G
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S  LVE

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“The Return of Green Space”

Prepared for:

Environmental Service Committee

Noah Hopkins, Chair

Created by:

GeoSolve

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1. INTRODUCTION

1.1 PROBLEM

In order to improve the recycling program at Texas State University – San Marcos, the Environmental Service Committee has removed all collection receptacles throughout campus and place new receptacles where they are most needed. To comply with the necessary design and style adopted by the Campus Master Plan, current recycling bins must be replaced with a specific style and design. With each receptacle costing $750, it is imperative that the Environmental Service Committee place the new receptacles in the most beneficial areas.

1.2 PURPOSE

GeoSolve feels that, with the use of a geographic information systems database, we can establish the best way to utilize Environmental Service Committee's funds to maximize the benefit by prioritizing the locations of recycling bins. GeoSolve will create for the Environmental Service Committee of Texas State University a GIS database to establish the best possible locations to place the new recycling receptacles for the recently adopted Campus Master Plan. Each location should bring in as much recyclables as possible to justify the expense of each collection receptacle on campus. GeoSolve will present a flexible ranking of locations with respect to vending machines locations, dining halls, trashcan locations, bus stops, campus residents, and people within each building (faculty, staff, and students). All of these variables will fall into two sub-categories, high-density population areas and current locations of pick-up and drop off points for trash. We will supply all data collected with the final deliverables and, by referring back to our model, Environmental Service Committee can update the data as the variables change on campus. The flowchart and model also provided in the final deliverables ensure this flexibility by allowing and guiding the client through the analysis process. GeoSolve strives to maximize the effect of each location in order for the receptacles to collect as much recyclables as possible for the client.

1.3 SCOPE

Within the Request For Proposal that was received by GeoSolve, we were instructed to keep the scope of the focus of the project to the main campus of Texas State University at San Marcos. In our discussion with Noah Hopkins, chairman of the Environmental Service Committee, he stated that certain areas should not be included in the project. Those not to be included were the Freeman Ranch, due to the fact that this area is far removed from the rest of the focus area, maintenance facilities, and university owned apartments. The time frame of data collection is for the spring 2006 semester.

2. LITERATURE REVIEW

In an attempt to compare our study to other related projects, GeoSolve conducted an extensive search of the databases available at the Alkek Library. The closest and only result found that had any relation to our project was to the University of Oregon's website, http://darkwing.uoregon.edu/~recycle/HowTo.htm (last accessed 4 May 2006). This website has a comprehensive approach to establishing a recycling program on a campus-wide scale and served as a reference for different problems to take under consideration when locating recycling bins. One aspect of their study that was related to our “Return of Green Space” project was to walk the campus and get to know the sources of waste material. It did not, however, explore the route to placement of receptacles by geographic analysis, which was our primary focus.

3. DATA

3.1 GATHERING DATA

Immediately after we agreed to select the Campus Recycling RFP as our project, GeoSolve downloaded a DOQQ file, a satellite image of the Texas State University campus, from www.capco.com for visual reference. At our conference with Mr. Hopkins, he recommended we contact Chris Reynolds, Vice-President of Financial Services at Texas State University, to gather our secondary data. Shapefiles we received included: buildings, walkways, parking areas, contours and vending machine data. Not only did Mr. Reynolds provide our team with these files, but he also suggested we contact Paul Hamilton, Tram System Coordinator at Auxiliary Services.

Mr. Hamilton provided us with bus stop and route flow shapefiles. He then directed our team to Joe Meyer, at Institutional Research, who supplied us with a database detailing the counts of students in each building’s class per hour of each day, including course number. The last person contacted was Robert Stafford, Director of Facilities, from whom we received a trashcan shapefile.

3.2 CREATING A GEODATABASE

Once all the data was collected and refined, GeoSolve established a geodatabase. A program named ArcCatalog, part of ArcGIS, was used to help create the geodatabase. After the geodatabase was created, data was then imported to help simplify its organization so the data could be easily updated in the future.

3.3 HAND-COLLECTED DATA

Once all our secondary data had been collected, GeoSolve determined primary data was needed to update the portions of the secondary date that were no longer current, namely the trashcan and vending machine shapefiles. We had two options for gathering the primary data: modifying the existing shapefiles by hand sketching the locations of all trashcans and vending machines or using hand-held GPS unites to locate all outside trashcans and vending machines. The team decided that hand-held GPS units would be the most accurate and efficient way of locating outside trashcans and vending machines by eliminating human errors that would result from hand sketching. Also, it is easier to transfer the coordinates from the hand-held GPS units into an ArcGIS program. After all primary data was collected using the hand-held GPS units, it was imported into an ArcGIS program and overlaid with the walkways and building shapefile.

It was apparent the anticipated accuracy was inconsistent. GPS must have a good line of sight between the satellites and receiver units. Without a good line of sight, accuracy becomes distorted as tree canopies and narrow viewshed prevent good linkage between satellites and the receivers.

Several methods of correcting the discrepancy caused by the tree canopies and viewsheds were discussed. Fortunately, GeoSolve obtained, on three day loan, a Topcon HiPer Plus GPS system from Kolodzie Surveying Company in New Braunfels, TX. This survey-grade system is less affected by tree canopies and viewshed and has an accuracy of less than one centimeter. In order for the Topcon HiPer Plus GPS system to work, we first had to physically locate the National Geodetic Survey Monument AJ6952, designated as SWT1, located off Academy Street in San Marcos, TX. This monument is a ten foot deep concrete cylinder with a survey-grade brass disk stamped with the mark logo SWXSU. It is referenced in coordinated to the Texas State Plane Coordinate System of South Central National Adjusted Datum of 1983 (NAD83). This Coordinate System is the reference base that was used throughout the entire project.

