

MAKING CONNECTIONS: A FEASIBILITY STUDY AND VISUALIZATION
OF A SAN MARCOS, TX GREENWAY

HONORS THESIS

Presented to the Honors Committee of
Texas State University-San Marcos
in Partial Fulfillment
of the Requirements

for Graduation in the Honors College

by

Andrew Spurlin

San Marcos, Texas
May 2013

MAKING CONNECTIONS: A FEASIBILITY STUDY AND VISUALIZATION
OF A SAN MARCOS, TX GREENWAY

Thesis Supervisor:

Kevin Romig, Ph.D.
Department of Geography

Approved:

Heather C. Galloway, Ph.D.
Dean, Honors College

Table of Contents

List of Figures	ii
Acknowledgments	iii
Abstract	1
1. Problem Statement	2
2. Criteria Development and Evaluation	6
3. Methods	8
a. Using GIS to Identify Route Options	8
b. Multimedia Journal	11
c. Virtual Tour	12
d. Trail Demand Analysis in GIS	13
e. Web Development	14
4. Conclusions	15
5. References	16

List of Figures

Figure 1: Preferred Scenario (Map)

City of San Marcos Comprehensive Master Plan 2013

Figure 2: Route Options (Map)

Data from the City of San Marcos 2013

Figure 3: Route Option Comparison (Table)

Figure 4: Estimated Trail Demand (Map)

Data from the 2010 U.S. Census and City of San Marcos 2013

Acknowledgments

Big thanks to:

- Diann McCabe for meeting with me in my first semester at Texas State and encouraging me not only to finish an Honor's thesis, but to seek out opportunities elsewhere to grow and attempt improving the world around me.
- Susan Hanson for indirectly motivating me to make sure urban children have the outdoor playground I had as a child.
- People who let me use their stuff: Jordan Johnson, Alex Vanpelt, Melina Cowan, Will Doss, Kameron Fehrmann.
- Aaron Horn and John Borden for dealing with obnoxious computer questions.
- Family. Especially my parents for raising me in Dorchester TX, population: 109.
- Todd Derkacz for a random talk about the Violet Crown Trail.
- My advisor Dr. Romig, without whose guidance my project would have been even less focused.
- Rebecca Davis, for listening to a constant alternation between enthusiasm and pessimism and pushing me towards positivity.
- Barry Silverberg, director of Texas Association of Nonprofit Organizations, for summing up the purpose of my project:

*“...assumption 3: People are **moved** by visions and dreams, not details. Details are only important once we have become engaged with the dream. What the hell will it look like when it's finished?”*

Abstract

This project is an effort to spur the development of a pedestrian, bicycle, and wheelchair-accessible greenway connecting Purgatory Creek Natural Area and the river parks of San Marcos, TX. This project leaves the work of planning to the experts and citizens who should share their knowledge and input on the finer details of how a trail should be constructed and financed. Instead, research was directed towards the simpler task of identifying three potential routes for a multi-use trail based on varying levels of and definitions of suitability. This required the combined use of geographic information systems (GIS), web development, and multimedia to display the trail corridor in multiple scales. The hope is that offering viewers a virtual experience of the proposed trail will inspire the San Marcos community to step up and preserve a safe, inexpensive opportunity for outdoor recreation and alternative transportation in a rapidly-growing Texas community. This paper outlines the motivations, methods, and conclusions gathered during the research process.

Problem Statement:

The year 2008 was the first time in history that more people lived in cities than rural areas worldwide (United Nations, 2012). While generating jobs, income, and other benefits to new urbanites, this migration places greater demand on resources to house, transport, provide medical care for, and generally support urban populations. Across the board, the United States is being challenged to provide adequate infrastructure, encourage active and healthy lifestyles, and mitigate or prevent the degradation of critical natural resources. The most obvious example of this need for dramatic restructuring might be the fact that Americans spent a combined 4.2 billion hours sitting in traffic in 2009 (American Society of Civil Engineers). Each new person moving to or being born in a U.S. city means one more person that needs to get from point A to point B.

Unfortunately, data suggest that infrastructure growth is lacking. The ASCE continues to report that between 1980 and 2005, automobile vehicle miles traveled increased 94% while available lane miles increased only 3.5% (2009). This population growth in urban areas may also have some less obvious consequences.

