CENTRAL ARIZONA CONSERVATION ALLIANCE

A Central Arizona Conservation Alliance Report:

Conservation Opportunity Areas in Central Arizona
A Mixed Methods Approach to Identifying Special Areas for Conservation

Completed April 2022

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EXECUTIVE SUMMARY

Maricopa County has been experiencing the most rapid population growth in the United States for several years, threatening natural open areas in the region with related and necessary urban development. An expansive, high-quality network of regional open spaces and habitat connectivity corridors will be necessary in order to provide equitable access to high quality natural areas throughout the Phoenix-metro area and to protect Sonoran Desert biodiversity. The Central Arizona Conservation Alliance brought together ecological data and expert opinion to describe what this hypothetical network could look like through the identification of conservation opportunity areas (COAs) to support this regional goal.

The process of producing the resulting map of COAs in Central Arizona was a two part process by which (1) spatial data was synthesized with the support of an expert advisory committee to produce a comprehensive map ranking areas for their importance in maintaining habitat integrity, and (2) a stakeholder process that presented this map to participants from local governments, nonprofits, and businesses (such as land developers) and engaged them to assess the effectiveness and feasibility of protecting these areas.

This process resulted in the identification of 28 conservation opportunity areas throughout Maricopa County, with 21 being located in the western section of the county (see Figure 4), and 7 located in the east (Figure 5).

Key reasons for protecting these areas as described by experts include their service as habitat blocks and ecological linkages, rich biodiversity/quality, recreation value, hydrological value, ecosystem services and related economic benefits, historic/archeological significance. Of these, nearly all opportunity areas increase quality habitat availability and connectivity across the region, with individual areas supporting specific services.

There are a total of 11 different “Actions Which Can Be Taken” identified by the expert stakeholders (Table 3), with each selection being tailored to the specific circumstances of the individual COAs. Of these, the most commonly suggested action was land exchanges, which appeared in 22 of the COAs described. Acquisition, designation, and mitigation were also common suggestions, with each being linked with more than 10 COAs. In all but the case of mitigation, these suggested actions involve shifting land into some kind of protected status by any managing entity. Planning and management also play key roles in many of the COAs, as land status alone will not maintain high quality habitats.

1. INTRODUCTION

Biodiversity loss is a challenge to human and environmental well-being the world over, and while this phenomenon is driven by a variety of context-specific factors, habitat loss and fragmentation tend to be of highest concern (Betts et al., 2017; Brooks et al., 2002). In the context of cities, urban development is a major driver of habitat degradation and loss (Elmqvist et al., 2016), and in Maricopa County that development is linked to one of the fastest growing populations in the United States (Maricopa Association of Governments, 2021). In conjunction with the loss of ecological quality with increasing levels of isolation (Chase et al., 2020; Ryser et al., 2019), small, isolated habitat blocks with lower biodiversity also contribute less ecosystem services to surrounding communities (Dee et al., 2019; Keyes et al., 2021).

While many unfamiliar with the vibrancy of the Sonoran Desert may consider this loss of desert habitat to be relatively low impact in regards to biodiversity, the Sonoran Desert is, in fact, one of the most biodiverse in the world (Dimmitt et al., 2015). Furthermore, this landscape and its native species have a deep indigenous history, the desert is home to many globally charismatic species such as the saguaro (*Carnegiea gigantea*), and its ecosystem services are as varied and essential as other, greener ecosystems (Hodgson, 2001; Jenerette et al., 2011; Teff-Seker & Orenstein, 2019).

Furthermore, the cultural and health importance of access to nature remains high in deserts, including the Sonoran Desert of Arizona, and such access is threatened by rapid urban development for the communities of Central Arizona. As mentioned above, the indigenous people of this region have cultivated deep cultural connections with this landscape (Erickson, 2021; Fish & Fish, 1992), and there are many sacred and archeologically important sites throughout the region linking modern peoples with ancestors and ancient societies (Wienhold, 2013). People of all backgrounds also benefit immensely from the social and health benefits that access to nature provides, in conjunction with the variety of cultural values that individuals may have (Remme et al., 2021). Access to nature in the Phoenix-metro area has been exceptional in the past, due to the large and spread-out city and county desert parks and preserves (Ewan, et al., 2004). However, equitable access among community members of different racial backgrounds and income is being increasingly impacted by rapid development which has increased the distance between many communities and natural open spaces, making them inaccessible without a car and means to drive long distances, and by decreasing the size and quality of natural spaces within the urban area (Park et al., 2021).

The direct impacts of urban development on the habitats of Maricopa County and the communities connected to them, are not the only concern for ecosystem services and their integrity. Other indirect challenges arise as human activities (such as habitat modification, industry, outdoor recreation, etc.) in surrounding habitats increase. These include an increase in invasive species, such as noxious weeds, often introduced and initially spread by people (e.g. along roads, degraded lands, and carried by cars and shoes) (Pejchar & Mooney, 2009). Linked to invasive plant species population expansion in and around urban areas in Maricopa County, are increased fire fuel loads (Abatzoglou & Kolden, 2011). Many invasive plants in the region, such as buffelgrass (*Pennisetum ciliare, Cenchrus ciliaris*) and red brome (*Schismus barbatus*), crowd and carpet formerly patchy, desert landscapes and dry out seasonally (National Park

Service, 2019; US Department of Agriculture, 2014). Thus, both human and naturally caused fires occur more extensively and intensively in impacted areas. The incidence of wildfires also increases due to human activities, and in 2020, more than 80% of wildfires in Arizona were human caused (Department of Forestry and Fire Management, 2020).

Faced with these challenges and rapid urban development in such a unique landscape which many species and people rely on, it is essential to plan for habitat connectivity and the protection of essential places within the range of potential development and related increases in resource extraction.

Historically, habitat protection in the urban areas of Maricopa has aligned with conservation action nationally. This habitat protection was initially reactionary, and focused on the potential loss of recreational opportunities and cultural services, particularly in cases where local communities realized that their treasured natural spaces and the species within them were about to be lost to development or exploitation (Doran & Richardson, 2010; Franco, 2013; Robin, 2011). For example, the upper elevations of Camelback Mountain were protected in 1973 as Echo Canyon Park after a long-term grassroots movement responded to continued house-building on the peak that impacted the aesthetics of the mountain and access to recreational amenities (Stern, 2014).

Conservation efforts worldwide have attempted to shift from defensive planning to forward-thinking with a focus on habitat connectivity, biodiversity health, and human uses where there is human capacity, funding, and political will to do so. This proactive habitat protection is designed based on patterns of population growth, development, and resource use and is ideally adaptive to changing circumstances and increases in data (Margules & Pressey, 2000; Villarreal-Rosas et al., 2020). In the Maricopa context, Maricopa County Parks and Recreation Department carried this out with the creation of a park system with open spaces located around the edges of the Phoenix-metro urban area as it was in the early 2000s. The vision and planning that went into the acquisition and management of these lands now ensures recreation opportunities for growing communities, enhances property values and quality of life for urban residents, and protects habitat as the urban area continues to expand (Maricopa County Parks and Recreation, 2014).

However, in all cases, protected areas both old and new are threatened by a lack of protected connectivity to other natural open areas and desert spaces surrounding the city. This is due to continued development in response to years of rapid population growth and a looming housing crisis in 2021 (Maricopa Association of Governments, 2021; Robustelli et al., 2020; Shrestha et al., 2012). The large expanses of natural open space that have served the Phoenix-metro community in recent decades have and will continue to see increasing pressure, necessitating the protection of more open space in order to provide equitable access to recreation and maintain biodiversity in the Central Arizona region (Liu et al., 2016; Smith, 2021). In conjunction with these pressures, networks of habitat corridors will become more necessary as the city expands. Without these networks of robust linkages, areas already protected and enjoyed by the community will see a decrease in the quality as biodiversity in these preserves suffer from isolation, lack of resources, and increased vulnerability to natural disasters, such as wildfire (Ignatieva et al., 2011; Lynch, 2019).