Since a GPS is not affective inside buildings, all indoor vending machines were hand counted. This was a week long process that entailed exploring, floor by floor, every building on campus. Each vending machine in a building was counted and categorized according to its contents, such as bottles (both glass and plastic), aluminum cans, and snacks.

3.4 REFINING DATA

When refining our data, GeoSolve verified that our hand collected data matched the data that was transferred to the ArcGIS program and our team also inspected the secondary data collected from Texas State University personnel to ensure there were no overlays and gaps with each shapefile. Some of the Excel files received from Chris Reynolds and Joe Meyers needed to be processed and refined into database files in Microsoft Access. Therefore, GeoSolve consulted with Chris Reynolds, the VP of Financial Services, to secure his assistance in cleaning up and summarizing the tabular data. Our original file consisted of numbers in each building per class, per day for a one week period. The condensed data yielded a new database file consisting of the summary of students in each building for one week. This new database file was joined with our polygon shapefile illustrating our methodology.

The two downloaded DOQQ files were not suitable for our needs of this project. To solve this problem, each image was exported as a TIFF image, merged together, and was trimmed to our specified locations. This newly created TIFF image was then imported into ArcGIS, without spatial orientation, and georeferenced to our data in the GIS to give orientation and spatial meaning to the image.

4. METHODOLOGY

Our goal for the Return to Green Space project was to find the best locations for the new recycling receptacles. To accomplish this goal, we used a geographic information system known as ArcView 9.1 and performed an analysis based on three main factors: current trashcan locations, source locations of potential recycling materials, and estimated weekly population concentrations.

4.1 CREATING A DENSITY RASTER

GeoSolve felt the two most important factors for finding the best new recycling receptacle locations should be both the locations of potential recycling materials and the current trashcan locations. We then went out and collected the locations of all the sources of potential recycling materials and also noted whether it was a source of glass, aluminum, plastic, and trash. For this analysis, we only considered glass and aluminum, because the Environmental Service Committee said the new recycling receptacles would only collect these materials.

GeoSolve also felt the current trashcan locations were important to our analysis, because most of the recycling bins have been in the same locations for about five years, which means people consistently use them. Not only do current trashcan locations provide clues as to where people generally throw out there materials, they are also important because in the campus master plan the new receptacles will be placed together as a set of three, one trashcan, and two recycling bins. We needed to locate the current recycling bins for these two main reasons.

In the analysis, we chose to represent these two factors as a density analysis. A density analysis is calculated as a magnitude of different point features per unit area. Performing a density analysis shows where the concentrated areas of point features are located. To create the density raster, we had to perform a density analysis on both the current trashcan location shapefile and the vending machine shapefile. We first created a density raster of the current trashcan locations (see Figure 1).

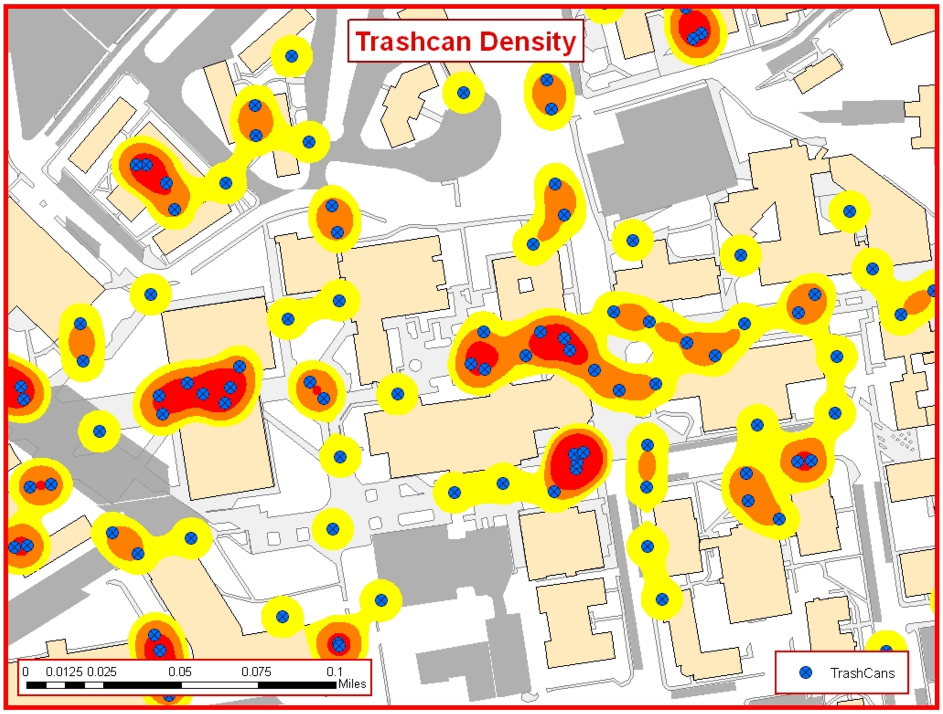


Figure 1.

The next step was to select out all of the glass and aluminum vending machines from the rest, so we would only be considering the materials applicable to the needs of the Environmental Service Committee. Once this was accomplished, GeoSolve created a density raster to show the concentrated areas of glass and aluminum (see Figure 2).