Despite benefits of city life such as increased opportunities for income and access to social services, urban-dwellers' lives are increasingly divorced from nature, from labor-intensive work, and from time spent outdoors in general. This is one of many factors contributing to a variety of physical and mental health issues. Five chronic diseases associated with obesity account for more than two-thirds of all deaths in the United States (Partnership to Fight Chronic Disease, 2013). Mental health conditions such as A.D.H.D., anxiety, and depression are all on the rise. The good news is that time spent outside and experiencing nature can actually serve as a therapeutic form of

preventative medicine. Time spent outside has been shown to “reduce anxiety and depression, lower the risk of diabetes and heart attack by 50%, reduce symptoms of ADD” and generally improve a person’s health (National Wildlife Federation, 2013).

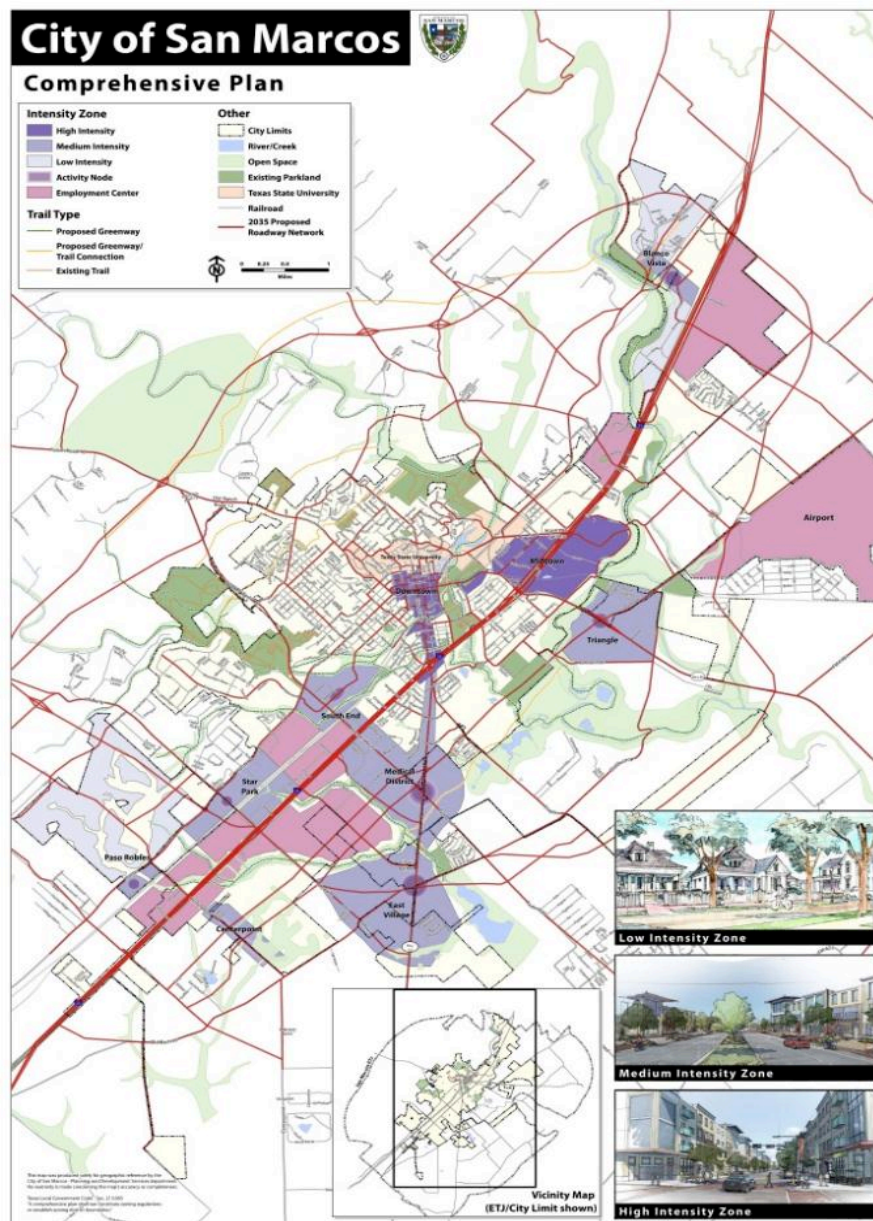
Despite having an extensive system of parks and protected areas throughout the city of San Marcos, few places are in greater need of alternative transportation and opportunities for contact with nature. According to the most recent census estimates, the metropolitan area made up by Austin, Round Rock, and San Marcos are growing faster than any other region in the United States (Castillo, 2013). With each new slab of concrete and new driver on the road, ‘getting outside’ becomes more difficult and more important than ever before. Rapid growth calls for a solution that relieves pressure on already inadequate road networks and encourages healthy lifestyles by providing safe, inexpensive opportunities for outdoor recreation.

