



**Sustainable Infrastructure and South Mountain Village:
Water**

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Table of Contents

Introduction	2
Purpose	2
Study	
Area	3
Initial Site Visit: Rio Salado Audubon Center and Restoration Area	3
Analysis	
Restoration of Current Riparian Areas	3
Social Connectivity	6
Physical Connectivity	8
Maintenance, Management, and Institutions	11
Development and Future Planning	14
Conclusion	19
Appendix	
Appendix A	20
Appendix B	21
Appendix C	22
Appendix D	26
References	29

Abstract

This study addresses the social and physical constraints and opportunities for South Mountain Village, particularly along the Rio Salado as it intersects with the proposed light rail extension on Central Avenue. The primary goals guiding this document are ecological restoration, social and physical connectivity, maintenance, management, development and future planning. This study discusses the history of the Rio Salado riparian area, analyses current riparian conditions, and provides context from similar cases both locally and nationally.

It has been demonstrated that access to recreational opportunities can improve the livelihood and reduce negative health effects for residents nearby (Wolch 2014). With this in mind, the physical connectivity of South Mountain residents is assessed to determine the degree of accessibility to recreational areas of the Rio Salado. This analysis will also be used to address areas in which residents do not have equitable access and will be used to guide recommendations to increase that access. Additionally, as growth occurs, existing social vulnerability concerns are addressed in regard to marginalized populations relying on the area’s ecological and grey infrastructure for refuge.

As the Rio Salado 2.0 Project and the Valley Metro South Central light rail extension begins construction and the opportunity to develop increases, residents and business owners are concerned that redevelopment will affect the integrity and connectivity of the area. This study outlines how these changes may affect stakeholders while keeping the area accessible and equitable for all. Evaluation of the sites and parcels surrounding the Rio Salado for future development while taking into account its rich history and needs of the community is important for the community and the City of Phoenix as a whole. This study incorporates concepts from the Rio Salado Beyond the Banks Area Plan and other existing plans and regulations for the area. This study aims to provide a roadmap for future development along the Rio Salado at South Mountain Village in a sustainable and equitable way.

Introduction

The Rio Salado has been an important part of Central Arizona's history for centuries. The Hohokam, an ancient agricultural Indian tribe, originally built an extensive canal system from the rivers tributaries to irrigate their fields (DeSemples; Hirt et al. 2008). As new settlers began to inhabit the Valley, the canals were rediscovered and reconstructed for use once again. It was the reuse and evolving civilizations in the Valley that gave Phoenix its name, a city reborn from an older civilization (DeSemples 2008). Unfortunately, the river's recent past is not as grand. The Rio Salado, once a perennial body of water, has been modified so extensively through mining and damming that it is usually a dry river bed surrounded by old gravel pits and industrial land. However, the City of Phoenix and many other invested groups are currently working to bring back the ecological and cultural significance of the Rio Salado.

The City's restoration of the Rio Salado carries a long, multi-decade history. Almost fifty years ago, Arizona State University's Design School planned and designed the entirety of the Rio Salado from Mesa to West Phoenix (Bohem 2017). With strong support from ASU and multiple levels of government leadership, Tempe Town Lake became the beaming example for this vision. In recent years, Senator John McCain has began to revive this sense of unity along the entirety of the river. As such, our study will focus on the Rio Salado at the City of Phoenix South Mountain Village from 16th Street to 19th Avenue.

In addition to the Rio Salado project, the City of Phoenix and Valley Metro are completing final designs for the South Mountain light rail extension, which will address transportation issues and connectivity running north and south on Central Avenue. The addition of this project will bring an influx of people and new development to the area. This study will involve ways to mitigate, manage, and develop with sustainability and resiliency in mind.

Purpose

Access to water is crucial to all major civilizations in human history (Solomon 2010). The valuable resource has significantly influenced human advancement. Additionally, with the use of dams and canals, humans have sustained life in unlikely places, such as Phoenix, Arizona. Water is also valued as more than something that sustains and as something that adds significant social and psychological benefits for residents. Proximity to water allows for many social, mental, and economic benefits by allowing people to have access to nature and recreation. Environmental amenities also foster social interactions that increase happiness and community among individuals. With the re-imagining of Rio Salado, the area can be transformed with the help of residents and other stakeholders. Therefore, this study addresses current accessibility to water amenities and the institutional management of the riparian resources and recreation sites in South Mountain Village.

Study Area

The study area addresses the north and south boundaries of the Rio Salado at the South Mountain Village from 19th Avenue to 16th Street (Figure 1). Broadway Road acts as the southern boundary of the study area due to the accessibility and walking distance from these neighborhoods to the Rio Salado (about one mile). Because there is vacant land and endless amount of opportunity on both sides of the river bank, it is important to venture north of South Mountain Village to analyze the side owned by the City of Phoenix and other private landowners, such as Union Rock and Materials Corporation.

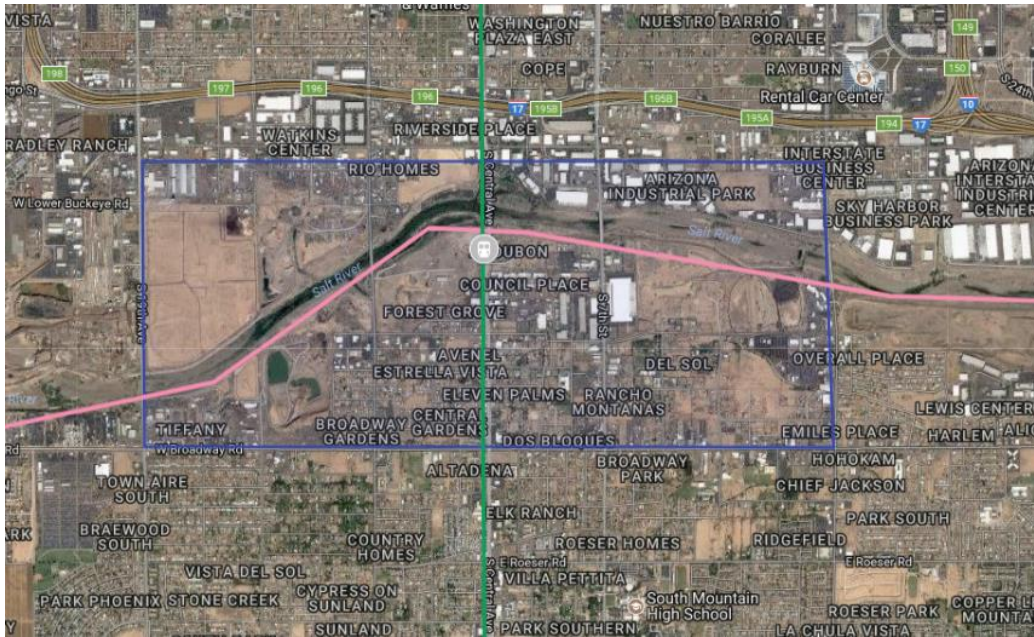


Figure 1: Map of the Study Area

Initial Site Visit: Rio Salado Audubon Center and Restoration Area

In March 2018, our team visited the Audubon at Rio Salado on Central Avenue. We explored the Rio Salado trail system and took preliminary inventory for infrastructure, wildlife, and development in the study area. During the site visit, we observed stormwater drains, debris and plants in the river area, and the vacant or land previously used by sand and gravel companies (Appendix A). As a key environmental amenity, we also chose to explore the Audubon restoration site.

The Rio Salado Audubon Center is a facility located on Central Avenue that specializes in conservation and restoration. Its mission is to “envision an Arizona with a rich and diverse natural heritage, where there is ample habitat for birds and other wildlife, where a majority of its people appreciate and participate in their natural environment, and whose children are educated and motivated to become the conservation leaders of tomorrow” (Audubon). Future developments and conservation efforts within the study area should be done with consideration to the current physical, social, and political environment.

Analysis

Restoration of Current Riparian Areas

The goal of this section is to study the current riparian restoration status and water infrastructure along the area. Case studies were carried out to see potential fail-to-safe strategies that could be used along riparian areas, providing greater urban connectivity and business opportunities.

Dams, water diversion, groundwater pumping, sand and gravel mining has led to a degraded Rio Salado riparian system. In 1990, the Rio Salado Environmental Restoration Project was developed to rehabilitate five miles of the Rio Salado through the City of Phoenix. The restoration objectives of the riparian areas were to restore habitat in and around the Rio Salado through Phoenix and Tempe and to create a complete and diverse riparian system with a mix of native wetland and plants, mesquite, cottonwood, willow, wetlands, and open water. The restoration also intended to increase environmental

education and recreation opportunities to the local community. To introduce water into the dried up river, groundwater is delivered from five wells with a capacity of one million gallons a day each, with one well serving as a backup.

Current Riparian Areas

To study the current riparian status, groundwater, vegetation and water source distribution were mapped out from satellite images (Figure 2). Canals, groundwater wells, and stormwater discharge deliver water to the wetlands and riverbed. The vegetation mainly concentrated between 7th Avenue and 7th Street, where most of the canals and groundwater wells are located, and between 19th Avenue and 7th Avenue where an industrial water pit is discharged into the riverbed.