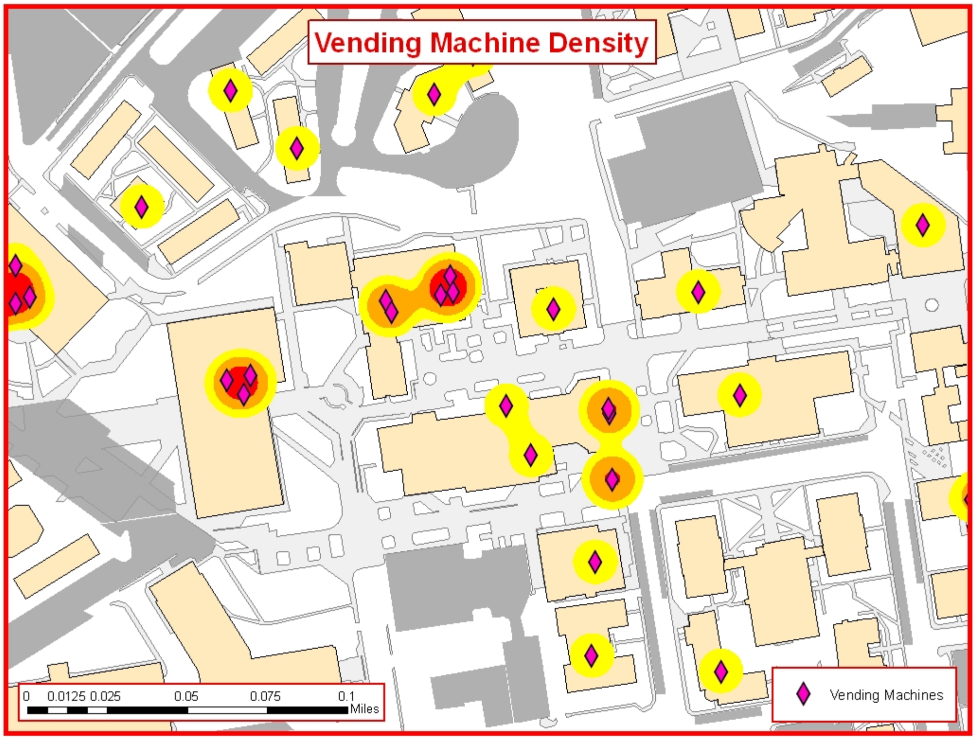


Figure 2.

Once we had both of the rasters created we then reclassified each so that GeoSolve could start setting up the data to provide a ranking system for the entire analysis. To place the new recycling bins, our primary goal of the project is to provide a ranking system showing the most important locations for recycling bins, by density of trashcans, vending machines, and population, to locations with less importance.

Once the two raster data sets were reclassified, GeoSolve then joined the two with a simple raster calculation (see Figure 3).

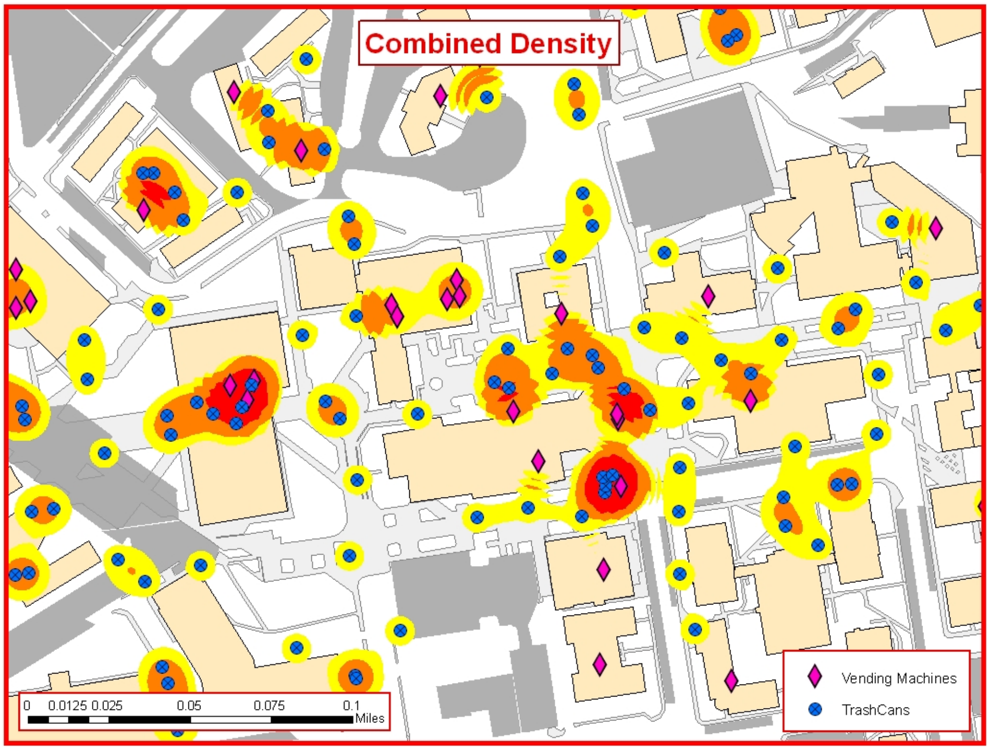


Figure 3.

4.2 WEIGHTING THE RESULTS BY POPULATION

After the density raster was created, which shows the areas throughout campus that have both a high concentration of potential recycling materials and high concentrated areas of trashcans, GeoSolve wanted to break down our ranking system to show areas throughout campus with higher concentration of students, faculty, and staff and weight them accordingly, with less populated regions showing less emphasis.

