion control measures are described in this section with an emphasis on utilizing existing topography to the extent possible to minimize cut-and-fill.

MPOS Site Specifics

Tijeras Arroyo

Tijeras Arroyo is the largest arroyo in the metropolitan area, broken politically by multiple jurisdictions. West of the Sandia Foothills, the Tijeras Arroyo has eroded a valley floor of 1000' or more in width. Most of the proposed arroyo open space is privately owned. Kirtland Air Force Base prevents the arroyo from being a continuous link between the foothills and the river. Tijeras is classified in the plan as a Major Public Space Arroyo

Planning Policy A.1 states the following goals for Major Public Space Arroyos:

- Conserve natural resources and environmental features including natural flow of water and the drainage capacity of the largest arroyos in Bernalillo County, the natural state of historic environmental features, geological features such as bluffs, wildlife habitat and corridors, native vegetation, the infiltration of water into the arroyo's gravel soils and recharge of the aquifer; provide wildlife corridors from both the Rio Puerco Escarpment and the Sandia foothills to the Rio Grande;
- Provide opportunities for outdoor education and recreation including trails for a variety of users;
- In the case of Tijeras, help shape urban form by providing a southern edge to the eastern portion of the contiguous city development, and a view corridor along the arroyo and along I-40;
- Provide trail corridors along arroyos;
- Protect the public from natural hazards including flooding, sediment transport, unstable slopes, and unstable and collapsible soils.

Land Use Policies B.1-B.4 proclaims the primary function of the Major Public Open Space Arroyos as major drainage ways. Other uses of these arroyos should be compatible with that function.

The Tijeras Arroyo Corridor Plan (draft stage-1990) made clear drainage issues would govern arroyo treatment options and that these issues would not be resolved through the corridor planning process. The Major Open Space Facility Plan recommends that the Open Space Division and the Planning Department work with the responsible drainage authorities to incorporate open space, trail and park concerns into drainage management plans (the AMAFCA drainage management plan for Tijeras Arroyo was

adopted in 1981). It is believed that this approach would be more effective in fulfilling the policies of the Facility Plan for Arroyos.

The Facility Plan for Arroyos (1986)
Policies specific to Major Open Space Arroyos

Policy 1 – Where appropriate**,** preserve existing 100-year floodplain by dedication to or purchase by the City as Major Public Open Space.
PURPOSE – to preserve topography, vegetation, views, natural drainage processes, and to implement Comprehensive Plan open space policies;

Policy 2 – Design drainage facilities to blend visually with adjacent land.
PURPOSE – to blend visually with open space characteristic, protect and enhance existing vegetation and wildlife, and provide visual contrast to developed areas of the city.

Policy 3 – Necessary drainage controls for development adjacent to a MPOS Arroyo shall be developed jointly by AMAFCA and the City Engineering Division through master drainage studies as part of the arroyo corridor planning process.
PURPOSE – the protection of natural drainage systems, existing topography, and vegetation;

Policy 4 – Preserve existing topsoil and vegetation in R.O.W. associated with public or private improvements by reseeding with native and/or naturalized vegetation.
PURPOSE – to prevent erosion and preserve unique natural features;

Policy 5 – Landscaping within the public R.O.W. shall be encouraged.
PURPOSE – to preserve and enhance open space characteristics;
DETAILS – Landscaping should enhance elements of topography, scenic views, and areas containing public amenities. This section introduces the idea of minimum, medium and high intensity landscaping approaches, where the minimum landscaping approach includes reseeding and native shrubs. See pages 29 and 30 for illustrations.

Policy 6 – The entire 100-year floodplain of a MOS Arroyo in a Developing Urban area when left in a natural or semi-natural condition …shall be credited as open space less the amount of right-of-way that would be required for draining control if a fully concrete-lined 100-year channel were constructed.
PURPOSE – to establish park and/or open space credit in Developing Urban areas for naturalistic channel treatments;

Policy 7 – Design of public amenities shall be planned and programmed as part of the arroyo corridor planning process.
PURPOSE – to set a standard or arroyo corridor plans;
DETAILS – At a minimum, recreational programming for Major Open Space Arroyos shall include the following:
Shaded picnic and rest areas incorporating benches, tables, drinking fountains and toilet facilities, where appropriate

Hiking and/or bike trails, where appropriate to access Major Public Open Space area
Shaded parking lots and secure bike bicycle parking area, where appropriate
Accessible areas designed so that motorized recreational vehicles are prohibited from entering pedestrian and bicycle-oriented trails and open space

Additional Plan Information on the Tijeras Arroyo

The watershed of the Tijeras Arroyo is a mountainous, 130 square-mile area lying generally east of Albuquerque. The watershed is generally undeveloped, with existing development consisting primarily of low density residential land uses.

Tijeras Canyon/Carñuel Plan 2007 - East Mountain Area Plan 2006 – Cultural History and Environmental Research

Cultural History

Throughout its history, Tijeras Canyon has been an important travel corridor. In the 17th and 18th Centuries, the Canyon served as a passage and campground for Apache Indians. Hispanic settlers of this period traveled to the Canyon for timber, hunting and trading. Through the Civic War both Union and Confederate armies laid claim to this vital passage to the west. More recently, automobiles have laid claim to the canyon as one of the most beautiful stretches of Historic Route 66.