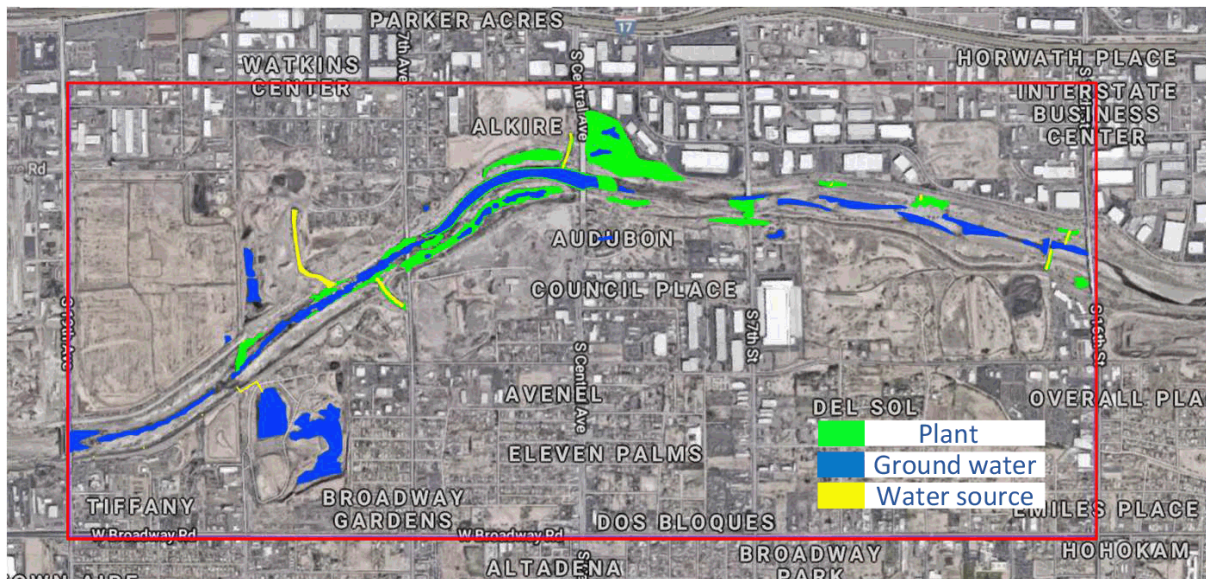


Figure 2: Plant, Groundwater, and Water Source along the Riparian Restoration

To introduce water into the dried up river, groundwater is delivered from five wells, each with a capacity of one million gallons per day. The well and pump stations pump water to reservoirs located along the Rio Salado. Gravity flows from the reservoirs and canals which enter wetlands and other places where flood irrigation is used. Drip irrigation is used as a supplement to natural rainfall. To prevent water loss during transportation, canals were lined and the reservoirs were lined with geotextiles. Between 19th Avenue and 15th Avenue, untreated stormwater and industrial wastewater is discharged directly into the Rio Salado.

Restoration Case Studies

Riparian restoration holds the potential to increase biodiversity along an urban waterfront, support community education, improve water quality, provide flood storage, and offer public recreation opportunities. For example, in Houtan Park (Shanghai, China), a series of treatment wetlands were restored to bioremediate the polluted river water and provide the flood storage. The Harlem River Waterfront Edge (Manhattan, New York) uses porous materials to allow the soil to filter stormwater and absorb wake energy.

Riparian restoration could provide greater urban connectivity and business opportunities to the Phoenix Metropolitan Area. For example, the restoration of San Antonio Riverwalk (San Antonio, Texas), turned the once floodplain into a city park network which is now an important part of the urban fabric and renowned tourist attraction. The restoration of San Antonio Riverwalk has several phases (Figure 3) with each phase having their own focus. In the first



Figure 3: Different Phases of San Antonio Riverwalk

phase, the river bed was built into a two-side riverwalk surrounded by commercial development. The second phase, which was the first major extension of the Riverwalk, was beyond the natural banks to the new convention center in 1968. Additional hotels and retail centers were built as the river walk became a local landmark and tourist attraction. During this period, the river became a crucial part of urbanscape and tourism. The third phase began in 2009 as the City decided to extend the riverwalk north (Museum Reach). This extension is more distinctive from commercial development in the original phase. In 2011, the Riverwalk was extended several miles to the Mission Espada to the south side of the City. This extension was notable for its emphasis on ecological control and recreation for the local community as it provides both hiking and biking trails along the riverside as well as connection to greenways.

The current reach of the proposed Rio Salado 2.0 redevelopment is forty-five miles. Similar to the different phases of the restoration of San Antonio Riverwalk, the restoration of Rio Salado does not need to be homogeneous. The restoration Tempe Town Lake brought business and recreational opportunities for the local community and has allowed the City of Tempe to thrive economically.

Social Connectivity

The goal of this section is to address the soft infrastructure component of social connectivity. Therefore, key stakeholders are outlined in order to see the connectivity between them and the Rio Salado now, and in the future. Focusing on the Rio Salado section between 19th Avenue and 16th Street, south of Watkins Road and north of Broadway Road, dozens of stakeholders can be identified. Geographical stakeholders include business owners, land owners, churches, residents, and schools. Use-value stakeholders include trail users (foot, bike, and horse), Nina Pulliam Audubon visitors and volunteers, Rio Salado Habitat Restoration visitors, and soon to be light-rail users. Philosophically impacted stakeholders include the EPA, Liberty Wildlife, Arizona Game and Fish, and South Mountain Visitors. Lastly, economic stakeholders, which are very similar to geographic stakeholders, include the City of Phoenix, Valley Metro, landowners, and business owners. Each stakeholder is important to understand the social connections that will shape Rio Salado now and into the future.

Stakeholders were identified by multiple site visits to the Audubon Center and Rio Salado Habitat Restoration Area, as well as a literary search on the Rio Salado 2.0 project, area mapping, and surveying (see Appendix C2, C3 and C4). After identifying stakeholders, research on the connections between different groups was conducted through interviews and online resources. Interview questions can be seen

in Appendix C. Social themes were then identified through analysis of interview questions and online resources. Themes include, changing social connections and the lack of local residential interactions. By understanding what social connections stakeholders have with Rio Salado, we can better understand what the strengths and weaknesses of the area are and offer suggestions for implementing a sustainable social site in southern Phoenix.

The first major theme identified was the change in social connections that have been and will continue to occur in the study area. The area has been getting more attention as different stakeholder groups have been improving the area from old sand and gravel pits into a recreational area that reawakens the area. In an interview with a volunteer from the Audubon Center, it became clear that visitorship grows each year. The volunteer believes the attraction comes from connecting people to the natural environment and desert water, something the City has pushed far away to the outskirts of town. Currently, the area serves as a recreational site where many social interactions occur between multiple stakeholders. When asked what the future holds for the area, with the addition of the light rail down Central Avenue, the volunteer responded, "I am not sure. It will be different but I am not sure if that will be good or bad."

In the South Central Environmental Assessment by Valley Metro, the light rail extension is promoted as something that will connect the Rio Salado Restoration Area and Audubon Center with other recreational areas (Forrest and Paukowits). The South Central light rail extension is expected to terminate at Baseline Road, less than three miles from South Mountain Park (see Appendix C6). Connecting green spaces in a city has been a technique used to increase urban biodiversity as well as enhance social and economically viable areas ("Green Spaces"). The benefits the light rail will bring are apparent. More green spaces will be connected and more people will have access to enjoy Rio Salado and accompanying areas. "With more visitors comes more management," the volunteer admitted, but "with more visitors there will be more awareness of what we have in our backyard and we need to protect that." As more people experience the Rio Salado area, the more they feel connected to it and determined to keep the area clean and accessible for enjoyment. This will likely facilitate social connections between stakeholders who share a similar goal for the area.

The second theme uncovered is the lack of local residential stakeholders involved in the study area. Much change has been occurring in their backyard but no studies have been done on their interaction with Rio Salado, bringing up the concern of gentrification. South Mountain village residents are typically minority people who make less than the median household income of Phoenix ("Household Income") (See Appendix C1). With the addition of the light rail on South Central Avenue, and an increase in visitors to the restoration site and Audubon area, physical connectivity is increasing. Better physical interaction can foster social connections in the area, but are all stakeholders being reached equally? Looking at the study area google map (see Appendix C2) we can see there are several churches and a few schools nearby. However, in an interview with a volunteer from the Audubon, interactions between the center and residents was unknown. The volunteer mentioned they do school programs and visits but did not know if the local schools were involved. When doing a survey of the visitors in the restoration area and Audubon site, many visitors admitted they were not from South Mountain Village.

Much of the area is a mix of industrial, commercial and residential areas. With the addition of the light rail and the enhancement of Rio Salado, property values in the area are expected to increase, which

could force out nearby residents. Outreach methods and social connections need to be analyzed to see what can be done differently to protect equitable access to Rio Salado while continually enhancing the area for the enjoyment of all. The Audubon Center as well as the Restoration Area have been the leaders in outreach and education on the Rio Salado. The Audubon has school programs, volunteer programs, workshops, and conservation education. The Habitat Restoration Area also supplies a rich history of the area and the importance of conservation in southern Phoenix. However, historically minority people are not the target of these outreach and educational programs. This is an important discovery for Rio Salado to determine new ways to reach all stakeholders, so that all people have access to a socially stimulating and physically benefiting area nearby.

Many stakeholders are affected by the revitalization of Rio Salado. For most, revitalization allows them to have better access to green spaces and conservation areas where they can learn about native desert habitats and species. For others, it is a beneficial project that will lead to economic development. However, for some, the change that has been growing in South Mountain village is problematic due to fears of gentrification. In order for the revitalization of Rio Salado to enhance all stakeholders' social connectivity with water and the natural desert habitat, more interaction involving local residents must be done. Environmental gentrification has been on the rise as many cities begin to green neighborhoods and public areas. To stop environmental gentrification, communities such as Greenpoint, in Brooklyn, have attempted the "green-enough" approach to clean up their town without fully allowing for new development (Tuhus-Dubrow). Although Greenpoint has encountered extreme gentrification, the community activism and green enough approach has allowed the community to slow it down and be a part of the impending change.