To represent the most populated regions throughout campus we used data which listed the amount of students, faculty, and staff, on campus throughout a week. GeoSolve then joined the count per week data to a shapefile, which we digitized, that broke up the campus by building region. This gave us an idea as to where there are higher concentrations of people throughout the week (see Figure 4).

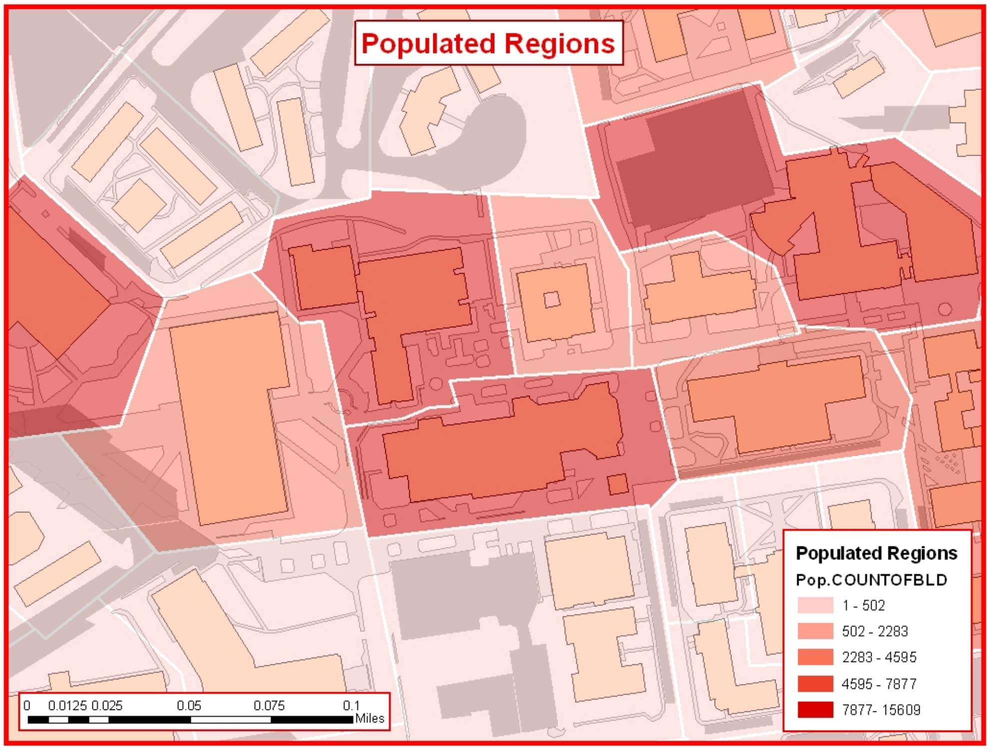


Figure 4.

Once we had something to represent the areas throughout campus with the highest concentration of people, we then reclassified regions into three groups so we would only have to break down our original density map by three more groups. To break down the density analysis into three groups we created three new raster data sets by reclassifying the original density analysis three separate times. We reclassified the density results, which was already broken down into three separate orders (most important, second most important, and third most important) and then created the three new raster data sets by multiplying the original density analysis three times. Each time we reclassified an order (for example, most important) and gave it a value of one while everything else was given the NoData value (see results of this process in Figures 5, 6, and 7).

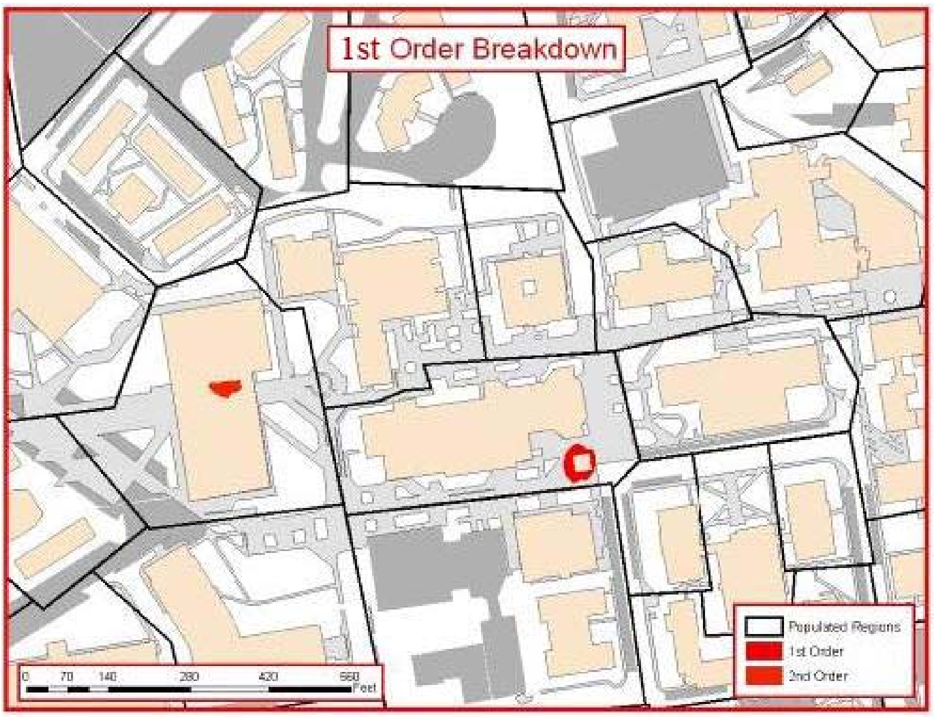


Figure 5.

