RECLAIMING FORGOTTEN CORRIDORS: AN URBAN GREENWAY SYSTEM UTILIZING SECONDARY WATERCOURSES IN TUCSON, ARIZONA

By

Wendy Lotze

A Master's Report Submitted to the Faculty of the

COLLEGE OF ARCHITECTURE AND LANDSCAPE ARCHITECTURE

In Partial Fulfillment of the Requirements
For the Degree of
MASTER OF LANDSCAPE ARCHITECTURE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2007

STATEMENT BY THE AUTHOR

This thesis has been submitted in partial fulfillment of the requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Wendy Lotze

ACKNOWLEDGEMENTS AND DEDICATION

So much of this work relies upon the vision and hard work of those who have come before me; researchers, designers, planners and advocates for the land. I would like to especially acknowledge Margaret Livingston, who worked hard to give the opportunity for three students to explore – in their own ways – the magic of Tucson's forgotten corridors. Her dedication and enthusiasm for the region has bolstered my own, and I owe a substantial part of this success to her.

Special acknowledgement also to Steve Anderson of Pima County Natural Resources Parks and Recreation, whose seemingly endless well of knowledge, particularly of local land issues and recreation, has supported this project tremendously. The community owes a great deal to his passion, and I hope that this work helps in some small way to forward his vision for the trails of Pima County.

Finally, I dedicate this paper to my husband, Gary. His patience, support and objective eye has kept me sane, well fed and humble. To say I couldn't have done this without him is not enough – truth is I just couldn't *do* without him. Love you trout.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Like many cities in the western United States, Tucson, Arizona, was developed on a geometrically determined grid system, with streets aligned with a preset north-south/east-west alignment that paid little heed to the area's natural features and topography. Through necessity, certain watercourses were maintained to help deal with the occasional and sometimes severe flood waters that converge upon the area – however, these features were hidden within, or in some cases under, the urban matrix. The continued existence of these spaces presents a unique opportunity however, to begin reclaiming the natural connections that were forgotten. This study seeks to examine how secondary watercourses can be partnered with other greenway features such as primary watercourses, parks, established greenways and proposed future greenways to create a regional greenway system that connects desirable destinations throughout the city. Special focus is placed upon identification of public open spaces and amenities as destinations, such as parks, school campuses, libraries and community centers and recommendations for new destinations at pedestrian-friendly intervals. Through the careful integration of this destination-based design, greenway experiences become more rewarding and thus more valuable to the user, motivating preservation of these corridors which would ultimately benefit both the community and the natural environment.

INTRODUCTION

Tucson's unique location at the base of three major mountain ranges as well as the proximity of perennial water has made it a center for human activity in the region since pre-history. Some historians even argue that the Tucson basin is the longest continually inhabited city in the United States, with signs of human activity dating back to over 12,000 years. A combination of this unique geology, warm climate and the rapid expansion of the economy of the desert Southwest has made Tucson one of the fastest growing cities in the United States over the last ten years.

In the face of this rapid development, the City of Tucson and Pima County have struggled to preserve the special way of life that the natural features of the area afford, as well as to provide the kind of amenities people expect of larger cities. Typical of cities of the western U.S., the competition for land among commercial, retail, residential and recreational uses has resulted in a patchwork pattern of land use, with urban sprawl presenting substantial conflicts for natural systems. Although in the last two decades, Pima County has authored some innovative and forward thinking strategies for conservation and recreational planning, prior decades of uncontrolled growth have left the central urban core with little connectivity to the large natural spaces that surround it.

Watercourses play an important role in the ecology of the desert by linking neighboring natural areas and often supporting a high density and diversity of vegetation. In developed areas, semi-natural watercourses can continue to provide a relatively high quality habitat, especially for certain native avian species that might have been otherwise been not supported in urban areas. By striving to balance human and wildlife needs in

the design of greenway trails, a richer space is created which can be more rewarding to recreationists, commuters and urban wildlife.

Recreational Watercourses

In 1983 a major flood brought on by weeks of heavy rain and resulting erosion, property damage and infrastructure impacts caused civic leaders in the City of Tucson and Pima County to rethink their approach to flood control. Previous efforts had focused upon creating deep, wide, concrete lined channels to contain floodwaters and direct them through the urban area as quickly as possible. Development had occurred adjacent to these channelized watercourses, exposing homes and businesses built in the floodplain to flood. The Army Corps of Engineers, responding to the deaths and property damage caused by the 1983 flood, instituted a requirement that the city protect the banks of the watercourses as a preventive measure. Pima County responded by proposing an entirely new approach to flood control, giving special recognition to land-use remedies, such as establishing floodplain parks – devoting a substantial fraction of flood-control monies to land acquisition, rather than infrastructure construction (Little 1990).

The effort focused upon the primary watercourses in the Tucson area, beginning with the Santa Cruz River and its major tributaries, Rillito and Cañada del Oro Creeks. With two bonds totaling over $28 million passed in 1984 and 1985, the County began acquiring lands along these watercourses, many of which were damaged during the 1983 flood. With strong ongoing citizen support to preserve desert washes not only for flood control, but as important wildlife habitat, spaces of natural beauty and recreational

opportunities, the river park system began to take shape. By 1988 the Pima County Department of Transportation and Flood Control District had constructed 3.5 mi. of linear park features along the Rillito Creek, and expansion of the existing 1 mi. section of linear park along the Santa Cruz River was underway (Little 1990). Today, the County and the City of Tucson manage over 32 mi. of river parks along the Rillito Creek and Santa Cruz River.

The success of the greenway trails along the primary watercourses has lead to an interest in developing linear parks along other smaller watercourses. The Paseo Lupe Eckstrom is a three-quarter mile long path along the Tucson Diversion Channel (TDC) – once called the Julian Wash – managed as a partnership between Pima County Natural Resources Parks and Recreation (NRPR) and the City of South Tucson. The Pima County NRPR is implementing a plan to create a 17 mi. greenway with recreational trails along the TDC and Julian Wash alignments with the help of municipal governments and local developers. Other, smaller scale, developments have occurred along these smaller watercourses, some lead by neighborhood organizations and public coalitions, although the effort lacks an organized regional scale plan. The eagerness of the County to use flood prevention right-of-way to create linear parks and the power of county-city partnerships is a model capable of creating many more miles of successful greenway trails in the future.

Open Space Recreation

Not only has the unique geography of the Tucson area encouraged the growth of a new urban core in the desert; it has also motivated policy makers and planners to take large measures toward natural preservation. Both the ecology of the Sonoran Desert and the Sky Islands that rise out of it has been the subject of both regional and national attention for many years. As a result, the urban area is surrounded by large expanses of preserved open space, much of which is associated with the region's mountain ranges. National, state and regional governments operate these areas with varying levels of public access, and each of them is an important amenity for the residents of Tucson. This includes the two districts of the Saguaro National Park, Ironwood National Monument, the Coronado National Forest, Catalina State Park, Tucson Mountain Park as well as several smaller regionally operated parks and open spaces.

Many of these amenities, however, are accessible to residents of Tucson only by automobile. Although bicyclists and hikers may use the roads and trails to access the interior of the parks and forests, nearly all of them must drive to trailheads and parking areas located on their periphery. Tucson's sprawl patterns and lack of trails leading from the urban core to the outlying areas create a dependence on private transportation to access these public lands.

In 1989 Pima County produced the Eastern Pima County Trail System Master Plan, a comprehensive planning document encompassing the metropolitan Tucson area and surrounding public open spaces. The Plan was developed to respect the tradition of trail recreation that was seen as "…a significant part of the outdoor lifestyle that is

treasured by area residents and attracts visitors, newcomers and businesses to Southern Arizona" (Dames & Moore 1989). While the plan focused largely upon the issue of access to trails located on private or State Trust lands, it also placed emphasis upon offsetting the effect of rapid urban development on the availability and quantity of trails and future trail alignments.

The ambitious plan created a network of existing and proposed trails totaling more than 1500 miles. The network would ultimately tie the Pima County system into a larger statewide trail system, as well as linking other metropolitan trail systems to connect parks and other public lands. Connection to trails in the National Parks and Forests, as well as those on State Trust Land and preserves, was critical. It also prioritized the expansion of the river park system to serve as the "backbone" of the regional system and in order to connect with "all major public lands" in the region, as well as trails that could offer the community "multiple benefits" including flood control, groundwater recharge, wildlife habitat and open space protection (Dames and Moore 1989). The City of Tucson and towns of Marana, Sahuarita and Oro Valley adopted the county document into their General Plans. Although the plan was subject to a poartial update in 1996, the changes that have occurred in eastern Pima County since the initial plan have prompted the County, along with the City of Tucson and the Town of Marana to begin working on a new regional trails master plan. The governments are working together along with the Pima Trails Association (PTA) and other community groups to create a plan that responds to the needs of the residents of eastern Pima County.

Although the majority of city governments in the area have adopted elements of the Pima County trails plan, they have gone a step further by including statements concerning the importance of trail systems in their general plans. The City of Tucson General Plan, adopted in 2001, includes a provision that the city provide "…an interconnected urban trail system throughout the city to meet the recreational needs of pedestrians, bicyclists and equestrians" (City of Tucson 2001). Within the supporting text is a clause that the city will accomplish this goal using enhanced roadways and natural and improved washes. The Towns of Marana, Sahuarita and Oro Valley include similar wording it their plans as well. Although this process is still in its early stages, priorities are already being established that will ensure that trails in the urban core receive particular attention (Steve Anderson, personal communication November 2006).

Secondary Watercourses

Although supporters of greenway and trail development in Eastern Pima County have identified the urbanized secondary watercourses as potential greenway corridors, their priority for further exploration or development has remained low – largely because of land ownership, zoning and safety issues, as well as limited funding, which mandates a priority placed upon major corridors. However, as infill growth and the increase of commercial and residential densities are promoted within the city's core, the recreational needs of urban dwellers also grows. While finding new active recreation spaces for ball fields and courts is challenging within such a developed context, space for linear parks and the momentary escape they can provide may already exist along these watercourses.

With a little creativity and vision, these nearly forgotten spaces can become a vital amenity.

LITERATURE REVIEW

> "There are all sorts of opportunities to link separate spaces together and while plenty of money is needed to do it, ingenuity can accomplish a great deal. Our metropolitan areas are crisscrossed with connective strips. Many are no longer used, or only slightly used for their original purpose, and they are so ugly it is hard to visualize their being transformed into an amenity. But they are there if we only look." (Whyte 1968)

Urban Greenway Trail Systems

The movement toward the establishment and reclamation of greenways in America has been gaining energy and momentum since it first appeared in the 1960's. Although the idea was old even then, the renewed emphasis and importance of preserving these "natural" corridors has become a hot political and emotional topic for both urban and rural populations in every part of the country. In rural areas, greenway planning tends to emphasize the preservation of important natural or rural features against the onslaught of development (Little, 1990), and efforts tend to focus largely upon environmental and ecological concerns, with recreation or transportation lesser considerations. Urban greenways, however, have a very different focus, as they are often already surrounded by an unnatural matrix, and must respond to a larger population of users and controls.

The Evolution of Greenway Systems

In 1985 President Ronald Reagan created the President's Commission for Americans Outdoors, a group of 15 experts charged with – among other things –

assessing the nation's recreation lands and resources, the roles of government and private sector in providing recreation opportunities and the relationship between outdoor recreation and quality of life for Americans. One of the strongest recommendations to come from the group's 1987 report was advocacy for a "living network of greenways", which could not only provide people with access to open space close to where they live, but could also begin to weave together the rural and urban spaces in the American landscape (President's Commission 1987; Fabos 1995). The report imagined "…walking out your front door, getting on a bicycle, a horse or trail bike, or simply donning your backpack and, within minutes of your home, getting off along a continuous network of recreation corridors which could lead across the country."

The report may not have created the push for greenways, which had been growing in America since the 1960's, but it gave the movement significant publicity and attention. One response was the creation of the American Greenways program to follow up upon the Commission's recommendations. The program worked with Charles Little to create the book *Greenways for America* in 1990, which outlined not only the evolutionary history of greenways, but various case studies that were in place and coming into existence across the country (Noonan 1990). Little's book has become the definitive background resource for the greenway movement in America.

Little begins the story of the American greenway with Fredrick Law Olmsted's plan for the University of California, Berkley in 1865. In it, Olmsted proposed to preserve the Strawberry Creek drainage and preserve it as a public open space, complete with pleasure walks and carriage ways. Although the plan was never realized, it sparked

an idea in Olmsted that he took back east with him. In New York, along with his partner Calvert Vaux, he pursued the idea that no single park space could provide a complete nature experience to visitors –parks needed to be linked to one another and to the surrounding community. The pair began to create green "parkways" connecting their park projects and nearby neighborhoods, including the Ocean and Eastern Parkways of Prospect park and Boston's Emerald Necklace. Their work began to influence other firms of the time, and these recreational parkways appeared in other areas such as H.W.S. Cleveland's metropolitan park system for Minneapolis-St. Paul (Little, 1990).

These parkways were originally intended for leisure trips in carriages and on foot. The appearance of the automobile in the early part of the 20th century and it's ascension to everyday use changed the nature of these parkways significantly. Parkways became green roadways, and pedestrians and other recreational uses were moved aside to facilitate commuting and commerce. The emergence of garden cities and suburbs pushed planning in a direction that emphasized quick movement of people from one point to another in order to get suburban residents to their jobs in the city. It wasn't until the late 1960s that planners began to return their focus to recreation and preservation of the natural features of the landscape.

Little credits William H. Whyte with the initial publication of the term "greenway" in his 1968 book *The Last Landscape*, and in fact sites several of Whyte's books and papers as key to promoting the concept of linked open spaces made accessible to the general public. Whyte's quote at the top of this section is as applicable and important today as when it was first published nearly forty years ago. He felt that linear

strips of open space were more efficient than large blocks of similar area – especially in urban areas where open land can be hard to come by. He is especially hopeful about the uses of the arroyos and drainages of the West and Southwest, "concrete-lined ditches" that, rather than being thought of as nuisances, could become some of the best connectivity devices of all.

A year later, in 1969, Ian McHarg published his ecologically-based planning method in *Designing with Nature*. McHarg's method produces site maps with overlays that indicate the "best places" for development with a light or white color. Darker areas indicate steep slopes, wetlands, ridgelines, stream corridors and other natural features that are either environmentally sensitive or require expensive mitigation for development. Little points out that many streamside greenways are easily justified by McHarg's teachings. The best areas for recreating are also, frequently, the best areas for natural conservation.

In 1970, William Flournoy created a plan for what Little calls "the earliest comprehensive local greenway *system* in the country" in Raleigh, North Carolina. The Capital Area Greenway promoted linear open space as the best way to "soften the urban image", and used the waterways of Raleigh – including minor branches and forks – to provide recreation, flood mitigation and conservation opportunities. Implementation of the plan was begun in 1974, catalyzed, in part, by poorly controlled development and flooding. The system has grown to encompass over 54 miles of trails and 3000 acres of open space (City of Raleigh 2006). Although Flouroy is not widely credited for his work

in Raleigh, Little believes that his vision and influence was pivotal in advancing the "modern greenway movement."

The 1970 and 80s saw several regions beginning to develop plans for greenways and greenway systems. Denver's Platte River Greenway, the Yakima Greenway in Washington State and the Hudson River Valley Greenway in New York state are among the most famous examples of greenways started in this period (Little 1990). Then, in 1987 the President's Commission wrote their recommendation for a "living network of greenways" and the movement took off.

The increased number of greenway systems and proposed projects worldwide has led to a growth as well in the literature and theory of greenway development. In 1995, the *Landscape and Urban Planning* journal published an entire edition devoted to greenways in the United States, with three major purposes: to thoroughly introduce the movement and it's theory, to reach a more comprehensive definition of greenways through the examination of the literature and history, and to begin to define logical sub-groups of greenway scholarship (Fabos 1995). Many of the 25 papers included in the assessment became the basis for ongoing greenway projects and informed hosts of researchers, planners and landscape architects poised to begin greening their environment. The continued interest in the topic led the journal to duplicate their effort ten years later in 2006, this time focusing on the international greenway movement.

Types of Greenways

The term “Greenway”, though only recently accepted, has become a widely-encompassing catchword that is used to describe a variety of open space projects in wilderness, rural and urban areas. Although each greenway is unique in the opportunities, challenges and surprises that it presents, repeatable patterns do arise due to the location and goal of the greenway project.

Greenways in many undeveloped, rural areas are created in an effort to conserve natural and cultural connections in the face of suburban development (Miller, 1998). Although recreational trails are often provided, the focus of these corridors is more multi-objective – addressing wildlife movement needs, flood mitigation issues, education and bio-diversity (Searns, 1995). Rural greenways can also be used to attempt to soften the transition between rural and urban settings, even allowing elements of the rural landscape to intrude into the urban fabric to provide connectivity and recreational opportunities (Hellmund and Smith 2006, Little 1990).

In the design of greenways in urban areas, neighborhood connections become more critical issues, and the need for trails, and alternative transportation routes are often key motivators. One class of exception could be urban greenways that are developed along watercourses. Frequently, these open spaces begin in the aftermath of destructive and expensive flood events which motivate local officials to create a more natural, sustainable solution for flood damage mitigation and prevention (Flink et al. 2001, Little 1990, Lusk 2002).

Increasingly, urban greenways are being seen as a way to connect schools, parks and neighborhoods within the community (Furuseth 1991). Although these systems

often make use of natural or man-made linear amenities – such as watercourses, utility corridors and abandoned rail beds – their course is determined as well by the location of desired destinations, residential densities and specific use areas. These efforts have been supported largely by transportation and planning officials seeking to provide alternative transportation routes, hoping to relieve congestion and pollution in our cities. Often, such development centers on bicycle users as commuters, placing less emphasis upon pedestrian and recreational users (Lusk 2002).

Suburban or ex-urban greenways are typically a disjointed mixture of urban and rural elements. Increasingly, these trails and linear open spaces are being required of new developments in order to link them to broader, regional systems and provide a continuous trail between urban and rural settings. Ex-urban greenways attempt to meet both the needs of the bicycle commuter and the weekend recreationalist by providing a variety of trail options and frequent activity nodes providing picnicking, scenic overlooks and play equipment.

There is a growing push among greenway advocates to recognize that both urban and ex-urban greenways can also serve as important habitat spaces for urban wildlife and vegetation. Although the strips are frequently only wide enough to provide edge habitat, various design strategies can be used to increase the viability of these greenways for interior species. As such applications become more desirable, planning for urban and suburban greenways becomes more complex. However, the results are often an improved user experience and a space that addresses the needs of both the natural and the urban community (Bryant 2006, Patton 2006).

Many regions are developing large-scale open space plans that include greenways in the urban, suburban and rural context. These plans are developed as a part of intra-agency cooperation to preserve the quality of life, ecological integrity and long-term sustainability of a region. Instead of being the sole purveyance of Landscape Architects and Planners, these greenway systems are now planned with transportation and flood engineers, ecologists, greenspace advocates and architects. Not only can these regional greenways be used to direct growth away from critical habitat and recreation amenities, they can also begin to encourage appropriate clustering and create walkable, sustainable communities (Flink et al. 2001, Little 1990, Southworth 2005). This more holistic approach is a departure from the more traditional theory of centralized park planning, and "…nature protection combined with recreation constitutes a framework for greenways planning" (Fabos 1995).

Challenges of Urban Greenways

While rural and suburban greenways are frequently planned as an attempt to conserve a resource before an area is developed, urban greenways must frequently be retrofitted through developed land uses. This sort of retrofitting creates a unique set of issues for urban greenway systems. Perhaps one of the most important is choosing an alignment for the greenway or trail that does not become cost prohibitive or present a difficulty in acquiring lands (Moore 1998). One of the common techniques uses is to locate corridors along lands that are either already publicly held or which might be willingly donated through easements or other allowances. These other properties include

private rail or utility corridors that are either no longer in use or which could simultaneously support both recreational and commercial use, as well as portions of public property which, due to flooding, security or other issues, may not be desirable for other uses. Using Geographic Information Systems (GIS), planners identify these corridors and begin to explore how they can be linked into a more complete system (Flink et al. 2001).

Because they are surrounded by existing development, urban greenway trails intersect obstacles such as major transportation routes and industrial complexes more frequently than those in rural or urban areas. Several methods have been developed for easing the impact of these obstacles, such as signed or lighted crosswalks, underpasses and bridges. In many cases retrofitting pedestrian underpasses or bridges can be cost prohibitive, however users report that the need to stop and wait for traffic at other kinds of crossings is a major obstacle to use (Flink et al. 2001), so balance between these techniques is critical to the success of the corridor. Industrial or unsightly areas are another concern, especially for longer greenways that may traverse many different parts of an urban area. Studies have shown, however, that unattractive areas of a trail do not have as great an impact upon the quality of the user's experience as might be commonly thought if balanced with attractive and meaningful destinations (Lusk 2002).

Other challenges that urban greenway planners encounter are more difficult to solve. One of the most critical problems is the issue of public opinion – especially those opinions of property owners adjacent to a proposed greenway or trail alignment. There is concern about increased crime and vandalism associated with installing a public space

immediately adjacent to what was once isolated private property. Research has found that these fears typically dissolve after the greenway has been implemented, but they can be a very critical issue during the planning process (Flink et al. 2001, Moore 1998). Public meetings are an excellent forum for discussing these issues and beginning to alleviate these concerns. Although trail safety and design will be discussed in a later section, it is worth noting here that developing detailed maintenance strategies can help considerably with nervous neighbors. A well maintained space is perceived as safer and less apt to encourage crime, and may actually improve landowner's perceptions of neighboring open space (Flink et al. 2001, Kaplan et al. 1998).

Involving the public in the planning process can help to engender support through a sense of community ownership as well as helping to alleviate fears. Public meetings are also an important forum to discuss the social, economic and ecological benefits of greenways in an urban context (Flink et al. 2001, Gobster 1995, Moore 1998).

Benefits of Urban Trails and Greenways

Restorative Effects of Greenways

The idea that increased interaction with the natural world has a positive impact upon people's lives is gaining momentum in social fields, such as public health and psychology. The definition of what constitutes this nature, however, has been changing. Whereas once escape might have been sought from larger wilderness areas or romantic urban parks, people are increasingly finding it possible to have a restorative natural experience in thoughtfully designed, smaller natural spaces close to them. In this

paradigm, the “natural world” is not determined by distance from human influence, but instead can be found in everyday, often unspectacular natural environments all around us (Hellmund and Smith 2006, Kaplan et al. 1998). Greenways in urban areas offer this kind of opportunity to provide rich natural experiences where people live, work and play.