Other similar approaches concern strengthening community planning in the area through organizations like PUSH Buffalo and 596 Acres. PUSH Buffalo in Buffalo, NY and 596 Acres in the New York City Metropolitan area are local nonprofits that fight for fair and affordable housing as well as community activism and green spaces ("What We Do" & "Mission and Story"). Little research on residents in South Mountain has been done and therefore there is a strong need for public participation in the area to uncover how the local residents want the area to develop and how they interact with Rio Salado. By strengthening ties between locals and similar organizations such as PUSH Buffalo and 596 Acres, South Mountain can develop sustainable and affordable housing, as well as equitable access to the green spaces in the area. Strengthening community activism and planning in the area will ensure that locals are apart of the planning process and the change in their neighborhoods.

Physical Connectivity

The goal of this section is to assess and improve upon the physical connectivity of South Mountain Village residents to recreation and water resources. Parks, recreation opportunities, access to nature, and access to water can provide numerous benefits to people, especially those living in urbanized areas where nature is seemingly non-existent and typically sparse in urban cores. There are a wide range of health benefits associated with green spaces that include increased sites for physical activity, enhanced overall health, and reduced risk for all-cause mortality and chronic disease (Wolch 2014). The connectivity of people with green spaces and access to opportunities for recreation and nature is important to improve the overall livelihood and quality of life for residents in South Mountain Village. Green spaces are found to provide many ecosystem services to residents surrounding them, as they can filter air, remove pollution, reduce noise, reduce temperatures and urban heat island effect, and can help infiltrate stormwater more

rapidly and replenish groundwater as a result (Wolch 2014). In an arid climate such as Phoenix's, access to water is naturally limited by the climate, but is also critical to improving the quality of life for residents in South Mountain Village. This section of this report aims to investigate where the existing recreational resources are in South Mountain Village and then evaluate the connectivity of residents in terms of access to recreation opportunities through transit and/or pedestrian oriented transportation. In doing so, the connectivity of each resident will be known and then recommendations to improve the connectivity of disadvantaged residents can be made.

To assess the connectivity of South Mountain Village Residents to water and recreation opportunities, ArcGIS is used to map the current access of residents to these opportunities. For the purposes of this study, adequate access shall be considered to be within a walkable range, or within a walkable range with the use of public transportation. Here, a walkable distance is considered to be within a half mile and public transportation is considered to be any public bus, light rail, or bus rapid transit operated by city government or the local transit authority, Valley Metro. Major transit stops and recreation opportunities will be mapped. For this study, recreation opportunities will be considered any public parks, public recreations centers, wildlife or mountain preserves, and walking or biking trails along natural or canal pathways. Additionally, water opportunities will be defined as public canals, bodies or natural or man made water bodies, and riparian areas such as the Rio Salado. Once areas of recreation are mapped, spatial analysis will be conducted using ArcGIS to determine resident's proximity to recreation and/or water. First, an analysis will be conducted to determine access based on walkable distance along streets and pedestrian trails alone. Then, public transportation will be factored in, assuming that if a person can get to one bus or light rail stop (by walking a half mile), then they can get to any other bus or light rail stop within the City. This assumption might not always be feasible, but is made to simplify this analysis so that ArcGIS may be used. Finally, a combination of public transit and bikeways will be factored in, assuming the average person is willing to bike a distance of two miles one way to reach a destination. Again, this assumption does not hold true for all populations, but is made to simplify the analysis. Data and shapefiles used for this model can be found in Appendix B.

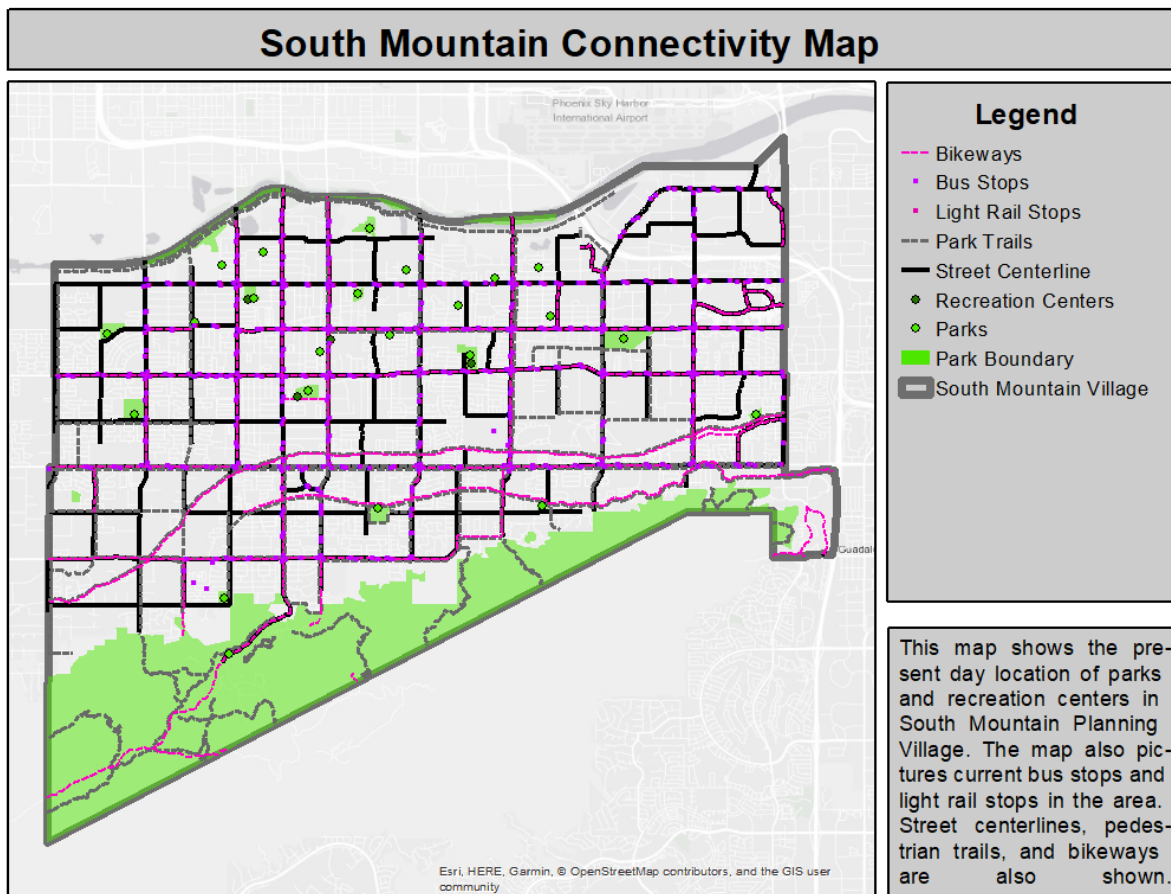
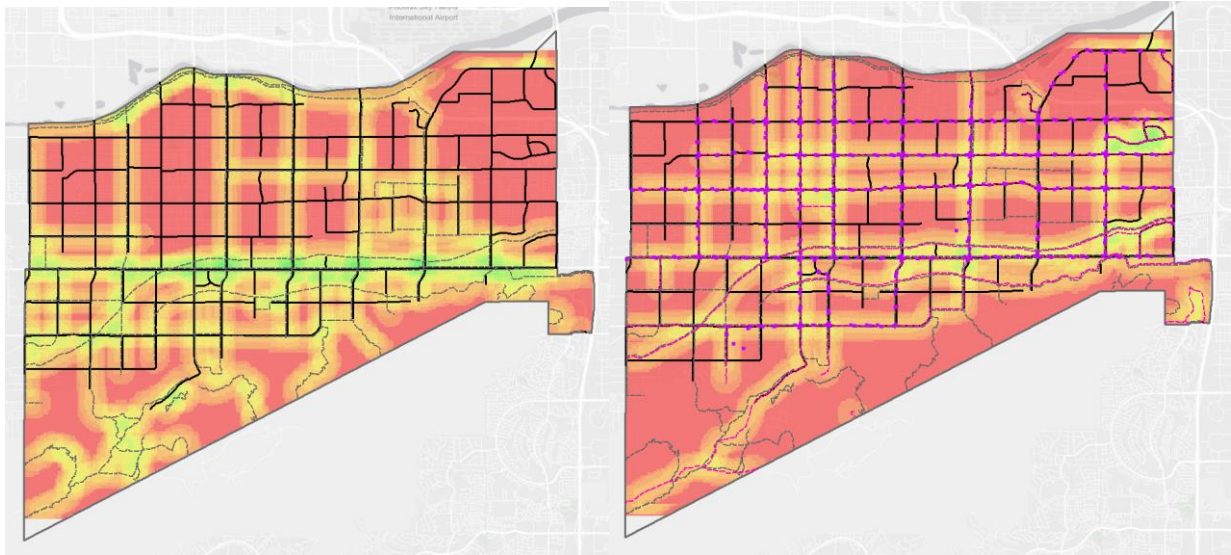


Figure 4: Map of South Mountain village showing current bikeways, bus and/or light rail stops, pedestrian trails, streets. Parks and park boundaries are shown in green.