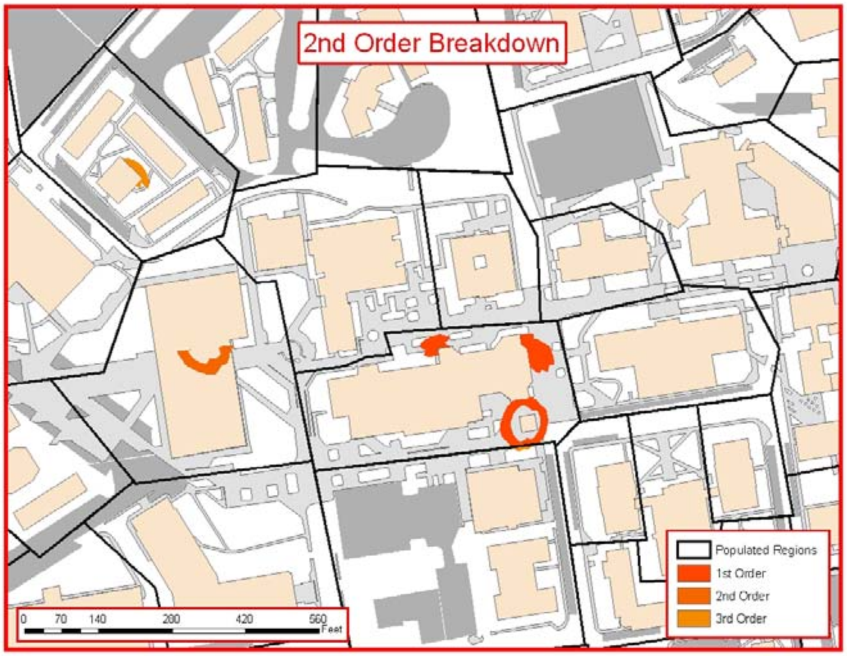


Figure 6.

When the three orders where created from our original density analysis, which showed the regions throughout campus with the highest concentrations of glass and aluminum vending machines as well as trashcans, GeoSolve combined these rasters with our populated region raster. To combine the two, we performed another raster calculation, which we had to perform three separate times, since we had broken up the original density raster into three different rasters, which represented their order of importance. Once we combined the two, the density rasters with the populated region raster, GeoSolve then ended up with new results which would have left us with a map showing nine different orders of importance, but in this case, since our first order fell into only two different populated regions, instead of three, were left with eight.

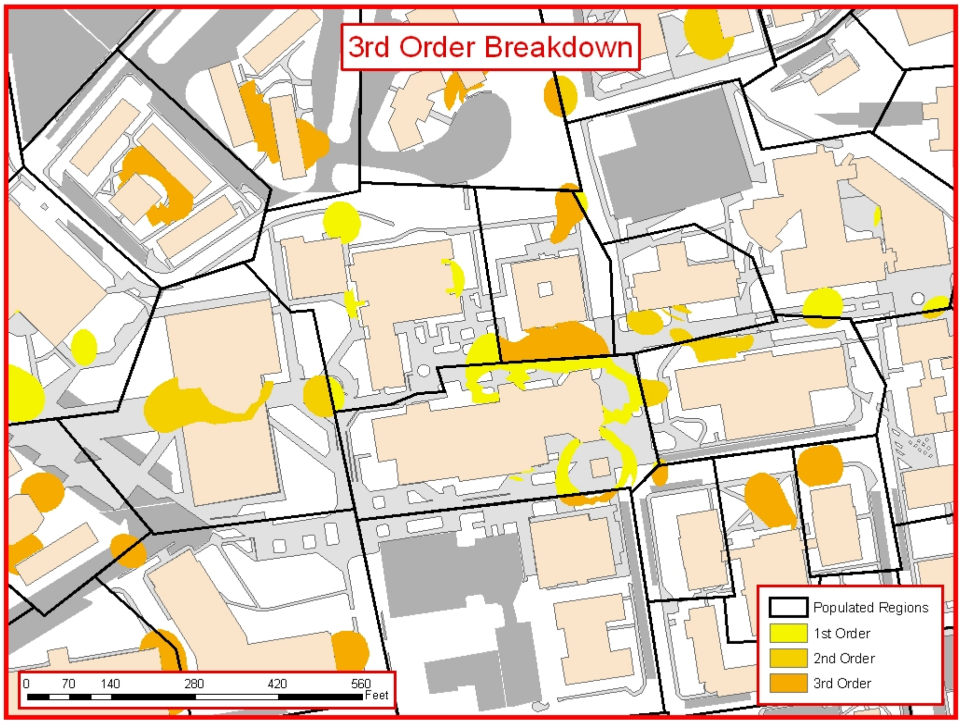


Figure 7.

4.3 CLIPPING FOR STUDY AREA

The final step taken to complete our analysis was to clip the areas throughout campus that were not to be included in the analysis. This included the regions inside buildings, since the recycling bins are to be outdoors, and the regions such as university owned apartments and facility buildings. To clip the university owned apartments and facility buildings from the study area, we used a simple method of digitizing a polygon border and clipping the study area to it, yielding only the regions we wanted to show.

To clip out the regions inside the buildings, we converted the buildings shapefile into a raster data set, and then reclassified it so that the buildings had a NoData value, while everything outside of the building was given the value of one and then multiplied our final results to it, so everything inside the buildings would be clipped out.