Natural environments provide more than exercise opportunities for humans, they often have many of the elements needed for a restful and restorative experience that can help people to recover from the mental fatigue caused by everyday life. The Kaplans argue that environments that provide certain elements can start to alleviate this fatigue and restore people’s natural balance (1998). These elements include; a feeling of being “away”, a sense of depth or extent, a level of emotional fascination, and compatibility with the comfort and needs of the visitor. Greenways, although they are relatively small areas, can be designed to offer all of these elements at regular intervals throughout a larger portion of developed areas. Their linear nature make these “restorative” areas even more accessible (Hellmund and Smith 2006) and an greater proximity to where people live means that they are not required to expend large amounts of time and money to enjoy them.

Several studies have been conducted attempting to relate greener cities with improved individual health, and they generally show evidence that trails, trees, nature and open space help people stay healthier longer. Although some the methods of some of these studies have been questioned, there is a growing trend to accept that the increased physical activity, cleaner air, and mentally restorative opportunities green infrastructure

systems can provide lead to healthier people and communities (Benedict and McMahon 2006).

The Civic and Economic Benefits of Greenways

The most frequently cited economic benefit of greenways, is the positive effect the proximity of natural areas and linear parks can have on property values. During the "Big Dig" project in Boston, the creation of an underground artery provided the opportunity to redevelop one mile of old arterial freeway space into a linear amenity to be called the Rose Kennedy Park. Even before the park was built, adjacent property values in the vicinity began to climb at a rate much higher than in other neighborhoods. By the time the park was completed, a 38% increase over the Boston average was seen (Hellmund and Smith 2006). In Salem, Oregon, land adjacent to a greenbelt was valued at $1,200 an acre more than land only a few thousand feet further away (Benedict and McMahon 2006). Many other studies have shown that greenways nearly always have some positive effects on land values, and that they never have negative effects (Crompton 2001, Flink et al. 2001, Nichols 2004). This increase in land values not only benefits land owners, but can lead to additional income for municipalities from property taxes as well as the ability to attract higher-income individuals who can contribute to the overall economic vitality in a given area.

Some argue that there is a potential down side to the improvement in property values associated with greenways and other types of public projects. Many greenways – particularly those being retrofitted in the urban core – begin life in less desirable areas, such as abandoned rail corridors and cement lined canals that have served as refuge for

the homeless. These individuals are invariably displaced when the new greenway is constructed, and they are often pushed farther from the services and resources that they need to access (Hellmund and Smith 2006).

This kind of gentrification also happens in established neighborhoods, increasing rents and property taxes. As a more affluent population moves in, individuals without the income to maintain their homes are pushed out. Often these individuals must move further from their jobs and services in the urban core to areas where public transportation and other public services can be harder to access. Careful, regional scale plans are necessary to maintain a level of social justice in the face of these kinds of changes (Hellmund and Smith 2006).

Greenways can help to increase the value and utility of the public spaces that they touch as well. These spaces are often in public ownership and are publicly maintained, so an improvement upon them adds to common equity (Little 1991). This increase in access and usability of public parks, schools and civic centers has a tremendous benefit to the community that some researchers are trying to quantify financially (Crompton 2001).

Increased land and resource value is only one kind of economic benefit that can come from greenways, however. The effects of increased consumerism associated with some greenways – particularly those that attract tourism dollars – has been documented in several cases, and goes beyond the sale of property to include increased business at nearby coffee shops and restaurants, bicycle retailers, outdoor outfitters and other retail stores (Benedict and McMahon 2006, Gobster 1995, Lusk 2002). In Denver in 1996, for example, there were 149 active bicycle shops – compared with just 28 in Atlanta, even

though Denver's population trailed Atlanta by more than a million people. This difference can be attributed to the availability of trails and pathways within the Mile-High City (Benedict and McMahon 2006).

Greenways can also have a productive – rather than consumptive – gain, especially as an opportunity for alternative transportation. Commuting on greenways and urban trails can reduce strain on the urban transportation infrastructure, help to alleviate pollution and congestion and reduce the number of driving-related accidents on city streets (Gobster 1995, Lusk 2002). These spaces can also provide other opportunities such as public gardens with the potential to produce foods and exercise spaces (Hellmund and Smith 2006).

Using greenways as a part of a larger green infrastructure approach increases the potential for their economic benefits. The American Forests organization estimates that trees in urban areas nationwide contribute more than $400 billion in storm water retention each year by reducing the need for costly storm water retention facilities (American Forests 2006), and that natural systems provide nearly an eight to one dollar savings ratio versus man-made flood control structures. The creation of greenways and systems to protect watersheds from pollution can also save governments millions of dollars over expensive construction and maintenance of water treatment facilities. Cities such as Boston, New York and Ocean City have been acquiring land along the watersheds that feed into their cities in an attempt to control development, reduce pollution and protect natural systems. These programs not only save money, but they provide the additional

economic, social and ecological values of greenways without any additional investment (Benedict and McMahon 2006).

The social and economic value of a greenway system depends largely upon the way that people ultimately use the space. Unsuccessful greenways are often the result of a planning process that did not take into account the needs of the community and potential users and instead created the resource in a sort of policy vacuum. Including the community in the planning process can lead to a more successfully designed system, as well as greater public ownership and pride in the project (Flink et al. 2001, Hellmund and Smith 2006, Kaplan et al. 1998). There is even evidence to suggest that the positive impact of public involvement extends beyond those who directly participated in the planning process to those who simply were aware that the public was included (Kaplan et al. 1998).

Who Is on the Greenway?

Given the importance of including potential users in the planning process, several studies have been conducted in the last 15 years to determine who ultimately uses these corridors and what their motivations are. Universally, the studies find that the majority of greenway users are well educated Caucasians with at least a moderate income (Furuseth 1991, Lee 2002, Lindsey 1999, Lusk 2002), even when the population in the neighborhoods adjacent to the corridors did not reflect these demographics (Lindsey 2001). Increasingly, efforts are being made to try to attract a broader spectrum of the population to urban greenways by providing a variety of recreational opportunities and

designing trails that are accessible to more diverse portion of the community (Kaplan and Kaplan 1998, Lusk 2002).

Many contemporary urban greenway systems are designed as multi-use facilities, with considerations for pedestrians, bicyclists, runners, equestrians and most recently in-line skaters. Within each group are sub-groups, including those who use the greenway primarily for commuting, those seeking exercise and those with a more leisurely purpose – such as bird watchers or families with young children. The distances traveled by the users vary, largely as a factor of speed. Bicyclists, traveling much faster, are more likely to travel several miles, and are generally more frustrated with breaks or stops in the trail. Leisurely pedestrians, however, may travel less than a mile from their starting point, and are more flexible in their need for an uninterrupted, continuous trail (Gobster 1995, Lee 2002).

Even though these users each have different expectations for their experience, universally they report the greatest benefit of their time on greenways as an opportunity to relax and enjoy nature (Gobster 1995, Lee 2002, Lusk 2002). Commuters, despite their speed and destination-oriented travel, still report enjoyment of natural elements along the path and indicate that their preference for the greenway over other paths is partly motivated by pleasant scenery (Lusk 2002). Perhaps this common motivation is a part of why, in spite of numerous potential conflicts, most greenways have a low occurrence of disputes between different user types (Lee 2002).

Another important characteristic of habitual or occasional greenway users is where they live in relation to their preferred trail. Although studies differ in determining

how far an individual is willing to travel on foot, by bicycle or automobile to reach a greenway, most seem to agree that distances of 5 miles or less encourage more use and engender more community pride for the greenway (Flink et al. 2001, Gobster 1995, Lindsey 1999). In a 1991 study of the greenway system in Raleigh, North Carolina, Altman Furuseth found that 58% of greenway users traveled less than 5 miles to reach the greenway, and 90% traveled less than 10 miles. Another study conducted in Chicago found that users of smaller, local trails frequently traveled less than 2 miles to reach the greenway, while users of larger regional trails were willing to travel farther (Gobster 1995). This concept of combining local scale and regional trail systems has become an important part of greenway planning nationwide.

Design Considerations for Urban Greenway Systems

This review has already placed some emphasis upon the inclusion of the community in the planning process for greenway systems – both as a tool for engendering support and ownership, and as a way to ensure that the greenways meet the needs of the public. It is often difficult for greenway advocates to release control over the planning process in this way, for it removes the concept of the greenway from the realm of the "absolute good" and introduces other problems, opinions and concerns to the process – ideas that may not ultimately support the creation of a greenway system (Hellmund and Smith 2006). However, given that the community has reached the conclusion that a greenway system is indeed warranted, there are several design strategies that planners can use to create more successful networks of public open space.

Trail Systems

Many greenway projects are born out of a need to preserve a single section of a corridor or reclaim a small piece of natural landscape – such as a community initiative to save their local stream or re-greening an abandoned railway alignment through their area. These grassroots efforts can sometimes focus too hard on immediate, local needs and objectives (Flink et al. 2001). Other greenway projects are born large scale, such as the Appalachian Trail, which connects thousands of miles of open space under one linear feature. Long distance greenways lure attention of recreationists and planners looking to capture or recreate the mythology of the "unbroken wilderness", sometimes neglecting needs of neighboring communities (Hellmund and Smith 2006). A well-designed system will be a combination of shorter, local connections and long distance greenways that link both to one another and to important nodes within their communities.

Successful greenway and trail plans become part of a larger plan for transportation, recreation, open space and commercial growth – perhaps part of a larger scale green infrastructure plan. They will be created with the input of not only landscape architects and planners, but hydrologists, ecologists, transportation engineers, educators and other community experts. This systems approach can begin to use greenways to shape the way that people interact with the natural and urban fabric, and can multiply the benefits of each space it touches (Flink et al. 2001, Gobster 1995).

Planned for Variety

Many of the design characteristics which make individual greenways appealing to users can also be extrapolated to greenway systems as a whole. Many greenway

designers seek to accommodate as many separate user groups as possible within each recreational greenway. Bicyclists have different wants and needs than joggers and walkers, and groups recreating together have different needs than individuals (Flink et al. 2001). Providing for each group can be a challenge – especially when their needs contradict one another. Pedestrian users, including walkers, joggers, and birders prefer a softer, unpaved trail surface with a narrower tread and a more sinuous line consistent with a slower, more natural experience. Bicyclists and inline skaters, on the other hand, prefer paved trail surfaces and require a wider tread and more vertical clearance in order to facilitate their faster movement through the space (Flink et al. 2001, Gobster 1995). In the Tucson area particularly, equestrian users are another important group, and their needs for softer trail surfaces, higher vertical clearances and adequate distance from bicyclists and pedestrians presents an additional challenge (Steve Anderson, personal communication August 2006).

A greenway system can function in much the same way by providing a variety of greenways, each with a character and design strategy that can meet the needs of a spectrum of users. Larger, regional scale greenways are typically designed to accommodate the full range of visitors, while smaller, local scale greenways can be aimed more specifically at a single group – such as small neighborhood trails designed for pedestrians only or trails near major roadways that are intended primarily for bicycle commuters. Planning for this range of activities not only increases the number of potential users of the greenway system, it also helps these users to customize their experience to their own needs (Gobster 1995).

The result of this combination of larger and smaller scale greenways is a more complex texture that can be more responsive to the changing nature of the community. Concentrating on smaller, local projects which can be implemented in greater numbers over larger "showcase" projects can also help to foster more equitable access for a larger portion of the community (Hellmund and Smith 2006). When resources permit larger scale projects, regional greenways can be used to connect smaller projects, provide a greater variety of opportunities for longer experiences and adventures, and to reinforce the system's role in supporting regional connectivity, ecology and economics.

Accessibility

Hellmund and Smith (2006) continually reinforced that ease of access is one of the key factors to the success of greenways. The greenway's linear nature, they argue, offers greater opportunities for the community to access nature than more traditional large blocks of open space. Linearity does not guarantee access, however, especially along corridors that after years of neglect have become fragmented and unaccessible by development. Watercourses and abandoned rail lines in particular are often blocked from adjacent property and road access for safety purposes – and these barriers can run uninterrupted for miles. This reduces the porosity of the corridor and discourages human and wildlife use. Adding to the difficulty, much of the development along these corridors is not oriented towards a potential trail along the greenway. It can be difficult recognize that a corridor lies behind an industrial complex, and a greenway trail system would be similarly hidden. Increasing the porosity of the trail system is essential to establishing the importance of the paths and their accessibility to users.

Access points that are too distant may discourage not only users who need to travel too far to reach the greenway but also those wishing a shorter trip while on the trail. Providing logical and memorable turn around points or destinations midway through longer sections can alleviate some of these problems (Lusk 2002). Accessibility also has a large impact on the feelings of safety and comfort of users when on the trail. The ability to get on and off the trail at regular intervals can alleviate fears of being isolated or trapped and can provide reassurance of the availability of help in the case of an accident or emergency (Kaplan et al. 1998, Flink et al. 1999). This extends beyond physical access to include visual access as well. Long stretches of trail where businesses or homes are not oriented towards the trail can be perceived as unnerving. Providing opportunities for "eyes" on the greenway – through encouraging development to face the greenway, developing sight corridors and even volunteer patrolling – can greatly increase the comfort level of users and reduce the perception of crime (Kaplan et al. 1998, Lusk 2002).

Access points can also serve as destinations and wayfinding devices, so they should be planned to make an impression upon the user. Access points can be given a hierarchy,– with major access points occurring at community facilities with parking, such as commercial or transit centers, and minor ones situated primarily for those accessing the trail without the need for parking (Flink et al. 1999). Major access points, then, become opportunities for public facilities such as shaded benches, comfort stations and water as well as information about the greenway including maps, educational materials and notices. Minor access points should be unique enough to be memorable as

wayfinding or destination points and can be excellent opportunities for additional community "ownership" – whether through public art opportunities, locally selected "station names" or small community-maintained garden spaces (Flink et al. 1999, Lusk 2002).

Continuity

Although refitting greenways into a developed urban context can be challenging, some design strategies can help to maintain continuity, create interest and provide for a variety of experiences. Alternative routes such as quiet residential streets, unused parking areas and other linear features can be use to mitigate existing barriers along a corridor. Identifying these routes as part of the trail should help to reassure the user that the path continues in a given direction (Flink et al. 1999). By combining traditional and non-traditional alignments, a greater continuity can be achieved within the system, encouraging use and increasing the scope of opportunities the system may provide.

Walkability and Destinations

The term "walkability" originated with the New Urbanism movement in the 1990s (Southworth 2005). The movement was founded by urban designers, planners and architects in an attempt to address the problems associated with rapid suburban sprawl, disinvestment in central cities and environmental degradation (CNU Charter 2001). New Urbanist planning attempts to create new communities and to revitalize existing ones based upon the model of successful, "pre-automobile" cities and towns. There is a great deal of emphasis placed upon creating a pedestrian and bicycle friendly atmosphere

throughout these new communities in an effort to, among other things, reduce pollution, encourage social interaction, and improve physical health through exercise. While many of New Urbanism's tenets have garnered criticism – not the least of which is the doubt that even with clever design strategies, Americans may well be unwilling to leave behind their car-dependent lifestyles (Harvey 1997) – its growing power in the world of community planning has lead to a great deal of research into what makes a successful community design. Walkability has grown beyond urban planning and become an important concept in fields as varied as public health, park and trail design, and transportation planning (Flink et al. 1999, Lyden 2003, Southworth 2005).

Although many scholars have presented definitions of walkability, this report will use that of Michael Southworth of the University of California, Berkley. He defines walkability as "the extent to which the build environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort and offering visual interest in journeys throughout the network" (2003). A highly walkable environment, then, not only provides the safety and opportunity, but also rewards users by appealing to their senses along the route. This applies not only to recreational walking, but is especially important for encouraging walking as an alternative to automotive travel.

Although research on how far people are willing to walk as basic transportation (as opposed to recreation) is still thin, studies show that typical daily trips for purposes such as shopping, dining or commuting to work range from about 400 feet to one quarter mile (Krizek and Johnson 2006, Southworth 2005). Studies also indicate, however, that

the quality of the trail has an impact upon this distance, and that well designed and visually appealing trails can result in users being willing to walk further as transportation (Lusk 2005, Pikora et al. 2006, Southworth 2005). The proximity of retail, commercial and civic centers which neighborhood residents regularly access can be expanded by use of appropriate walking surfaces, such as sidewalks and trails, as well as associated safety devices such as path lighting and crosswalks to increase overall connectivity of the community (Pikora et al. 2006).

Many of the same considerations that aid in commuting use can also enhance and encourage recreational experiences. Although recreational users are typically willing to travel longer overall distances, their trip length and quality is still impacted by the condition of the trail and the distance between destinations (Lee 2002, Pikora et al. 2006). There is a growing movement to combine active park sites with trails to encourage people to access parks by walking or by bicycle. This combination of recreational goals can make for a richer overall experience. Trail systems such as the Platte River Greenway in Denver and the Lakefront Trail in Chicago have been specifically designed to link existing active recreation parks and are frequently used by families accessing these amenities (Lusk 2002).

In 2002, Christine Lusk completed a dissertation for the University of Michigan studying how greenway and trail users experienced destinations along their path. In her study, destinations were not necessarily stopping points or transportation goals, but included nodes and visually distinct moments in their journey which, when they stopped or passed through, the user felt as though they had “arrived”. Her study included both

recreational users and commuters on the trail, whether bicycling, walking, jogging or inline skating. Although she found a marked difference in the distance between preferred destinations among users of different modes (bicycle, pedestrian, skater), there was little difference between users commuting on the trail and those recreating.

Additionally, Lusk found that the average number of desired destinations along the trail tended to be consistent regardless of the length of the trip or the mode of travel. Pedestrians traveling three miles on the Stowe Recreational Path in Vermont or thirty miles on the Vail I-70 Trail in Colorado both indicated that on average they preferred three destinations on their path. Climate and slope also had little impact on the distance between or total number of preferred destinations. The West Orange Trail in Florida, through a hot, humid area and nearly level had very similar results to the Vail I-70 Trail through the cooler, steeper Rocky Mountains. The study concluded that an average of three destinations along a path, an average of four miles apart would serve most users of a multi-use path. She did suggest, however, that paths serving primarily pedestrians and slower-moving user groups should place destinations closer together to accommodate slower movement and shorter trip length, with distances of 2/3 of a mile to 2 miles between. Placing destinations too close together, while not a problem for users, typically does not benefit them, and can cause the cost of the project to increase and present other issues during the implementation phases of the project.

According to Lusk's findings, preferred destinations typically represent convergences of physical features, activities and meanings, including places to eat, benches, restrooms, views and natural elements. Pairing trail destinations with adjacent

resources such as museums or downtown centers can also add to the ultimate success of the greenway system. With these kinds of rewarding, interesting destinations, even visually unappealing trails through "uninteresting" territory can be made fulfilling, well-used amenities.

The national scope of Lusk's study, as well as its concentration on highly rated greenways is encouraging for the applicability of the results in the Tucson area. Although the hot arid climate is frequently cited by residents as a strong reason for *not* recreating or commuting on trails and paths, appropriate design considerations and placement of amenities should help to alleviate some of these issues. The summer heat can be equated with the harsh Chicago winters on the Lakefront Trail, heavy snows in Vermont on the Stowe path or extreme heat and humidity found on Florida's West Orange trail.

METHODS

Study Area

The study area is within Tucson's city limits and bounded by five major greenways that will ultimately connect to one another to form a recreational ring around the city and serve as the "backbone" for the regional trails system. Four of the five greenways are Pima County River Parks: the Rillito River, Santa Cruz River, Pantano Wash and Julian Wash. Although this system of river parks has not been completely developed, they are a major component of the Pima County Trails Master Plan and, when complete, will provide a vital framework to a secondary-watercourse trail system. The fifth greenway is a part of the redevelopment of Houghton Road. Pima County Department of Transportation has included a 50 ft. wide corridor along the new roadway for a greenway trail running from south of I-10 to the eastern part of Tucson.

The urban core of Tucson occurs within the boundaries of these greenways, including urban development, higher-density suburban areas and many of the area's major commercial centers. Also included in the study area are campuses for both the University of Arizona and Pima Community College, as well as Davis-Monthan Airforce Base.

Study Watercourses

Watercourses selected from within the study area include ephemeral watercourses with a flow rate between 2,000 and 10,000 cubic feet per second (cfs) as reported by the Pima GIS Library (figure 1). Table 1 below describes each of the watercourses and its overall length. Watercourses or portions of watercourses that were included in the previous work (AZGF PO5001) were reviewed, and those either entirely below ground or

share the same alignment as roads or streets were removed from the study as retrofitting these corridors can be prohibitively expensive.

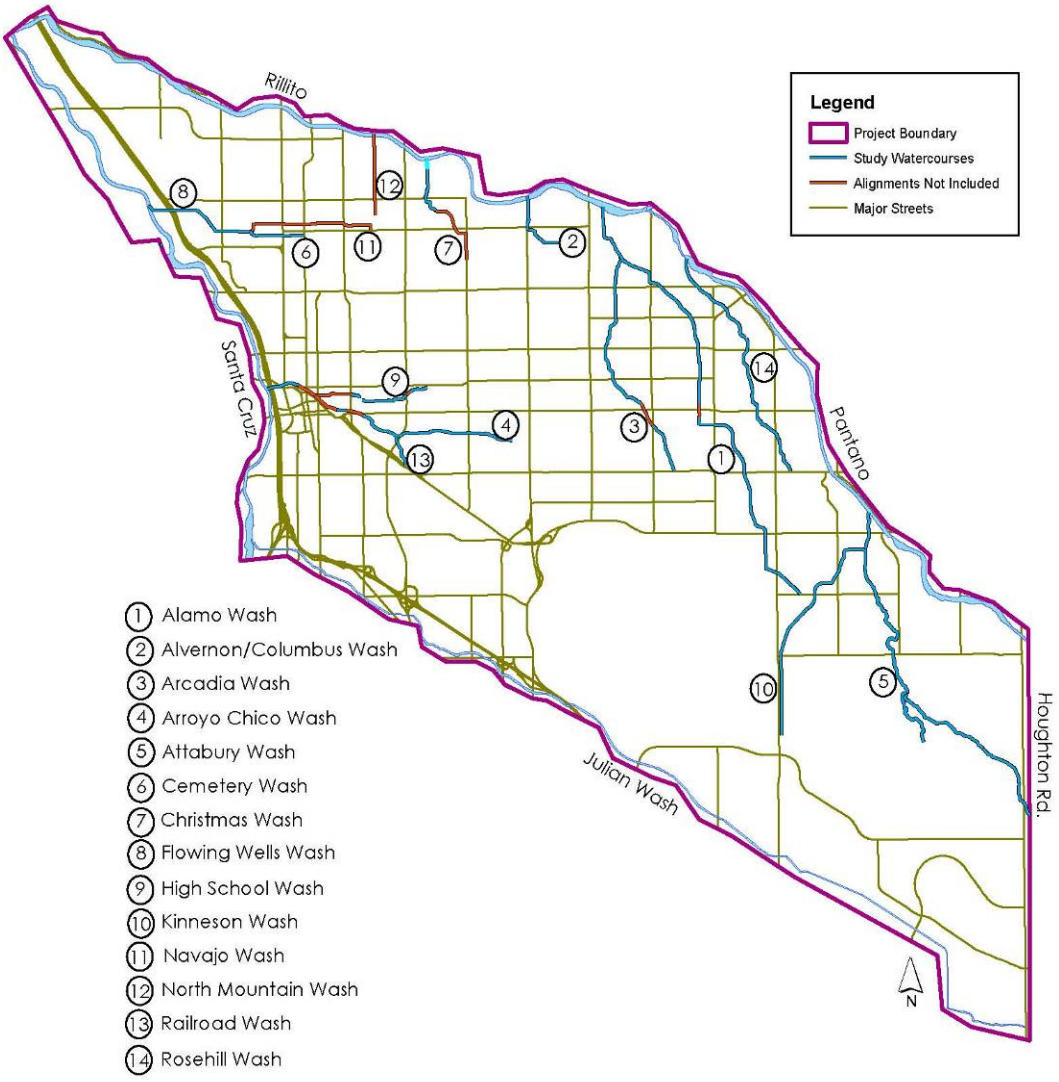


Figure 1. Map of watercourses in study area.