With this data, an analysis was conducted to determine how connected South Mountain village is in terms of walkability alone, and then in terms of accessibility with transit and bikeways included. These values will then be used to identify critical areas of disconnectivity to recreation and water. Once these critical areas are identified, suggested areas of improvement for added connectivity as well as added recreation opportunities can be made. To conduct this analysis, spatial analyst tools within ArcGIS were used to determine the kernel density of different transportation features. The kernel density tool calculates the density of features within a specified area and can be used for line and point features such as streets and bus stops (“How Kernel Density works”). This was used to find the density of transportation features for walkability as well as total transit for this analysis. The results for total walkability and total transit access are pictured in Figures 5a and 5b respectively. Areas with high accessibility are shown in green, and areas of low accessibility are shown in red. These colors correspond to the density of features in that area. It is interesting to note that when only walkability is considered, the area surrounding Baseline Road, and the road itself is the most walkable area because of the Western Canal located in that area. South Mountain preserve also has high walkability because of its hiking trails. When transit is considered, the Western Canal still has high access, but the point of highest access is located in the north eastern corner of the planning area, likely because of increased transit stops in that area.



Figures 5 a-b: On the left, overall walkability is shown and on the right overall transit access is shown. Red areas are areas with low density, and green areas are ones with the highest density.

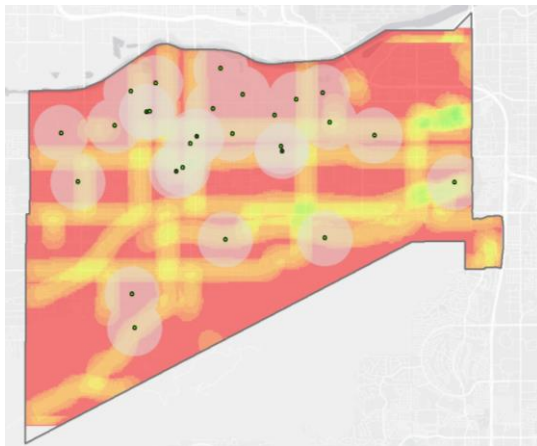


Figure 6: Map of half mile parks and recreation buffer on top of transportation density.

Once the density of different transportation features was found, a half mile walkable buffer was applied to each park and recreation center within the planning village so that the relationship between recreation opportunities and transportation access could be determined. This resulting map is shown in Figure 6. This map helps to paint a useful picture of the current connectivity within South Mountain Village, as it shows where recreation opportunities area in regards to available transportation. In looking at this map, it is clear that the Northeastern corner of the village has low connectivity and little recreation within it. This holds true of a smaller section of land just south of that portion of the map, as well as a portion in the Southwestern corner of the map. These are areas that need increased connectivity as well as parks and recreation. The, there are other areas of the map that have existing parks and

recreation opportunities, but little connectivity. These are areas that need increase transit and walkable access to connect to the rest of the village. These are mostly concentrated in the Northwestern corner of the map and in the northern half of the central part of the map. These targeted areas are shown in Figure 7, where a blue outline dictates an area that needs increased parks and connectivity, and a black area needs increased connectivity.

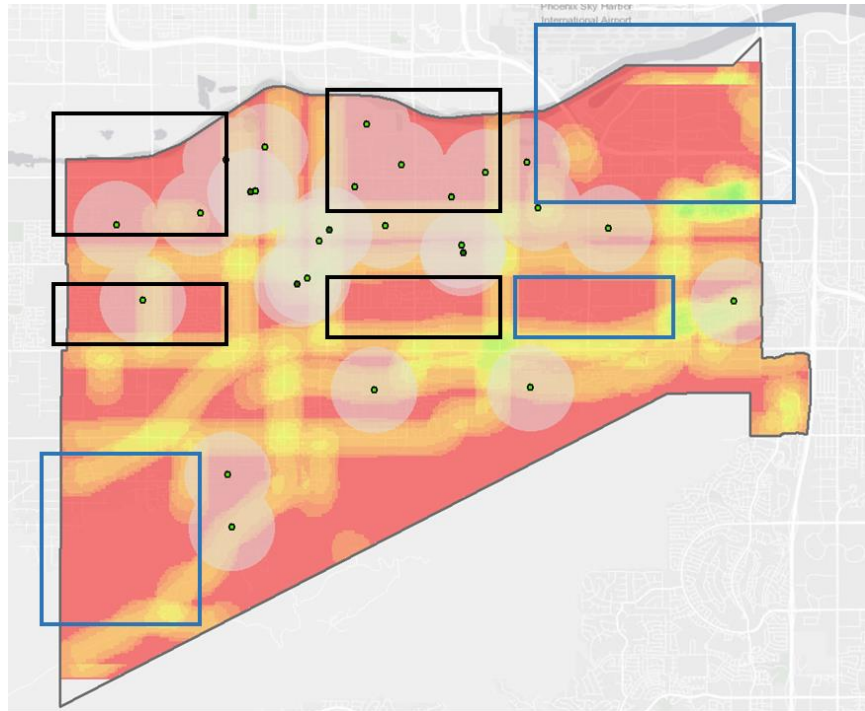


Figure 7: Recommended areas for improving connectivity are boxed in black, and recommended areas for improving connectivity and recreation opportunities are boxed in blue.

Maintenance, Management, and Institutions of Rio Salado Habitat Restoration Area along proposed Central Avenue light rail extension

Existing Relationships and the Social Ecological System

The section of the Rio Salado that coincides with the light rail extension area includes the Nina Mason Pulliam Audubon Center and the City of Phoenix’s Rio Salado Restoration Area. The restoration area is managed primarily by the City of Phoenix’s Park Rangers in partnership with the Audubon Center. The existing restoration area was completed via Federal government Army Corps of Engineers funding (65%) and a \$16 million City of Phoenix bond for restoration and cleanup. Continued maintenance of the plants, animals, and infrastructure is conducted by the City. The Audubon Center is formally situated on land leased from the City of Phoenix. Leveraging Ostrom’s (2009) social-ecological systems framework, Figure 8 highlights the primary relationships between the resource system (RS), the resource units (RU), the Governance System (GS), the Users (U), and the interactions between the social-ecological system.

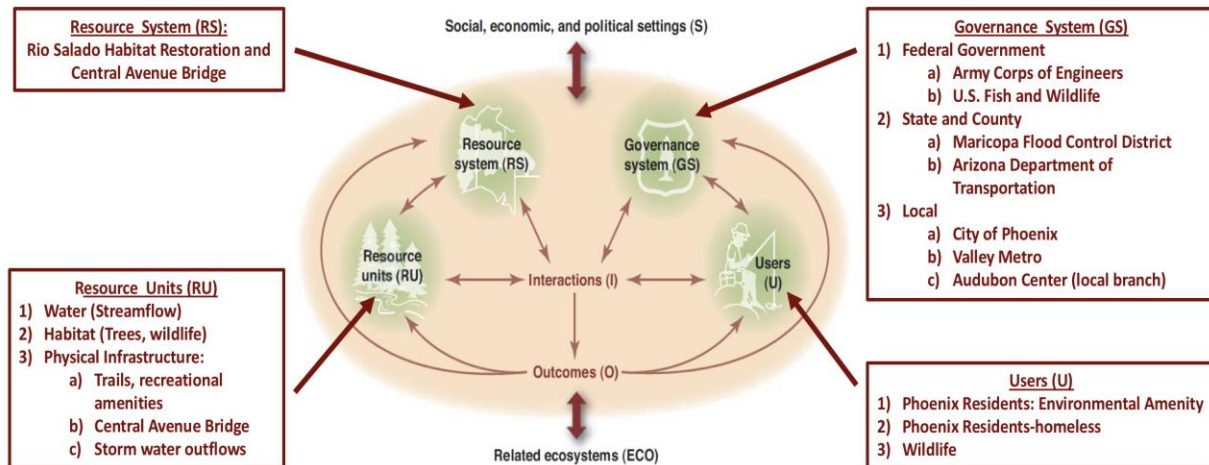


Figure 8: Map of Social Ecological Systems in the study area.

Blue Infrastructure

Within this area, flow in the Rio Salado is required due to the restoration requirements from the federal classification of the river as a “water of the United States” (Forrest, 2016) At this time, flow continues to the Tres Rios and Gila River in the west valley. Within the area, there are 22 City of Phoenix stormwater outfalls that discharge in multiple locations (C2HM report). The restoration was built to accommodate 100 year storms and flood events and was done in collaboration with the Army Corps of Engineers. Although there are multiple trash grates and efforts to prevent point and nonpoint pollution, there is visible trash and likely contamination in the stormwater runoff. The area could likely benefit from improved grate technologies and runoff systems as connected to the streets and inflow areas.

Grey Infrastructure

The Central Avenue bridge is a key point of Phoenix’s North-South connectivity and future co-location of the light rail extension. The bridge is also situated directly over the habitat restoration and has critical supports standing in the river (Figures 9 and 10). As such, environmental and engineering assessments by the City of Phoenix, Valley Metro, and the Federal Government are required before construction and modification can be completed (Valley Metro EA, Valley Metro and Parks Interviews).



Figure 9: Elementary school field trip with Audubon Center Volunteer pointing to owls nesting in bridge



Figure 10: Central Avenue Bridge from trail

An important infrastructure resilience and maintenance issue concerns the current and proposed bridge design and construction. Before the extension can be built, Valley Metro must comply to a series of regulations that are highlighted via an Environmental Assessment related to the habitat and river body. Further information of the permitting required, particularly from the Federal Government's U.S. Fish and Wildlife, Arizona Department of Transportation (ADOT), and the Army Corps of Engineers are highlighted in Appendix D.