5. RESULTS

According to our analysis, overall there are several areas throughout campus that would be ideal to put the new recycle receptacles. The best area to place the new recycling bins on the west side of campus would be on the northwestern side of Harris dinning hall (see Figure 8). Also, GeoSolve observed that there are several high-density gathering areas near residential halls Blanco and San Saba that would be good areas of possible locations for the recycle bins.

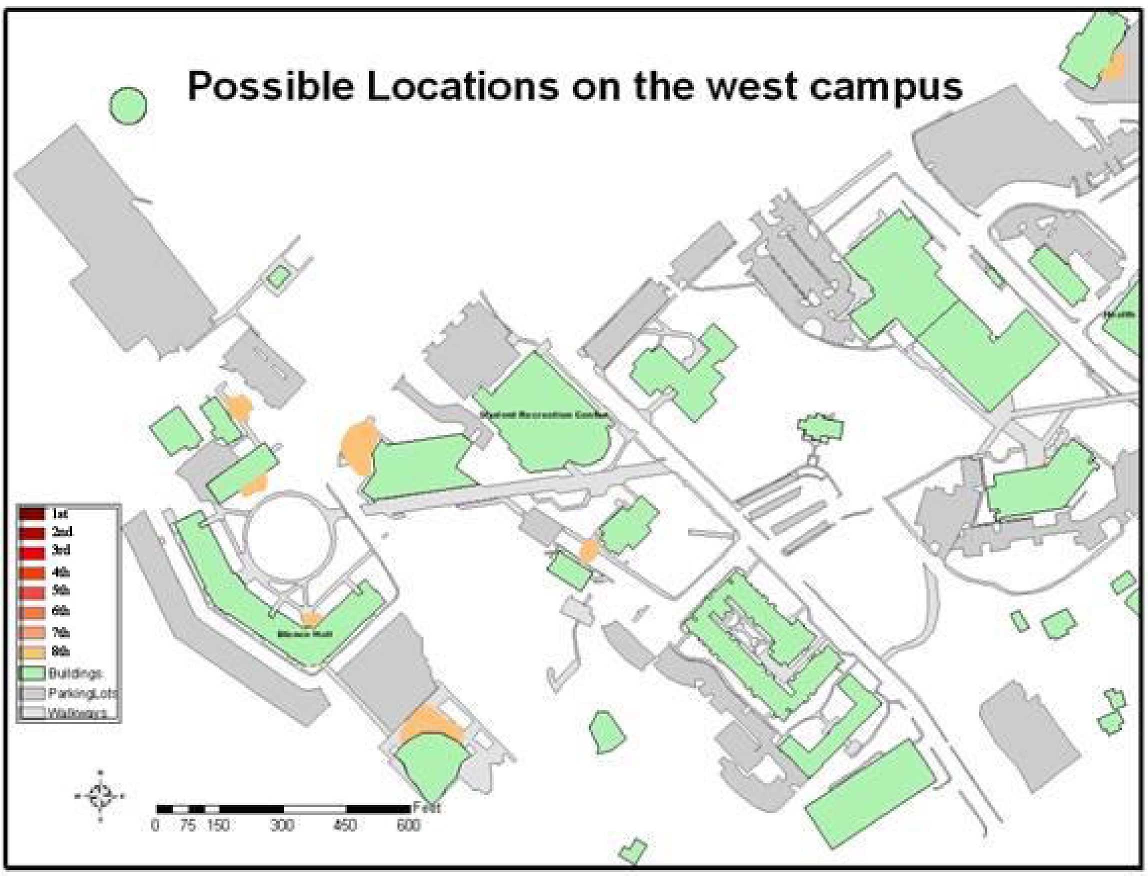


Figure 8.

In the central part of Texas State University, there are many beneficial areas for recycle bins. Figure 9 shows that there are locations with high priority under the breezeway of

Alkek Library and near the Paws N Go kiosk by the southeast corner of Evans Liberal Arts building. The next best set of potential locations would be near Arnold Hall's smoking area, the entrance of Jackson and Tower Halls, the Texas Tram bus stop at L.B.J Student Center, the vending machine area on the eastern side of Evans Liberal Arts, and the north main entrance of the Evans building.

In addition to these areas, we suggest other bins be placed at the entrances of L.B.J Student Center, the walkways between Alkek Library and Evans Liberal Arts building, near the south entrance to the Chemistry building and by the north entrance of Flowers Hall. Also, the quad entrance of Derrick Hall would be an excellent location of recycle bins.