Table 1. Details of watercourses in study area.

Map ID	Name	Length	Notes
1	Alamo Wash	7.7 mi	
2	Alvernon / Columbus Wash	1.1 mi	
3	Arcadia Wash	4.4 mi	
4	Arroyo Chico Wash	1.7 mi	Daylighted portions only
5	Atterbury Wash	7.9 mi	Including 6043 ft tributary
6	Cemetery Wash	.9 mi	
7	Christmas Wash	.9 mi	Southern portion below 2000cfs
8	Flowing Wells Wash	1.7 mi	
9	High School	1.8 mi	Daylighted portions only
10	Kinneson Wash	3.8 mi	
11	Navajo Wash	2.2 mi	Shares alignment with road – do not include
12	North Mountain Wash	1.3 mi	Shares alignment with road – do not include
13	Railroad Wash	.5 mi	
14	Rosehill Wash	4.2 mi	

To facilitate analysis and mapping, the study area was divided into three zones, based upon geographic grouping of washes (figure 2). These include the West, Central and South Zones (table 2). The zones were selected visually, to divide the study area roughly into more manageable areas – there was no demographic, geographic or physical calculation used. Only the Alamo Wash alignment crosses more than one zone boundary, and portions of it appear in each analysis.

Table 2. Zones for study watercourses.

Map ID	Wash	Zone
1	Alamo	Central and South
2	Alvernon / Columbus	Central
3	Arcadia	Central
4	Arroyo Chico	West
5	Attabury	South
6	Cemetery	West
7	Christmas	West
8	Flowing Wells	West
9	High School	West
10	Kinneson	South
13	Railroad	West
14	Rosehill	Central

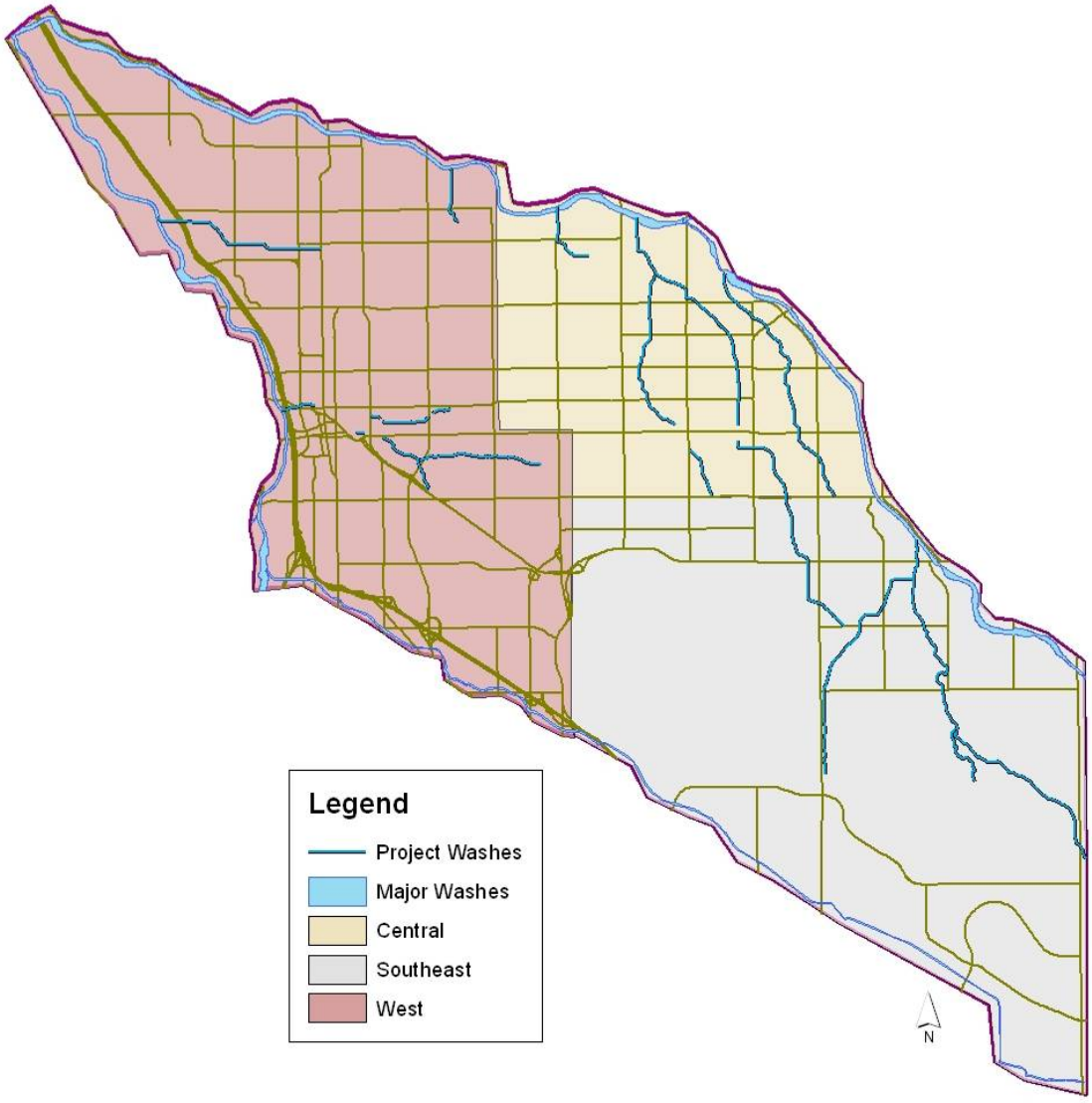


Figure 2. Study area zone divisions to facilitate mapping.

Existing Infrastructure to Support Urban Trails System

This assessment examined both connections to the existing urban trails system and destinations that may support the user's experience on the trail. Although there is considerable support to using pedestrian-friendly retail opportunities as destinations, the study focused on public amenities, specifically existing and proposed greenway trails, public parks, public school campuses, libraries and community centers. These features

provide opportunities for public access, potential staging areas and recreational destination use without additional permissions from private landholders.

Because the focus of this study is upon urban greenways trails as recreation opportunities, rather than off-roadway trails as transportation or safety features, certain established urban trails were not included. Greenway trails with segments directly adjacent to a roadway in an attempt to maintain connectivity through a tight space were included, however those trails which for the majority of their length are within or directly adjacent to a roadway without a vegetated buffer were not considered in the study. Table 3 outlines details on the greenways included in the study and specifies the length of each within the study area.

Table 3. Breakdown of existing greenway condition and length.

Map ID	Greenway Name	Status	Length (in mi)
1	Barraza-Aviation / Golflinks Greenway	Built	9.80
		Proposed	4.46
		Total	**14.26**
2	Broadway Greenway	Proposed	**2.52**
3	David Bell Bike Path	Built	**1.44**
4	El Paso and Southwestern Greenway	Approved	**5.18**
5	Houghton Greenway	Approved	**6.75**
6	Julian Wash Park	Approved	12.15
		Built	3.93
		Proposed	1.3
		Total	**17.38**
7	Pantano River Park	Approved	5.16
		Built	0.27
		Total	**5.43**
8	Pima County Detention Basin Path	Built	**2.38**
9	Rillito River Park	Built	**12.13**
10	Santa Cruz River Park	Built	**10.95**

Using ESRI's ArcView GIS software, public amenities were located within the study area, including parks, libraries, community centers and schools. Each established and potential secondary watercourse greenway was buffered by 1/8 mile (665 ft) as an acceptable walking distance, and the buffers were compared to the location data on public amenities to identify those which might be used within the greenway system. Figure 3 shows the greenways and public amenities located within the study area.

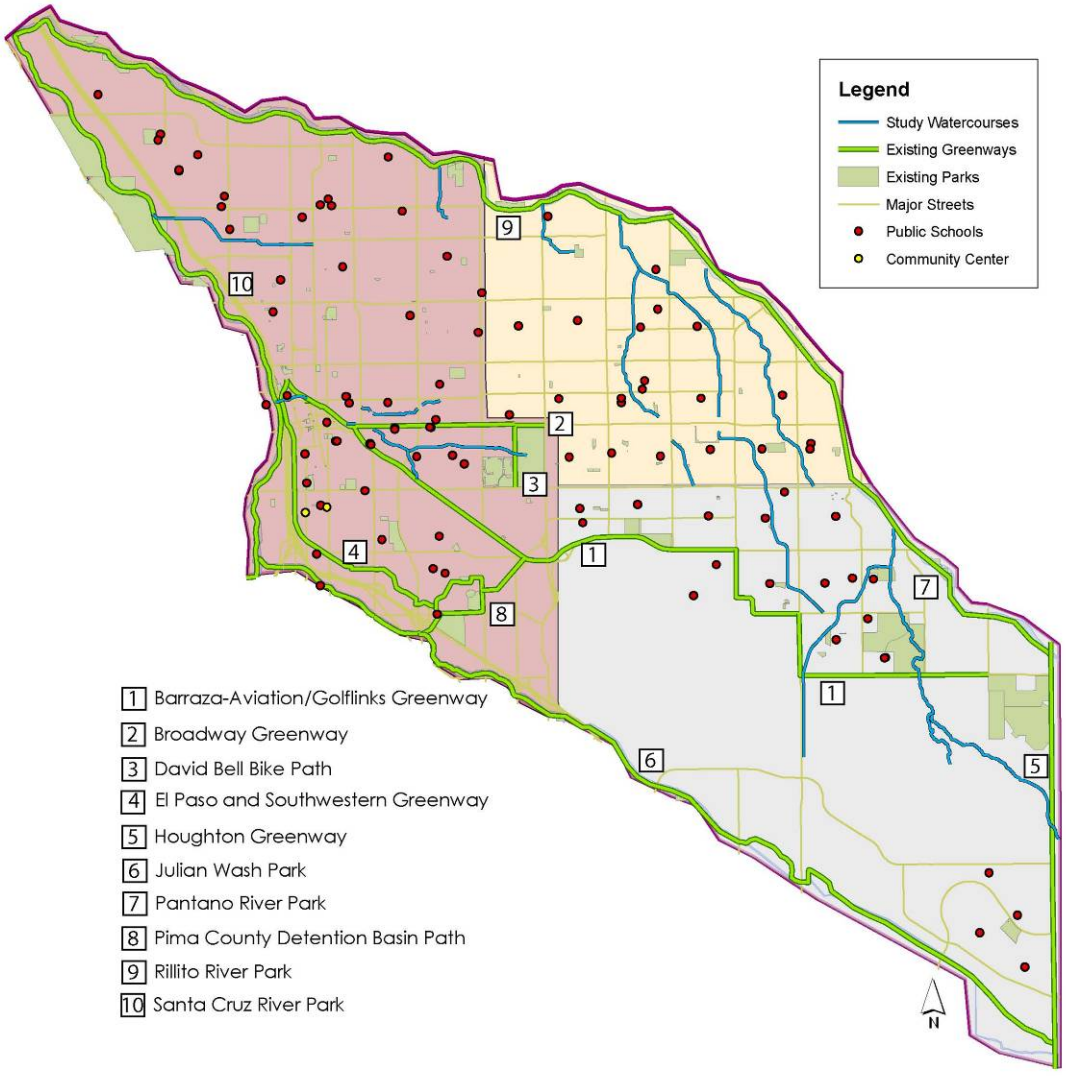


Figure 3. Existing greenways and public amenities.

Data for schools, libraries and community centers was originally in a GIS Point file and therefore represented as a geographic point rather than a polygon. Points that fell within or close to the edge of the buffer boundaries were identified visually, and then the precise boundaries were drawn into a new data file based upon parcel data and aerial photographs. Park data from Pima County delineated park boundaries. Those amenities whose boundaries that fell within the 1/8 mile radius were added to a new data set for analysis in the study.

Potential Destination Opportunities

The identified existing and proposed infrastructure was analyzed for gaps greater than 1/2 mi. among potential links and destinations. An assumption was made that destinations – including recreational amenities and/or staging opportunities - should be located at intervals of approximately 1/2 mi. to best serve the neighborhoods that surround them. This is based upon these greenways having a narrower, possibly unpaved trail surface which could largely limit use to pedestrians. Research showed that these users typically travel a mile or less to reach destinations (Gobster 1995, Lee 2002, Lusk 2002). Points were placed along the watercourse alignment where identified amenities occurred, and where potential and existing trails intersected. In the case of those amenities which were not directly adjacent to the trail, a point was placed where the connecting path might intersect the main trail. For existing greenways, developed access points and staging areas which were not covered in the other layers were also assigned a point. These points were buffered by a ½ mile. Where points were separated by more than a ½ mile ($\pm$ 300 ft) a new point was placed indicating the approximate location of a proposed destination.

Additionally, the study examined larger scale barriers that would occur along secondary watercourse greenways, such as land use prohibitions, the absence of a watercourse alignment to follow (watercourse is underground) and major infrastructure conflicts.

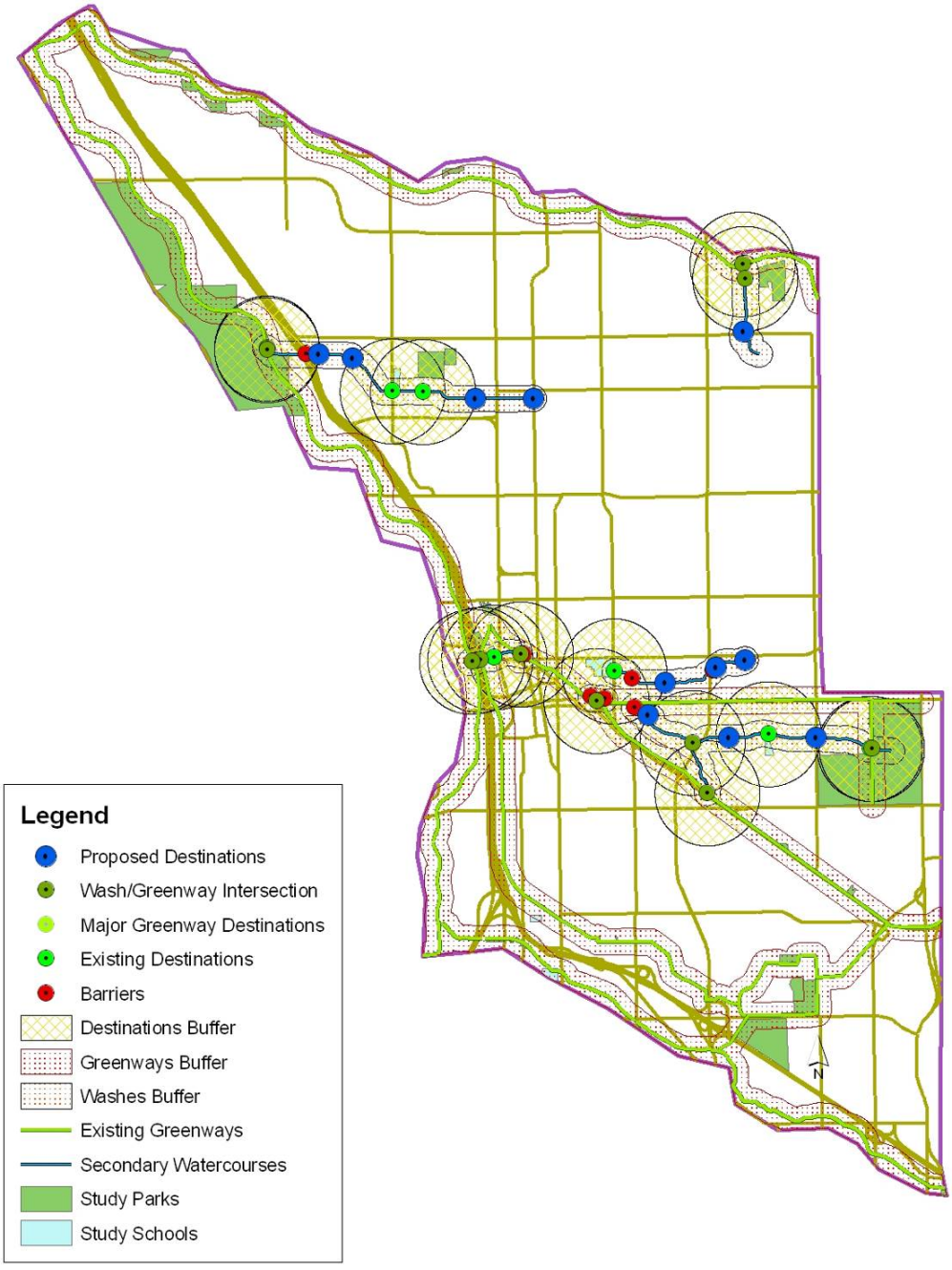


Figure 4. Sample half-mile buffer analysis map.

Rankings for Proposed Destination Locations

For each proposed destination location, properties within the 1/8 mile greenway buffer zone were analyzed to find appropriate areas for new amenities using data from the Pima County Parcels layer and 2005 aerial photography. The most ideal location for a new destination would be within the public right of way that defines the wash corridor. However, many segments of study washes are not within a public corridor, or corridors were not of sufficient width to accommodate such development. In these instances, the preferred parcel within the buffer zone would be publicly-owned, undeveloped land – as acquisition and development of the property presents the least cost and legal obstacle. Developed, privately held land would be the least desirable, often requiring considerable expenditure for land which may be legally difficult to acquire. Table 4 outlines the categories of land use that were considered for proposed destinations. A ranking of 1 indicates an ideal situation; a ranking of 6 indicates the least ideal. Where amenities were able to be located within the publicly held wash corridor itself they were considered to be on undeveloped public land.

Table 4. Proposed destination parcel ranking.

Land Ownership	**Development Status**	**Ranking**
Public	Undeveloped	1
Public	Partially Developed	2
Semi-Public (*i.e. Homeowners Assn)*	Undeveloped	3
Private	Undeveloped	5
Semi-Public (*i.e. Homeowners Assn)*	Developed	4
Private	Developed	6

Design

Finally, three proposed destinations will be chosen to illustrate the kinds of design strategies that can be used throughout the system to create a diverse yet cohesive

pedestrian trail system. The selected destinations demonstrate how different land characteristics such as size, ownership and physical relationship to the trail alignment can be developed into viable amenities along urban corridors.

RESULTS

A total of 114 existing destinations, classified as either public open space or access points, were identified along the existing greenway system and secondary watercourses within the three designated study zones, totaling over 3413 acres of public recreational space in urban Tucson (Table 5).

Table 5. Identified destination opportunities along existing greenways and secondary watercourses in Tucson, AZ.

Study zone*	Number	Total area (acres)
West		
Parks	24	1598
Schools	7	57
Intersections	25	n/a
Total	**57**	**1655**
Central		
Parks	12	208
Schools	9	125
Intersections	9	n/a
Total	**30**	**333**
South		
Parks	14	1246
Schools	7	179
Intersections	6	n/a
Total	**27**	**1425**
Overall total	**114**	**3413**

* Based upon rough geographic division of study area

Twenty three locations for proposed destinations were identified based on the study objective to increase connectedness along these corridors by locating destinations 1/8 mile or less from the greenway. The majority of these were sited on publicly owned land. In one instance it was necessary to place the destination on developed, privately held land. Acreage provided for each location is listed Table 6, although it may not be

necessary to utilize the entire site. Rankings prioritized parcels based on ease of development. Undeveloped public parcels, deemed easiest to develop into public amenities were ranked highest. Developed private parcels rated lowest. In the case of those destinations located on developed or private property, design recommendations should be as minimal as possible to encourage collaboration with land owners. How this might be accomplished will be addressed in the design section of the document. Detailed maps of each proposed destination are included in Appendix A.

Table 6: Summary of proposed destination opportunities by ranking along existing greenways and secondary watercourses.

Ranking*	Description	Total Number	Total Acres
1	Undeveloped, Public	7	56
2	Partially Developed, Public	7	40
3	Undeveloped, Semi-Public	0	0
4	Undeveloped, Private	4	67
5	Developed, Semi-Public	4	12
6	Developed, Private	1	1
Total		23	176

***** based on development potential

In each sub area, the largest number of existing destination opportunities were active recreation parks. These amenities provide a wide range of potential activities, as well as vehicular parking, restrooms, shade and comfort elements (such as benches, tables and water fountains). A total of 50 active recreation parks were found which met the study criteria, ranging in size from less than an acre to over 100 acres. Utilizing these public facilities as staging areas, active and passive destinations would significantly enhance the quality of user experience on the trail system, as well as increasing community access to the greenways.

The second most common destination opportunities were points where the secondary watercourse greenways would intersect with existing greenways. Although many of these points do not occur at locations with significant public facilities, they serve as excellent destinations and provide opportunities for longer, more varied trips along the trail system. Perhaps more significant than the conjunction of the secondary watercourses to the primary watercourses and their greenways are the connections that occur within the interior of the study area to urban greenways. These connections can create a more complex system of potential trail loops. Especially for individuals desiring shorter trip lengths, these interior connections make the overall greenway system more accessible

The final category of destination, although very close in frequency to the intersections, is the public school campuses. Beyond the more obvious facilities provided, such as access to playgrounds, active recreation features and parking opportunities, a trail access to school campuses could also encourage more families to walk to school. According to the US Department of Health and Human Services Center for Disease Control (2006), 36% fewer children use active transportation (walking and biking) to get school today than 35 years ago, contributing to the growing problem of childhood obesity and related diseases. One of the primary barriers to active transportation noted by parents was fear of pedestrian-vehicular accidents. Off road greenways could reduce this fear and encourage healthy activities among families in communities with nearby trail systems.