One of these solutions is the creation of greenways. Greenways Inc., the planning firm that literally wrote the book on multi-use trails, defines a greenway as “corridors of land recognized for their ability to connect people and places together.” Greenways, in contrast to parks, are created entirely to connect the places people live, work, and play. As a result, these multi-use trails allow being physically active, experiencing nature, and using alternative transportation to become safe, convenient, and part of the community’s lifestyle. To some extent, this culture is already present in San Marcos.

The city’s very own open space advocacy group, San Marcos Greenbelt Alliance, has spearheaded the proposal, creation, and maintenance of greenspace and trails throughout the community for the combined purposes of environmental protection and outdoor recreation. In fact, the city’s recently completed comprehensive master plan, the

document created through collaboration with city officials and citizens alike to plan the future of San Marcos, prescribes an extensive network of parks, greenspace, and trails. Included as Figure 1, the Preferred Scenario Map is a document from the master plan that visually depicts how the city would like to see itself grow and develop in the coming years.

Figure 1 : Preferred Scenario Map



In effect, the most promising sites in San Marcos for parks and trails have already been written into the city's planning goals. However, the document's broad scope sets no specific deadlines for individual goals and does not include specific information as to how a particular goal should be reached. A "connected system of greenspaces and trails" will not appear overnight, and so it is necessary to begin creating them, one by one. It's also necessary to set priorities, to start creating trails first that may be more useful, more vulnerable to development, or a wiser use of the community's resources. This project is focused on the creation of one single greenway identified for its immediate potential as a transportation, recreation, cultural, and environmental protection resource for the San Marcos community. This project revolves around simple research questions:

- *Where are the most suitable sites for a multi-use greenway connecting Purgatory Creek Natural Area and the river parks of San Marcos, TX?*
- *How can the trail corridor and all of its features of interest be displayed in an interactive way that engages discussion and action?*

Criteria Development and Evaluation:

Answering these questions requires setting priorities so that the most useful, environmentally sensitive, or political feasible corridors are preserved before they are developed as business parks, apartment complexes, and so on. In order of significance, the criteria used to select Lower Purgatory Creek are outlined below. The trail must:

- be written into San Marcos' comprehensive master plan. This way, it works towards a goal expressed by the community.
- protect a critical or significant environmental feature, especially those that contribute to water quantity and quality. Corridors most likely to be developed in the near future were determined to be of higher priority.
- connect two pieces of greenspace to preserve a safe corridor for wildlife and pedestrian travel.
- ideally run through land that is easily obtained for the purpose.
- be adjacent to recreation, transportation, economic, or cultural features of interest.
- exist on terrain that accommodates a wide variety of users (i.e. walkers, cyclists, those with disabilities).

Of all the trails planned out in Figure 1, few satisfy the criteria as well as the area surrounding Purgatory Creek between Wonder World Drive and CM Allen Parkway does. This area connects two of San Marcos' most significant recreational resources: Purgatory Creek Natural Area and the parks surrounding the San Marcos River. Setting this aside as a linear park has a number of environmental benefits as well. It forever protects a tributary of the San Marcos River from impervious cover and may have the

ability to connect users with a challenged water resource in a community whose identity is simultaneously shaped by drought and the abundance of spring-fed waters.