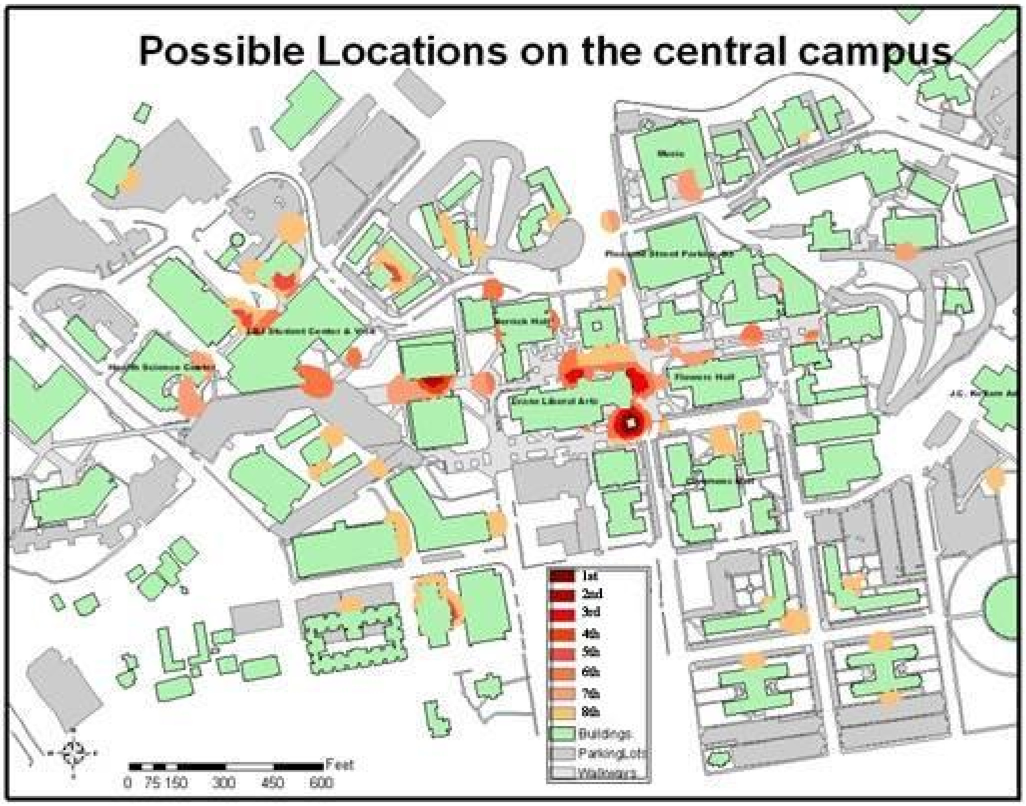


Figure 9.

The east campus area includes Sewell Park and Bobcat Stadium parking lots. According to the Figure 10, the first priority locations would be both tram stops in the Bobcat lots. In addition to the areas above, GeoSolve recommends Environmental Service Committee to locate recycle bins near the trashcans in Sewell Park.

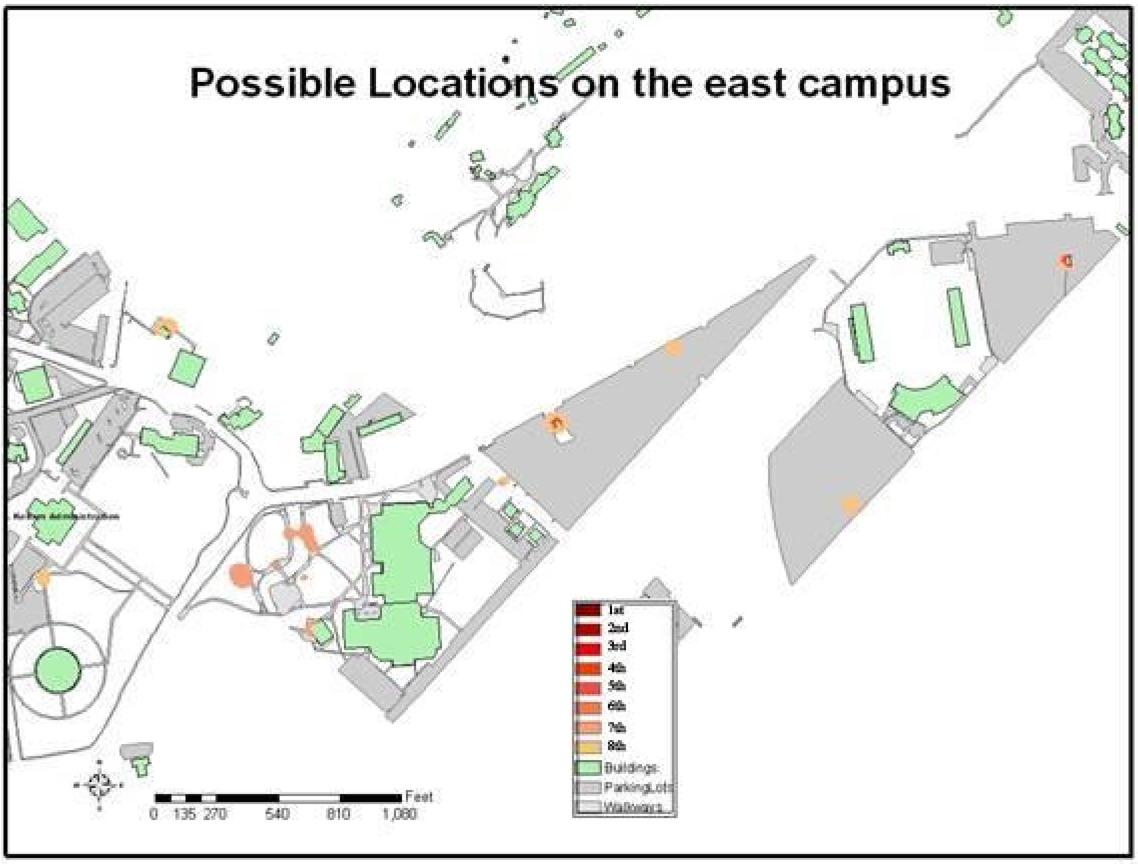


Figure 10.

6. DISCUSSION

GeoSolve found this project to be straight forward yielding basic spatial analysis indicating a ranking system for the placement of the recycling bins. Utilizing the gathered data, our team determined specific locations that would be ideal for the campus recycling bins. These preferred locations have a high concentration of trashcans, vending machines, and student population. Placement of the recycle bins in these targeted areas would maximize the use of funds provided for the Environmental Service Committee.