In nearly every case where a significant barrier was identified, the circumstances creating it were unique. Several of the so called “barriers” could be interpreted as destinations with different study criteria. Retail shopping centers, business parks, a

cemetery and others may have blocked the process used here, but with additional creative thinking, could be turned into major amenities along the greenway.

Figure 5 presents a system-wide view of existing and proposed destination locations and barriers as well as existing and proposed greenway alignments.

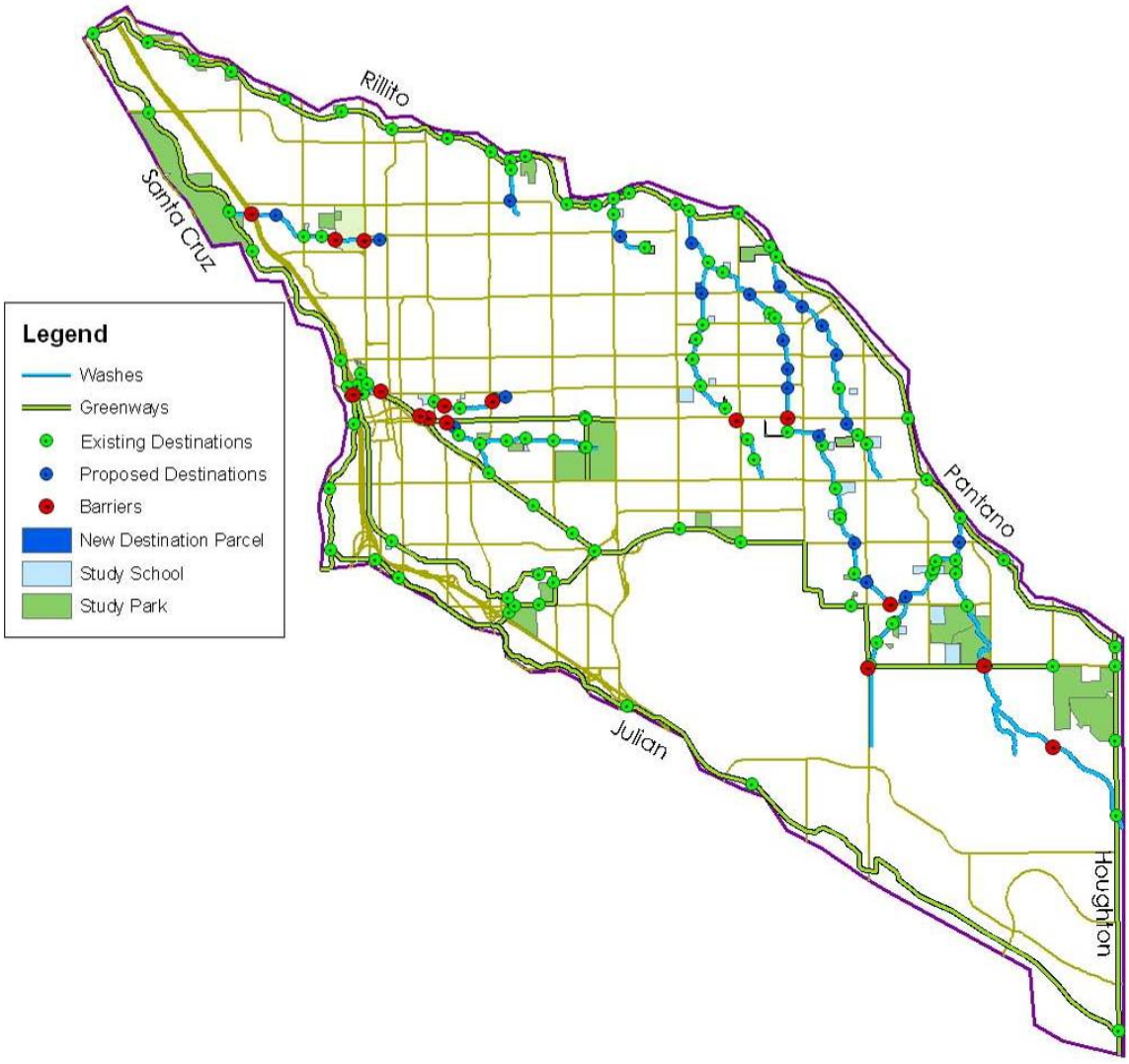


Figure 5. System-wide greenways, destinations and barriers along secondary watercourses.

The Recreation "Hole"

Examination of the whole study area revealed a large space in the very central core of Tucson where few parks and no greenway-quality secondary washes occur (figure

6). This area represents a roughly 75 sq. mi. hole in the recreational system of the city. Those drainage ways which did exist in this area have either been merged with street al.ignments (i.e.. Mountain Avenue and Mountain Wash) or erased entirely. It is a shortcoming of the secondary watercourse trail system identified here that it does not serve that large area, and additional studies could reveal other connective strips that could be developed to expand the greenway system into the area.

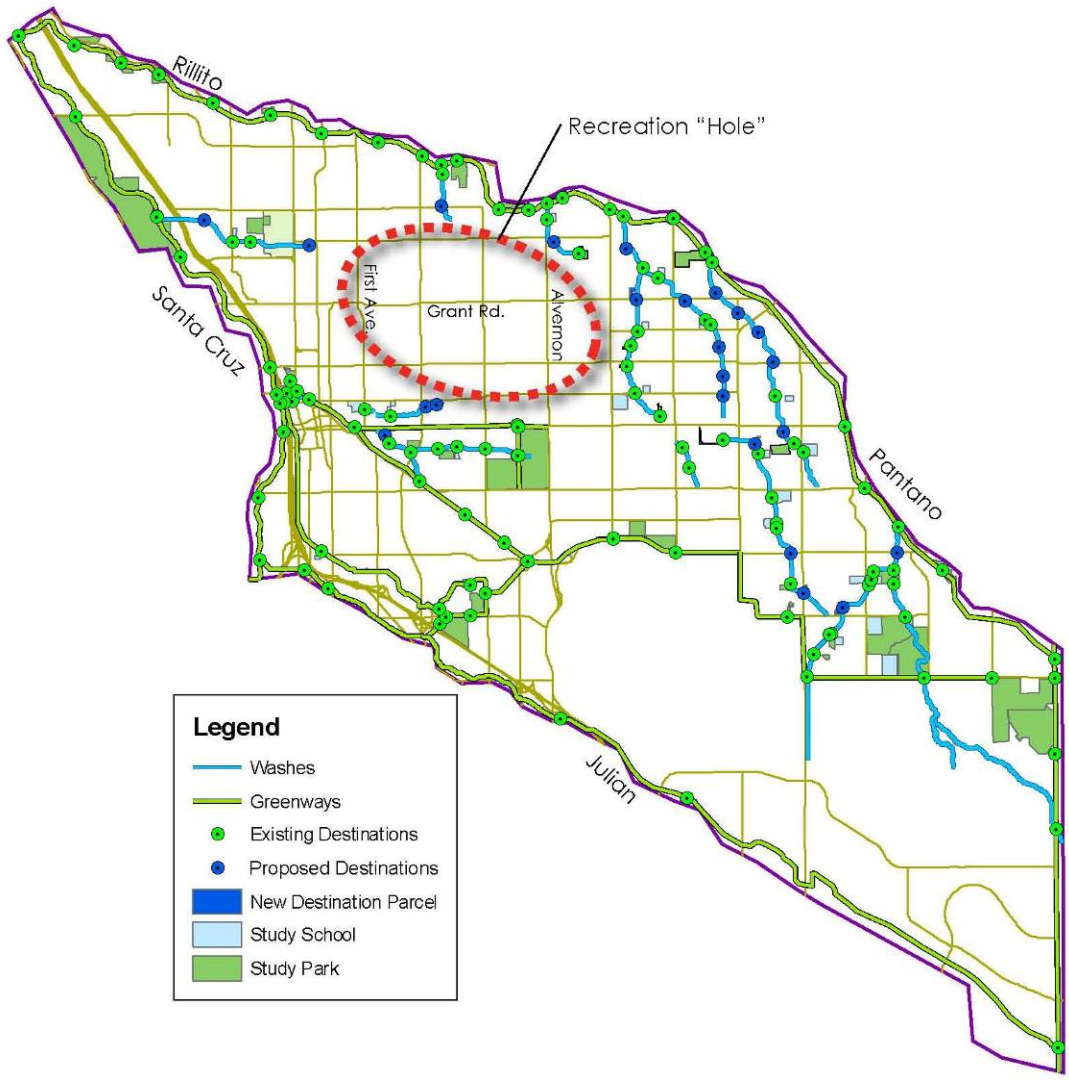


Figure 6. The Recreation "Hole" – an area lacking recreational opportunities in central Tucson.

West Zone

The West Zone includes some of the oldest neighborhoods in Tucson, including the nationally registered historic districts of El Presidio, Barrio Viejo, Armory Park and Barrio Anita. It also encompasses Tucson's downtown area, the campuses of both the University of Arizona and Pima Community College and pedestrian-friendly retail districts such as the 4th Avenue Merchant's Association and University Blvd. As illustrated above in Table 4, this sub area had the largest number of existing destinations, which alone might indicate that this Zone could be an excellent candidate for the beginnings of a secondary watercourse trail system. However, historic development has frequently moved the watercourses below ground in a variety of tunnels, culverts and pipes. Several watercourses disappear underground for a mile or more through the downtown area, creating major connectivity barriers. Figure 7 below shows the locations of the existing and proposed destinations as well as the major barriers identified in this area.

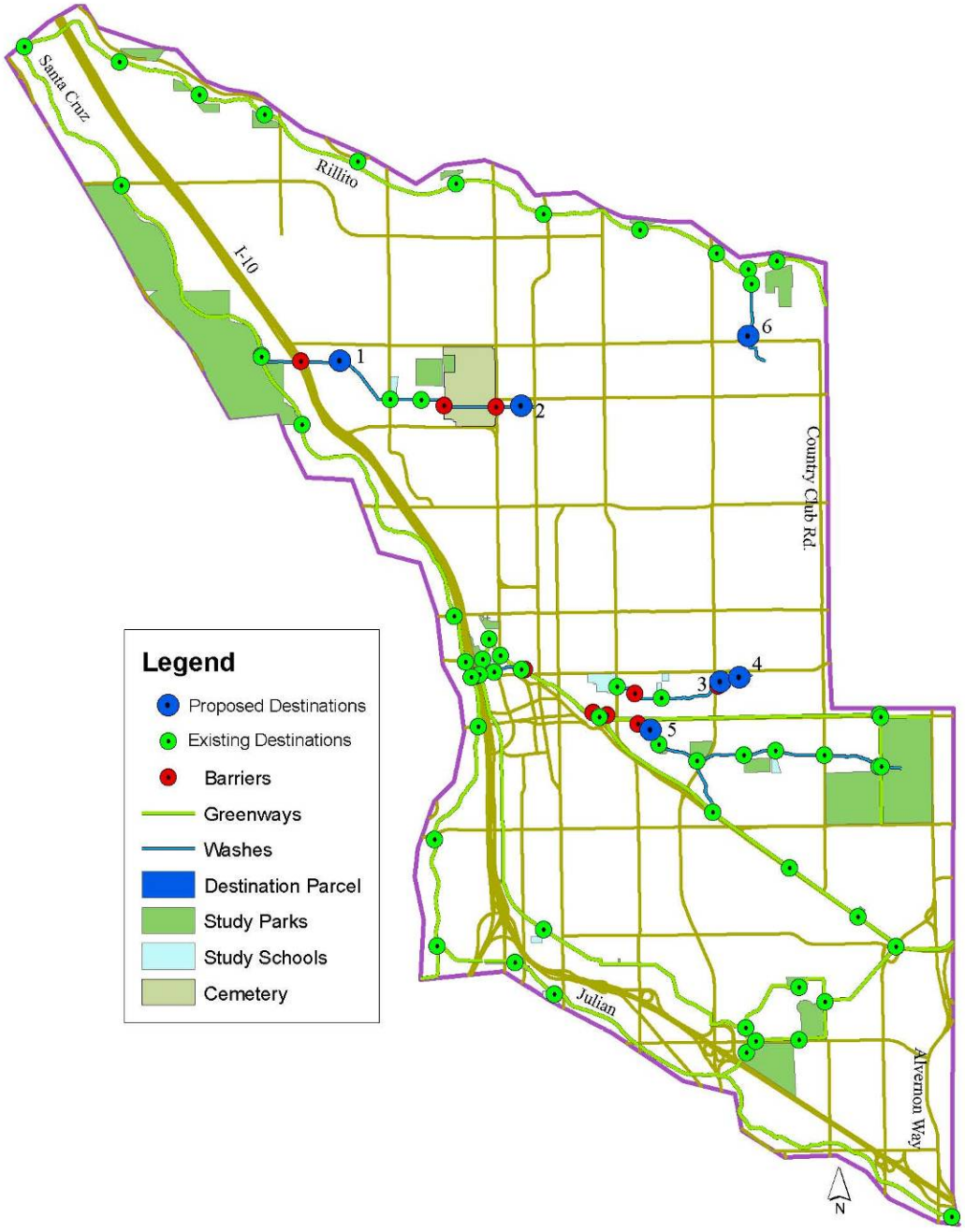


Figure 7. Proposed and existing destinations and barriers in West Zone.

Existing Destinations

Table 7 details the existing destinations identified along the greenways and secondary watercourses in the West Zone. There is a relatively higher number of parks in this Zone because of the ongoing effort to establish parks in the flood-prone areas along the Rillito and Santa Cruz Rivers. The River Park sections in this area were among the first developed, and nearly all of these segments have been completed to match the most recent river park model, including a Divided Urban Pathway and access points located at 1 mile intervals. The success of the river park program in this area is encouraging for greenway development countywide.

Although two major campuses are located in this Zone, neither is accessible along the greenway trail system. This is due, in part, to the majority of the watercourses through the center of town being rerouted underground through culverts. Although efforts have been made to create pedestrian and bicycle friendly routes to these campuses, additional links to the campuses from the greenways system could further encourage active transportation.

Table 7: Summary of West Zone existing destinations

Destination Name	Associated greenways and watercourses	Size (acres)
Parks		
Ouray Park	El Paso and Southwestern	7.6
Ironhorse Park	Barraza-Aviation / Golflinks	8.6
Reid Park/Randolph Golf Course	Arroyo Chico	450.0
Jacobs Park	Flowing Wells/Cemetery	38.4
Jacobs Park Addition	Flowing Wells/Cemetery	10.4
Street Scene Park	El Paso and Southwestern	0.5
Augie Acuna Los Ninos Neighborhood Park	Julian	2.3
Kino Veterans Memorial Sports Complex	Julian / Detention Basin	95.9
Kino Veterans Memorial Community Center	Detention Basin	55.0
James Thomas Park	Detention Basin	8.9
Country Club Park	Barraza-Aviation / Golflinks	2.7
Eastmoor Park	Barraza-Aviation / Golflinks	1.9
Estevan Park	Santa Cruz	8.5
Flowing Wells District Park	Rillito	17.8
Dan Felix Recreation area	Rillito	20.4
Chistopher Columbus Park/ Silverbell Golf Course	Santa Cruz	751.6
Curtis Park	Rillito	14.4
Children's Memorial Park	Rillito	6.2
Rillito Park	Rillito	5.1
Northcentral District Park	Rillito / Christmas	43.8
Paseo de Lupe Eckstrom	Julian	8.1
TUSD Fields	Arroyo Chico	17.7
UofA Fields	Arroyo Chico	19.5
City of Tucson Open Space	Arroyo Chico	2.2
Schools		
Tucson High	High School	23.3
Howenstine High School	Arroyo Chico	6.7
Davis Magnet Elementary School	Arroyo Chico	3.1
Walter Douglas Elementary School	Flowing Wells	6.5
Wakefield Middle School	Julian	8.3
Mission View Elementary School	El Paso and Southwestern	4.0
Mansfield Middle School	High School	5.7

Barriers

Three significant barriers presented themselves during the analysis of this Zone: sections of buried watercourse alignments, Interstate 10 and the Evergreen/Holy Hope Cemetery. High School Wash and Arroyo Chico Wash originally ran through the

downtown area, and are currently routed underground before emerging west of the proposed alignment for the Barraza-Aviation Greenway (figure 8). Due to dense development and expensive infrastructure investment, it is unlikely that these watercourses will be day-lighted, so an alternate alignment through the downtown area would be necessary to provide continuity for the greenway. Interestingly, at the western terminus of High School Wash's above-ground alignment is the campus of Tucson High School. This is one case where a barrier is also a destination, and this "end point" of the trail could provide additional educational opportunities about the nature of watercourses in the desert and how the treatment of these waterways has changed over the last 100 years.

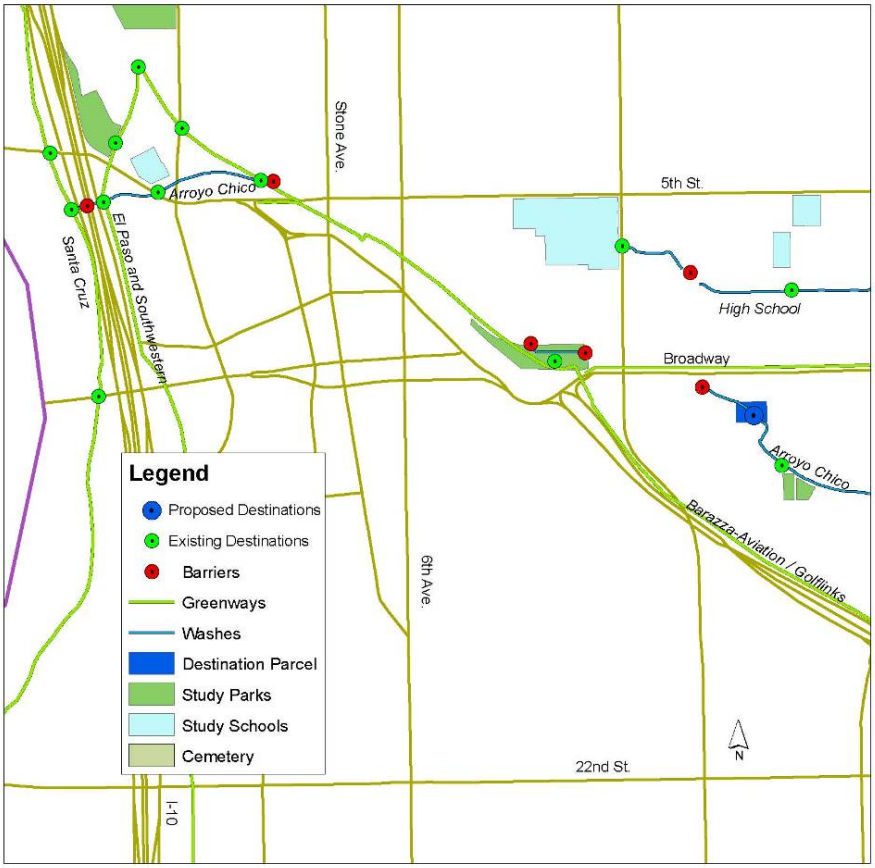


Figure 8. Above ground wash segments in West Zone – downtown Tucson.

Interstate 10 is a 6 lane (soon to be 8 lane) freeway that serves as a major transportation artery for travel between the northwest and central parts of the Tucson area. Its course through the study area roughly parallels the Santa Cruz River to the west and the Union Pacific Railroad tracks to the east. This means that every tributary wash flowing into the Santa Cruz from the east must cross both the railroad tracks and the interstate before reaching the river. Both the Arroyo Chico and Flowing Wells greenways would be blocked here, as the wash underpasses have not been developed with pedestrian use in mind. Connecting the eastern portions of the greenways with the Santa Cruz River Park would require development of either pedestrian overpasses or underpasses in both locations.

Cemetery Wash is so named because it flows through the heart of the Evergreen and Holy Hope Cemeteries. Although these are not publicly owned facilities, they are open to the public and already have many attractive amenities – including parking, shade, grass and rest areas. Although it creates a barrier to the planning process for this study because additional amenities might not be developed through this area, the land use does not block pedestrian access. The cemeteries could be seen as a destination amenity in their own right, especially on those holidays when families visit their loved ones.

Proposed Destinations

Due to the high instance of existing amenities in this area, only six areas were identified as needing additional destination development. All proposed destinations were able to be located on publicly owned lands, and those parcels which were developed were often sites with limited use, such as well sites and utility access points. The size of most

of these parcels is relatively small, which is reflective of the dense development found in this area (Table 8).

Table 8. Summary of West Zone proposed destinations.

Map no.	Development Ranking	Acres	Parcel Information	Associated Greenway
1	1	1.39	106-12-0300, 106-12-0290	Flowing Wells
2	2	0.15	107-11-1120	Cemetery
3	2	0.14	125-07-5930	High School
4	1	0.14	125-07-3340	High School
5	1	2.51	124-12-1150	Arroyo Chico
6	2	0.12	Prince Rd. Right-of-Way	Christmas

Central Zone

The Central Zone contains the highest number of secondary watercourses, with a potential for nearly 17 miles of trails along these alignments alone. In spite of the lower number of existing destinations compared to the West Zone, the destinations found here tend to be spaced at a more regular distance, rather than clustered. This Zone is largely characterized by moderate-density residential development and commercial centers located along the arterial roadways. In the southern part of this area are the Broadway Business Corridor and the Williams Center, a sort of second downtown for Tucson, with a concentration of office complexes, retail and restaurants.

The portions of the Rillito and Pantano River Parks that bound this area are dramatically less developed than in the West Zone. Development of the Rillito River Park has been halted by complications that occur at the Rillito-Pantano confluence, and several sections of the path are interrupted by land ownership issues. The Pantano River Park is only now beginning to be developed, with less than 1 mile of the Pantano River Park completed at this time. Land ownership issues and path alignment are still being resolved along this corridor.

Although the secondary watercourses provide excellent north-south trail opportunities throughout the area, there is a notable lack of east-west greenway alignments, which limits trip variations for users. The identification of one or two east-west corridors between the secondary watercourse trails would increase the network of the system and create more loop opportunities. Figure 9 below shows the locations of the existing and proposed destinations as well as the major barriers identified in this area.

