Central Texas Geospatial Consulting

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Rio Vista Park: GPS Inventory and Land Management

Prepared by: Central Texas Geospatial Consulting

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# 1. INTRODUCTION

## *1.1 Summary:*

Rio Vista Park is 14 acres banking the San Marcos River. The Park is located approximately 1.25 miles downriver from the headwaters of San Marcos River. The area is primarily used for recreational purposes and includes amenities such as a swimming pool, picnic areas, indoor restrooms, and areas for basketball or tennis. This semester Central Texas Geospatial Consulting (CTGC) plans to take over the task of surveying the park area to establish a GIS-based inventory of current park features. Once we complete this task, we will then determine the best way to handle the impervious coverage in the park and prepare possible changes that can be made to help alleviate any negative outcomes the impervious coverage causes. At the end of the semester, CTGC plans to present the City of San Marcos a map of the Rio Vista Park providing San Marcos Parks and Recreation a geodatabase of the park.

## *1.2 Purpose:*

This study will create a visual map of Rio Vista Park that the City of San Marcos will be able to provide to the community and other interested parties. CTGC will be collecting GIS points of amenities at the park; Table 1 shows a detailed list of points collected. By generating a geodatabase of Rio Vista Park, San Marcos Parks and Recreation Department will then have a template that can be use on all of the city parks or green spaces. In the process of observing and mapping Rio Vista Park, CTGC will also provide suggestions to the San Marcos Parks and Recreation Department about possible changes with the impervious coverage that is currently in use around the park. These suggested changes will recommend removal of some of the impervious coverage and moving some the remaining impervious coverage away from the San Marcos River in order to help the river ecosystem and the improve the visual appeal for all of the community to enjoy.

## *1.3 Scope:*

The scope of this project will include the areas of Rio Vista Park bounded by the San Marcos River, Cheatham Street, and CM Allen Parkway (figure 1) as specified by the City of San Marcos. All processes and tasks will be completed during the spring semester of 2015 (January 2015-May 2015). CTGC will provide the city with the proper documentation of the work completed by May 2015.