One of the current challenges for this project is an interesting social-ecological feedback loop related to the strong environmental regulation of this particular habitat. Because of the area's significance for bird nesting, a safe harbor agreement has been completed and permits are awaiting U.S. Fish and Wildlife approval. This means that impacts of construction cannot occur during nesting and hatching times, (e.g. Figure 9) and therefore significantly limits

the time when construction to the bridge can occur. In addition to this complication, the river flow cannot be diverted during construction because of ecological concerns. Therefore, the right of way for vehicular and equipment movement at the riverbed is limited even further and complicates construction timelines and capacity.

Resource Users and Vulnerability

It is known that marginalized populations and particularly the homeless use this area for refuge and illegal homesteading (Palta et al. 2016). There is shade, often a degree of privacy due to the tree cover, and water for bathing, drinking, and waste. Management of the area respects human life and the use of the area as a publically available resource. Illegal use of the area is managed through proper channels via public and non-profit resources. However, as development grows increased visitorship occurs from the light rail extension, careful attention should be placed on this often unspoken use of the physical and natural infrastructure. Social justice concerns should be addressed so that the City maintains a balance for ecological, social, and infrastructural concerns. Especially because the area is a key environmental refuge from the heat and aridity, it should be enjoyed and appreciated by those from all socio-demographic backgrounds. If the area serves as a life giving resource currently, social vulnerability exists via the use of the natural and physical infrastructure and should be addressed as growth continues.

Development and Future Planning

Opportunities and constraints were measured for the developable study area including land ownership, land use, zoning, and future planning through methods of GIS, Maricopa County Assessor's Office, and the City of Phoenix Planning and Development Department. This section outlines the development goals in which the City and surrounding residents would like to see in the future with sustainable and resilient infrastructure at the forefront.

Zoning in the area around the Rio Salado is majority industrial (Figure 11). These uses may have been beneficial for the neighborhood in the past, but with future light rail and housing opportunities along South Central, it may be in the City's best interest to utilize this land for sustainable redevelopment. This could include housing, small commercial and employment, and recreational opportunities, all while preserving the environmental integrity of the Rio Salado riparian area.

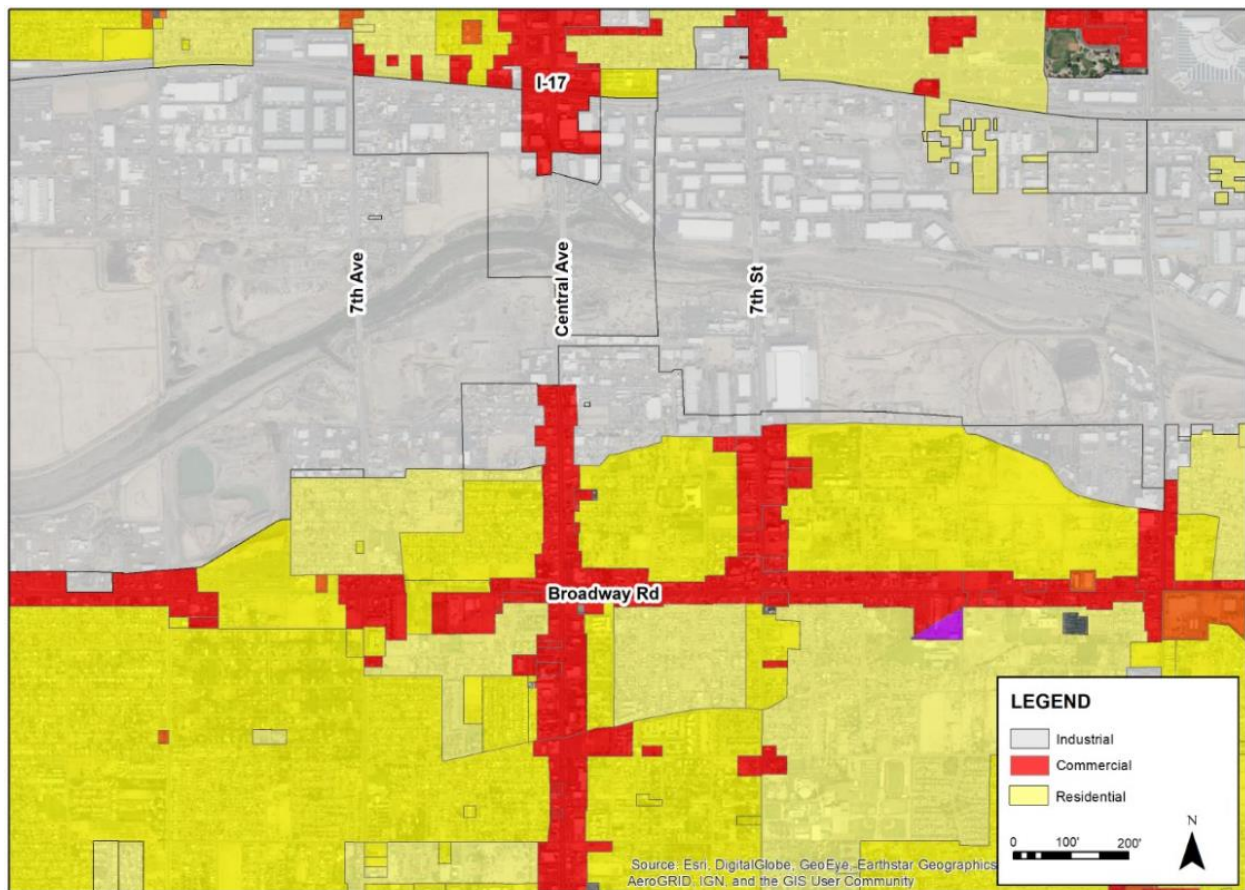


Figure 11: City of Phoenix Zoning

The City of Phoenix has applied an overlay to the area of the river to the study area from 19th Avenue to 32nd Street (Figure 12). The Rio Salado Interim Overlay District discourages unwanted land uses like tattoo and pawn shops, as well as industrial uses such as car repair or soil and gravel industries. Any existing uses like these under this overlay will be considered “legally non-conforming” and will be allowed to stay and operate in the condition they are now, but will not be able to add or change to a similar use. This overlay also calls for the area to develop around the “Commerce Park” use, which is similar to development around Tempe Town Lake. Commerce Park use includes research or business parks with offices, restaurants, and certain housing types. When reviewing these provisions, it is clear that the City of Phoenix is intending the Rio Salado area in South Mountain to be developed and integrated as part of economic and social development.