Conservation activities related to habitat corridors are active in natural open spaces currently on the fringes of the growing city. As of 2021, on the western edge of the Phoenix-metro area, the White Tank Mountains Conservancy is working with scientists, decision-makers, and developers to create functional habitat connectivity between the White Tank Mountains and the surrounding wilderness areas in response to the planned development encircling the mountain range. Likewise, the McDowell Sonoran Preserve in Scottsdale is studying, in real time, the effectiveness of a connectivity corridor called the "Gooseneck" as development fills in on either side of the narrow connector between the northern and southern portions of the preserve.

Within this historic context, it is essential for long-term conservation planning to consider prioritizing land acquisition for future natural open space and habitat connectivity within Maricopa County (Lynch, 2019). The scale and rapidity of regional development will otherwise make reactionary efforts less effective, and the importance of robust ecosystems is becoming more essential as the impacts of climate change become apparent with historic droughts and increasingly common, catastrophic wildfires. Culturally, this heightened importance was also demonstrated during the COVID-19 pandemic, during which parks across the United States saw a large increase in visitor-ship with people looking for escape and safe places to recreate (Alizadehtazi et al., 2020; Shartaj et al., 2022), and this was reflected in Central Arizona. However, as with urban areas across the globe, ecological data will not be sufficient for the development of such networks due to the complexity of land ownership and decision-making mechanisms, as well as the close connection between people and natural open spaces.

We believed that coupling complex data with expert perspectives in Maricopa County to identify key conservation opportunity areas serves as a crucial step towards a comprehensive and actionable plan for an ecologically-sound natural open space network in Central Arizona. It also relates to the Regional Open Space Strategy for Maricopa County – Goal 1, objective 1.2 which states "Identify and map natural infrastructure and open space conservation priorities. Develop a comprehensive regional open space vision inclusive of priorities spanning urban, suburban, rural, and wilderness areas." The results of this interdisciplinary effort are reported here.

2. METHODOLOGY

The process of producing the resulting map of COAs in Central Arizona was a two part process by which (1) spatial data was analyzed to produce a comprehensive map ranking areas for their importance in maintaining habitat integrity, and (2) a stakeholder process that presented this map to participants from local governments, nonprofits, and businesses (such as land developers) and engaged them to focus needs on key areas that could be feasibly protected in the future to insure habitat integrity and quality into the future.

2.1 Study Context

The study area covered in this report is Maricopa County, which is located in Central Arizona and includes Arizona's capital, Phoenix; with the some spatial analyses being done on the area represented by Maricopa County and associated HUC 10 watersheds. The county itself is 9,224 mi^2 of mixed-use land area which includes intense urban/industrial use, suburban, military, agricultural, and natural areas. This is also the current and ancestral lands of the O'odham, Piipaash, Yavapai and the ancient Hohokam people. Currently, the county has a population of 4.22 million, with the largest demographics being white (55% of the population), and Hispanic or Latinx (31% of the population) (U.S. Census Bureau, 2019).

The population of Maricopa County is one of the fastest growing in the United States since 1980, and for ten years from 2009-2019 it was the fastest growing county in the country. By 2050, Maricopa is projected to have 6.7 million people living within its boundaries (Maricopa Association of Governments, 2021). This growth will necessitate the rapid development of urban areas in the county in order to provide sufficient housing for the growing community (Robustelli et al., 2020). While essential, urban growth and development will have negative impacts on the environment, causing habitat loss, fragmentation and degradation. It is known that these impacts are major drivers of biodiversity loss worldwide (Elmqvist et al., 2016; Liu et al., 2016), and have and will continue to represent a major challenge to ecosystems in this region.

The natural open spaces of Central Arizona are managed by city, county, state and federal governments, and local land trusts; a variety of non-profits also support the management and maintenance of natural open spaces in the region.

2.2 Habitat Integrity and Water Resources Analyses Maps

The spatial data used during this project's stakeholder process was provided by the CAZCA Greenprint, a natural infrastructure viewer built by the Trust for Public Land. This tool was built using data and expertise from a technical advisory team which included the Nature Conservancy, the Arizona Game and Fish Department, and Sonoran Institute. In order to produce the analyses maps that were utilized in the stakeholder meetings described here, the technical advisory team provided guidance on the identification and weighing of the criteria used in the models underlying the analysis layers, verifying the modelling methodologies, recommending the best data sources, and otherwise ground-truthing the resulting GIS models. For more details on this methodology, reference Appendix I.

The finalization of the analysis layers was then carried out through an iterative process of (1) GIS data collection and modelling, (2) advisory team feedback, and (3) the refining of models to the satisfaction of the advisory team.

In particular, the analysis layers for Ensuring Habitat Integrity and Protect Water Resources were key to the production of the focused Conservation Opportunity Area map produced here. The criteria included in the Habitat Integrity layer and their relating weights are shown in Table 1a, and the criteria for the Water Resources layer are shown in Table 1b. Figure 1a shows the resulting Ensuring Habitat Integrity layer, and Figure 1b shows the Protecting Water Resources layer.

Table 1a: Criteria and weights assigned by the technical advisory team for use in layer modelling for the Ensuring Habitat Integrity Layer.

Criteria	Weight
Rural and urban habitat blocks	22%
Ecological linkages and corridors	20%
Riparian areas	22%
Landscape integrity	12%
Species richness	15%

Table 1b: Criteria and weights assigned by the technical advisory team for use in layer modelling for the Protecting Water Resources layer.

Criteria	Weight
Headwaters	17%
Perennial streams and rivers	19%
Intermittent and ephemeral rivers, washes and streams	12%
Wetlands	15%
Ponds, lakes, and reservoirs	6%
Seeps and springs	16%
Enhance natural recharge	5%
Floodplain	10%