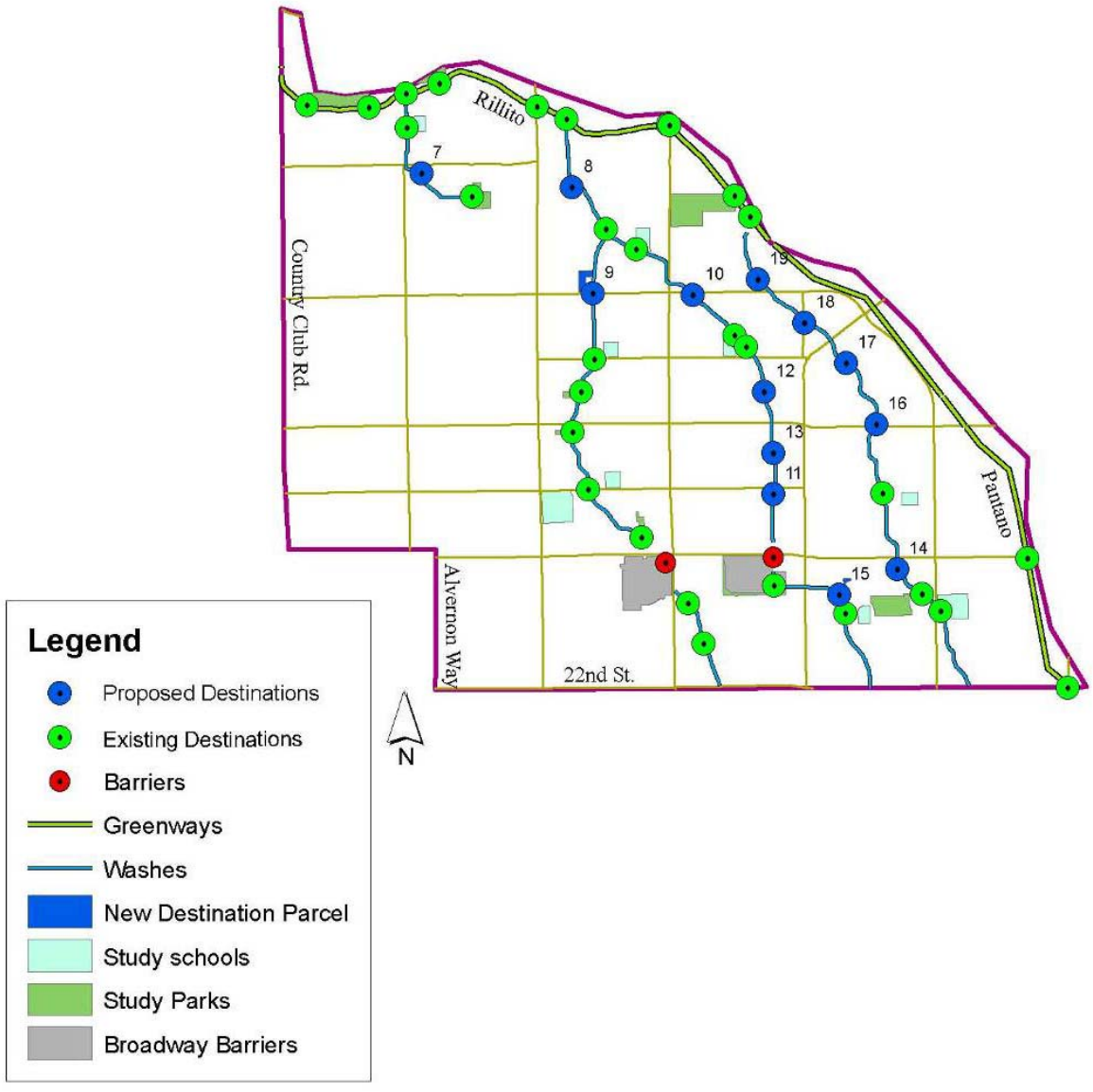


Figure 9. Proposed and existing destinations and barriers in the Central Zone.

Existing Destinations

The existing destinations identified in the Central Zone are detailed in Table 9. Although the number of active recreation parks found along the greenways in this area is smaller, more of the parks are located on the secondary watercourse trail system, rather than being a part of the larger river park recreational development. These parks also tend to be smaller, older neighborhood parks, which could reinforce the local scale and intimate feel of the secondary watercourse trails.

Table 9. Summary of Central Zone existing destinations.

Name	**Greenway Intersected**	**Size (in acres)**
Parks		
McCormick Park	Columbus	14.2
Pinecrest Park	Arcadia	1.3
Swanway Park	Arcadia	2.2
Twenty-Thirty Park	Arcadia	4.6
Villa Serena Park	Alamo	1.1
Sears Park	Alamo	8.1
Palo Verde Park	Rose Hill	27.4
Fort Lowell Park	Pantano	59.0
Brandi Fenton Memorial Park	Rillito	29.7
Wilshire Park	Arcadia	3.2
Mesa Village Park	Arcadia	2.1
George Mehl Foothils District Park	Rillito	4.8
Schools		
Davidson Bilingual Elementary School	Alvernon	10.0
Whitmore Elementary School	Alamo	10.3
Fort Lowell Elementary School	Arcadia	8.5
Rincon/University High School	Arcadia	35.2
Duffy Elementary School	Arcadia	9.1
Dodge Middle School	Alamo	10.2
Kellond Elementary School	Alamo	7.7
Booth-Fickett Elementary School	Rose Hill	27.0
Hudlow Elemntary School	Rose Hill	7.4

Barriers

Both the Arcadia and Alamo Washes are in underground culverts as they cross Broadway Blvd. In both cases, major commercial developments are built over the washes, making day-lighting of these watercourses highly improbable. However, the Park Place Mall over sections of the Alamo Wash and the Williams Center over sections of the Arcadia Wash could serve as potential destinations. Both locations provide shopping opportunities, restaurants and employment centers, as well as public parking and open plaza space. Careful design and cooperation with the managers of these properties could turn difficult barriers into interesting opportunities for additional greenway linkages.

Proposed Destinations

The Central Zone had the highest number of proposed destinations in the study. This is due, in part, to the larger amount of corridors within this area, but also to the nature of the development here. The washes meander through long stretches of residential development, encountering a few small local parks along the way. In order to encounter destinations at the desired interval, creative space planning may be necessary. Although there were many opportunities for using public land to achieve this, in some cases destinations would need to be incorporated into privately held properties (Table 9). The sizes and nature of these amenities could, in many cases, be integrated with the current use of the land.

Table 10. Summary of Central Zone proposed destinations.

Map #	Development Ranking	Acres	Parcel Information	Associated Greenway
7	1	0.06	110-06-014D	Columbus
8	1	0.10	Within Floodway	Alamo
9	4	7.39	110-11-1179C	Arcadia
10	5	0.25	121-05-021A - NE corner	Alamo
11	2	0.52	127-14-001A	Alamo
12	1	0.21	121-07-0610	Alamo
13	2	0.39	127-10-159A, plus portion of floodway	Alamo
14	6	0.16	134-22-123D, South portion	Rose Hill
15	2	1.06	134-23-136A	Alamo
16	5	0.22	133-14-235C, western portion	Rose Hill
17	5	0.63	133-14-1610 , 133-14-4850, portion of floodway	Rose Hill
18	5	0.10	133-16-027R plus portion of floodway	Rose Hill
19	4	0.22	110-16-223A, eastern portion	Rose Hill

South Zone

The South Zone is the least developed of the study areas, and the area where the largest amount of new development is occurring. This area completely contains the Davis-Monthan Air Force Base, which consists largely of open space with a few concentrated residential and military areas. Both the Houghton Greenway and the majority of the Julian Wash Linear Park that border this area are still in the planning stages, although the major landownership issues that plague the Pantano Wash are less significant on these greenways, and they are likely to be completely implemented within the next twenty years. There is still a considerable amount of open, undeveloped desert within this area, and opportunities for open space parks and more natural amenities would change the character of proposed amenities in this area. The proposed greenways and amenities should be developed to maintain this more suburban/rural character. Figure 10 summarizes the locations of the existing and proposed destinations as well as the major barriers identified in this area.

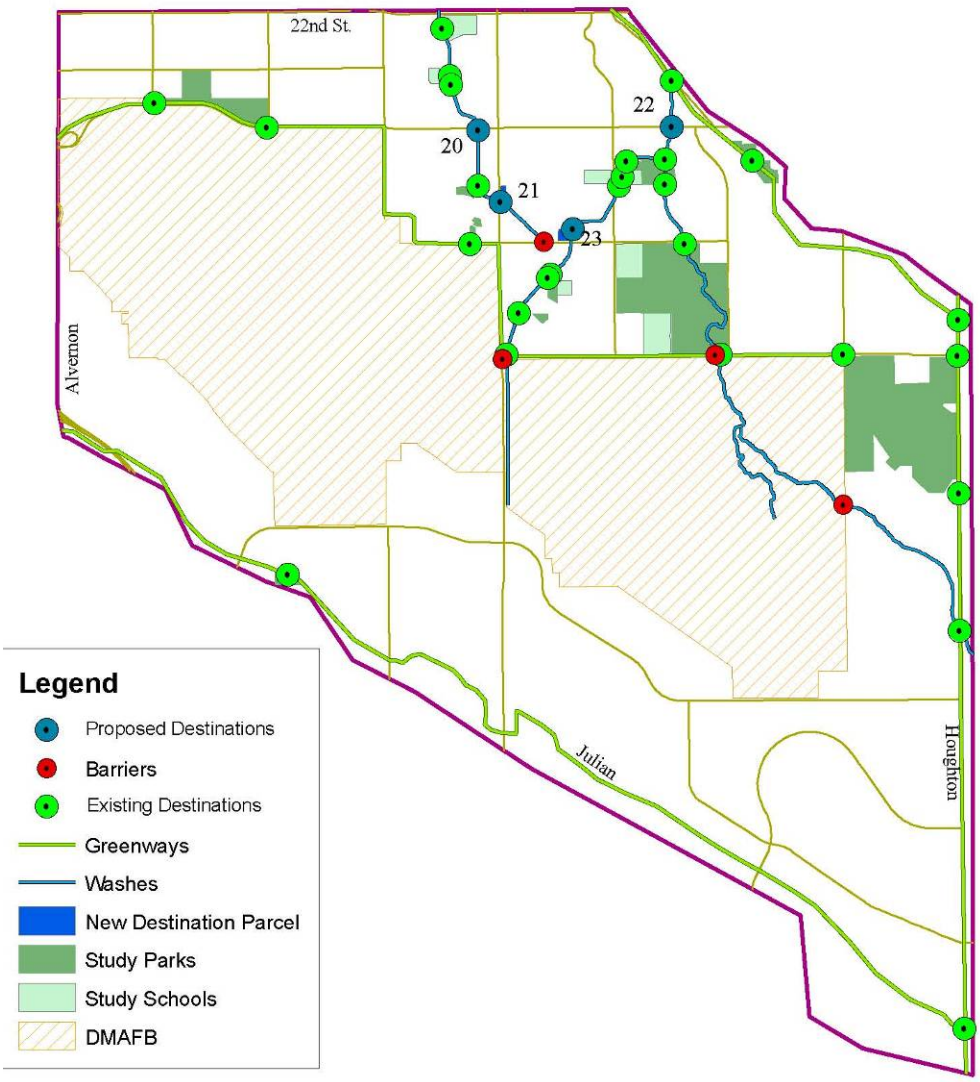


Figure 10. Proposed and existing destinations and barriers in the South Zone.

Existing Destinations

The watercourse and greenway trails in this area have the potential to link several larger recreational facilities – including golf courses, natural open space trails parks, large active recreation parks and small neighborhood spaces. In addition, there are several planning projects for new parks in this area – including a skate park along the Barraza-Aviation path and an additional golf course near Houghton Road. The schools that have potential to be linked by this trail system are each located on one of the secondary

watercourses; this trail system would provide a unique amenity for many students and their families. Table 11 below provides the details of the existing amenities identified along these trails.

Table 11. Summary of South Zone existing destinations.

Name	Greenway Intersected	Size (in acres)
Parks		
Houghton Road Golf Course	Houghton / Atterbury	254.9
Thomas Jay Littletown Regional Park	Julian	10.4
Fantasy Island Trails Park	Houghton / Atterbury	336.4
Fred Enke Golf Course	Houghton / Atterbury	230.0
Abraham Lincoln Regional Park	Atterbury	190.2
Lakeside Park	Atterbury / Kinneson	50.1
Michael Perry Park	Pantano	36.4
Groves Park	Kinneson	11.9
Groves Park	Kinneson	4.2
Escalante Park	Barraza-Aviation / Golf Links	4.6
Vista del Pardo Park	Alamo	7.4
Tierra del Sol Park	Alamo	2.2
Golf Links Sports Complex	Barraza-Aviation / Golf Links	70.4
Freedom Park	Barraza-Aviation / Golf Links	38.4
Schools		
Ford Elementary School	Kinneson	9.9
Carson Middle School	Kinneson	17.7
Santa Rita High School	Atterbury	44.9
Lyons Elementary School	Kinneson	10.0
Pima Community College East Campus	Atterbury	53.8
Wheeler Elemntary School	Alamo	8.0
Palo Verde High School	Alamo	35.5

Barriers

Perhaps the most significant single feature of this area is Davis-Monthan Air Force base – over ten thousand acres of open space, residential development and military facilities. Although portions of the base are not entirely off limits to visitors, security and safety concerns make the control of people on and off the property essential. Both the Kinneson and the Atterbury Washes cross the base, and are essentially unavailable for

development past the boundary line. This creates a connectivity break between all of the greenways to the north and the Julian Wash Linear Park to the south. Although many local residents work on the base, it is difficult to consider a destination amenity, since the watercourse trails do not correspond with major access points. The greatest opportunity for crossing this barrier could be Kolb Rd. Development of a off-roadway greenway along this alignment could connect the northern greenways and Kinneson Wash with the Juilan corridor.

The Atterbury wash segment that crosses the base is actually located on land the Airforce leases from the City of Tucson. The parcel consists of several thousand acres of undeveloped desert – a resource that is nearly unheard of in any urban core. The possible conversion of this land in the future to other uses should consider the excellent open space recreational and natural preservation opportunities the Atterbury corridor presents.

Figure 11 details the other barrier identified in this area. The terminus of the Alamo Wash Greenway would occur just short of connecting with both the Kinneson Wash Greenway and the Barraza-Aviation / Golf Links Greenway. Although this does not present a major problem to users of these greenways, providing a 3500 linear foot connection between the Barraza, Alamo and Kinneson alond Escalante Rd. would greatly improve the accessibility and variety of the greenway trails. It would also help to alleviate the barrier presented by the Air Force Base by providing loop trail opportunities.

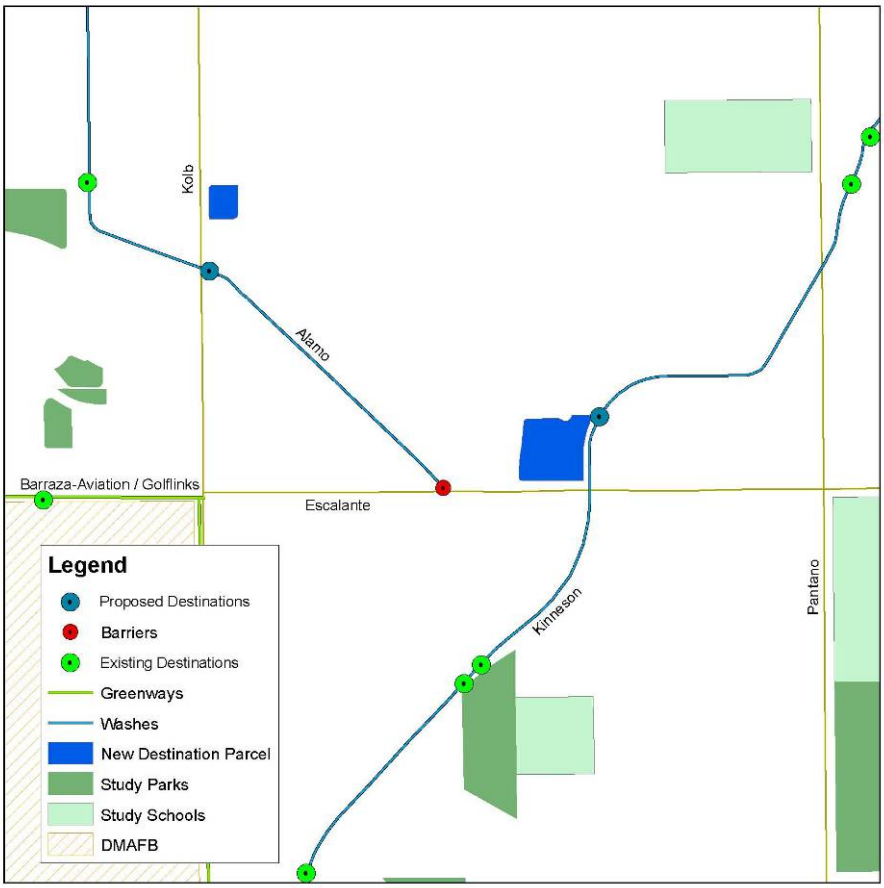


Figure 11. Alamo Greenway terminus

Proposed Destinations

The South Zone had the smallest number of proposed destinations – in part because of the percentage of the area that is occupied by the Air Force base. Half of the destinations were able to be located on publicly owned property. The other two were able to be sited on property that is privately owned, but not developed. Since these properties are still in the planning stages, it is much easier for the City and County to work with the owners on incorporating trail amenities into their future development. Table 12 details each proposed destination.

.

Table 12: Summary of South Zone proposed destinations

Map #	Development Ranking	Acres	Parcel Information	Associated Greenway
20	4	4.22	136-23-007K	Alamo
21	2	1.59	136-21-007A	Alamo
23	4	6.64	136-21-5190	Kinneson
22	1	1.13	136-01-008C	Atterbury

DESIGN RECOMMENDATIONS

Introduction

The general goal for the design section is to present recommendations for both developing proposed destinations and for integrating existing destinations into the trail system of Tucson. In order to present recommendations to a variety of common issues among the proposed destinations, three sites were selected to receive a design treatment. These three sites were selected to be representative of the conditions found on the other proposed sites. Suggestions for how to integrate these techniques and elements into the existing destinations were included in the discussion.

Site Selection

The three sites selected represent a variety of conditions that are common to the proposed destinations, including land ownership, site size and location in relation to the physical wash alignment (Table 13). The conditions represented at these sites are representative of the range of proposed destinations.

Table 13: Summary of sites selected for design recommendations

Proposed Destination #	Watercourse	Relationship to Watercourse	Size	Land Ownership
7	Columbus	Within floodway – no parking opportunities	.05 ac	City of Tucson – Undeveloped
10	Alamo	Adjacent to watercourse –parking opportunities	.25 ac	Private/Retail – Developed
21	Alamo	Disconnected from watercourse – possible parking opportunities	1.59 ac	City of Tucson - Undeveloped

Destination 7 Recommendations

This site is a triangle-shaped parcel along a sharp curve on Columbus Wash (figure 12) which is owned by the City of Tucson. At this point, the wash is in a concrete channel with 8' high, steep walled banks, and there is no immediate access to the site from the wash except by a simple metal ladder (figure 13).

There are many opportunities to develop areas like destination 7, small slices of vacant land along the banks of the watercourses. Additional native plantings, benches, public art and shade structures would be sufficient to create a sense of place without disturbing the function of the land as a flood buffer. Destinations such as site 7 need not be large or elaborate to provide a sense of arrival for pedestrian users along a local scale trail such as these.

Figure 12. Proposed destination 7 location.

Figure 13. Looking downstream from destination 7.

In order to make the space more accessible to pedestrian users, the narrow corridor between the edge of the bank could be cleared of excess vegetation, and the trees could be trimmed overhead to allow pedestrians to pass through the 6-7ft strip of public property. A small pedestrian bridge from the access point at the top of Sycamore Blvd would further increase the accessibility of the proposed destination to residents of the neighborhood to the west of the wash. The previous study by Jones (2005) recommended the use of the cement wash banks for public art to increase the appeal of the corridor. More public art, designed to project overhead from the proposed site, would add an element of curiosity to draw people into the otherwise difficult-to-see destination space above the wash channel (figure 14).

Figure 14. Re-designed view looking downstream from destination 7.

Figure 15. Proposed destination 7 from site.

The small space on the banks could be designed as a peaceful resting place along the trail. The existing natural vegetation (figure 15), combined with additional middle-story plants, would attract wildlife to the space, and bird and lizard viewing could become a welcome activity for users (figure 16). The area is close to two mobile-home parks, and these properties have direct views of the parcel. These "eyes" would make this parcel less attractive to vagrants and criminals, making it a better candidate for the installation of seating and public art installations than sites which may be less observable. Working further with the landholders along this portion of the wash could also widen the corridor on the eastern bank and create an even larger amenity for the residents and the neighborhood as a whole.

Figure 16. Re-designed view of proposed destination 7.

Destination 10 Recommendations

Destination 10 is located in the far parking lot of a large strip-style retail center (figure 17). This location offers excellent visibility for a trail head – being directly adjacent to a major arterial road – as well as potential for staging opportunities. The retail center itself could become a destination for near-by residents wishing to walk to the shops and restaurants here. The parking lot was originally designed for a major grocery retailer, but the anchor store has since changed to a department store, and the parking needs have diminished. Utilizing a small corner of the lot for a trail head and a few trail parking spaces would have little negative impact upon the businesses, and may serve to draw people into their shopping area.

Other privately owned parcels recommended for development as destinations could be treated in a similar way, using portions of the watercourse right-of-way and under-used parking areas to create welcoming spaces that potentially enhance the owner's ability to use their property.

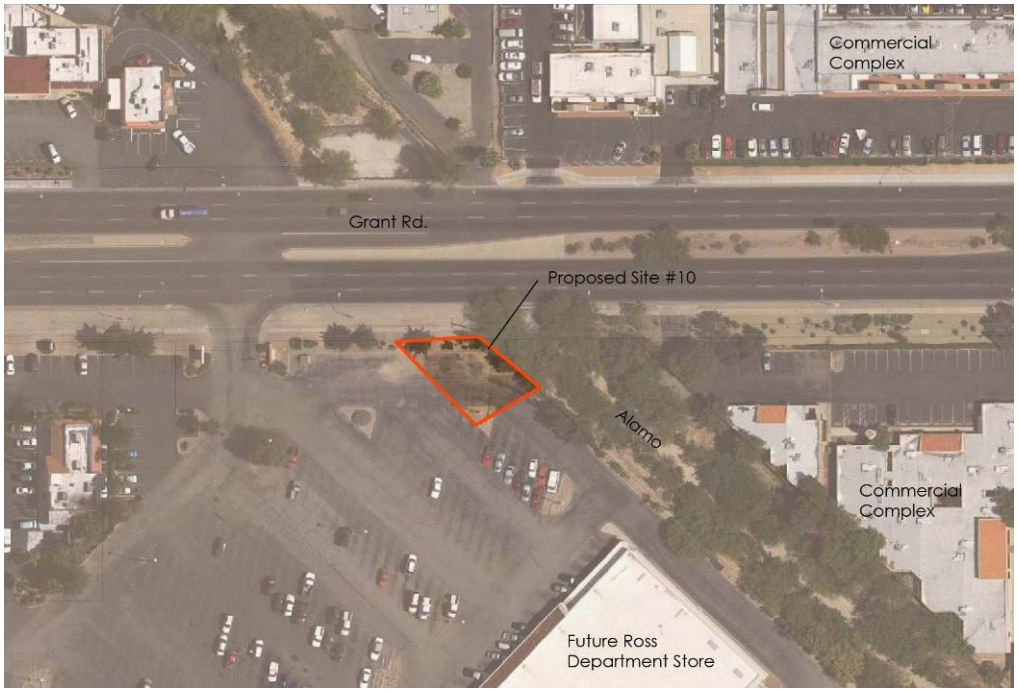


Figure 17. Proposed destination 10 location.