The area's worth as a transportation resource also relates to its location. The corridor contains multiple bus stops and the bus station, neighborhoods and apartments, parks, restaurants and other businesses and places of work. It would neighbor the planned stop of the Lone Star Rail District, a proposed passenger railway that would connect the cities of Austin and San Antonio. There are also significant cultural features, including the Dunbar Historic District, the Calaboose African American Museum, the LBJ MLK Crossroads Memorial, Veterans of Foreign Wars hall, meeting place for scouting troops, a Boys and Girls Club, churches, and an elementary school. There's no shortage of destinations along the trail corridor, and Figure 1 indicates that there will only be more in the coming years. The map shows medium-intensity and high-intensity development planned for the Wonder World-Hopkins intersection and the downtown area, respectively. Development in the area further validates the need for environmental protection, as well as safe opportunities for alternative transportation and outdoor recreation.

However, creating a trail requires more than identifying an area with destinations or natural resources worth protecting. Purgatory Creek hits barriers, passes through public and private land, under streets and railroads, runs into utility lines that must be maintained, and occasionally lands in somebody's backyard who might not welcome strangers walking through. This project is about taking the general route as drawn in Figure 1 and taking it as close to the ground as possible, evaluating feasibility and visually highlighting features along the way.

3. Methods:

3.1. Using GIS to Identify Route Options

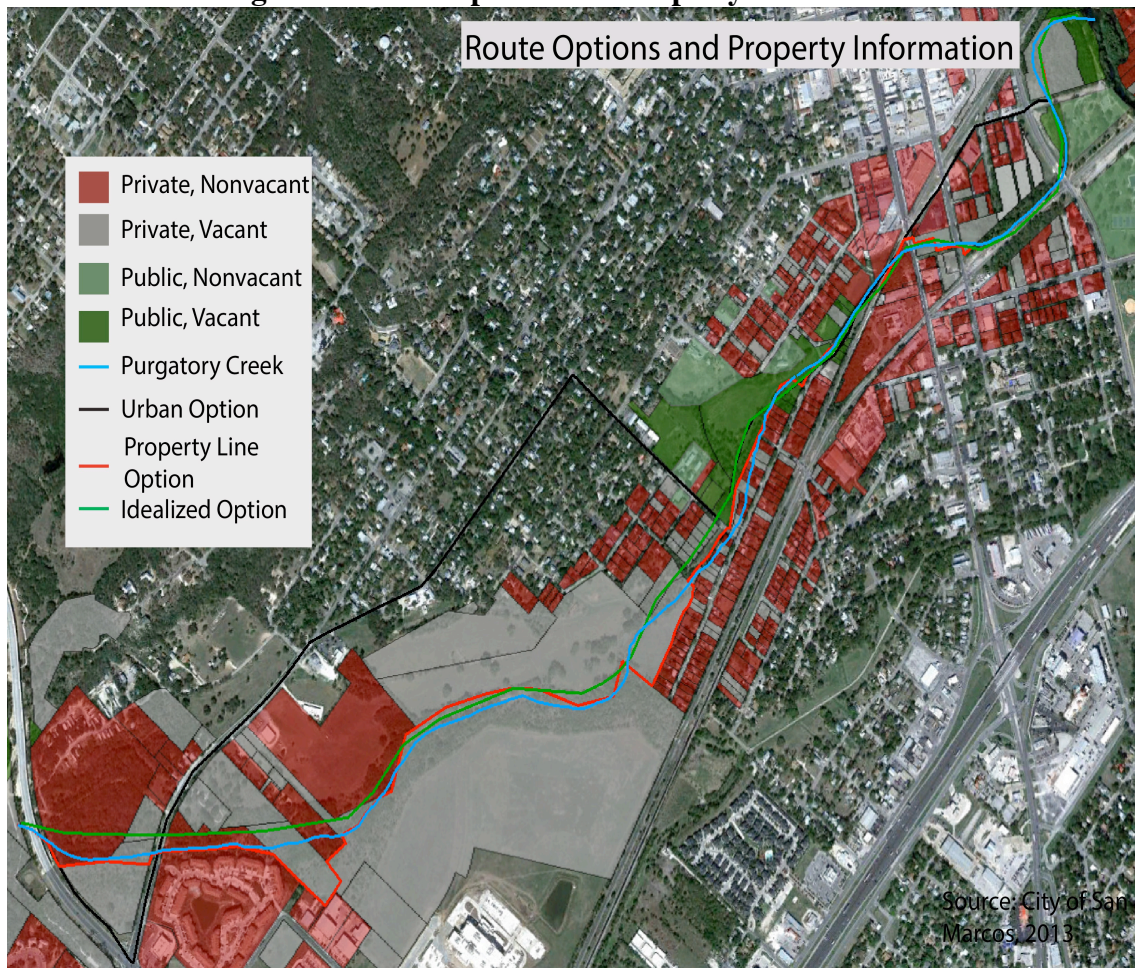
Geographic Information Systems, or GIS, are a valuable tool when trying to combine tabular (attribute) data with the location (spatial) on the ground that it describes. This task involved acquiring data from the city's GIS department and combining it all in ArcGIS, a spatial software often used by geographers and land management agencies. Using a file that outlined the location of Purgatory Creek, all pieces of land within 200 feet of the stream were selected and created as a separate file. 200 feet was an arbitrary number chosen as the outer limit beyond which land used would not satisfy the criteria as they relate to environmental protection. In ArcGIS, each parcel of land came attached with basic information about how it was owned and managed. Whenever possible, the trail corridor was routed through land that was condemned to dwelling structures. These areas are best used for recreation because the danger of flooding makes them prohibited to other uses that would demand flood protection or insurance. Beyond this, the GIS analysis focuses on two components of a particular parcel's management.