The area also has a long history of human settlement. Native American populations lived in Canyon villages nearly 900 years ago. Eleanor Mitchell has reported nearly 60 buried ancient Indian villages exist in the area. In 1763, the Governor of New Mexico under the Spanish Crown ordered permanent settlement in Tijeras Canyon to help buffer the larger settlement of Albuquerque from nomadic tribes. A plan was developed to move the then landless *genizaros* (Hispanic Indians) and *mestizos* (Spanish and Native parentage) to the canyon for land distribution. After various periods of abandonment, the permanent settlement of Miguel de Laredo de Carñuel was established with the Carñuel Land Grant of 1817. This community represents the oldest continually inhabited settlement in the Sandia Mountain Range.

The communities of the Tijeras Canyon have worked the land since their arrival. Initially these lands were utilized for self-sustaining agriculture, where poor rocky soil, droughts and early and late frosts meant subsistence crops (wheat, pinto beans, corn, peas, pumpkins, and oats. The mountain pastures were ideal for sheep, goats and some cattle and also home to herds of buffalo for hunting. Firewood was hauled in wagons to Albuquerque as late as 1937.The industrial revolution created local jobs in gold, silver and coal mines, at sawmills, and in railroad construction. During Prohibition Era of the 1920's, the manufacture and sale of bootleg whiskey to Albuquerque was a major business enterprise for the Tijeras Canyon communities The Escabosa (Spanish for broomgrass) community was named in honor of the grasses of the area, which they used to make brooms.

Cultural Tidbits

Tijeras means scissors in Spanish, and was so named because the major roads, north-south and east-west, came together like scissors. The original cross over the highway at Carñuel was erected in 1932. *Descansos* (highway crosses) are located throughout the canyon communities. Many of the crosses along the hillsides throughout the plan area delineate the historic markers of land grant common lands.

Environment

Soils – Much of the areas soils are derived from the alluvium of the Tijeras Canyon comprised of sandstone, gneiss, limestone and granite. Areas of bedrock and weathered gravel known as Orthids soils, occur where bedrock materials are limestone, sandstone or schist. These soils, called Tijeras Sandy Loam, are typically thin to very thin, with little to no vegetation due to large amounts of oversized materials. Major and minor faults dissect the area allowing water to flow through the bedrock formations. Such FRACTURES as well as overlying alluvium in the valleys are the water source for local wells.

Vegetation – The canyon vegetation is primarily composed of Piñon, juniper, cactus, chamisa and yucca sparsely located along the hillsides. The riparian zone along the Tijeras creek is dominated by cottonwood and willow. More recently, the riparian area has been infiltrated by invasive species such as Russian olives, salt cedars and elm trees. Nap weed and Russian thistle have also negatively impacted the native landscape.
The east face of the Manzanita Mountains is dominated by shrubby grassland with large pockets of Ponderosa Pine, Piñon Pine, and Gambel Oak occurring on western slopes. A healthy vegetative cover stabilizes and enriches the soil and slows runoff from precipitation. This encourages soil absorption, reduces erosion, and encourages aquifer infiltration. All these factors are essential to a healthy watershed.

Wildlife – The area is situated in one of the major flyways in the Americas leading to a wide variety of migratory bird species. In addition, coyotes, prairie dogs, rattlesnakes, and other mammals, reptiles and amphibians common to upland New Mexico are found within this area. Bear kills have occurred in the East Mountain Area where people were unintentionally attracting wildlife (bird feeders, pet food, unsecured garbage cans, and water troughs), and then being surprised when the drought-starved animals appeared.

Light Pollution – The East Mountain Area follows House Bill 39 (1999), or the "Night Sky Protection Act". This requires all new outdoor lighting installations (public and private) to meet the specifications outlined in the Lighting Ordinance. Existing lighting shall be reduced to meet the specifications in the ordinance, preferably with the assistance of incentives rather than enforcement.

View Preservation – In addition to larger panoramic views, local meadows, structures, forests, stream courses, and drainages, particularly at major road intersections, are key elements of the valued rural character. Open meadows and grasslands, most of which are privately owned; provide visual relief and a "sense of openness" for the community. However, due to the open landscape, much of which is privately owned, the natural

scenic quality of the East Mountain Area is vulnerable to significant impacts from development.

Drainage – Multiple uses of drainage areas should occur whenever possible; that is, arroyos can provide corridors for adjacent recreational trails, open space connections, and storm water flows. When feasible, arroyos should be left in their natural state to help maintain the rural character and natural environment of the area. Future trail locations in conjunction with arroyos shall be coordinated with drainage requirements to ensure safe horizontal and vertical clearance between the trails and the arroyos. Due to potential flash flooding in natural arroyos (where people in the lower reaches many not be able to see a cloud burst in the upper reaches of the drain basin due to the topography), it is imperative that all trails be placed at an elevation which is above the water surface during a 100-year storm event plus the desirable freeboard. Additionally, due to the wave action in the natural arroyos, a prudent buffer or adequate horizontal and vertical clearance between trails and arroyos should be provided.