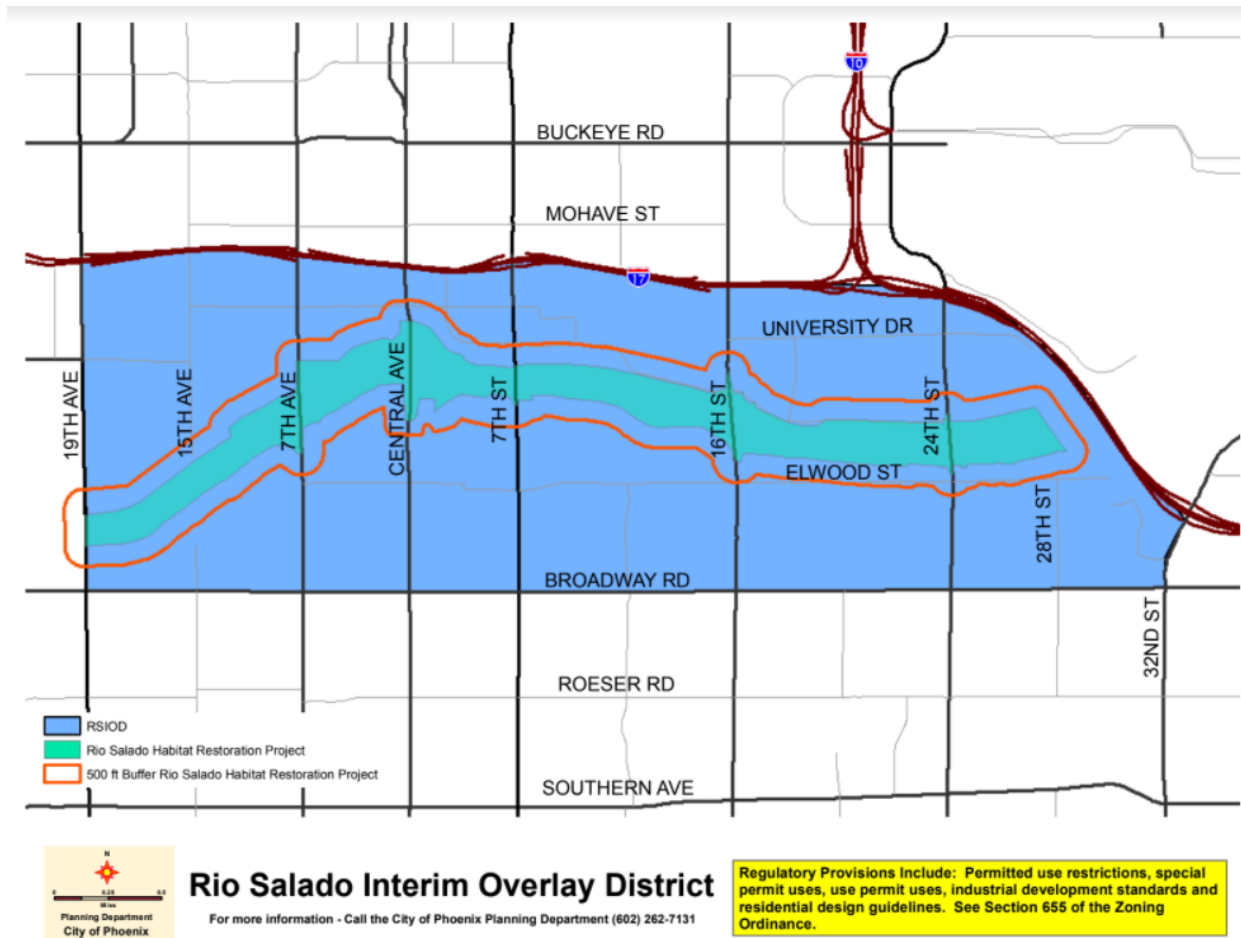


Figure 12: Rio Salado Overlay District

The Rio Salado “Beyond the Banks” Area Plan (Figure 13), completed in 2003, outlines the goals the City of Phoenix and the community would like to establish for the area, including access, ambience, education, employment and economic development, history, housing, public participation, recreation, safety, and transportation. The study area boundaries for the plan are Interstate 17 (I-17/Maricopa Freeway) and Interstate 10 (I-10) to the north, Broadway Road to the south, 32nd Street to the east and 19th Avenue to the west.

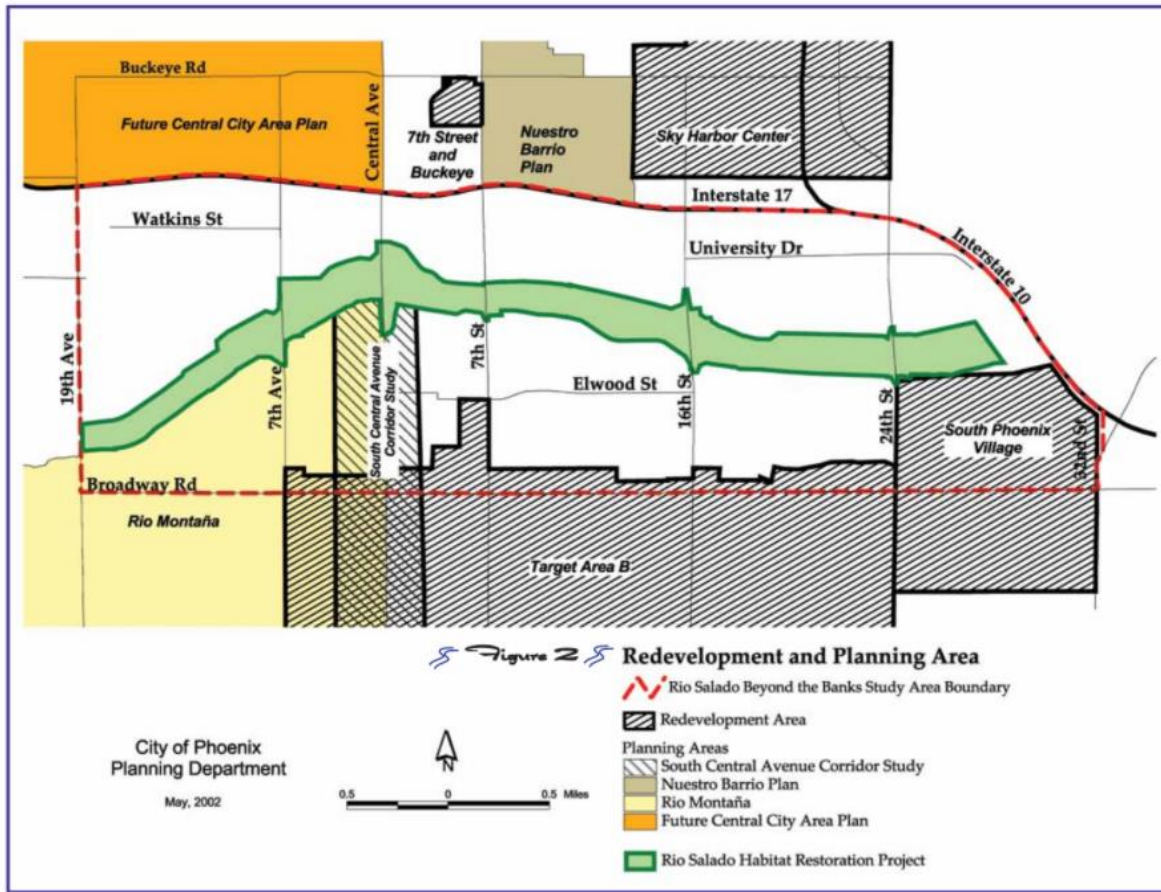


Figure 13: Beyond the Banks Area Plan

The Beyond the Banks Area Plan called for appealing "showcase" projects near the river emphasizing attractive development to kick-start revitalization and demonstrate the employment and economic development opportunities available for both small and large businesses. As mentioned in the Social Connectivity section, revitalization should reflect the values of existing residents and increased opportunities for home improvement as an option for long-term residents of owner-occupied dwellings. The plan suggests incentives to create better housing and encourage infill development, including better access to shopping, schools, and employment. With schools in the surrounding area, the Beyond the Banks Area Plan encourages development of science and environmental curricula that involve a first-hand observation of the ecological systems of the restored river. The plan calls for public/private partnership efforts to develop an environmental educational center adjacent to the Rio Salado Project to facilitate hands-on learning opportunities for students and residents throughout the Phoenix area. This goal was brought to fruition through the Rio Salado Audubon and other educational centers that may develop in the coming years.

The Beyond the Banks Area Plan is intended to encourage and enhance access for the public to the Rio Salado. The plan stated revitalization adjacent to the Rio Salado Project should create attractive, natural spaces for public enjoyment that extend and enhance the natural setting provided by the Rio Salado. The plan also specified recreational opportunities adjacent to the Rio Salado should provide activities both for residents and for visitors, ranging from active and athletic pursuits to more passive and contemplative ones. In line with the Physical Connectivity section, the plan emphasizes opportunities to connect existing trails and open space corridors to the Rio Salado. Public health, safety, and security was a priority concern in planning for revitalization. The plan stated the location and proximity of residential areas in relation to industrial areas should carefully consider the health and safety of residents. In addition, transportation such as pedestrian and bicycle-friendly opportunities for accessing and enjoying the Rio Salado Project should be given a high priority in transportation planning. These opportunities have begun with the planning of the Valley Metro light rail down Central Avenue with a stop at the Audubon Center, but multimodal connectivity will continue to be at the forefront of the planning process.

Another policy document more recently created by the City of Phoenix is the Del Rio Area Brownfields Plan (2013). This plan focuses on guiding development in the brownfield areas around the Rio Salado, directing the assessment of needs on these sites, and identifying resources to assist with redevelopment. Figure 14 depicts the final outcome of the community lead Del Rio Parks Master Plan, which consists of recreational and sport uses, green space, amusement park, solar plant, and leaves space for the Del Rio RFP that is currently in the decision making process (Del Rio Landfill RFP). In addition to this plan, there are multiple other sketches designed by the public showing different scenarios for this area. These scenarios include parks, multifamily housing units, educational facilities, and restaurants. Community engagement and public participation was a very important aspect of the planning process. Nearby residents, businesses, communities, and youth were and will continue to be actively involved in planning and decision-making that affects the Rio Salado. Public participation not only provides input to the revitalization process, but encourages active support and long-term commitment.

RIO SALADO PARK/DEL RIO LANDFILL Conceptual Master Plan



Figure 14: Del Rio Parks Master Plan

The City of Phoenix has provided development incentive, regulation, and policy documents to allow for sustainable, yet economically viable development of the Rio Salado. Using the Interim Rio Salado and Transit Oriented Development Overlays, future construction can be high density housing and office along Central Avenue and the future light rail extension. Additionally, commercial, office, and mixed-use development can be built in the existing industrial areas that are either vacant or legally non-conforming. Even with this kind of high density development in an urban area, the case studies outlined in the Restoration section have illustrated the potential of protecting and developing the riparian area along the Rio Salado as a high quality recreational area with an attractive tourism aspect.

Conclusion

The Rio Salado provides South Phoenix, and all use-value stakeholders, a unique and socially important natural riparian site in the Sonoran Desert. Current conditions were analyzed in this report to better understand the waterways, connectivity, opportunities, and constraints. As the South Central light rail extension brings more attention and access to the area, it is important to understand the consequences on the Rio Salado, the surrounding community, and other stakeholders. Although development is needed in the area, it is important to maintain the viability and equity of the site through restoration and management practices with social and physical connectivity in mind. Equitable access and development at a sustainable speed can allow for a resilient community and riparian ecosystem now and in the future. Maximizing on the benefits of the Rio Salado will be a social and economic gain for Southern Phoenix, if done with the community and the natural habitat in mind. This analysis has led to the following findings and recommendations:

1. Although the current area is maintained well by City of Phoenix Parks Department, additional resources should be allocated for maintenance of the area to address increased use, assistance for marginalized and homeless populations and engaging residents. Additional resources can help build capacity prior to the completion of the light rail and help predict future emergent or exacerbated micro and macro issues.
2. There is a lack of local use of the Rio Salado restoration site and Audubon. Community planning and capital can be strengthened in the area by partnering with agencies that help residents both organize and idealize the benefits of their neighborhoods. By doing so, development in the area will better serve those who live in South Mountain and allow them to be a part of the change that is occurring around the Rio Salado. Local stakeholders are an important part of the areas unique and interesting history, without more public participation from this group, their values and needs may not be reflected in future development.
3. With future development in mind, it is important to stay true to community lead visioning processes such as the Beyond the Banks Area Plan and the Del Rio Area Brownfields Plan. This way, there can be development that holds true to the sustainability and resilience of the Rio Salado recreation area, while allowing for commercial and housing developments and economic opportunities for South Mountain. Community outreach organizations and career opportunities in line with the character of the area will create a more economically viable and connected neighborhood.