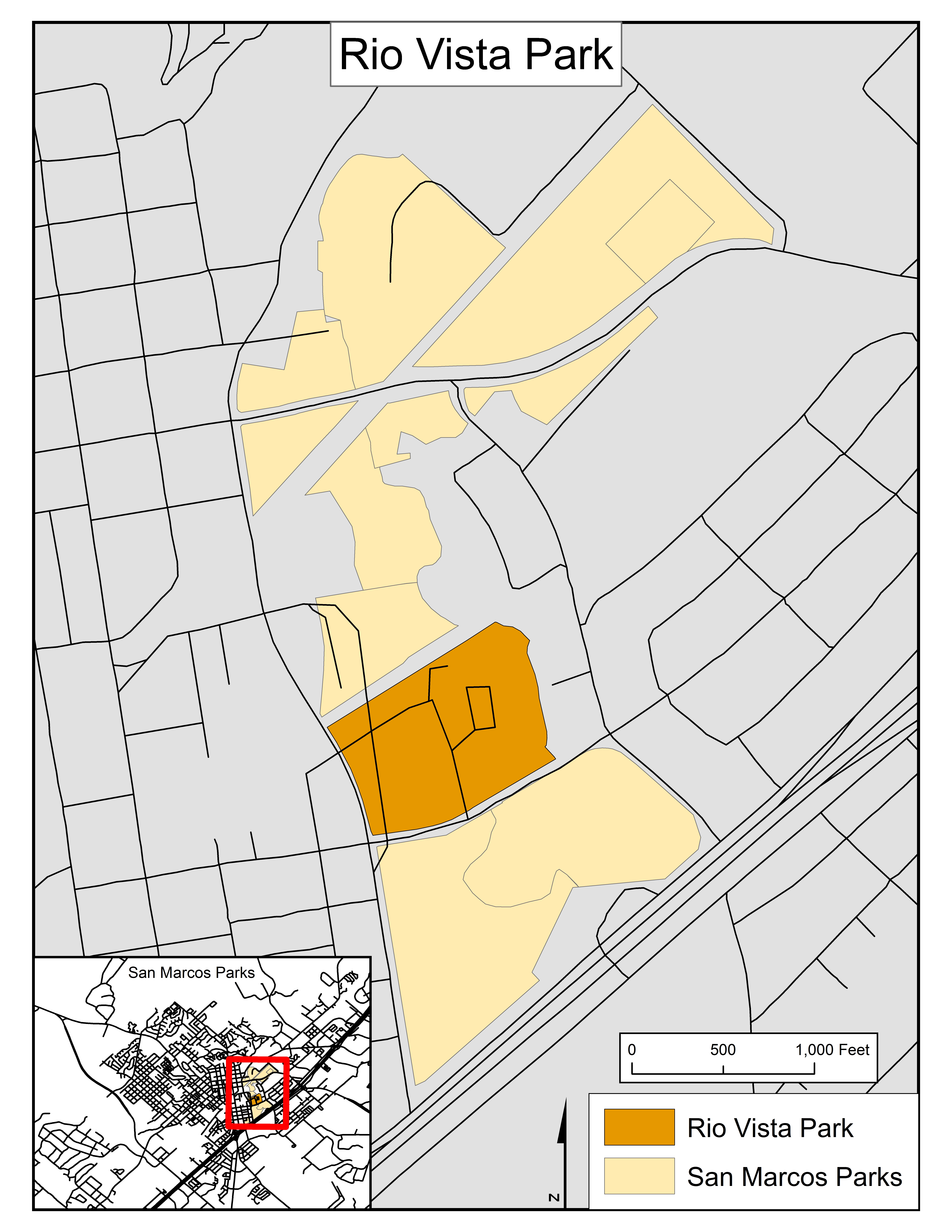


Figure 1

|  |  |
| --- | --- |
| **Parking Spaces** | **26** |
| **ADA Parking Spaces-#** | **10** |
| **Park signs** | **100** |
| **Bike Rack** | **3** |
| **Trash Receptacles** | **Cement – 12, Wooden – 41** |
| **Recycling units** | **6** |
| **Picnic pads** |  |
| **Pavilion-size** | **1 - 52x28** |
| **Trail footage** |  |
| **Water fountain** |  |
| **Park benches** | **11** |
| **Bar-B-Q Grills** |  |
| **Charcoal disposal bin** |  |
| **Doggy Bag station** | **2** |
| **Light Poles** | **32** |
| **Restrooms** |  |
| **Group Picnic site # of Tables** | **number of tables under the pavilion (line 7-8)** |
| **Tennis Courts** | **8 courts – 113x336** |
| **ADA ramps** | **8** |
| **Ciggarette But Cans** | **6** |
| **Black Iron Fence** | **787 ft** |
| **Yellow Gates** | **2** |
| **Pool** | **207x321** |
| **Ranger Station** | **26x32** |
| **Pad by Ranger Station** | **18x28** |
| **Noon Lions Club Trailer** | **1 - concession stand** |
|  |  |
|  | Parking (polygon) |
|  | safety (point) |
|  | disposal (points) |
|  | slabs (polygon) |
|  | path (line) |
|  | water fountain (point) |
|  | benches (polygon) |
|  | grills (point) |
|  | structures (polygon) |
|  | fencing (line) |

Table 1

# 2. LITERATURE

In the United States, impervious cover had been determined to be "concrete or asphalt. Impervious covers can be roofs or parking lots, but they all have at least one thing in common – water runs off of them, not through them” (Frazer, 2005). With the

growth of our cities comes more parking lots and roads to accommodate the influx of new people. Unfortunately, these parking lots and roads are some of the most impervious surfaces in use today. “As much as 65% of the total impervious cover over

Americas’ landscape consist of streets, parking lots, and driveways” (Frazer, 2005). In city parks, more and more areas have been set aside for parking lots or concrete trails. With all of this concrete being laid, there is a direct effect on the

surrounding environment and wildlife. Since the water does not run through the surface, it will run off of the surface usually to a nearby stream, or river carrying any chemicals, garbage or other debris along into those streams or rivers. This runoff

can disturb the delicate habitats in and around those streams, or rivers. With regards to Rio Vista Park, any runoff from the current impervious areas  will flow into the San Marcos River.