Figure 18. Proposed destination 10 from site.

Currently, this corner of the parking area receives a good amount of illegal dumping and transient activity (figure 18). This is an ideal location for a trail kiosk, with maps and other information about the Alamo Wash Greenway, as well as other greenways and destinations in the area (figure 19). Local users accessing the trail from the neighborhoods could use the kiosk as a destination point or a meeting area and users from further away could use the site to park their cars, meet friends and begin their trip.

Replacing some of the older, non-native vegetation which has been in poor repair for years with fresh native plantings would not only increase the visual appeal of the site, but could also further encourage wildlife to use the corridor.

Figure 19. Re-design of proposed Destination 10.

Figure 20. Possible path alignment at Destination 10.

The banks of the Alamo Wash are wide enough along this section to allow a small pathway along both edges of the wash (fig 20). Barriers similar to those used in the larger river parks could provide additional safety from the edge of the steep wash banks. Additionally, simple signage could help pedestrians with wayfinding when the precise path location may be unclear. Paths here are designed to be a natural surface which helps to reduce the impact of the trail upon the natural character of the wash, as well as serving as a traffic slowing device, discouraging faster users from the otherwise level and easy to use trail (figure 21).

Figure 21. Re-designed view of pathway at Destination 10.

Destination 21 Recommendations

This site is a capped Tucson Water well site owned by the City of Tucson. Aside from the fences around the well site and equipment storage, the site is undeveloped. It is in the heart of a suburban residential development and fronts a major artery – Kolb Rd (figure. 22). The site is not directly adjacent to its associated greenway, being removed by 400ft from the northern bank of the Alamo. Although the site may be inappropriate for purely recreational development due to its size and proximity to major roads, it is an excellent opportunity to develop a pedestrian-friendly retail space with a staging area for the greenway system. Other larger destinations located on major roads could be treated this way, especially those not adjacent to the watercourse. The draw of a cup of coffee or dining on a patio could encourage greenway users to travel the extra distance off the trail system to reach these worthwhile destinations.

Figure 22. Proposed Destination 21 Location.

Figure 23. Proposed Destination 21 from Kolb Road.

Currently, the site serves as storage for city equipment and a driveway for numerous residences that access the rear of their properties from the alleys on the east and southern boundaries of the site. However, this under-used parcel is a bit of an eye-sore for the neighborhood, as well as being one of the few pieces of open space in the immediate area (figure 23). Activating the space for both greenway users and residents by creating a pedestrian-friendly shopping or dining experience would benefit a larger portion of the community, as well as encouraging greenway use. Using the parking associated with the retail as optional greenway parking further encourages this kind of use. A trail kiosk and other signage here would help to connect the remote site to the greenway trail (figure 24).

Figure 24. Re-designed view of Destination 21.

Figure 25. Path from Destination 21 to Alamo Wash Greenway.

Key to connecting these remote destinations, both proposed and existing, is to create a trail language that orients users; from the greenway trail system to a safe path to the destination. The path between Destination 21 and the Alamo Wash Greenway is already furnished with a sidewalk, which crosses one residential street and a number of driveways before reaching the wash (figure 25). Using signals in the paving such as a change in texture or pattern, small signs along the path and a vegetation palette consistent with the trail corridor composition will aid users about system orientation and, and provide a visual connectivity between the destination and its associated greenway (figure 26). Echoing these signals at both the destinations and at various points along the greenway trail will provide continuity to the system as a whole.

Figure 26. Re-designed connection path.

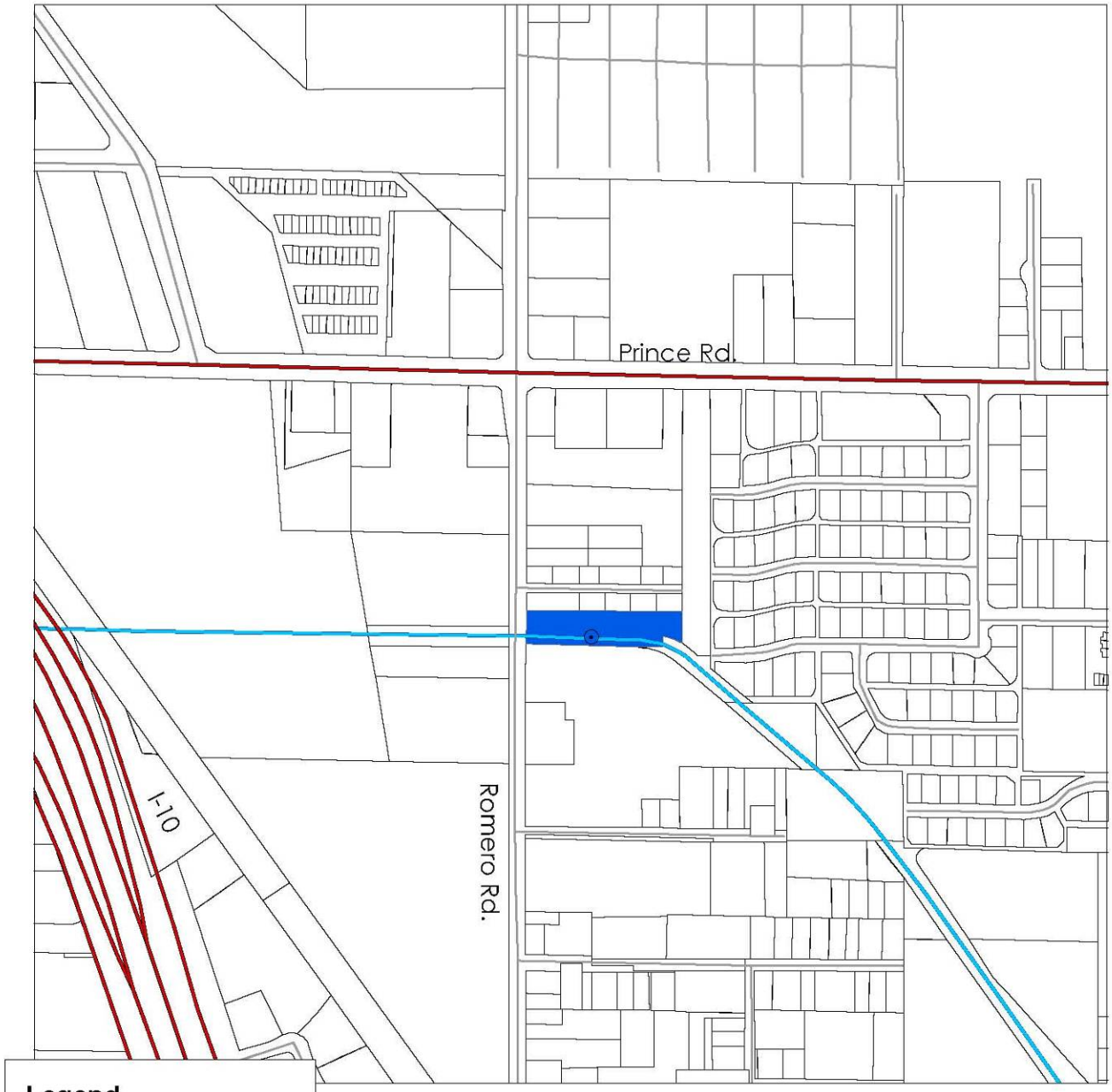
CONCLUSIONS AND RECOMMENDATIONS

Creation of appropriate destinations on urban greenway systems should take into account the condition of the systems, the demographic characteristics of the land uses surrounding each destination and the presence (or absence) of other recreational opportunities in the area. It is surprising, however, in my research on trail destinations and greenway planning how little attention destinations receive in the planning of many urban greenways. The emphasis is placed, often by necessity, upon obtaining and securing the corridor, then installing a usable path and appropriate safety features. However, planning for meaningful spaces along a trail that give users a sense of arrival is critical to the success of a greenway system. As several existing segments of urban paths in Tucson illustrate, the existence of the corridor on its own may not be enough – users have indicated a need to be "going somewhere", even if their destination is not a separate activity node (Lusk 2002). It is important enough to reserve a small portion of the effort in trail creation, even when that effort is constricted by financial, logistic and man-hour limitations.

Finally, the "Recreation Hole" presented in the Results section is an item of concern that is already in the mind of both city and regional recreation planners. Tucson has a great diversity in population. A thorough examination of the open space resources already available in this urban core, such as utility corridors and vacant parcels, could identify of opportunities to create additional recreation spaces on a small scale.

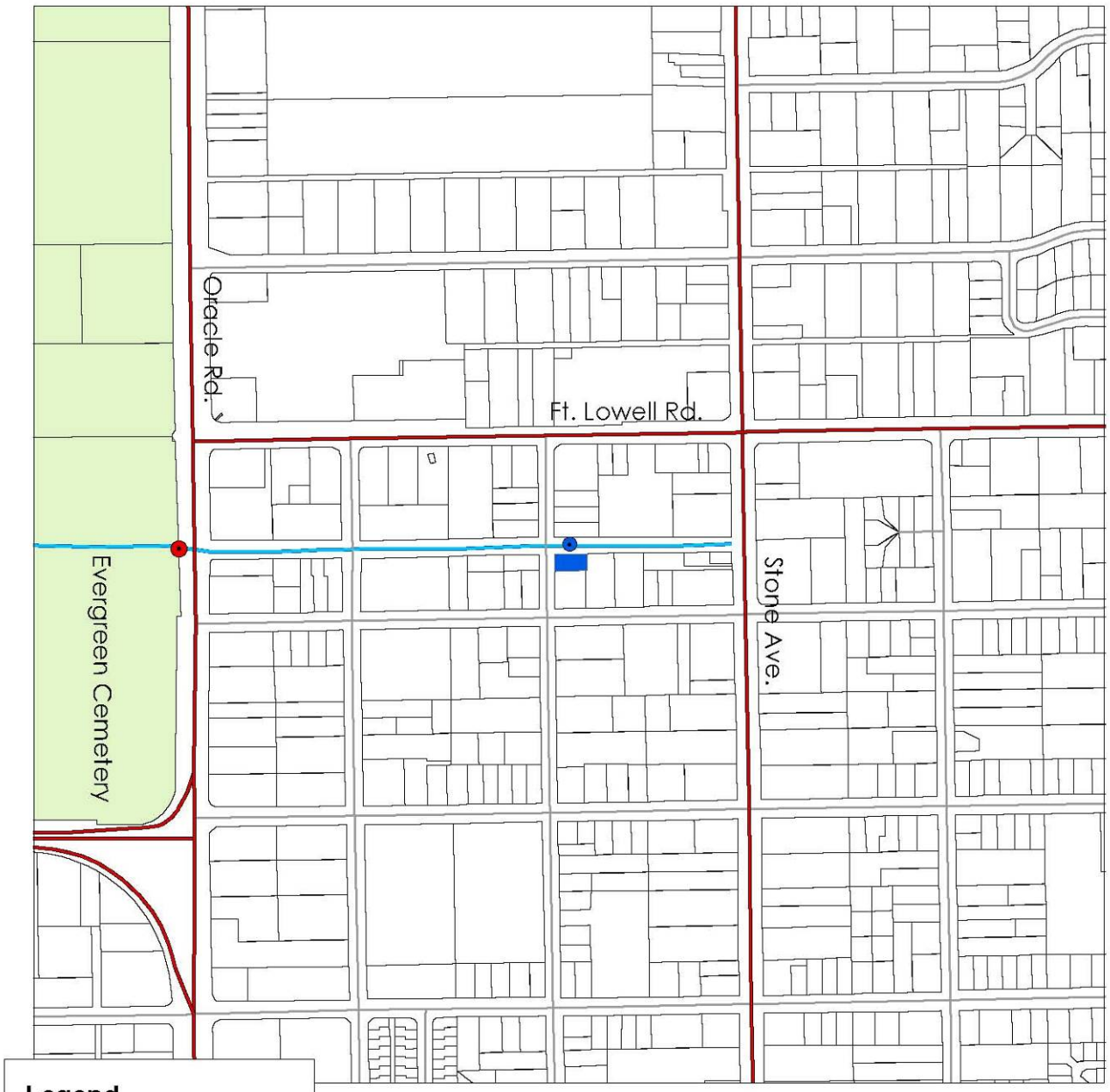
APPENDIX – PROPOSED DESTINATION LOCATION MAPS

Proposed Destination 1



Watercourse: Flowing Wells
Size: 1.39ac
Parcel: 106-12-0300, 106-12-0290
Land Ownership: City of Tucson - Undeveloped

Proposed Destination 2

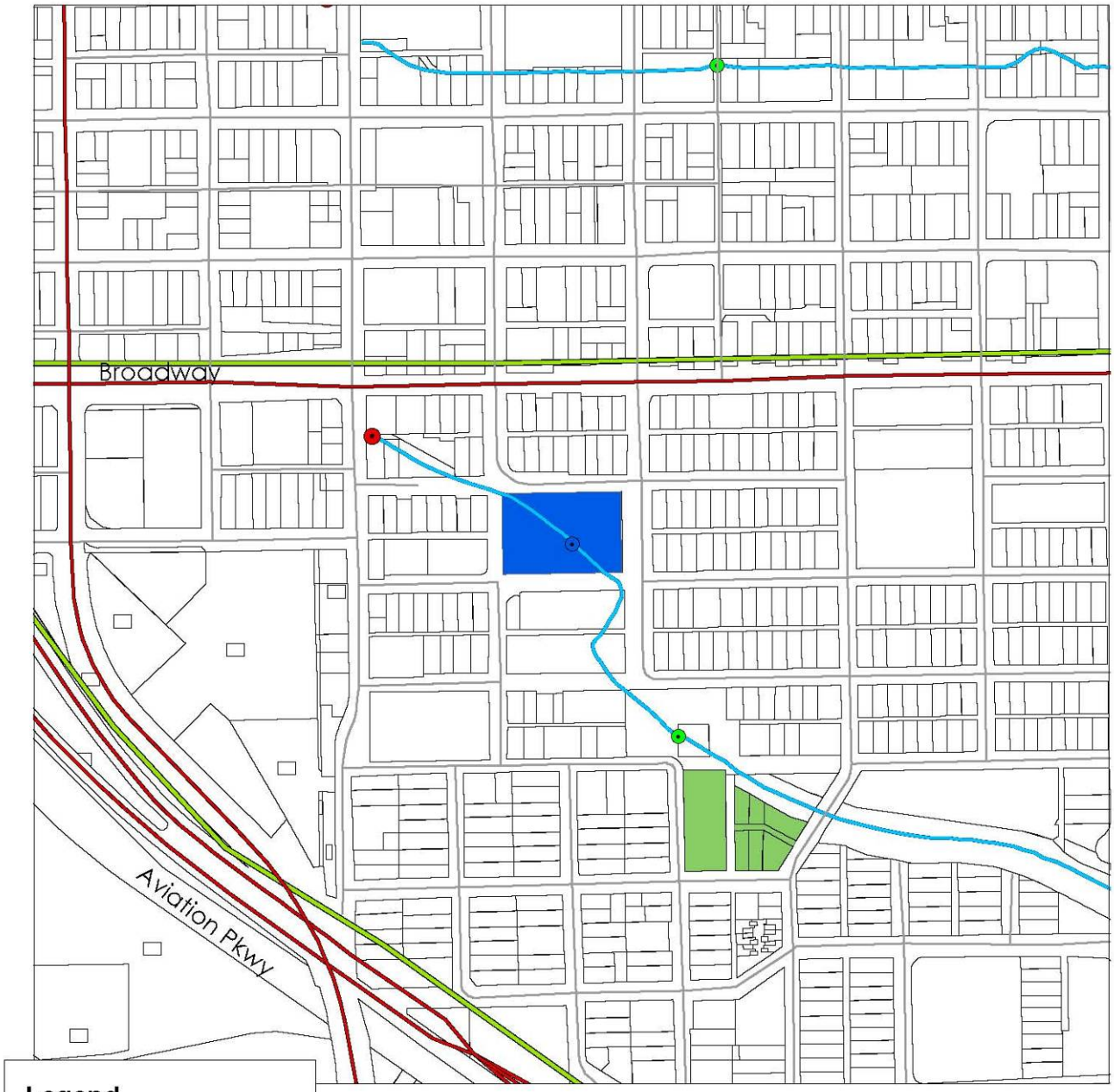


Watercourse: Cemetery
Size: .14 ac
Parcel: 107-11-1120
Land Ownership: City of Tucson - Well Site

Proposed Destination 3 and 4

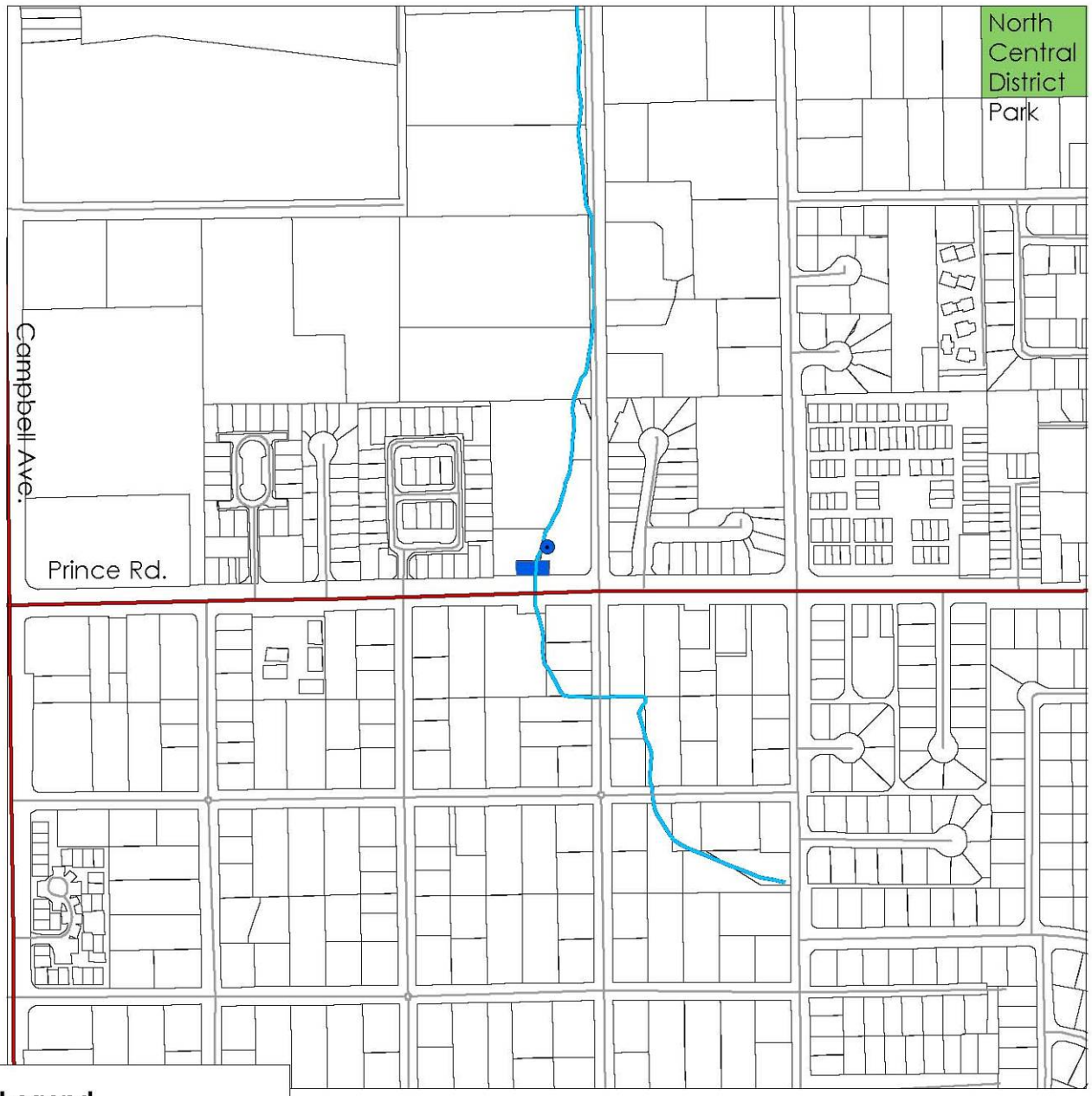
Watercourse: Highschool
Size: .14ac (#3), 13ac (#4)
Parcel: 125-07-5390 (#3), 125-07-3350 (#4)
Land Ownership: UofA - Parking Area (#3), City of Tucson - Undeveloped (#4)