Appendix A: Photos of Site Visit



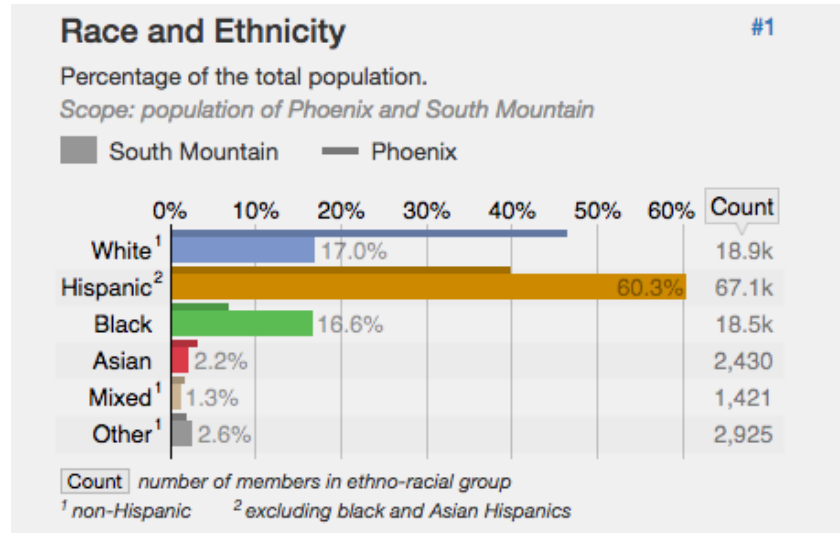
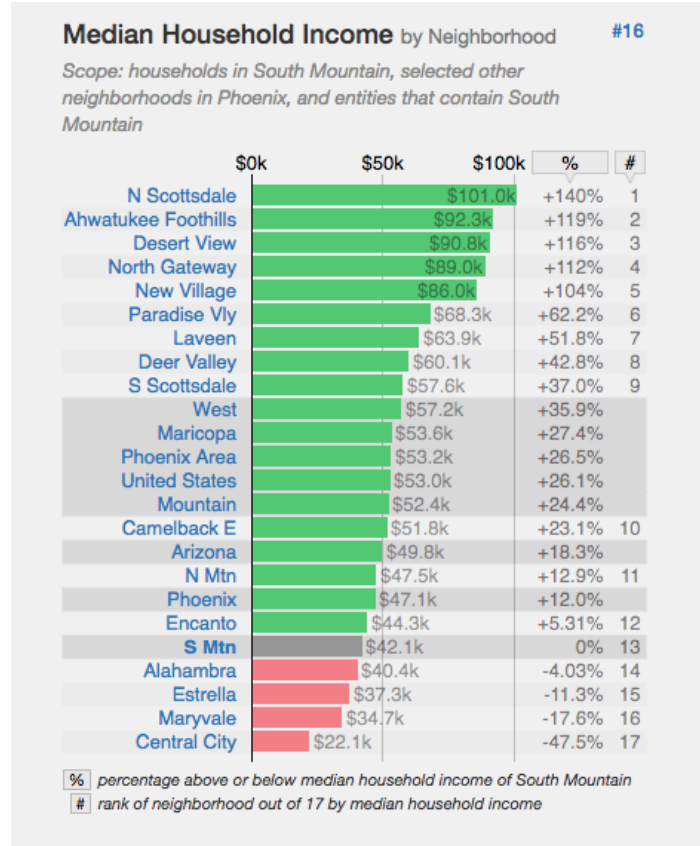
Appendix B: Data Sources Used to Create ArcGIS Maps

File	Type	Source	Description
Village	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/village	Outlines of 15 urban planning villages in Phoenix
Parks	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/parks	Points at which city parks are located in Phoenix
Park Boundary	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/park-boundary	Outlines of city parks
Recreation Centers	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/recreation-centers	Points at which recreation centers are located
Park Trails	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/park-trails	Paths of park/pedestrian trails within the City
Street Centerline	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/street-centerline	Centerline of city streets
Bus Stops	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/bus-stops	Points of Valley Metro bus stops.
Light rail Stops	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/light-rail-stops	Points of Valley Metro Light Rail stops.
Bikeways	Shapefile	https://mapping-phoenix.opendata.arcgis.com/datasets/bikeways	Paths for biking within the City, paved and unpaved.
Zoning	Shapefile	ASU Repository	Zoning Categories for all of City of Phoenix
Canals	Shapefile	2017 TIGER/Line Shapefiles/ prepared by the U.S. Census Bureau, 2017	Outlines of all waterways
Counties	Shapefile	2017 TIGER/Line Shapefiles/ prepared by the U.S. Census Bureau, 2017	Outline of counties in Arizona
Roads	Shapefile	2017 TIGER/Line Shapefiles/ prepared by the U.S. Census Bureau, 2017	Outline of all roads in Maricopa County

Appendix C

C1: Demographics

("Household Income")



("Household Income")

C2: Area Map of Study Area

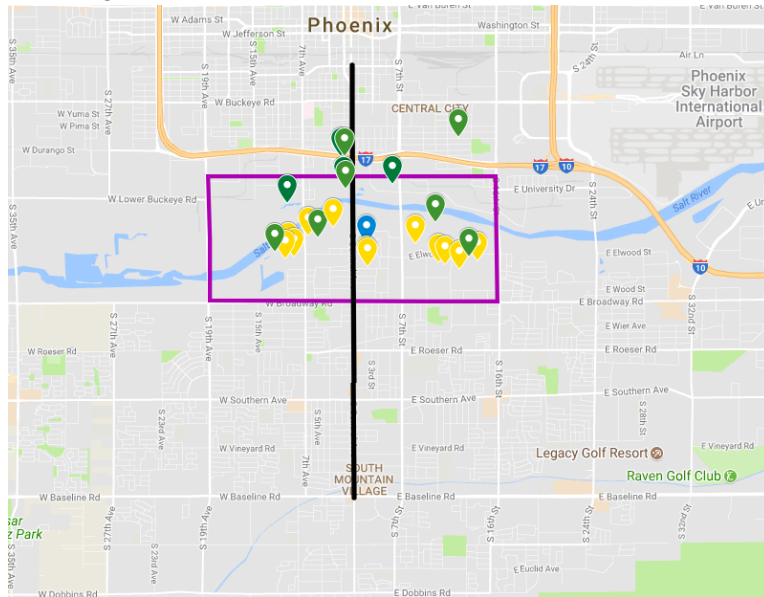
Pink Line = Study Area

Black Line = Proposed Light Rail Extension

Green Flag = Green Space or Trail

Yellow Flag = Church

Blue Flag = School



C3: Interview Questions

Q 1: How is the area changing? Why?

Q 2: What do you expect the area will be like in 20 years? 50 years?

Q 3: How will the addition of the light rail affect the area?

Q 4: Who are the main stakeholders in the area? How do they participate in Rio Salado Restoration?

Q 5: What are the social benefits of enhancing the Rio Salado?

Number of Interviewees:

1 Audubon Volunteer 4/3/2018

City of Phx (Parks) 4/20/2018

City Planner – Hasn't Replied 3/27, 4/11

Valley Metro – Hasn't Replied 3/27, 4/11

C4: Survey

Date:

Time:

Location:

Age Range:

Do they live in South Mountain Village?

C5: Survey Results

DATE: 4/10/18	Time: 9AM-10AM	Location: Audubon Center	
	# of Participants	South Mountain Resident?	
Age Range*		Y	N
>1 8	0	/	/
18- 50	2	0	2
50 +	4	/	4