Many people do not know the extent of pollution that contained in impervious runoff and dangers that this pollution  causes to our ecosystems. In Paving Paradise: The Peril of Impervious Surface, the article states that “Impervious surfaces collect

particulate matter from the atmosphere, nitrogen oxides from car exhaust, rubber particles from tires, debris from brake systems, phosphates from residential and agricultural fertilizers, and dozens of other pollutants” (Frazer, 2005). Considering Rio

Vista Park, runoff from the impervious surfaces around the area can be harmful to any wildlife within the park because the runoff water flows straight into the river. This danger does not just include aquatic environment but also the animals that depend

on the river for food and water and the people that use the river for recreational use. This pollution issue is also stated in the article "Impervious Surface Coverage: The Emergence of a Key Environmental Indicator"  when the authors state “this

diffuse from pollution, now the nation’s leading threat to water quality (Environmental Protection Agency 1994), is derived from contaminants washed off the surface of the land by storm water runoff, and carried either directly or indirectly into

waterways or groundwater” (Chester and Gibbons, 2007). In Paving Paradise, a scientist (Bannerman) who has spent over 30 years studying this exact issue gives an example of what could happen if we are not cautious, his example is:

“The example of Lake Wingra, a 1.3-square-kilometer lake in Madison. 'A hundred years ago,' he says, 'this lake was fed by around thirty-five separate springs. But today, because the lake is now almost entirely surrounded by urban areas, there are only four streams feeding the lake. Local organizations have gotten active in trying to restore the lake’s water quality, but it’s not the same lake it was a hundred years ago.' Lake Wingra now suffers from algal blooms caused by over fertilization, beach closures due to bacterial contamination, turbidity, and drying of surrounding wetlands” (Frazer, 2005).

With this research in mind, it is important that this project take a look at the impervious surfaces currently in use at Rio Vista Park and determine if there are eco-friendly alternatives that can be used as a replacement for the impervious areas.

# 3. DATA

Most of the data for this assignment will be collected in situ by CTSC, using a Trimble GPS unit. This unit meets Federal Geographic Data Committee standards for accuracy and precision. This includes collecting feature classes and attributes to form the basis of our geodatabase. Some examples include obtaining the location of trash cans, grills, and benches. Also we will be collecting data to help re-arrange the impervious cover of the park, which includes collecting the dimensions of all impervious cover at the park.

For other sources, the City of San Marcos has a library on their website where we will gather data. Park boundaries, river boundaries, GPS monuments for reference and the City’s own Land Development Code can all be downloaded freely from the City’s page. Also provided by San Marcos Parks and Recreation is a spreadsheet with a basic list of desired features and attributes to be collected. For more data we plan to use CAPCOG’s GIS data, USGS’s aerial imagery and Ebsco host for the majority of our literature review materials.

We plan to use a variety of software to accomplish our goal, including image manipulation software and technical software. Adobe Photoshop and Illustrator will be used to make content visually pleasing. Microsoft Excel and Word will be used to create important documents and calculations. ArcMap, GPS Pathfinder and ERDAS Imagine will be used to execute the GIS element of the project.

# 4. METHODOLOGY

There are two main objectives we will meet with our data; first we will create a precise and user-friendly inventory of park and green space features. Second we will propose plans to minimize, mitigate and maintain the impervious cover found at Rio Vista Park. They are two separate objectives with two separate processes. Both can be broken down into four steps, and both will require gathering data, from the client and in the field.

There are four main steps involved in our park inventory; to start we will meet with the other City of San Marcos (COSM) group to create a data dictionary in GPS Pathfinder. For this, we will use the COSM provided spreadsheet (table 1) as a template standardized for both groups and add features as necessary. This step also involves assigning attribute selections for each feature, this way we can record different attributes for similar features. For example, in our data dictionary we will have a “WASTE” attribute that will have multiple features to choose from, such as “DOGGY BAG STATION” and “CHARCOAL DISPOSAL BIN.”