Proposed Destination 5



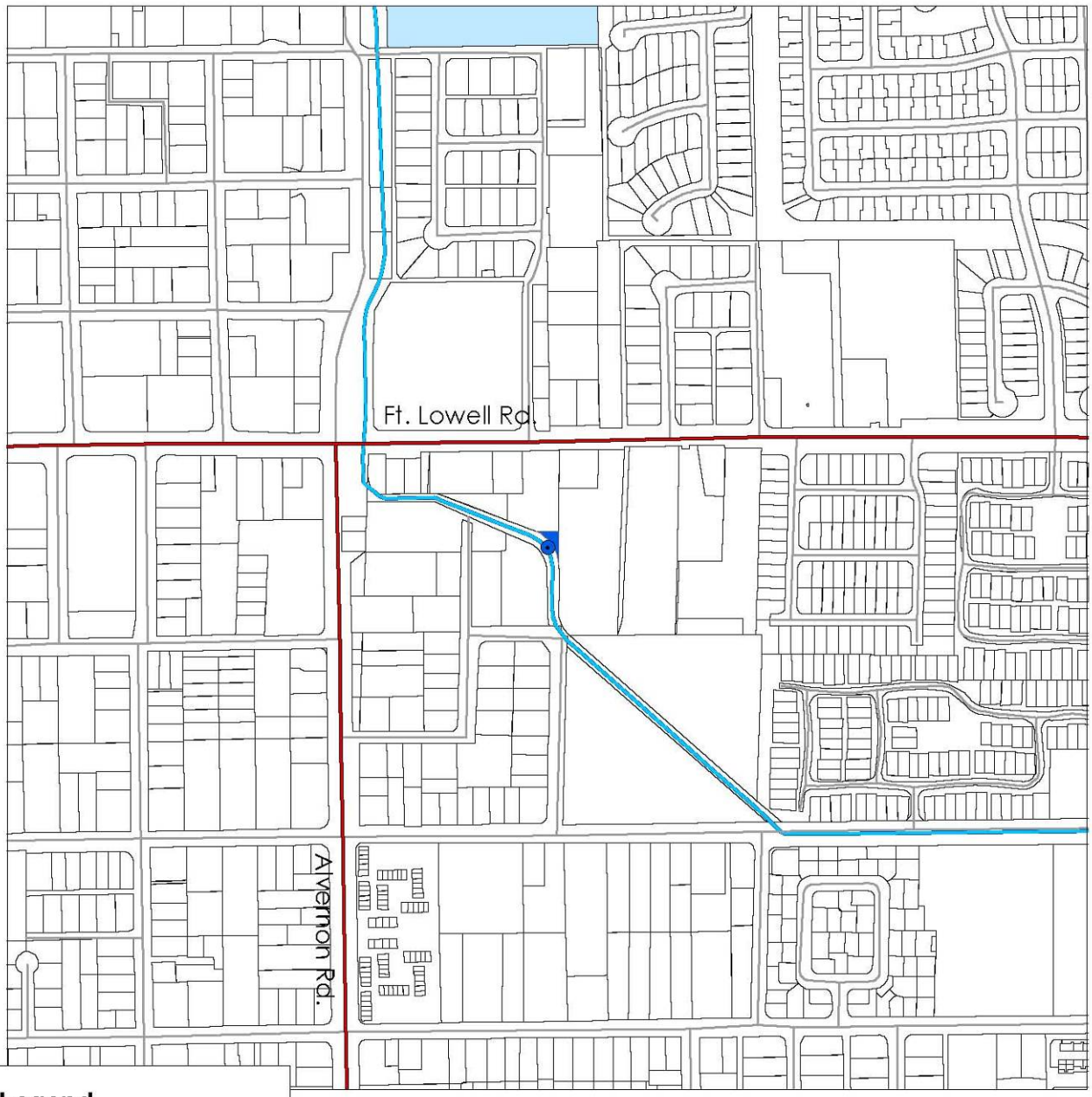
Watercourse: Arroyo Chico
Size: 2.5ac
Parcel: 124-12-1150
Land Ownership: City of Tucson - Undeveloped

Proposed Destination 6



Watercourse: Christmas
Size: .12ac
Parcel: Within Prince Rd. Right-of-Way
Land Ownership: City of Tucson - Undeveloped

Proposed Destination 7



Legend

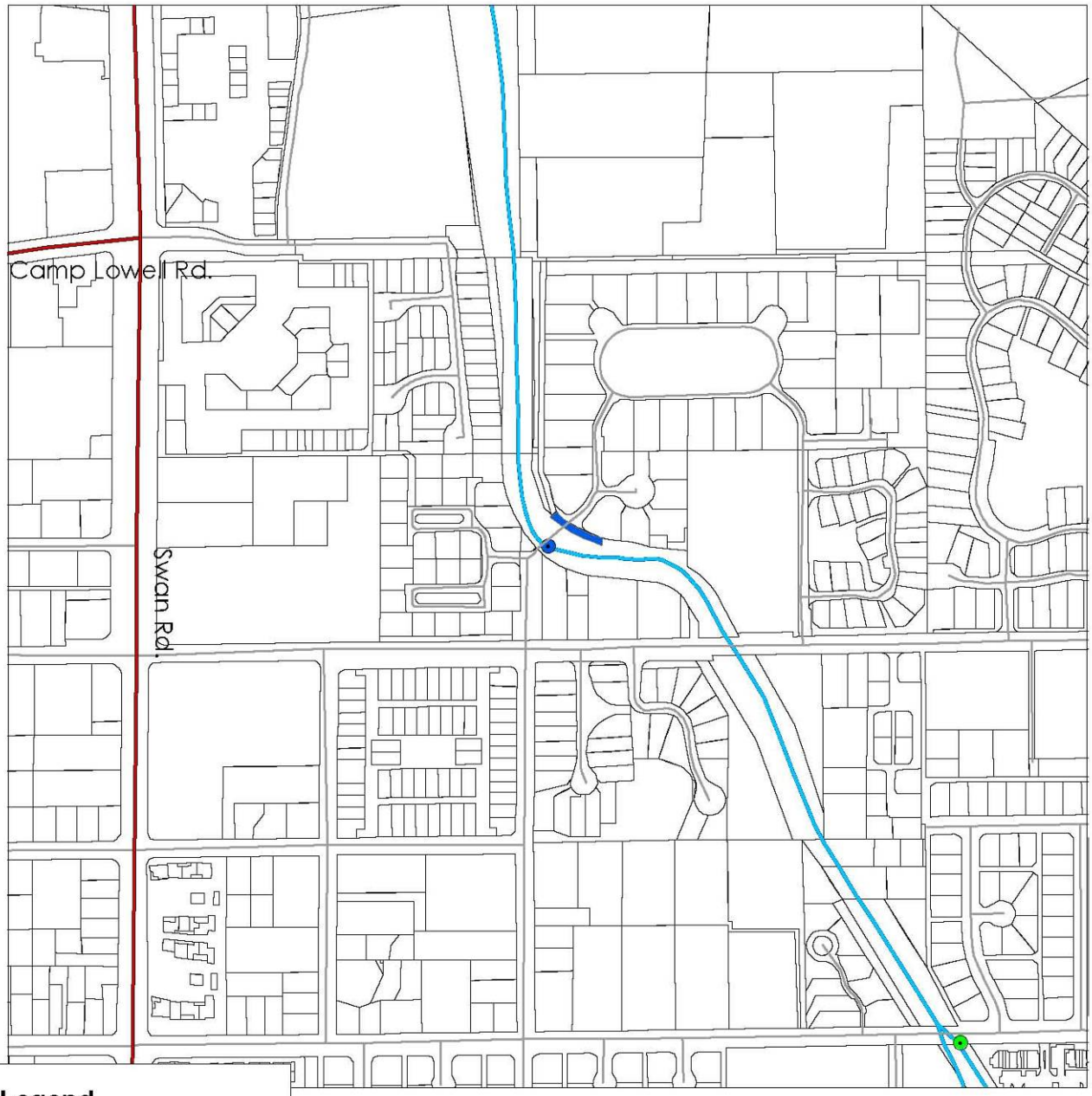
- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

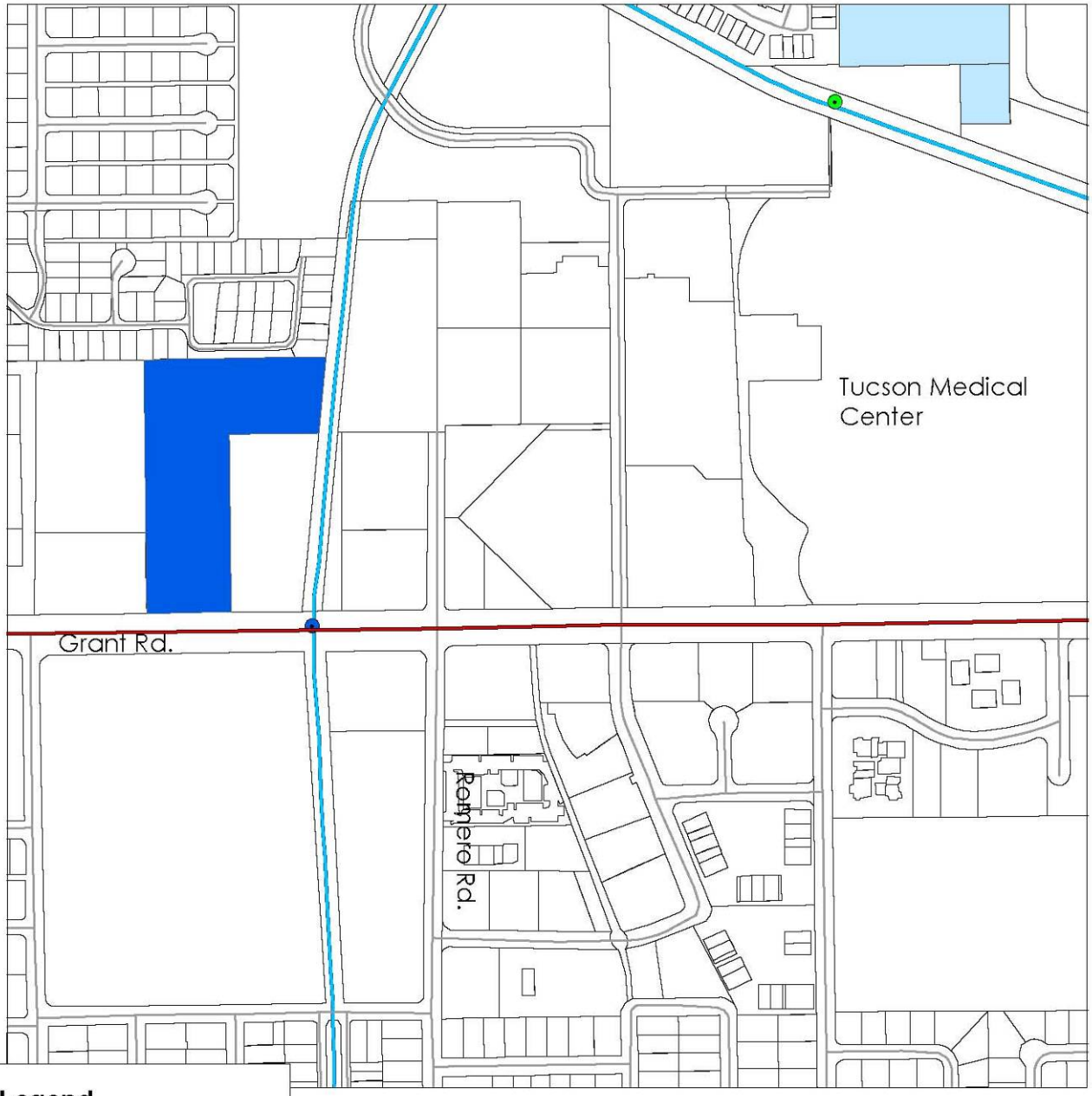
Watercourse: Columbus
Size: .05ac
Parcel: 110-06-114d
Land Ownership: City of Tucson - Undeveloped

Proposed Destination 8



Watercourse: Alamo
Size: .10ac
Parcel: Within Floodway
Land Ownership: Pima County - Undeveloped

Proposed Destination 9



Legend

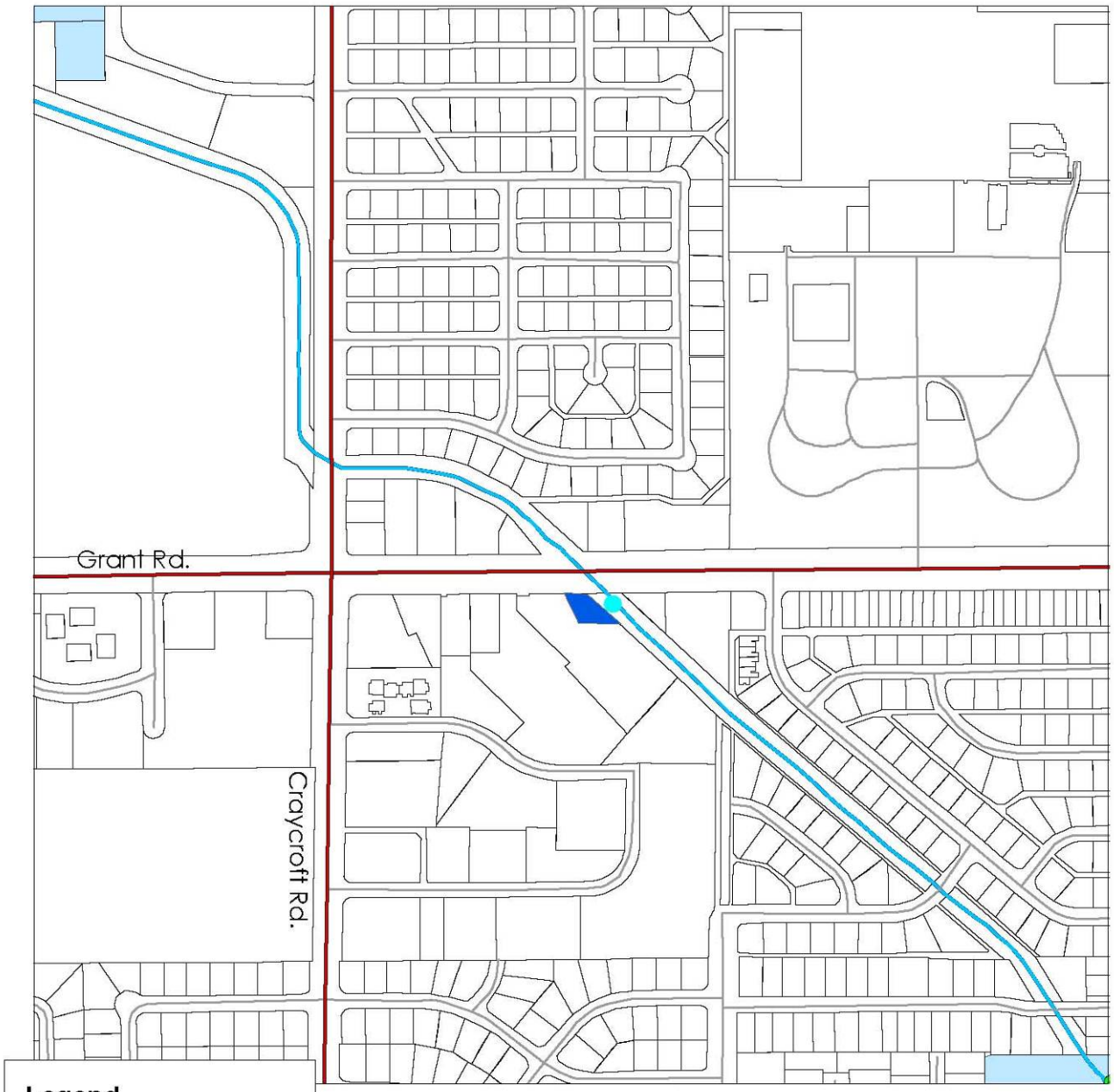
- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

Watercourse: Arcadia
Size: 7.38ac
Parcel: 110-11-1179c
Land Ownership: Private - Undeveloped

Proposed Destination 10



Legend

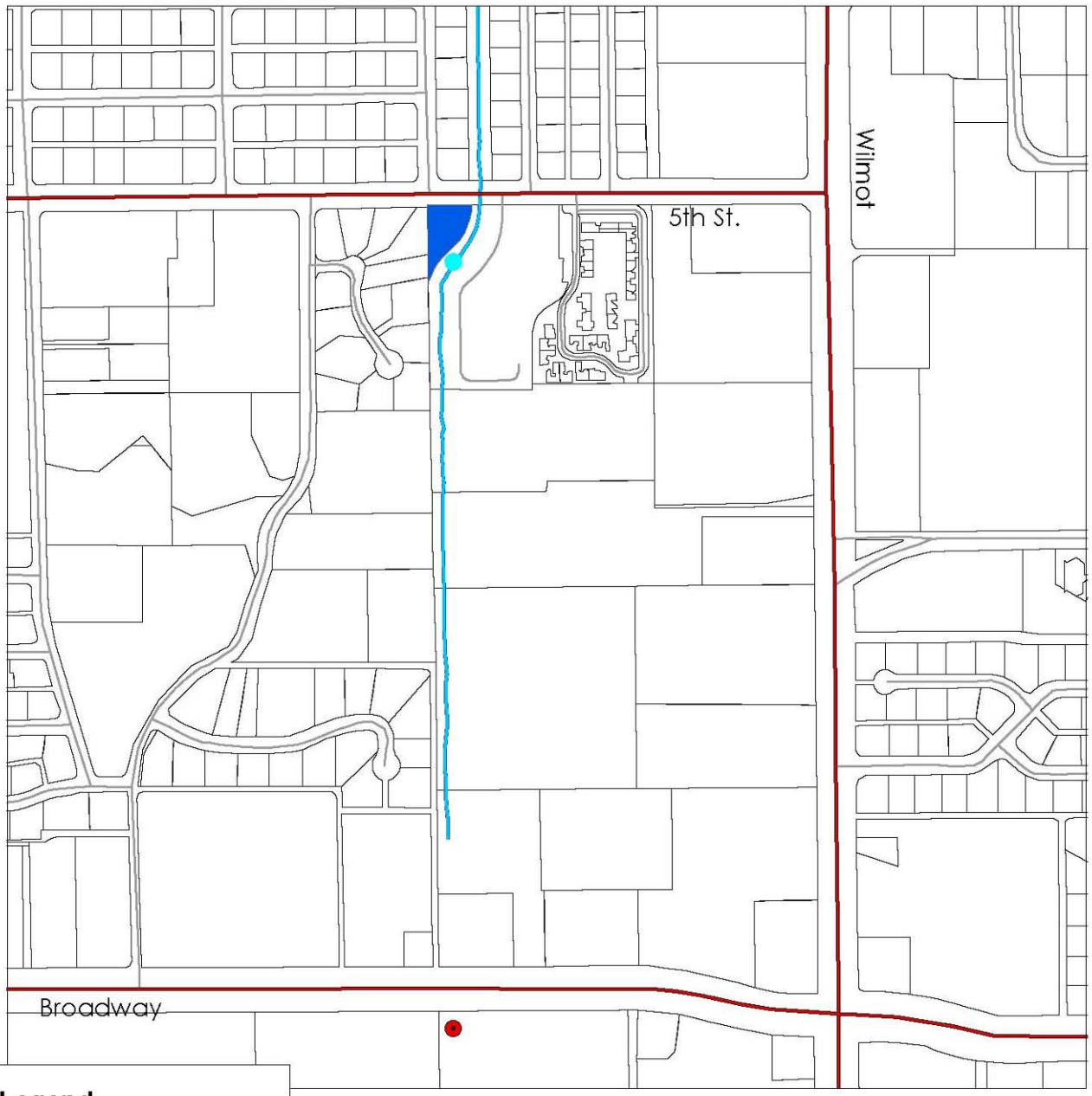
- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

Watercourse: Alamo
Size: .25ac
Parcel: 121-05-021A - NE Corner
Land Ownership: Private/Retail - Parking Lot

Proposed Destination 11



Legend

- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

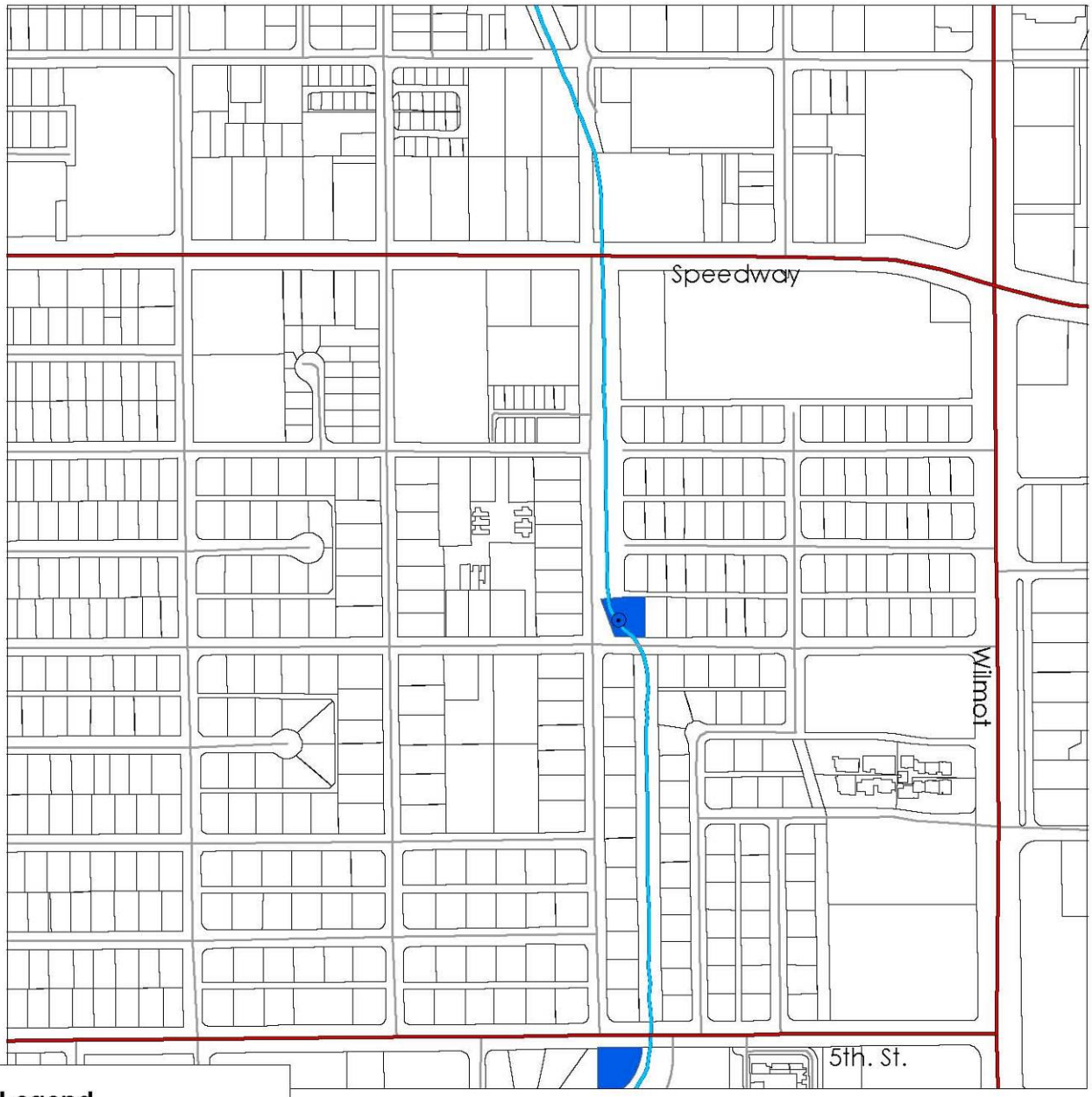
N

Watercourse: Alamo
Size: .52ac
Parcel: 127-14-001A
Land Ownership: City of Tucson - Well Site