1. Is it vacant or nonvacant?
2. Is it public or private?

These questions, along with whether or not a piece of land is condemned to dwelling structures, speak to a parcel's availability for use as a trail. Pieces of land are more easily obtained for recreational use when they are condemned, public, and vacant, respectively. Using these parcels within 200 feet of Purgatory Creek, new files were created that reflected this management information. These files, when combined with the course of Purgatory Creek, simplified the process of route selection. However, because

the trail's construction and route selection would likely depend on input from professionals and citizens, this study simply identified three options. These three options satisfy the criteria differently and allow the community to identify a route based on needs, availability of resources, and political will. Once drafted, routes were loaded into a GPS application on an Android Phone and walked to confirm that each route made practical sense. In addition to being included as a paper map, the files were exported into Google's keyhole markup language. This allows the maps to be presented in open formats such as Google Maps and Google Earth. These files are downloadable and linked on the webpage at: <http://makesmtxconnections.weebly.com/maps.html>. A map, taken from a screenshot of this file and edited in Adobe Illustrator, is attached below.

Figure 2: Route Options and Property Information



These routes were designed to provide options for San Marcos’ planners and citizens. In this way, they can identify how a particular option lines up with the availability of resources, as well as the political will from landowners, residents, city officials, and other community organizations. It’s entirely possible that the community could prefer a hybrid of all three, or something entirely different. The three route options are compared in the following table.

Figure 3: Route Option Comparison

Option	Land Ownership	Proximity to Other Features	Notes
Urban	Public and Condemned Land Only. No land acquisition required.	Close to the largest amount of bus stops, businesses, residences, etc.	Would take advantage of planned road-calming efforts along Hopkins and San Antonio Streets. Would function more as segregated pedestrian facility.
Boundary	Public and condemned land when along course of Purgatory Creek, and only land along property boundaries when necessary.	West of Mitchell Street, farther away from destinations. East of Mitchell Street, closer to destinations	Would require purchasing only right-of-way through private property or exercising an easement for only the width of the trail.
Idealized	Only land adjacent to Purgatory Creek, public and condemned land when possible.	West of Mitchell Street, farther away from destinations. East of Mitchell Street, closer to destinations.	Would require purchase of property.

3.2. Multimedia Journal

To allow the community to experience the trail without encouraging masses of people to wander on private land, a combination of video and spherical ‘street-view’ style photographs were taken to document the corridor. Street-view photos required the use of a Google Nexus 4’s ‘photosphere’ function. Photos were taken largely to document the landscape and provide users with an interactive view of the corridor. Photospheres were edited in Adobe Photoshop to include arrows that provide the suggested direction of the

trail when applicable. As this project is intended to be viewable by all, the photospheres were posted in a Google+ account, and uploaded to Google Maps via Panoramio. However, a few static photos were taken of flora and fauna, and of the new Hays County Government Center. The video was captured using a GoPro video camera. Another concern presented by this project's online hosting is that video sizes must be small enough to load on the average internet connection. Because shorter videos are smaller, the videos were taken while riding a bicycle rather than walking to keep file size at a minimum. The videos were then trimmed, attached, converted to browser-friendly formats, and uploaded to a private web-hosting account. The videos do not represent one route option over the other. They simply attempt to follow a combination of existing trails, used and unused roads, Purgatory Creek, and even deer trails when necessary to move as quickly as possible.