Next step in creating the park inventory is to test our features and attributes. For the sake of efficiency, a single features class will be created and tested in the field. This involves recording the position of numerous features and then transferring them from the Trimble GPS to ArcMap. This is where issues recording the data will appear and can be addressed before too much data is incorrectly gathered. Once this initial test is finished, and the data dictionary is complete, it will be necessary to collect a single object in each feature class. It is also important to record at a minimum one line, one polygon and one-point feature to upload into ArcMap for further review. Then we will revise the data dictionary accordingly as new features are discovered, and attributes are needed. Once revised we will finish with our data collection and again meet with the other COSM group to merge our databases into a single database for San Marcos to use in the future.

It is important to reduce the impact of impervious cover at Rio Vista, important for the park, the river and as a side effect it greatly improves a park visitor’s experience. Which leads to the second objective, to analyze the impervious cover at Rio Vista, which also can be broken down into four distinct steps. These include measuring the current impervious cover, analyze the impact of existing impervious cover to the park; investigate methods to reduce impervious cover and finally model proposed changes to the park to minimize, mitigate and help maintain its impervious cover.

To begin, we will measure the area of the existing impervious cover using our Trimble GPS device. This will provide us two things, we will have the spatial data to use for GIS processing and we will also have a baseline measurement to compare to later. When modifying impervious cover on the park grounds this baseline measurement is important because it is advisable to not exceed existing impervious cover. The spatial data will come in hand for further analysis and also to provide a before and after visual representation to the client.

Next we will analyze the current impact of impervious cover in the park. This includes looking at both its positive and negative impacts. For example, it has been evidenced that part of the parking lot is used to load and offload paddle boats; this should be considered in our relocation plans. It has also been evidenced that stream erosion is taking place at the park as a result of fast moving waters that can’t penetrate the ground quickly enough. Also there are non-point source pollution issues from the parking lots as well, and the impenetrable ground does not allow the water to be even slightly filtered before heading into the river.

Then we shall investigate and model various methods of reducing impervious cover. Our investigation will go beyond simply minimizing the impervious cover but also maintaining and mitigating it. To minimize we plan to look at reducing the lot sizes to shed excess impenetrable coverage and propose different surface materials like crushed rock where we can. To mitigate we plan to look at using a few tricks like rainwater collection, using vegetation where impervious cover was and proper rain gutters to keep storm water off slabs paved surfaces. It will also be necessary to look at proper maintenance of impervious cover, which mostly involves keeping the areas clean of pollutants and trash. Finally, we plan to assemble all findings and proposed changes for the client as part of the deliverables package.

The post processing is the penultimate step, and this is when we will configure the ArcMap geodatabase so that COSM employees can use it as a template or standard for other parks and greens spaces. It is important to make the database as intuitive and easy to use as possible, so this step will involve some adjustments to attributes and feature classes as needed. Another part of post-processing is exporting our points, lines and polygons from GPS Pathfinder to ArcMap, which involves assigning the GPS data the correct projection and coordinate system.

Finally, we will create and assemble all deliverables. The client has requested the following, an amenity geodatabase for Rio Vista, a map of the park with feature classes, map of proposed impervious cover arrangements, a report on the amenities of Rio Vista Park, methods used to collect GPS data, estimation of accuracy and precision of GPS data and the scientific methodology for the Geodatabase design process that may be repeated for future park projects and propose a course of action for mitigating impervious cover in

|  |  |  |
| --- | --- | --- |
|  | **Collect and browse supplied data/RFP** |  |
| **Begin Park inventory** |  | **Begin impervious cover analysis** |
| **Collaborate with other COSM group** |  | **Measure existing impervious cover** |
| **Test** |  | **Analyze the current impact of IC on the park** |
| **Did it work?** |  | **Investigate various methods of reducing impervious cover** |
| **Collaborate with other COSM group** |  | **Model different proposed changes** |
|  | **Post Processing** |  |
|  | **Assemble deliverables** |  |

the park.