*Age range are estimates for participants

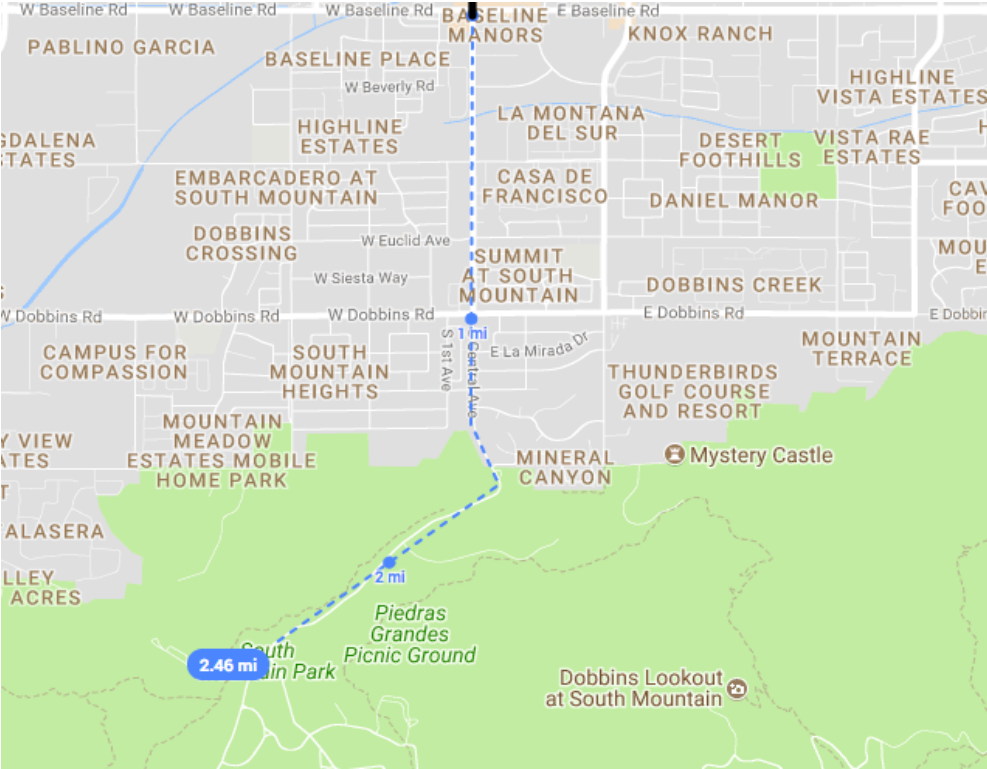
DATE: 4/12/18	Time: 8AM-8:30AM	Location: Audubon Center	
	# of Participants	South Mountain Resident?	
Age Range*		Y	N
>1 8	7	0	7
18- 50	13	0	13
50 +	3	2	1

*Age range are estimates for participants

DATE: 4/10/18	Time: 8:45AM-9:15AM	Location: Habitat Restoration Area	
	# of Participants	South Mountain Resident?	
Age Range*		Y	N
8 >1	5	0	5
18-50	8	0	8
50+	0	/	/

*Age range are estimates for participants

C6: Distance from South Central Light Rail Terminus to South Mountain Park



Appendix D : Highlights from the Valley Metro 2016 Environmental Assessment on the light rail expansion

https://www.valleymetro.org/sites/default/files/legacy-images/uploads/misc_reports/SouthCentralEnvironmentalAssessment.pdf

<i>Wetlands, Waters of the United States and Floodplains</i>	
Impact	<p>The Build Alternative crosses through the Salt River, a water of the United States (WOUS) under the jurisdiction of the U.S. Army Corps of Engineers (USACE). Within the Salt River lies the Rio Salado Habitat Restoration Area (RSHRA) that the City of Phoenix and USACE constructed. No permanent acreage loss of WOUS or wetlands is anticipated. Impacts on WOUS would include the temporary discharge of fill into 0.16 acre of wetlands and 0.60 acre of open water.</p> <p>Portions of the Build Alternative are located within three separate 100-year floodplains. Because the Build Alternative is on an existing alignment and would be graded to preconstruction elevations after construction, the Build Alternative would not substantially modify the topography in the study area. Therefore, no impacts to floodplains are anticipated.</p> <p>With implementation of mitigation measures, the Build Alternative would have no adverse effect on wetlands.</p>
Mitigation	<ul style="list-style-type: none"> • Valley Metro would prepare and submit an application to USACE for a Clean Water Act Section 404 permit for work in WOUS and wetlands. The Section 404 permit application would be submitted to USACE prior to construction. • To protect WOUS, the Contractor shall comply with all terms and conditions of the Section 404 permit as established by USACE, including the associated Section 401 conditions, certified by the Arizona Department of Environmental Quality. • Valley Metro would clearly identify the limits of the work area in wetlands and WOUS in the field (for example, by staking or flagging) prior to ground-disturbing activities. The Contractor would avoid all flagged and/or otherwise designated sensitive resource areas within or adjacent to the project area. • The Contractor would site temporary storage, staging, materials lay down and other work areas in uplands or previously disturbed areas to the extent possible.



Issue	Discussion
Mitigation (cont.)	<ul style="list-style-type: none"> The Contractor would ensure that all equipment remains inside the identified project limits and that it would not be stored, maintained or repaired in areas mapped as wetlands or WOUS. Valley Metro would develop a vegetation planting and habitat improvement plan using plant species used for the RSHRA to replace vegetation, including wetland vegetation, removed within the Salt River channel during final design and in consultation with the City of Phoenix. The Contractor would restore water flow and circulation patterns of the Salt River following construction to allow the wetland to reestablish The Contractor would develop and implement a Stormwater Control Plan that includes a Spill Prevention and Containment Measures Plan (staging areas, nonpoint source spills containment and clean up, concrete washout, etc.) for working within and adjacent to the Salt River channel and its wetlands. The Build Alternative is within a designated 100-year floodplain. Therefore, Valley Metro would provide an opportunity for the City of Phoenix floodplain manager to review and comment on design plans.
Water Quality	
Impact	<p>No aquifers or sole source aquifers exist in the study area. No existing groundwater wells would be affected by the Build Alternative.</p> <p>No impaired or non-attaining waters are in the vicinity of the Build Alternative. The light rail vehicles include provisions for containing possible pollutants such as oil and grease, but infiltration of these small losses into groundwater is possible.</p> <p>Although the Build Alternative is located primarily in the existing ROW, it would add a small amount of impervious surface area in the study area from the addition of stations, TPSSs, park-and-rides and other improvements outside the existing ROW. The increase would be negligible relative to the total impermeable area that results from surrounding development. Stormwater runoff would not substantially increase as a result of the Build Alternative.</p> <p>Work over waterbodies could introduce sediments and construction debris into canal or RSHRA waters.</p> <p>The Build Alternative would result in greater than 1 acre of ground disturbance.</p> <p>With implementation of the mitigation measures, the Build Alternative would have no adverse effect on water quality.</p>
Mitigation	<ul style="list-style-type: none"> The Contractor would be required to obtain an Arizona Pollutant Discharge Elimination System (AZPDES) permit prior to construction and to comply with the permit stipulations. The Contractor would file a Notice of Intent and Notice of Termination with the Arizona Department of Environmental Quality (ADEQ). The Contractor would be required to comply with the City of Phoenix's Stormwater Pollution Control Ordinance, which prohibits most discharges (indirect and direct) into stormwater systems. Prior to construction on the Central Ave or the Western Canal bridge, the Contractor would develop a containment system to prevent debris from entering the Salt River or the Western Canal during construction. Valley Metro would prepare and submit an application to ADEQ for a Section 401 Water Quality Certification. To protect water quality, the Contractor shall comply with all terms and conditions of the Section 401 permit. <p>With implementation of the mitigation measures, the Build Alternative would have no adverse effect on water quality.</p>



Issue	Discussion
<i>Ecologically Sensitive Areas and Threatened and Endangered Species</i>	
Impact	<p>The Build Alternative would result in a “may affect, but is not likely to adversely affect” finding for the Southwestern willow flycatcher and the Yuma clapper rail through the temporary loss of habitat. The Build Alternative would result in “no effect” to the yellow-billed cuckoo. In addition, the Build Alternative would not result in a “take” under the Bald Eagle and Golden Eagle Protection Act.</p> <p>Twenty-four birds protected under the Migratory Bird Treaty Act may occur in the study area. Some displacement of these species and their nests could occur because of the temporary loss of habitat and increased activity in the area during construction.</p>
Mitigation	<ul style="list-style-type: none"> • The Contractor would minimize construction activity disturbance to riparian vegetation by avoiding vegetation to the extent possible and trimming trees rather than removing them if practicable and without severely reducing the survivability of the tree. • Valley Metro would clearly define the limits of the work area in wetlands and the Salt River low-flow channel (for example, by staking or flagging) prior to ground-disturbing activities. The Build Alternative would avoid all flagged and/or otherwise designated sensitive resource areas within or adjacent to the study area. • The Contractor would not conduct any clearing, grubbing or tree/limb removal from March 1 to August 31 unless a wildlife biologist has conducted a bird nest search of the affected vegetation and has determined that no active bird nests are present. Vegetation removal may occur if the area has been surveyed within 5 days prior to removal as long as only inactive bird nests, if any, are present. During the nonbreeding season (September 1 to February 28), vegetation removal is not subject to this restriction. • The Contractor would stage and store materials and other work areas in uplands or previously disturbed areas to the extent possible. • The Contractor would keep equipment inside the identified Build Alternative limits; equipment would not be stored, maintained or repaired within the RSHRA. • Valley Metro would develop a vegetation planting and habitat improvement plan using plant species used for the RSHRA to replace vegetation removed within the Salt River channel. • The Contractor would develop and implement a Stormwater Control Plan that includes a Spill Prevention and Containment Measures Plan (staging areas, nonpoint source spills containment and clean up, concrete washout, etc.) for working within and adjacent to the Salt River channel. • Valley Metro would arrange for a wildlife biologist to perform a preconstruction survey within the RSHRA or Operations and Maintenance Center expansion area if construction occurs during the breeding season for migratory birds. • The Contractor would restore the Salt River channel, water flow and circulation patterns to preconstruction conditions following construction.
<i>Construction</i>	
Impact	<p>The project would result in short-term disruption impacts on local businesses and residents surrounding construction. Short-term impacts are also anticipated on utilities, traffic/ pedestrians/bicycles and air and water quality. Construction noise is also likely to be an issue. Avoidance of adverse impacts where possible, methods to minimize the overall construction duration as well as in any one location and mitigation to minimize these short-term adverse impacts would be implemented. As with any construction project, the adverse impacts would end upon construction completion.</p>

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