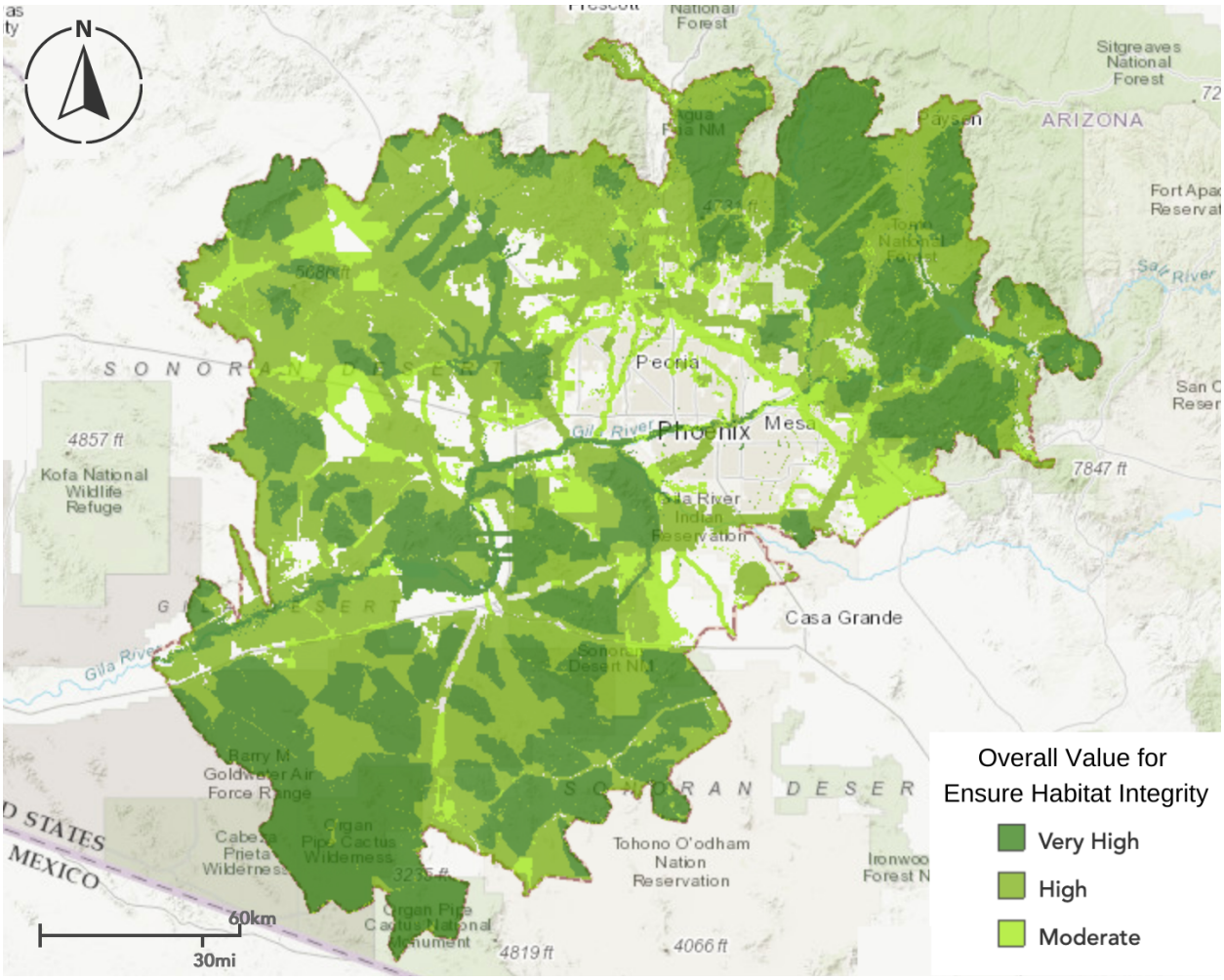

Figure 1a: Ensuring Habitat Integrity layer

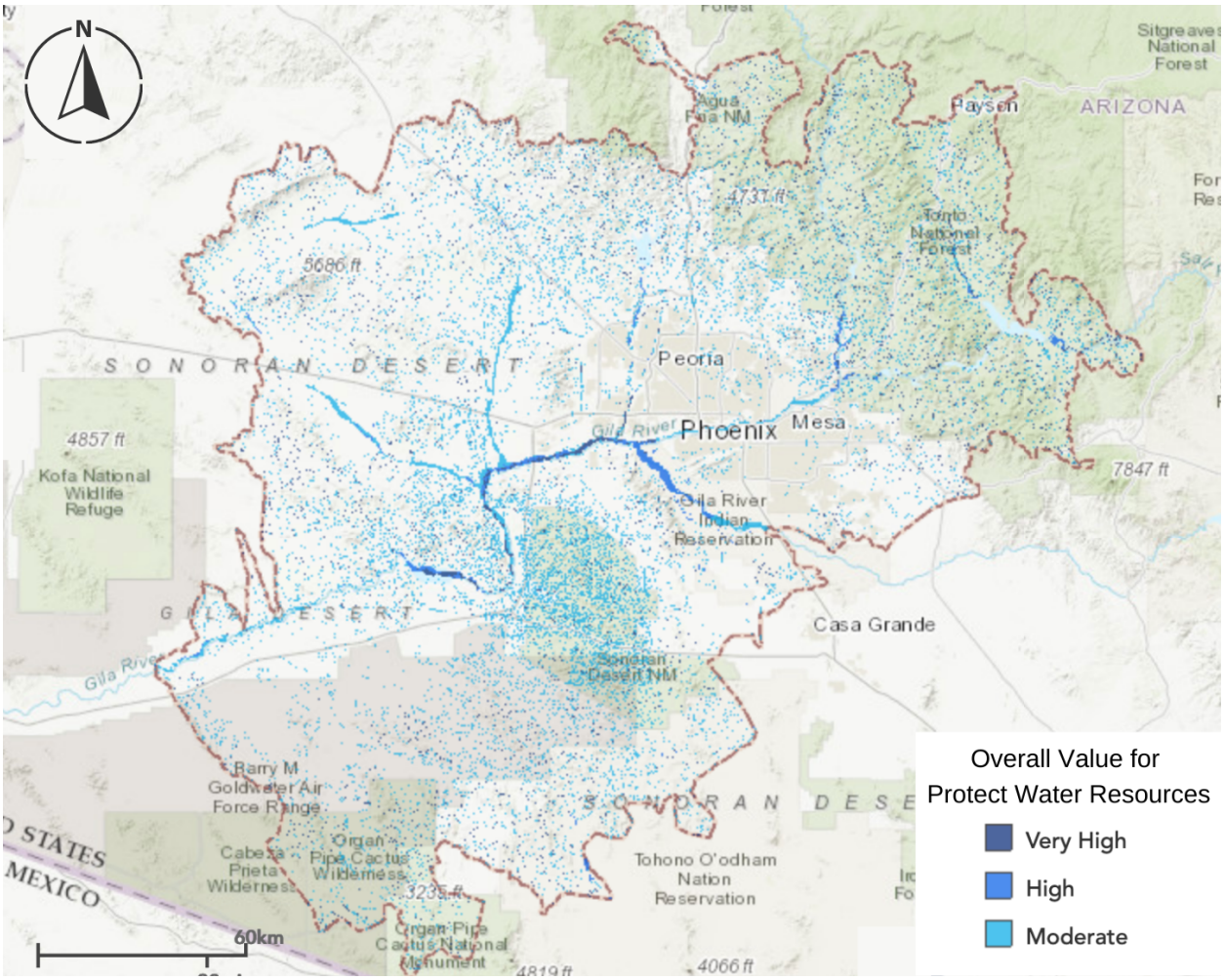

Figure 1b: Protecting Water Resources layer

2.3 Stakeholder Process to Identify Key Conservation Opportunity Areas

A secondary advisory team was brought together to assist in the identification of COAs which consisted of CAZCA's then steering committee (Maricopa County Parks and Recreation, Desert Botanical Garden, McDowell Sonoran Conservancy, and the Sonoran Institute) and additional stakeholders (Appendix II). Using the data described in section 2.2, this secondary advisory team identified an initial set of focused areas of conservation opportunities including intact habitats and linkages, which were both essential to conservation in the region and feasible for protection based on the data available in the Greenprint (including additional context layers such as land ownership). The expert analysis of individual opportunity areas identified at this time included the location and size of the areas, reasoning for their prioritization, and primary data from the Greenprint contributing to the identification of the location. (See Appendix III for a sample questionnaire.)

Landownership and these initial COAs were then put into base maps that helped form the basis of the stakeholder consultation that produced the final results reported here.

A large stakeholder meeting was held in January 2018, during which participants self-organized into two groups, the East Valley area of Metro-Phoenix, and the West Valley. During this meeting, the draft of the conservation opportunity area maps (along with a descriptive table) were presented to the stakeholders. A guided evaluation and discussion of these areas was then carried out. During this time, the stakeholders assessed the areas represented and discussed whether there were areas missing from the map. Appendix II lists the participants of this meeting, and Appendix IV contains an example of the questionnaire used during these meetings to guide the discussion, gather data, and carry out the assessment. After this stakeholder meeting, the results were synthesized by the project team and the feedback was integrated into the draft map of the focused opportunity areas in order to produce the final version.

3. RESULTING CONSERVATION OPPORTUNITY AREAS IDENTIFIED, REASONS FOR IDENTIFICATION, AND STAKEHOLDER SUGGESTED ACTIONS

The process described above resulted in the identification of 28 conservation opportunity areas throughout Maricopa County. Twenty-one are located in what was defined as the West Valley (the western portion of the county; see Figure 4), and seven are located in the East Valley (the eastern portion of the county; Figure 5). All locations identified in these maps are associated with names, the reasoning for their identification, the issues each area faces, and a list of actions that could be carried out to take advantage of the conservation opportunities presented by each area (Table 2).

There are two primary kinds of conservation opportunity areas identified: (1) corridors and (2) "bubbles." Opportunity areas are not identified as one or the other, and fall along a spectrum of both, but together these areas are meant to create wildlife habitat and movement corridors, as well as recreation and quality-of-life resources for residents and tourists. Bubbles are a term that emerged organically during the process of identifying the COAs; they encompass protected area(s) or non-designated area(s) identified as high value for protection. Corridors are more linear than the bubbles, and serve as connectors between protected areas, groups of protected areas, and/or areas that would have high value if protected (Beier & Noss, 1998).