Table 2 Methodology Flow Map

# 5. BUDGET

**Services** **Equipment**

|  |  |
| --- | --- |
| Project Manager | ArcGIS Subscription |
| 100 Work hours over 20 days | 100 work hours over 20 days |
| Hourly Rate: $45 | Cost: $6.00 per hour |
| Sub total: $4,500 | Sub total: $600 |
| Web Master/ Researcher |  |
| 100 Work hours over 20 days | Trimble hand held GPS unit |
| Hourly Rate: $43 | Rental cost: $50 per day for 75 days |
| Sub total: $4,300 | Sub total: $3,750 |
| GIS Technician |  |
| 100 Work hours over 20 days | 4 Computer workstations |
| Hourly Rate: $43 | Rental cost: $50 per day for 75 days |
| Sub total: $4,300 | Sub total: $3,750 |
| Researcher |  |
| 100 Work hours over 20 days | Office Supplies: $550 |
| Hourly Rate: $43 | Insurance: $5,000 |
| Sub total: $4,300 | Transportation: $1,000 |
| **Services Sub total: $17,400** | **Equipment Sub Total: $14,650** |

**Total Budget: $32,050**

# 6. TIME TABLE

Phase I- Data Collection

The data collection process will take approximately six weeks. A thorough GPS survey will be taken of Rio Vista Park, and that data will be processed into a File Geodatabase for the use of the City of San Marcos Parks Department. All fixed improvements will be catalogued in consultation with COSM personnel to insure that at every step of this process, their needs are being met.

Phase II- Data Processing and Analysis

The second phase of this project will take approximately one month, and will include production of both hard and soft copy maps, a written report for the City, a poster covering the scope of the entire project, and a project web site.

Phase III- Final Editing and Revision

Phase three will take approximately two weeks. This will include a quality assurance review of all hard and soft copy map products and written reports, a review of meta data to insure thorough documentation, as well final consultation with COSM officials to verify proper attribution of all Rio Vista Park survey data.

# 7. FINAL DELIVERABLES

Upon completion of this project, Central Texas Geospatial Consulting will deliver the following products to the City of San Marcos:

1. A File Geodatabase including all improvements and amenities at Rio Vista Park, per the city’s specifications for attribute data. All feature classes will be projected in the Texas State Plane Coordinate System, and based on the North American Datum of 1983.
2. And hard copy map of all data collected, representing each feature class of improvement at Rio Vista Park, in ANSI D format, per the COSM’s specifications.
3. A hard copy map of both the current state of impervious cover at Rio Vista Park, as well as Central Texas Geospatial Consulting’s recommendations for future mitigation and possible remediation.
4. We will provide the City with a final report detailing our data collection and processing methodology, estimations of data precision and accuracy, as well as lessons learned in order to streamline future survey data collection and processing for the City.
5. Central Texas Geospatial Consulting will produce a web site and a project poster to concisely document the entire scope of the project, for the benefit of both the City of San Marcos, as well as the students, faculty, and staff of the Texas State University Department of Geography.

# 8. CONCLUSION

Central Texas Geospatial Consulting (CTGC) will collect GPS and attribute data for the specific, requested features of Rio Vista Park. By completing this request, CTGC will come up with the most efficient way for the San Marcos Parks and Recreations Department to take GIS inventory for all other city parks and green spaces. CTGC will also create a universal data dictionary that the City will be able to use for all of the City of San Marcos’ parks and green spaces. When this project is completed, CTGC will provide the city with a digital representation of Rio Vista Park and will include an analysis of the impervious cover within the park boundaries. CTGC will provide possible improvement to the impervious cover areas in the summary report.

# 10. REFRENCE

**JOURNAL**

Arnold Jr., Chester L., and C. James Gibbons. "Impervious Surface Coverage: The Emergence of a Key Environmental Indicator." *Journal of the American Planning Association* 26 Nov. 2007. Print.

Frazer, Lance. "Paving Paradise: The Peril of Impervious Surfaces." *Environmental Health Perspective*. 11 July 2005. Web. 12 Feb. 2015. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1257665/>.

# 11. PARTICIPATION

Brian Singer: Project manager

Budget, Timetable

Johnathan Elkins: Webmaster, Graphic designer

Literature Review, Final Deliverables, Implications

Chris Rollins: GIS analysis

Data, Methodology, Implications

Amy Cogdill: Editor, Researcher

Introduction, Conclusion