Proposed Destination 12

Watercourse: Alamo
Size: .20ac
Parcel: 121-07-0610
Land Ownership: City of Tucson - Undeveloped Flood Plain

Proposed Destination 13



Legend

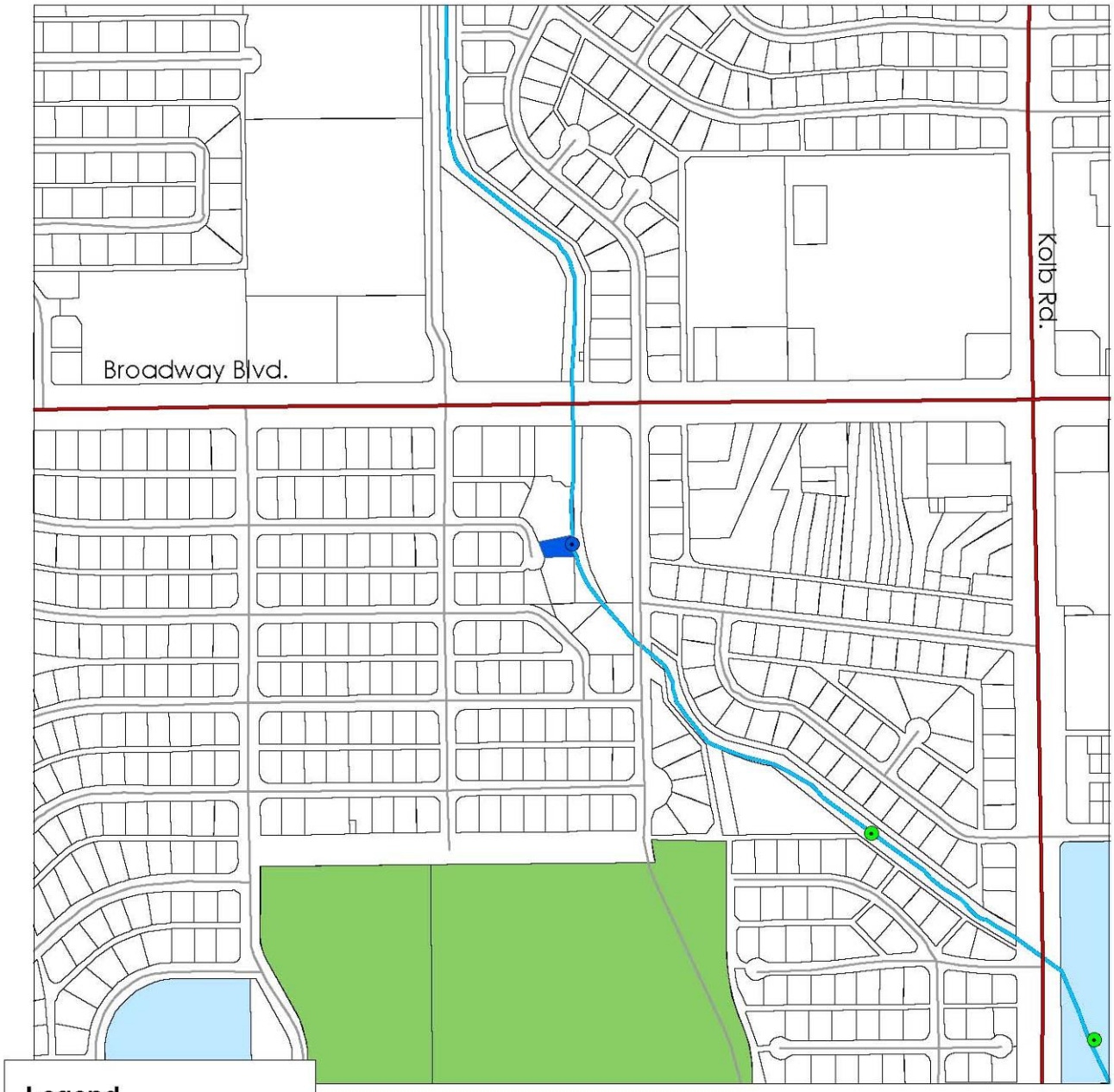
- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

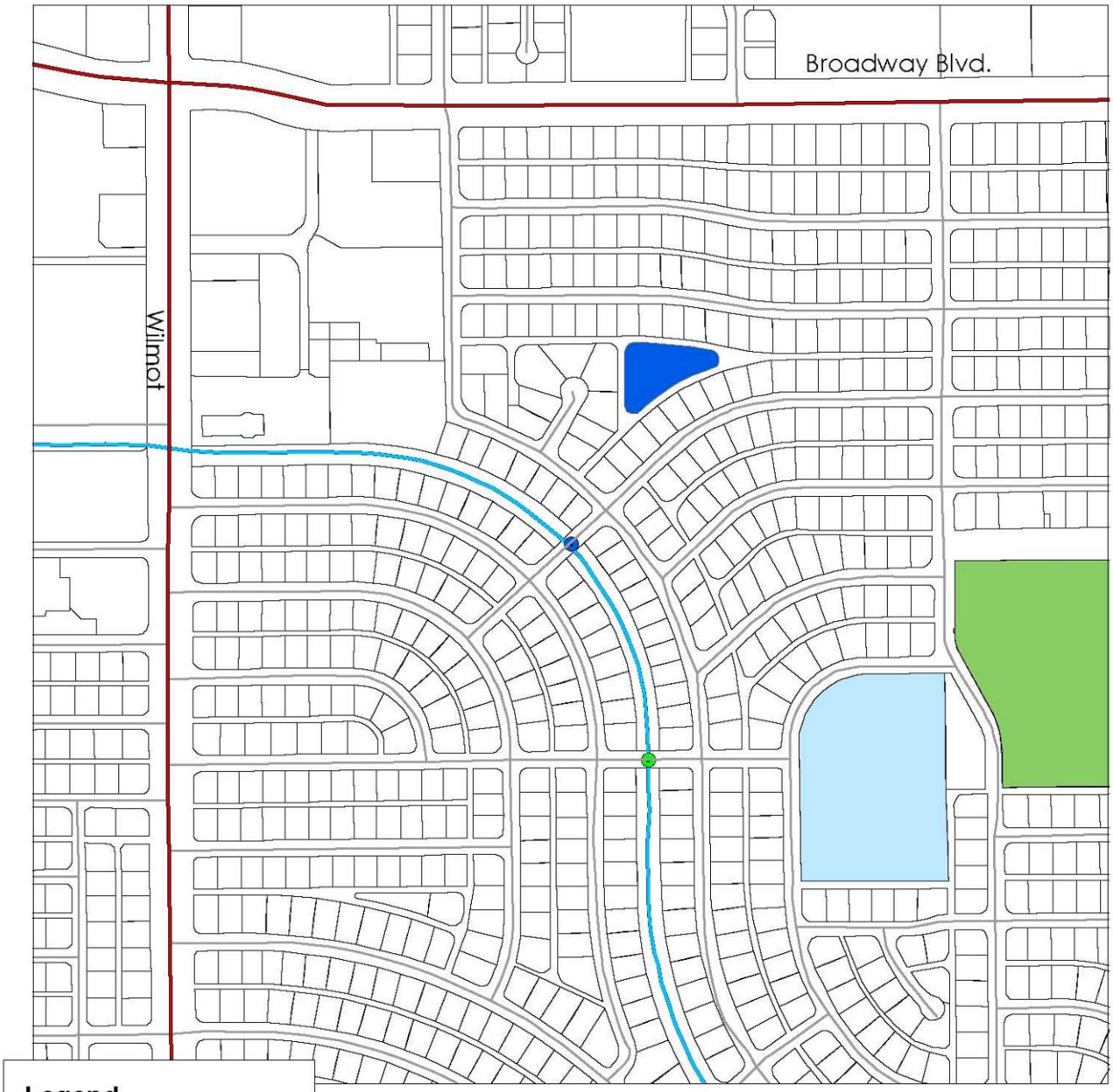
Watercourse: Alamo
Size: .38ac
Parcel: 127-10-159A
Land Ownership: City of Tucson - Well Site

Proposed Destination 14



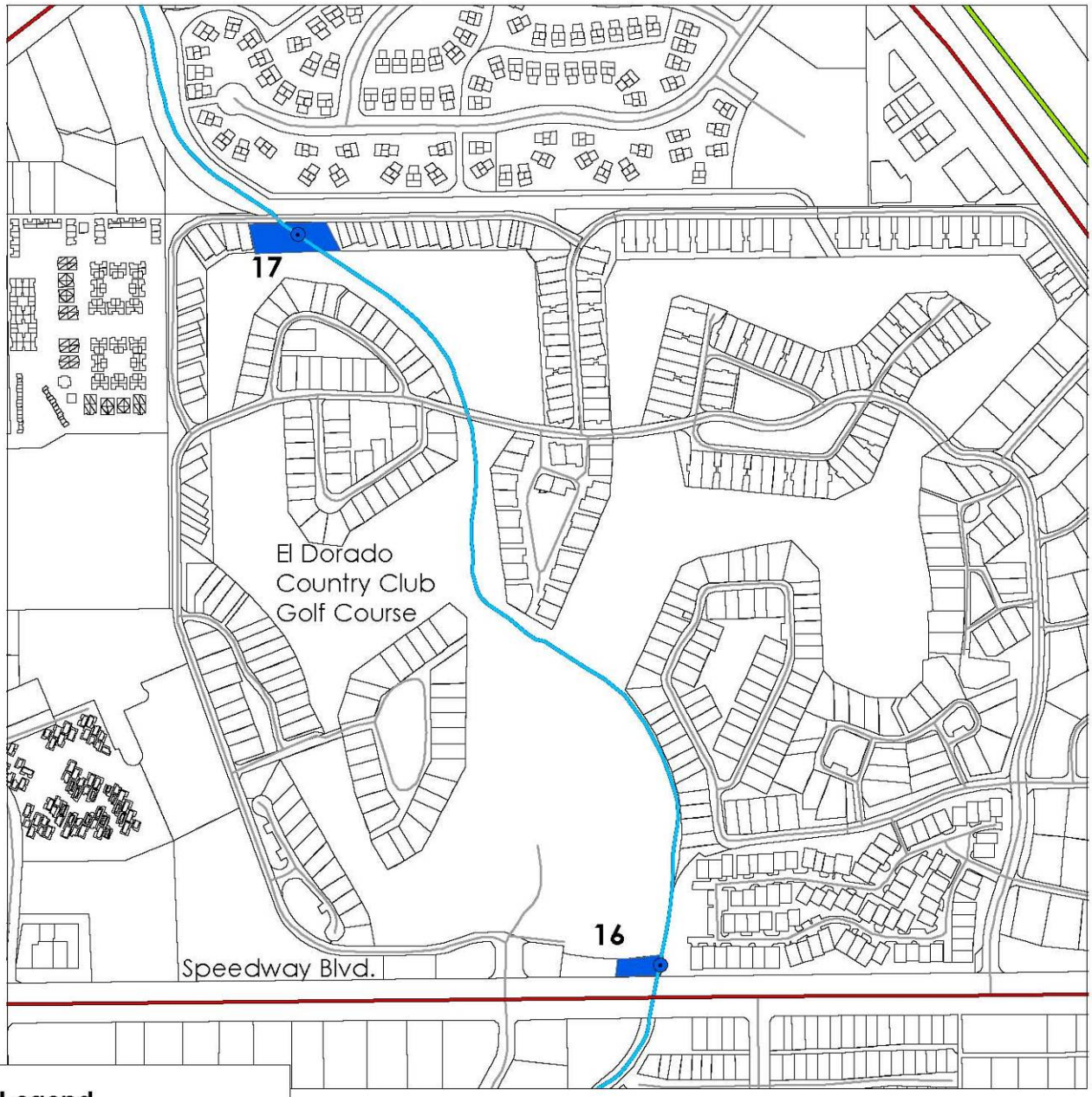
Watercourse: Rose Hill
Size: .15ac
Parcel: Portion of 134-22-123D
Land Ownership: Private - Parking Area

Proposed Destination 15



Watercourse: Alamo
Size: 1.06ac
Parcel: 134-23-136A
Land Ownership: City of Tucson - Well Site

Proposed Destination 16-17



Legend

- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

Watercourse: Rosehill
Size: .21ac (#16) .62 (#17)
Parcel: 133-14-235C (#16), 133-14-1610 & 133-14-3850 plus floodway (#17)
Land Ownership: El Dorado Country Club - Open Space

Proposed Destination 18-19

Legend

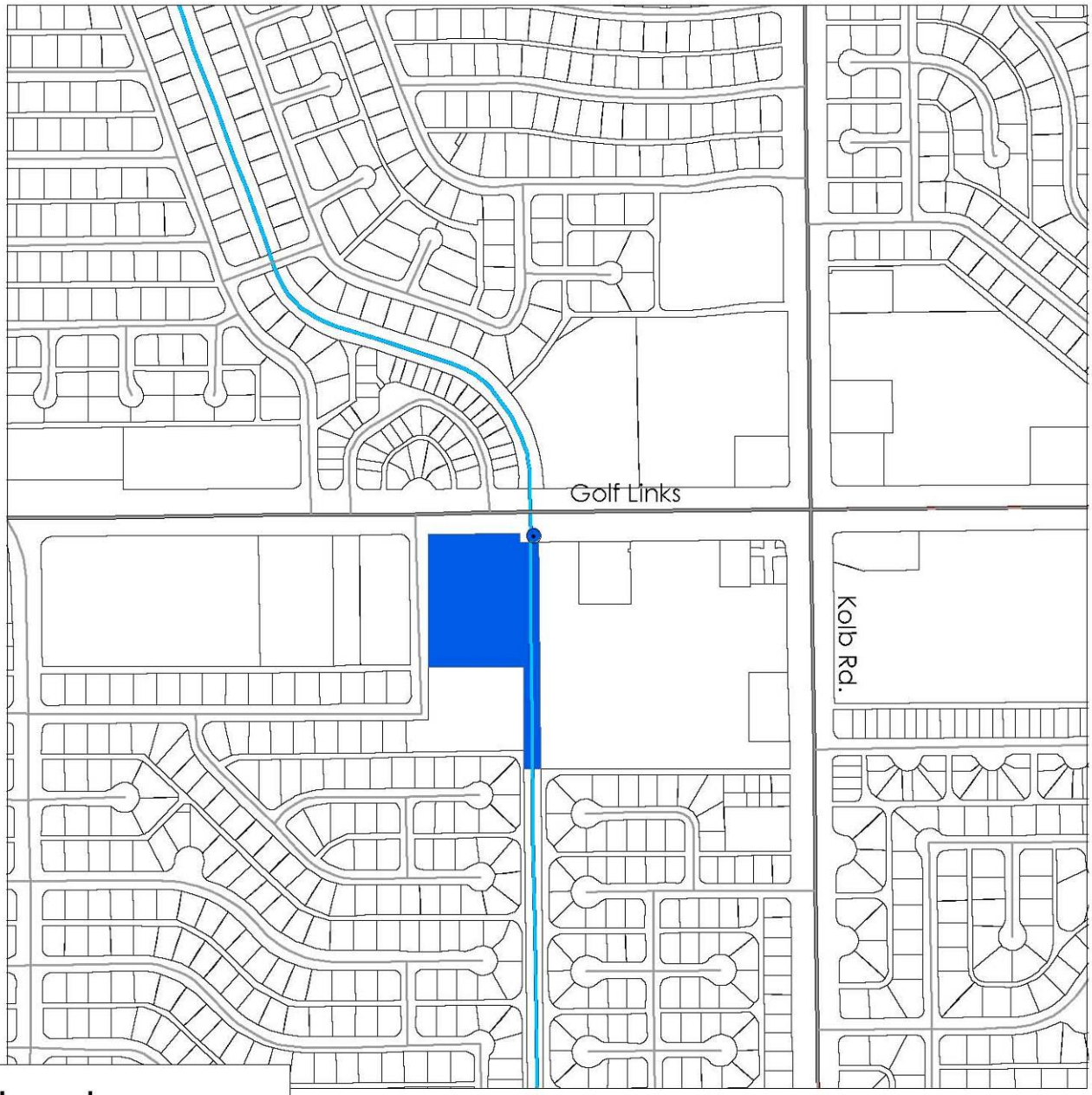
- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

Watercourse: Rosehill`
Size: .09ac (#18), .21ac (#19)
Parcel: 133-14-027R (#18), 11-16-223A (#19)
Land Ownership: Private, undeveloped (#18), Private, undeveloped (#19)

Proposed Destination 20



Legend

- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

1 inch equals 500 feet

N

Watercourse: Alamo
Size: 4.21ac
Parcel: 136-23-007K
Land Ownership: Private, Undeveloped

Proposed Destination 21

Watercourse: Alamo
Size: 1.59ac
Parcel: 136-21-007A
Land Ownership: City of Tucson - Undeveloped

Proposed Destination 22

1 inch equals 500 feet

N

Legend

- Washes
- Greenways
- Existing Destinations
- New Destination
- Barriers
- New Destination Parcel
- Study School
- Study Park

Watercourse: Atterbury
Size: 1.12ac
Parcel: 136-01-008C
Land Ownership: Pima County Flood Control

Proposed Destination 23

Watercourse: Kinneson
Size: .6.63ac
Parcel: 136-21-5190
Land Ownership: Private - Undeveloped

REFERENCES

American Forests. *American forests - urban forests.*Internet on-line. Available from <http://www.americanforests.org/resources/urbanforests/>. [November 21, 2006].

Arizona State Parks. Arizona trails 2000.

Arizona State Parks. Arizona trails 2005.

City of Tucson. 2001. *General Plan.* Tucson, AZ: City of Tucson.

Congress for New Urbanism. *CNU: Congress for the new urbanism.* 2006. Internet on-line. Available from <http://www.cnu.org/>. [10/26, 2006].

Crompton, John L. 2001. The Impact of Parks on Property Values: A Review of the Empirical Evidence. *Journal of Leisure Research* 33, no. 1: 1.

Dames & Moore. 1989. *Eastern Pima County Trail System Master Plan.* Tucson, AZ: Pima County Parks and Recreation Department.

Fabos, Julius G. 1995. Introduction and overview: the greenway movement uses and potentials of greenways. *Landscape and Urban Planning* 33: 1-1-13.

Flink, Charles A., Kristine Olka, Robert M. Searns, and Rails-to-Trails Conservancy. 2001. *Trails for the twenty-first century : Planning, design, and management manual for multi-use trails.* Washington, DC ; London: Island Press.

Furuseth, Owen J., Roger E. Altman. 1991. Who's on the Greenway: Socioeconomic, Demographic and Locational characteristics of Greenway Users. *Engivonmental Management* Vol. 15, no. No. 3: 329-329-336.

Gobster, Paul H. 1995. Perception and use of a metropolitan greenway system for recreation. *Landscape and Urban Planning* 33: 401-401-413.

Harvey, David. 1997. The New Urbanism and the Communitarian Trap. *Harvard Design Magazine* 1 (Winter/Spring) : 1-3.

Kaplan, Rachel, Stephen Kaplan, and Robert L. Ryan. 1998. *With people in mind : Design and management of everyday nature.* Washington, D.C.: Island Press.

Krizek, Kevin J. 1., Pamela J. 2. Johnson. 2006. Proximity to Trails and Retail: Effects on Urban Cycling and Walking. *Journal of the American Planning Association* 72, no. 1 (Winter) : 33-42.

Lee, Jin-Hyung, David Scott, and Roger L. Moore. Fall 2002. Predicting Motivations and Attributes of Users of a Multi-use Suburban Trail. *Journal of Park and Recreation Administration* 20, no. 3 (Fall 2002) : 18-18-37.

Leyden, Kevin M. 2003. Social Capital and the Built Environment: The Importance of Walkable Neighborhoods. *American Journal of Public Health* 93, no. 9 (September) : 1546-1551.

Lindsey, Greg. 1999. Use of urban greenways: insights from Indianapolis. *landscape and Urban Planning* 45: 145-145-157.

Little, Charles E. 1990. *Greenways for america.* Baltimore: Johns Hopkins University Press.

Lusk, Anne C. 2002. Guidelines for greenways: Determining the distance to, features of and human needs met by destinations on multi-use corridors. Ph.D. diss., University of Michigan. Database on-line. Available from UMI, .

McHarg, Ian L. 1994?. *Design with nature.* New York: J. Wiley.

Miller, William, Michael G. Collins, Frederick R. Steiner, and Edward Cook. 1998. An approach for greenway suitability analysis. *Landscape and Urban Planning* 42: 91-91-105.

Nicholls, Sarah. 2004. Measuing the Impact of Parks on Property Values. *Parks & Recreation* , no. March: 24-24-32.

Noonan, Patrick F. 1990. Forward. In *Greenways for america.* Baltimore: The Johns Hopkins University Press.

Pikora, Terri J., Billie Giles-Corti, Matthew W. Knuiman, Fiona C. Bull, Konrad Jamrozik, and Rob J. Donovan. 2006. Neghborhood Environmental Factors Correlated with Walking Near Home: Using SPACES. *Medicine & Science in Sports & Exercise* 38, no. 4 (April) : 708-714.

Pima Association of Governments. 2003. *2003 community information data summary.* Tucson, AZ: Pima Association of Governments.

Pima County Government. *Sonoran desert conservation plan.* 2006. Internet on-line. Available from <http://www.pima.gov/cmo/sdcp/index.html>. [11/20, 2006].

President's Commission on Americans Outdoors (U.S.). 1986. *Report and recommendations to the President of the United States.* Washington, D.C.; President's Commission on Americans Outdoors: For sale by the Supt. of Docs., U.S. G.P.O.

Searns, Robert M. 1995. The evolution of greenways as an adaptive urban landscape form. *Landscape and Urban Planning* 33: 65-65-80.

Southworth, Michael. 2005. Designing the Walkable City. *Journal of Urban Planning and Development* 131, no. 4 (December) : 246-257.

US Department of Health and Human Services, KidsWalk-to-School: Then and Now — Barriers and SolutionsCenter for Disease Control. *KidsWalk-to-school: Then and now — barriers and solutions.* 3-22 2006. Internet on-line. Available from <http://www.cdc.gov/nccdphp/dnpa/kidswalk/then_and_now.htm>. [2-28, 2007].

Whyte, William H. 1968. *The last landscape.* Garden City, N.Y.: Doubleday.

Woolley, John, Gerhard Peters. *The american presidency project; executive order 12503-presidential commission on outdoor recreation resources review january 28th 1985.* 2005. Internet on-line. Available from <http://www.presidency.ucsb.edu/ws/?pid=38977>. [October 9, 2006].