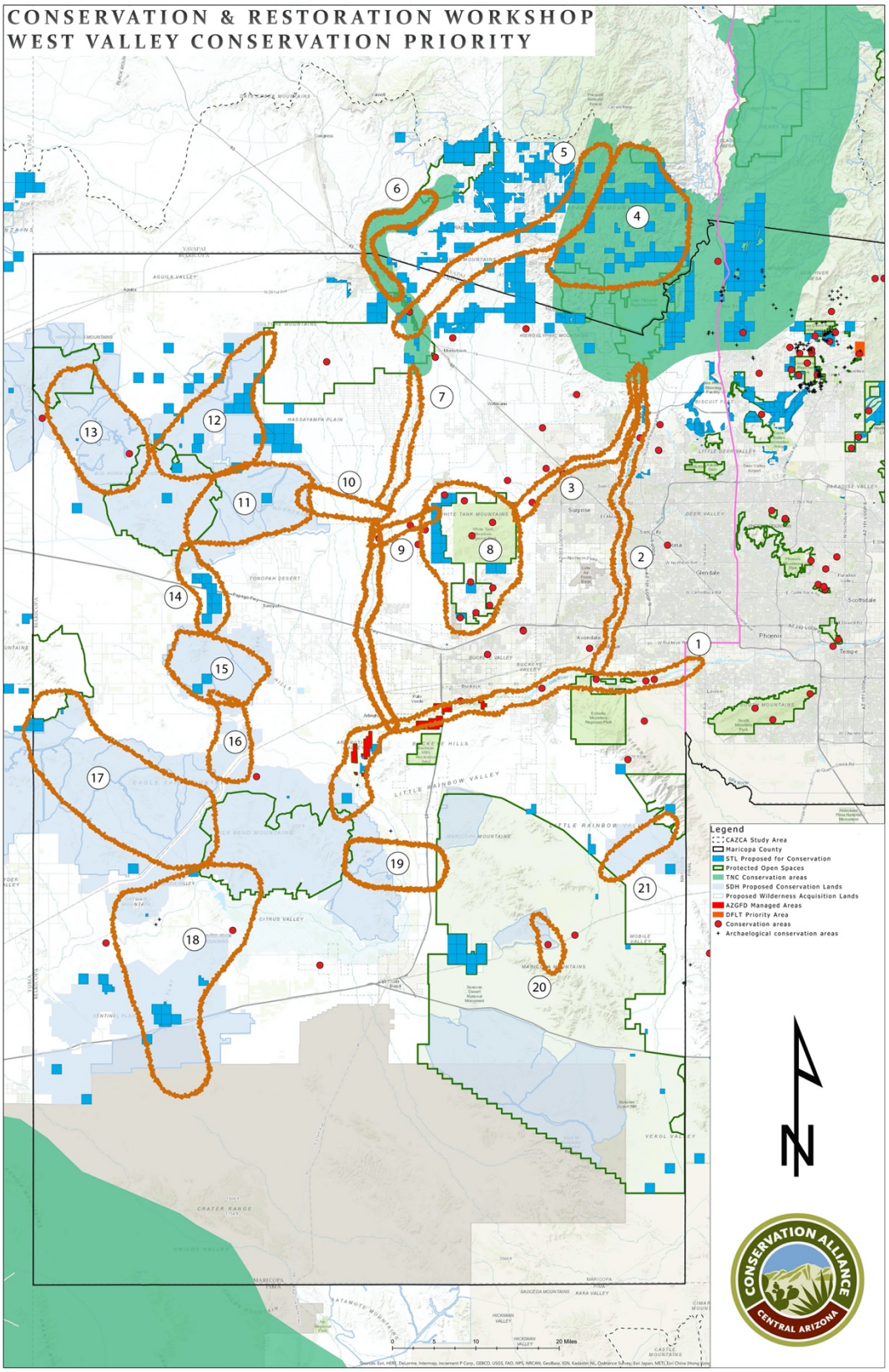
CONSERVATION & RESTORATION WORKSHOP
WEST VALLEY CONSERVATION PRIORITY
Legend
CAZCA Study Area
Maricopa County
STL Proposed for Conservation
Protected Open Spaces
TNC Conservation areas
SDH Proposed Conservation Lands
Proposed Wilderness Acquisition Lands
AZGFD Managed Areas
DFLT Priority Area
Conservation areas
Archaeological conservation areas
CONSERVATION ALLIANCE
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Figure 4: Map of the conservation opportunity areas identified in the West Valley.

Table 2: Descriptions of the conservation opportunity areas identified for the East Valley.

Conservation Opportunity Area (West Valley)	**Issues**	**Actions Which Can Be Taken**
1. The Lower Gila River	This 17-mile stretch of the Gila River is an important resource which provides ecological and economic values and benefits to the west valley. The future of the Gila River will need to be managed so that it continues to be an ecological and environmental asset. There are opportunities to develop conservation and restoration strategies in order to ensure the river sustains natural habitat areas and threatened and endangered species and these should be done on a regional basis. Other approaches will need to be developed to ensure public safety concerns are addressed as well as providing economic and recreational benefits to the communities along the river. The Gila River, and its tributary the Salt River, represent one of the most valuable ecologically resources in the urbanized area of the Phoenix Metro region.	• Management • Regional Planning • Mitigation
2. The Agua Fria River	This 30-mile stretch of the Agua Fria River has been identified as an important ecological corridor connection between Lake Pleasant and the Gila River. This section of the river also provides a hydrological and social connection between the two	• Management • Regional Planning • Mitigation

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	points. Many communities along this section of the river continue to support a long-planned West Valley Recreation Corridor within the river. These trails would connect neighborhoods, recreation areas, parks, schools and commerce centers along the corridor.	
3. McMicken Dam Conservation Area-	This a flood control facility operated by the Flood Control District of Maricopa County. The water storage area behind the dam and channels includes over 3,500 acres of possible conservation open space area, 15 miles of regional trails and a wildlife corridor that connects the Aqua Fria and the White Tank Mountains. Conservation of this area is in partnership with the City of Surprise and Maricopa County Parks Department.	• Management • Master Planning/Guidelines
4. Bradshaw/Hieroglyphic Complex	This area of the Bradshaw Mountain has been identified as an area that should be protected for its high quality of habitat. The upper reaches of the Agua Fria (above Lake Pleasant) are part of a wildlife preserve which supports coyotes, mule deer, javelina, and bobcat. This area is also important for its water resources and as a critical component of the natural recharge within the Agua Fria Watershed and it contains numerous different types of	• Regional Planning • Lease • Acquisition • Land Exchanges

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	riparian areas, wetlands, and intermittent and ephemeral rivers, streams and washes. The area is comprised primarily of federal and state trust lands with some privately held lands.	
5. Bradshaw Mountains to Vulture Mountains	Protecting the upper headwaters of the Hassayampa River is critical. This area not only provides valuable environmental services (natural recharge and flood protection) but supports a valuable riparian ecological area that is disappearing from the Arizona landscape. Development of state trust and private lands could impact the function of the Hassayampa and the quality of environmental services it provides the region.	• Management • Regional Planning • Acquisition • Land Exchanges
6. Upper Hassayampa River	Protecting the upper headwaters of the Hassayampa River is critical. This area not only provides valuable environmental services (natural recharge and flood protection) but supports a valuable riparian ecological area that is disappearing from the Arizona landscape. Development of state trust and private lands could impact the function of the Hassayampa and the quality of environmental services it provides the region.	• Management • Regional Planning • Acquisition • Land Exchanges
7. Hassayampa River Valley and Plain	This area has been identified as important to maintaining wildlife connectivity and linkages between the	• Management • Regional Planning • Acquisition • Land Exchanges