3.3. Virtual Tour

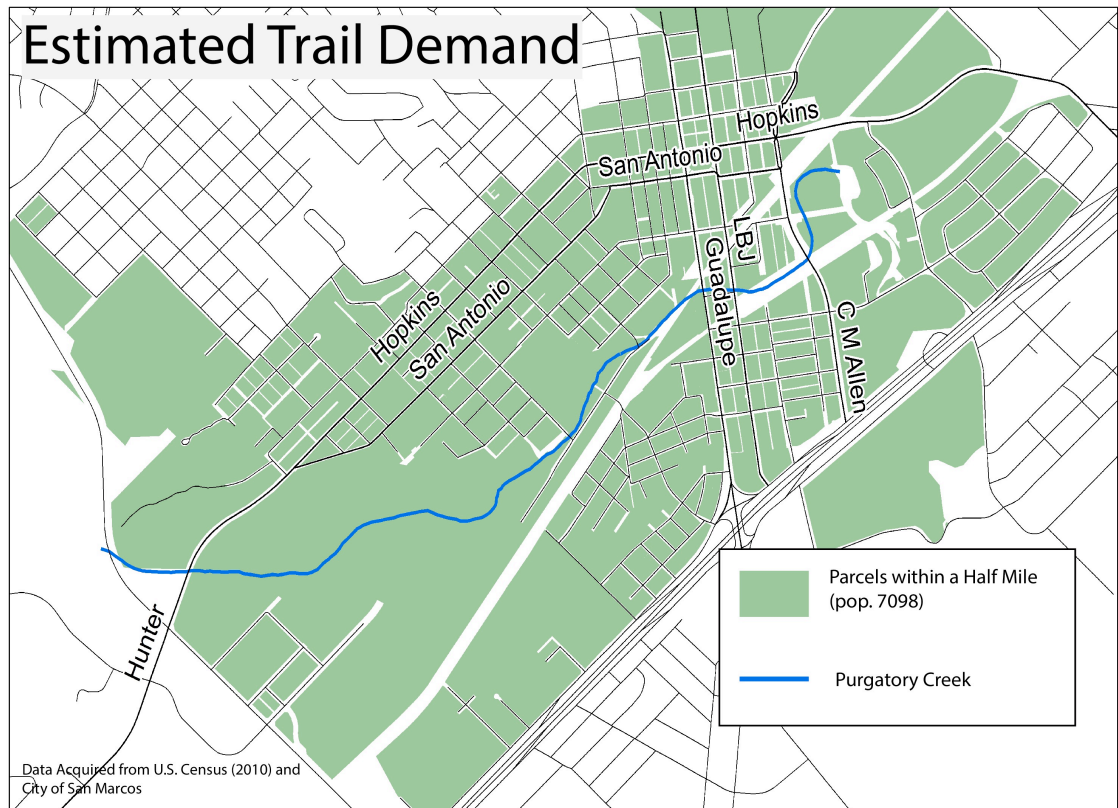
With the goal of emulating the immersive, interactive experience of Google Street View, a virtual tour was constructed. This involved the use of HTML and JavaScript and borrowed largely from a similar creation by the Swiss tech firm Hinderling Volkart. This model, found at <http://360langstrasse.sf.tv/page/>, highlights locations along a street in Zurich, Switzerland. Using the Langstrasse virtual tour source code and the trail's photo and video, it was possible to create an interactive experience of the trail corridor in which users could scroll through the trail and click to view features of interest. However, the tour's functionality was limited largely by the size of video files. To remedy this, videos were converted to different resolutions. This resulted in lower image quality, but allowed the virtual tour to load on slower internet connections.

3.4. Trail Demand Analysis in GIS

To further emphasize the effectiveness of this trail, I researched the relationship between park proximity and frequency of exercise. This relationship's most significant effects may be illustrated by a 2006 study in Pediatrics. This study focused largely on adolescents, whose recreational opportunities are typically limited to those places they can walk or ride a bike to. Their conclusions were that in a population of 1,500 teenage girls, each girl would achieve "35 additional minutes of physical activity weekly for each park that was within a half mile of their home" (Cohen, 2006).