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	Hassayampa River and the Gila River. It contains significant areas of habitat blocks for the Sonoran Desert tortoise and the Gila monster. This area is also in need of protection against sand and gravel mining.	
8. White Tank Mountains	There is an opportunity to protection the valuable ecosystem around the White Tanks Mountains Regional Park by working with neighboring municipalities, stakeholders and landowners. This will safeguard the valued habitat and wildlife linkages that rely on the White Tanks and the adjacent undeveloped lands that support connectivity and the diversity of species and habitat.	• Acquisition • Lease • Transfer of Development Rights • Master Planning/Guidelines • Land Exchanges
9. White Tank Mountains Wildlife Corridor 1	Maintaining open spaces and corridors between the White Tank Mountains and the Hassayampa River is critical in order to sustain a robust wildlife population. The area is comprised primarily of private and state trust lands with some federally held lands.	• Acquisition • Lease • Transfer of Development Rights • Master Planning/Guidelines • Land Exchanges
10. White Tanks Wildlife Corridor 2	Maintaining open spaces and corridors between the Hassayampa River and the Belmont Mountains is critical in order to sustain a robust wildlife population. The area is comprised primarily of private lands with some state trust lands and federally held lands. The area west of the White Tank Mountains has been	• Acquisition • Lease • Mitigation • Transfer of Development Rights • Master Planning/Guidelines • Land Exchanges

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	identified as an area for future transportation corridors as well as residential and commercial development for communities expanding west of the White Tank Mountains.	
11. Belmont Mountains	There is an opportunity to protect the Belmont Mountains as a wilderness area which would create more viable, long-term wildlife habitat and expand the migratory corridor between the nearby Harquahala Mountains and the Hummingbird Springs wilderness areas. Connecting these lands with additional wilderness designation will ensure that their wildlife populations are able to migrate safely with little disturbance as population and development expand westward Buckeye, and south from Wickenburg.	• Designation • Land Exchanges • Mitigation
12. Big Horn to Vulture Mountains	The area between the Big Horn Mountains and Vulture Mountains is important to maintain wildlife connectivity and avoid fragmentation. The region is significant habitat for raptors, and large predator species like mountain lions, desert bighorn sheep and antelope. Ensuring the protection of these federal lands would permanently protect the ecological, archaeological and recreational values of the west valley.	• Designation • Land Exchanges • Mitigation
13. Big Horn to Harquahala Mountains	Maintaining connectivity between the Big Horn	• Designation • Land Exchanges

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	Mountains and the Harquahala Mountains is important in order to preserve wildlife linkages and avoid fragmentation. This area is an important link in a chain of critical core habitat areas for wildlife traveling through the West Valley desert. The area also has historic significance as it is the home to a Smithsonian Institution Observatory built in the 1920's.	• Mitigation
14. Interstate 10 Wildlife Corridor	Maintaining connectivity between the Big Horn Mountains and Saddle Mountain is important so preserve wildlife linkages and avoid fragmentation. The development of wildlife overpasses and acquisition of state trust lands will secure these connections and ensure that their wildlife populations are able to migrate safely with little disturbance from humans, as population and energy development expand westward from Tonopah, Buckeye, and Wickenburg.	• Designation • Land Exchanges • Mitigation
15. Palo Verde Hills	The Palo Verde Hills are made up primarily of BLM lands that sit amidst a sea of vacant private and state lands. They serve an important role as they provide valuable habitat and corridors for wildlife as it moves south to the Gila Bend Mountains and the Gila River. Within the hills is Saddle Mountain which contains crucial bighorn sheep habitat that is known to be lambing	• Designation • Land Exchanges • Mitigation

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	grounds. The lush foliage of this high desert spot supports a range of wildlife including the desert tortoise and other threatened species. The area is home to many unique archaeological sites from prehistoric cultures.	
16. Palo Verde Hills to Gila Bend Mountains	This is an opportunity to secure a connection to the Gila Bend Wilderness from the Palo Verde Hills. This area has been impacted by numerous jeep roads and ad hoc trails blazed by ORV's, hikers and cattle. Despite this it remains and an important north/south habitat linkage to the Gila River and should be protected.	• Designation • Land Exchanges • Mitigation
17. Gila Bend Mountains to Eagletail Mountains	The area is home to many unique archaeological sites from prehistoric cultures and is believed to have contain important cultural and ceremonial sites. This area contains intact Sonoran Desert habitat for native species including the Big Horn sheep. This area is primarily federal lands but is in need of a higher level of protection.	• Designation
18. Sentinel Plain and Painted Rock Mountains	This undeveloped BLM land located southwest of the Gila River and west of Gila Bend contains high value habitat and is the wildlife linkage between the river and the Barry Goldwater Military Range (BMGR). There is a need to increase the level of protection on these BLM lands and restore wildlife connectivity between the Gila River and the	• Designation • Land Exchanges • Mitigation

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	BMGR. The area contains state trust lands that have conservation values.	
19. Gila Bend Mountains to Sonoran Desert National Monument	The Gila Bend Mountains and the Sonoran Desert National Monument are federal holdings that are separated by the Gila River. The river is comprised primarily of private agricultural lands. There is an opportunity to secure wildlife connections between the two federal areas and ensure that their wildlife linkages are preserved.	• Designation • Land Exchanges • Acquisition • Mitigation
20. Wildlife Crossing De Anza Trail	The historic De Anza Trail (SR 238) bisects the Sonoran Desert National Monument between the North and South Maricopa Mountains Wilderness. It runs perpendicular to a major wildlife corridor that traverses the monument from north to south. There is a need to restore wildlife connectivity between the mountains and create a safe wildlife passage to allow for the migration of desert bighorn sheep, mule deer, bobcats, desert tortoise and other mammals that make their home in the monument.	• Designation • Land Exchanges • Mitigation
21. Little Rainbow Valley to Sierra Estrellas	Between the Sonoran Desert Monument and the Sierra Estrellas' lies the Little Rainbow Valley. Both areas contain valuable habitat blocks and wildlife linkages for the variety of species that live in the monument and the Estrellas. Little Rainbow Valley is the wildlife linkage	• Designation • Land Exchanges • Mitigation

Conservation Opportunity Area (West Valley)	Issues	Actions Which Can Be Taken
	between these two areas. It is threatened by solar development and the proposed route of the I-11 corridor. There is an opportunity to develop mitigation strategies for these development projects. This would include the construction of wildlife overpasses, consolidation of land by federal agencies, and mitigation strategies for other species impacted by future development in the valley.	

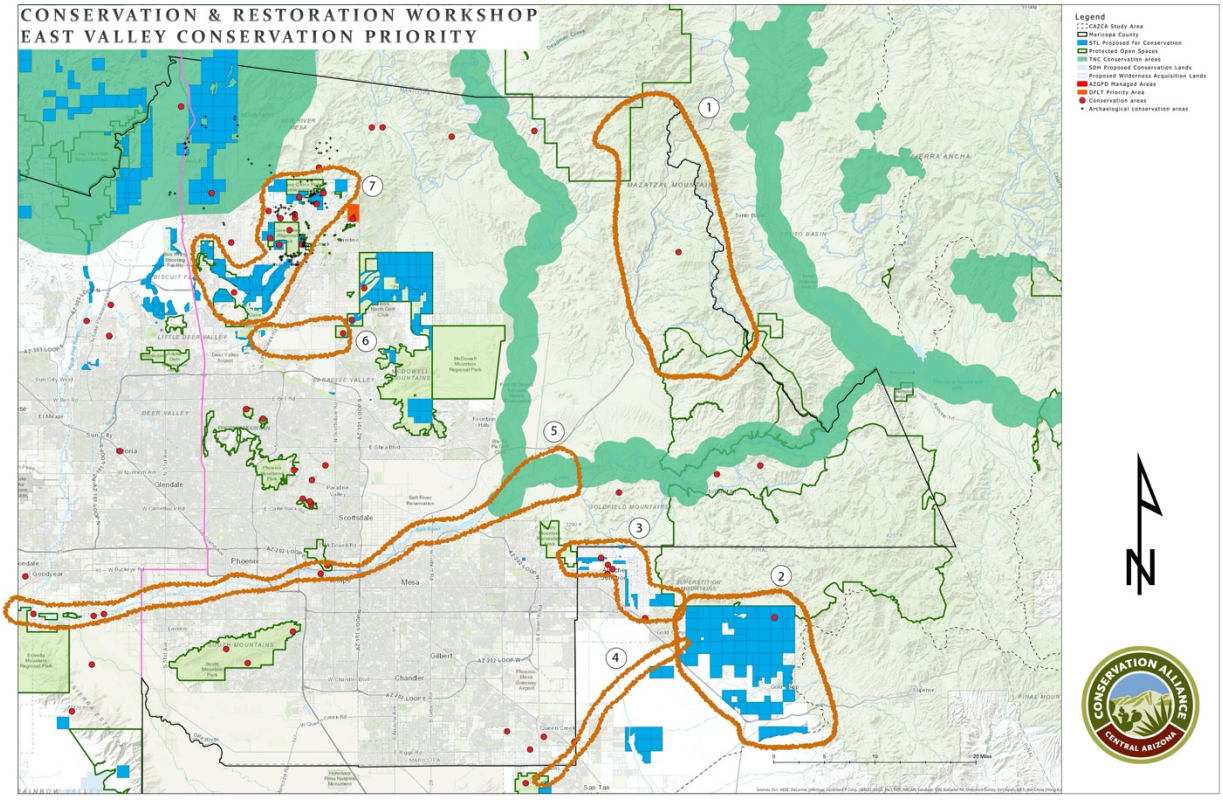

Figure 5: Map of the conservation opportunity areas identified in the East Valley.

Table 3: Descriptions of the conservation opportunity areas identified for the East Valley.

Conservation Opportunity Area (East Valley)	Issues	Actions Which Can Be Taken
1. Tonto NF Wilderness Connectivity:	This is an opportunity to connect two wilderness areas within the Tonto National Forest (TNF) as recommended in the Land and Resource Management Plan of the TNF. The area has wilderness characteristics and high conservation value as it contains important ecological linkages and habitat blocks. The area is valued for its recreational usage, which would be impacted by potential development threats.	• Designation
2. Superstition Mountains	This area encompasses 16,700 acres of state trust land located at the southwestern base of the Superstition Mountains. It is an opportunity to create a buffer of urban wilderness around the Superstition Wilderness area. A buffer zone would greatly ameliorate the urban encroachment against the southwestern base of the mountains. The area contains habitat blocks and ecological linkages and corridors and has been identified as having a very high level of landscape naturalness.	• Designation • Acquisition • Lease • Land Exchanges
3. East Valley Connectivity	This corridor represents an opportunity to connect four ecologically isolated and high value recreation open space areas (Usery Mountain Recreational area, Usery Mountains, Salt River and the Superstition Mountains). This corridor is designated as open space in the City of Apache Junction land use map and is currently comprised of vacant BLM and state trust lands.	• Acquisition/Lease • Easement • Master Planning/Guidelines • Land Exchanges
4. Superstitions Vista Corridor	This corridor is located primarily in Pinal County. It is an opportunity to connect two ecologically isolated	• Density Transfers

Conservation Opportunity Area (East Valley)	Issues	Actions Which Can Be Taken
	and high value open space areas (Superstition Mountains and the San Tan Mountain Regional Park). This corridor crosses a wide area of undeveloped state trust land known as Superstition Vistas. The many washes and drainages that flow off of the Superstitions into the flats of Superstitions Vista have created a rich ecological landscape that supports habitat blocks and the ability for wildlife to move across the landscape with minimal interference from human activity.	• Regional Planning-Pinal County/East Valley • Master Planning/Guidelines • Land Exchanges
5. Salt River to Gila River	This 35 - mile stretch of the Salt River that flows through Phoenix has been identified as an important resource which provides both hydrological and ecological values and benefits to the valley. While the Salt River rarely flows below the confluence of the Salt and the Verde River, there are still many sections where water is present. These "watered" sections have created areas of riparian habitat and are recognized for their variety of birds and abundant and diverse fish species. The river also provides many recreational opportunities including kayaking, boating, hiking, and fishing.	• Management • Regional Planning
6. The Preserve Connector	This six mile long corridor is an opportunity to connect the southwest corner of the McDowell Sonoran Preserve in Scottsdale to the Sonoran Preserve in north Phoenix. The corridor is currently undeveloped except for an existing powerline that traverses east to west. The corridor is a recognized ecological linkage between the two	• Easement • Transfer of Development Rights • Master Planning/Guidelines • Land Exchanges

Conservation Opportunity Area (East Valley)	Issues	Actions Which Can Be Taken
	preserves. It would be a valuable connection for wildlife and also presents the opportunity to create a trail connection between the two preserves. The corridor would connect the currently isolated Phoenix Preserve with a sustainable open space complex (Scottsdale's Preserve, the regional park, and the national forest).	
7. Sonoran Preserve to Cave Creek Regional Park to Spur Cross Ranch Conservation Area	There is an opportunity to connect three large desert preserves and parks in the northern part of the Phoenix metropolitan area and, through Opportunity Area 6 (above), to the large open space complex in the northeast Valley. These parks and preserves, and their adjacent undeveloped lands, are significant in that they sustain large areas of habitat and wildlife. Much of the land around these parks is currently undeveloped state trust land and provides valuable ecological linkages and corridors between the preserves and parks. The future development of these lands is inevitable and would encroach on or remove valuable connections and linkages between the three systems. It is important to connect these three systems not only to preserve large blocks of contiguous wildlife habitat but to also preserve the ecological corridors. This could be accomplished by acquiring undeveloped state trust lands, some of which have been identified as 2012 Conservation lands.	• Acquisition • Lease • Transfer of Development Rights • Master Planning/Guidelines • Land Exchanges

A short qualitative analysis of the text in the above table lends further insight into reasoning for the conservation importance, threats, and strategies for protection of the identified conservation opportunity areas. Key reasons for protecting these areas include their service as habitat blocks and ecological linkages, rich biodiversity/quality habitats, recreation value, hydrological value, ecosystem services and related economic benefits, historic/archeological significance. Of these, nearly all opportunity areas increase quality habitat availability and connectivity across the region, with individual areas supporting specific services. Threats to these areas was not identified in all cases, but the most common threat identified by the stakeholders was urban development/encroachment, with specific cases including the threat of mining, energy development, future transportation corridors, and use impacts from recreationists and cattle. Stakeholders likewise did not provide conservation solutions in all cases, but acquisition of land, development of conservation and restoration strategies, adjustments of land designation/higher levels of protection, and the development of mitigation strategies for development were included as options for various areas identified.

There are a total of 11 different "Actions Which Can Be Taken" identified by the expert stakeholders (Table 3), with each selection being tailored to the specific circumstances of the individual COAs. Of these, however, the most commonly suggested action was land exchanges, which appeared in 22 of the COAs described. Acquisition, designation, and mitigation were also common suggestions, with each being linked with more than ten COAs. In all but the case of mitigation, these suggested actions involve shifting land into some kind of protected status by any managing entity. Planning and management also play key roles in many of the COAs, as land status alone will not maintain high quality habitats, particularly in cases of interaction with various forms of human development and activity, including recreational development.

Table 4: List of "Actions Which Can Be Taken" identified by the expert stakeholders and their associated definitions

Action	Definition
Acquisition	Open space land managers obtain the rights to manage the land via a land purchase.
Density transfers	Strategic increase in development density in one area in order to preserve open space elsewhere.
Designation	Land use for an area is set for conservation.
Easement	An agreement by which the holder of the easement has the right to manage land that is owned by someone else.
Land exchange	A trade of land either among different public land managers or an exchange of public and private lands.
Lease	Rent for land is supplied in exchange for the right to manage the land.
Management	Implementation of strategies to maintain and restore quality habitats.
Master planning/guidelines	Creation of plans and suggested actions for lands which provide strategic guidance

Mitigation	Actions take to lessen the severity of habitat degradation and fragmentation.
Regional planning	Strategies developed for maintaining regional ecosystem functionality.
Transfer of development rights	Zoning changes by which development is redirected to lands more suitable for intense human activity and modification.