Using this information, I established one-half mile as a proxy that contributed to a resident's frequency and duration of exercise. Applying this in ArcGIS, all census blocks in San Marcos within a half mile of Purgatory Creek were selected. Using ArcGIS' attribute table, it was possible to determine the amount of San Marcos residents that would effectively be placed within a half mile of the proposed trail, and their potential for increased exercise as a result. This number excluded parcels on the west side of Wonder World Drive as a result of data discrepancies, and was calculated to be 7098 residents. It's worth noting that the Cohen paper only studied teenage girls, and as a result this proximity-based relationship may not reflect the total population's behavior. However, the findings still suggest that a significant number of residents would exercise thirty-five more minutes a week as a result of proximity to this trail. It's also likely that this number would only increase as medium and high-intensity growth occurs along Wonder World Drive as planned in Figure 1. The product is presented below.

Figure 4: Estimated Trail Demand



3.5. Web Development

In order to present these results in an engaging and dynamic format, all files were hosted on a private serverspace, and uploaded to a personal website. Using this website, located at <http://makesmtxconnections.weebly.com/index.html>, viewers can learn about the project, view maps, explore the virtual tour, view photos and videos, and provide feedback. As this project is something that hopes to encourage outside discussion, it seemed more fitting to present the bulk of the information in an interactive format rather than a traditional paper report. The project being presented online also means that as the project continues outside of this thesis, viewers will be able to access changes as the project gathers input and the trail's creation begins to be seriously discussed.

4. Conclusion

It became clear very early on that a thesis created by one student would not adequately represent the variety of interests involved in creating a greenway. It is likely that attempting to do so would risk ignoring some very significant technical, political, and cultural considerations that all contribute to the success of such a program. However, this project has attempted to do the next best thing, which is to motivate community discussion. To take a very general goal and present the closest available representation of what the finished product might actually look like. Research needs to excite feelings in residents and policymakers so that they are better equipped to make connections between places and the people that use and experience them.

Additionally, the project was also intended to serve as an example of a simple process that can be used to promote other similar programs. With a planned network of greenways that essentially circle the city, it's necessary to start somewhere.

Establishing greenways in Central Texas will only become a larger priority in the coming years as the region continues to urbanize and more stress is placed on the natural resources and infrastructure that support those who live here. San Marcos should continue to protect its water resources, as well as encourage citizens to be healthy, active, environmentally-conscious, and ultimately, more productive. Before it's too late, San Marcos should protect its future as a city where children can safely ride a bike without getting honked at, where the out-of-doors is free and available for all to experience right in the middle of the city. It's time to build the first of many connections.

5. References

American Society of Civil Engineers (ASCE). (2009). Report Card for America's

Infrastructure: Roads. www.asce.org/reportcard/2009/grades.cfm

Castillo J. "Old Story, New Chapter: Austin leads U.S. in Growth among Biggest Metro

Areas" Austin-American Statesman March 2013. <http://www.statesman.com/news>

Cohen D, Ashwood J, Scott M, et al. (2006). "Public parks and physical activity among adolescent girls." Pediatrics, 118(5): 1381-1389.

<http://www.ncbi.nlm.nih.gov/pubmed/17079539>

National Wildlife Federation (NWF). (2013). Why Be Out There: Health Benefits.

<http://www.nwf.org/be-out-there/why-be-out-there.aspx>

Partnership to Fight Chronic Disease. (2013). About the Crisis.

<http://www.fightchronicdisease.org/facing-issues/about-crisis>

United Nations, Department of Economic and Social Affairs. (2012). World Urbanization

Prospects, the 2011 Revision. <http://esa.un.org/unup/>

Maps Made with Data from:

City of San Marcos, TX. (2013). GIS Website: Parcels, Centerlines, Hydrology.

<http://www.ci.san-marcos.tx.us/index.aspx?page=281>

United States Census Bureau. (2010) Maps & Data TIGER Products: 2010 Census Demographic Profile 1.

<http://www.census.gov/geo/maps-data/data/tiger-data.html>