CONCLUSIONS

Within the next decade, Central Arizona is predicted to see rapid and large-scale urban development that will have lasting impacts on the biodiversity of the region and the quality-of-life of its residents. It is essential that action is taken to ensure habitat quality and connectivity are sustained despite population growth. These natural open spaces are also a historic characteristic of the Phoenix-metro area that continue to be of high value for the community and are an essential support for the collective well-being. Not only this but, these diverse habitats are the foundation for the flora and fauna of the region and beyond.

The conservation opportunity areas identified here represent a variety of options as well as a comprehensive plan for connectivity and habitat health in Central Arizona all based on expert stakeholder input. If protected through collaborative action among decision-makers, land owners, community members, and conservation actors, these opportunity areas would create a world-class metropolitan area well-suited for the new economy, and the region could serve as a global leader for biodiversity, nature-based heat mitigation, and quality-of-life for rapidly developing urban areas in arid regions.

In order to do this, however, considerable resources need to be mobilized for the acquisition of land, its management, and planning for multi-use in high-value buffer areas and development zones. This can only be accomplished by cross-disciplinary cooperation, discussion, and planning.

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APPENDIX I: Greenprint Analysis Layer Meta Data

Analysis Results			
Overall Stacked Priorities			
Layer Name	**Methodology**	**Description/Interpretation**	**Data included/Source**
Overall Results Equally Weights	This overall results is created by combining and equally weighting the overall results of Protect Water Resources, Ensure Habitat Integrity, and Mitigate Heat Risk. These three overall results are added together, the broken into five classes using natural breaks and then priority is assigned to the highest three classes.	The overall analysis results create a holistic picture of where parks and open space can do the most for people and the ecosystem in Maricopa County.	TPL-generated analysis
Protect Water Resources			
Layer Name	**Methodology**	**Description/Interpretation**	**Data included/Source**
Headwaters	Result value = 5 (Very High) 1. NHD Flowlines joined with NHD Plus Value Attribute Added table 2. Flowlines with stream order of 1 selected (headwaters) 3. Headwaters buffered 20m 4. Converted to raster and given value of 5	This layer shows 1st order streams from the National Hydrology Dataset (NHD) Flowlines and the Horizon Systems NHD Plus Value Attribute Added table. These headwater streams are buffered by 20 meters.	NHD flowlines NHD Plus VAA table
Perennial Rivers and Streams	Result value = 5 (Very High) 1. USFWS wetlands data queried to choose upper and lower perennial (values beginning with R2 and R3) 2. Data queried again to	All streams from USFWS National Wetland Inventory, excluding upper and lower perennial wetlands and excavated streams (x modifier).	USFWS Wetlands

	remove any features with the x modifier (which is excavated) 3. Converted to raster and given a value of 5		
Intermittent and Ephemeral Rivers, Streams, and Washes	Result value = 5 (Very High) 1. USFWS wetlands data queried to choose intermittent (values beginning with R4) 2. USFWS wetlands data queried to choose unknown perennial (values beginning with R5). (doing this was result of convervation and looking at data with Stacie/Bob/Kate) 3. Data merged together 4. Data queried again to remove any features with the x modifier (which is excavated) 5. Data buffered 20m each side 6. Converted to raster, given a value of 5	Intermittent (R4) and unknown perennial (R5) streams from the USFWS National Wetland Inventory. Features with the x modifier (excavated) are excluded, and then all features are buffered by 20 meters.	USFWS Wetlands
Wetlands	Result value = 5 (Very High) 1. USFWS wetlands data queried to choose Freshwater Emergent Wetlands and Freshwater Shrub Wetlands 2. Converted to raster and given a value of 5	Freshwater emergent wetlands and freshwater shrub wetlands from the USFWS National Wetland Inventory.	USFWS Wetlands
Lakes, Ponds, Reservoirs	Result value = 5 (Very High) 1. USFWS wetlands data queried to choose lakes, ponds, reservoirs 2. Converted to raster and given a value of 5	Lakes, ponds, and reservoirs from the USFWS National Wetland Inventory.	USFWS Wetlands
Springs/Seeps	Result value = 5 (Very High)	Seeps and springs from the National	NHD Points

	1. Seeps/springs selected from NHD points 2. Seeps/springs buffered 500 feet 3. Converted to raster and given value of 5	Hydrography dataset points, buffered by 500 feet.	
Enhance Natural Recharge	Result value = 1 - 5 1. Esri Green Infrastructure cores converted to raster based on score field (the core quality index value based on geometric values and soil variety, endemic species max, biodiversity priority index and ecological systems redundancy. This calculation is based upon the Green Infrastructure Center's (http://gicinc.org) scoring methodology in their Practitioner's Guides) 2. Reclassified using natural breaks and given values 1-5 with no data = 0	These Intact Habitat Cores from ESRI are minimally disturbed natural areas (based on NLCD 2011) at least 100 acres in size and greater than 200 meters wide, following methodology from the Green Infrastructure Center (http://gicing.org). They are scored based on 53 attributes from a suite of physiographic, biologic, and hydrographic factors wrapped up into a "core quality index". (See this site for more information.) Cores are ranked 1 to 5 based on the range of core quality index scores divided into quintiles.	ESRI Habitat cores
Floodplain	Result value = 0,4 (High),5 (Very High) 1. Floodways were selected from FEMA flood hazard area data, converted to raster and given value of 5 2. 100-year floodplains were selected from FEMA flood hazard areas data, converted to raster and given value of 4 (High) 3. Data combined with cell statistics maximum	Flood zones from FEMA given a value of 5 (Very High) for a floodway and a value of 4 (High) for a 100-year flood zone.	FEMA flood hazard layer
Overall Result for	This overall result for Protect Water Resources was created by weighting	Especially in a desert landscape, water is key. To protect water	Derived from criteria above. Weighted and

Protect Water Resources	and stacking the criteria listed above. Weights were decided on by the Technical Advisory Team: Headwaters: 17% Perennial Rivers and Streams: 19% Intermittant Ephemeral Rivers, Streams, and Washes: 12% Wetlands: 15% Lakes, Ponds, and Reservoirs: 6% Springs/Seeps: 16% Enhance Natural Recharge: 5% Floodplain: 10% These eight criteria results are combined using their assigned weights, then broken into five classes using natural breaks. Priority is assigned to the highest three classes.	resources, areas near water bodies should be protected. This not only helps mitigate water quality issues, but by creating public access to these resources all people can enjoy them. This overal result indicates where land conservation should be prioritized to protect Maricopa County's water resources.	stacked by TPL with the guidance of the Advisory Team
Ensure Habitat Integrity			
Layer Name	**Methodology**	**Description/Interpretation**	**Data included/Source**

Rural and Urban Habitat Blocks	Result values = 3 (Moderate),4 (High), 5 (Very High) 1. Resample large blocks data to 5m 2. Reclassify to give NoData 0 value, all other values remain same as original raster (prioritization of data provided by AGFD) Category 1 = 5 and Category 2 = 4 (High) 3. For small blocks, Identified census places >2,500 to be considered as populated areas 4. Clipped Esri Green Infrastructure habitat cores to urban areas 5. Convert small habitat cores to raster based on Score field (the core quality index value based on geometric values and soil variety, endemic species max, biodiversity priority index and ecological systems redundancy. This calculation is based upon the Green Infrastructure Center's (http://gicinc.org) scoring methodology in their Practitioner's Guides) 6. Reclassify all urban habitat into 2 classes using natural breaks, then reclassified so all highest values = 4 (High); lower values = 3 (moderate); all other areas 0 7. AGFD Deeded Lands, AGFD Managed Lands and AGFD Wildlife Areas	The data shown here are compiled from Arizona Game and Fish Department, the US Census, and ESRI to represent an area of land that consists of important wildlife habitat and can reasonably be expected to remain natural for at least 50 years.	Large Intact Blocks (AZGFD) US Census Places, 2015 Esri Green Infrastucture Habitat Cores AZGFD Deeded Lands AZGFD Managed Lands AZGFC Wildlife Areas

	converted to raster and given value of 5 7. Combine all data with Cell Statistics Maximum		

Ecological Linkages and Corridors	Result values = 3 (Moderate),4 (High),5 (Very High) 1. Resample data to 5m 2. Reclassify to give NoData 0 value, all other values remain same as original raster (prioritization of data provided by AGFD)	The data shown here represent models of potentially important areas for wildlife movement. These data come from various sources, some of which are derived through the monitoring of actual wildlife movements (empirical); some of which are inferred (theoretical models) by the relative intactness of the land and its potential for connectivity; and some of which are anecdotal from expert and/or local stakeholder observation of known movement areas. Ecological linkages and corridors should be interpreted as permeable areas or zones, as opposed to discreet paths, and used to prioritize where the highest values for maintaining statewide landscape connectivity occur. Conservation of linkages and corridors benefit wildlife, support ecological functions and provide intrinsic and extrinsic values for humans. Data and associated methodology reports can be obtained by contacting the Arizona Game and Fish Department directly.	Connectivity (AZGFD)

Riparian Areas	Result value = 5 (Very High) 1. Resample SHCGRiparianFINAL_NoTribal to 5m. Data has value of 5. (we were given revised data ~March 28, 2017, but switched back to original data on 4/18) 2. Pull riparian areas out of AZGFD modified ReGap data - value 124 reclassified to 5 (80, 83, 84, 85 are riparian but not in study area) 3. NWI Riparian data converted to raster and given value 5 4. Data combined with cell statistics maximum (prioritization of AGFD data provided by AGFD)	The data shown here are compiled from Arizona Game and Fish Department and the US Fish and Wildlife Service's National Wetlands Inventory. Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas are usually transitional between wetland and upland. Riparian areas have one or both of the following characteristics: 1) distinctly different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms.	AZGFD NWI Riparian areas
Landscape Integrity	Result value = 1-5 1. Resample data to 5m 2. Reclassify to give NoData 0 value, all other values remain same as original raster (prioritizatioon of data provided by AGFD)	This dataset represents the Arizona Game and Fish Department's landscape integrity analysis created during a statewide connectivity modeling project. Nineteen different factors were used to represent human modification on the landscape, and these were combined into a single dataset with 100 being the most intact lands with no human modification. For the	Landscape Integrity (AZGFD)

		Greenprint for Maricopa County, the data are ranked from 1 to 5, with 1 indicating lowest "value/importance", and 5 indicating highest "value/importance". In the case of the landscape integrity data, quantiles were used to group the original data into the 5 categories.	
Species richness	Result value = 1-5 1. SHCGSGCNFINAL_NoTribal resampled to 5m 2. Reclassify to give NoData 0 value, all other values remain the same as original raster 3 (moderate). ESA richness from TNC 2010 freshwater assesment buffered 20m 4. ESA richness data reclassifed 3 (moderate),4 (High),5 (Very High) based on natural breaks of # of species 5. Spikedace crit hab lines buffered 20m 6. All other AGFD crit hab polygon data merged with spikedace buffers, converted to raster and given value of 5 (Very High) 7. All data combined with cell statistics maximum *AGFD crit hab in study area: Spikedace, acuna cactus, chiricahua peop forg, gila chub, mexican, mex spotted owl,	The data shown here are compiled from Arizona Game and Fish Department and The Nature Conservancy. Together, these data represent species richness represented in an ecological community, landscape or region. Species richness is simply a count of species, and it does not take into account the abundances of the individuals in each species or their relative abundance distributions (not sure what this means). These data include birds, fish, mammals, and invertebrates.	a) Species of Greatest Conservation Need (AZGFD) b) ESA Richness from 2010 Freshwater Assessment (TNC) c) Critical habitat (AZGFD)

	narrowheaded, yellow billed cuckoo, razorback sucker, sonora chub, sw willow flycatcher		
Overall Result for Ensure Habitat Integrity	This overall result for Ensure Habitat Integrity was created by weighting and stacking the criteria listed above. Weights were determined by the Technical Advisory Team: Rural and Urban Habitat Blocks: 22% Ecological Linkages and Corridors: 20% Riparian Areas: 22% Landscape Integrity: 12% Species Richness: 15% [Note, a sixth criteria, Natural Heritage Species, was used in the analysis to create this overall result but is sensitive data and therefore is not shown in the web tool] These six criteria results are combined using their assigned weights, then broken into five classes using natural breaks.	The overall result of Ensure Habitat Integrity indicates where land conservation will be most impactful for important habitats. By incorporating habitat intactness, species richness, and important corridors to maintain connectivity, these lands are integral to wildlife.	Derived from criteria above. Weighted and stacked by TPL with the guidance of the Advisory Team

	Priority is assigned to the highest three classes.		

APPENDIX II: List of Participating Organizations in the Stakeholder Consultation Meetings

Arizona Army National Guard
Arizona Game and Fish Department
Arizona Office of Tourism
APS
Arizona State Parks and Trails OHV
Arizona Water Company
Arizona Wilderness Coalition
ASU School of Community Resources and Development
ASU School of Landscape Design
ASU Sustainable Cities
Bureau of Land Management
Circle G Development
City of Apache Junction
City of Avondale
City of Buckeye
City of Mesa
City of Peoria
City of Phoenix
Copper State Consulting Group
Desert Foothills Mountain Bike Association
El Dorado Holdings
Goodyear Recreation Board
GPEC
Maricopa County Planning
Maricopa Farm Bureau
Maricopa Trails and Park Foundation
MBAA
Town of Cave Creek
Town of Surprise
State Historic Preservation Office
Superstition Area Land Trust
Valley Partnership
Vitalyst Health Foundation
Retired Supervisor of Maricopa County (Individual)
Landscape Architect (Individual)

APPENDIX III: Initial Conservation Opportunity Area Identification Worksheet

Team: (circle one)

West Valley Conservation East Valley Conservation Restoration

Name of area:

1. Location and size

2. Why is this a priority? Give a short description (ie, biological, water resources, recreation, conservation, economics, health, social, immediate need, long-term development threats, identified in the Greenprint, identified by org/municipality/working group, other).

3. What are the primary factor(s) from the Greenprint that contributed to identification? (circle those that apply)

Rural and urban habitat blocks	Headwater
Ecological linkages and corridors	Perennial rivers/streams
Riparian area	Intermittent/ephemeral rivers, streams, washes
Natural heritage species	Wetlands
Landscape integrity	Seeps and springs
Species richness	Enhance natural recharge
Floodplain	
Community input	Personal knowledge
Overall value for ensuring habitat integrity	Overall value for protecting water resources

APPENDIX IV: Example Worksheet from the Secondary, Larger-scale Stakeholder Assessment of Identified COAs

1. The regional CAZCA dialogue incorporating more than 60 organizations developed the goal of creating "A robust network of habitat blocks and connections to sustain native plant and animal communities, provide opportunities for recreation, support clean air and water resources, and improve resilience."

a. Do the selected priorities advance the goal?
b. What additions should be made to better achieve the goal of creating a system of protected lands?

2. With input from a range of stakeholders and the partners of CAZCA, the steering committee elected to focus in the process on "regional priorities" which are defined as covering a wide geography, multiple jurisdictions, or containing significant federal and state land interests.

a. Do the mapped priorities represent regional priorities?
b. What areas should go away?
c. What areas are not represented?

3. Considering that there are multiple priorities identified through this process, they cannot all be tackled at once. In your group, identify the three of highest importance.

Comments and Observations for Opportunity Areas

Instructions: Please leave notes below on any of the opportunity areas, be sure to notate the number of the area you are commenting on as well as whether it is in the east or west valley (W1-22 or E1-7).