Because of the large volume of inside vending machines, pinpointing the specific location of each vending machine in the building would be extremely time-consuming. To save time, a shapefile grouping together vending machines in the center of each building was created. Had specific vending machine locations in each building been specified, the density raster files could very well show new high density areas that would, after completing our methodology, subsequently affect the priority ranking of the new recycling bins. Another problem would have arisen if Geosolve had aligned the inside bin locations with entrances to the buildings. Questions this approach would have brought up would be: how do you divide the vending machines per exit, an even split among the entrances? What about remainder machines?

Once the campus locations of the trashcans and vending machines were pinpointed, GeoSolve wanted a more precise picture of student traffic flow on campus. GeoSolve's project manager e-mailed Dr. Lee, a transportation systems instructor in the Geography Department, requesting a conference to discuss the possible use of the TransCAD program to represent student traffic flow across campus. At the meeting, Dr. Lee informed our project manager that TransCAD is a very complex program that is learned through a semester long course with an accompanying lab. Given the short time span for our analysis to be completed, our team did not feel we could adequately learn this complicated program by ourselves. If GeoSolve had been able to include data from TransCAD, our results may have been different. For example, other locations may have been selected and included in our ranking system. The ranking system itself may have rearranged the order of priority of the recycle bin locations. Because we were unable to include data from the TransCad program, GeoSolve feels our results are not as robust as we would have liked to produce. If our team could start over on this project, we would request more time so our group could incorporate the student traffic flow data from the TransCAD program with our collected and refined data to achieve more effective results.

7. CONCLUSION

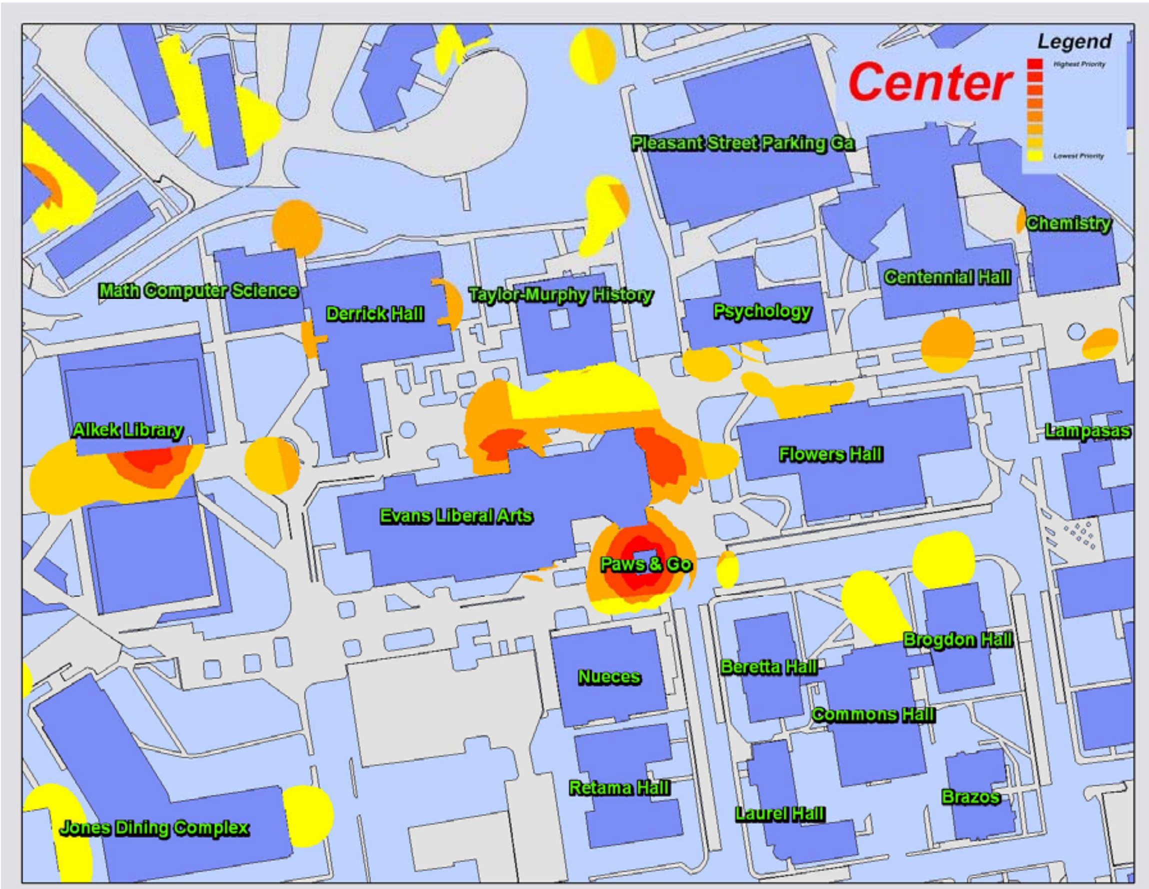
GeoSolve has performed a geographic information system analysis to determine the best beneficial areas for the Environmental Service Committee to locate newly designed recycle bins required by new Campus Master Plan on the Texas State University main campus. To acquire the best results, GeoSolve used precise primary data and reliable secondary data and thoroughly reviewed our analysis for human errors.

From the results, we specifically identify the best locations for recycle bins. In addition, GeoSolve recommends that bins be located in bus stop areas in parking lots because of Texas State's large number of commuter students. With our model, future studies will be easily undertaken to adjust for the expected fast paced growth of Texas State University – San Marcos.

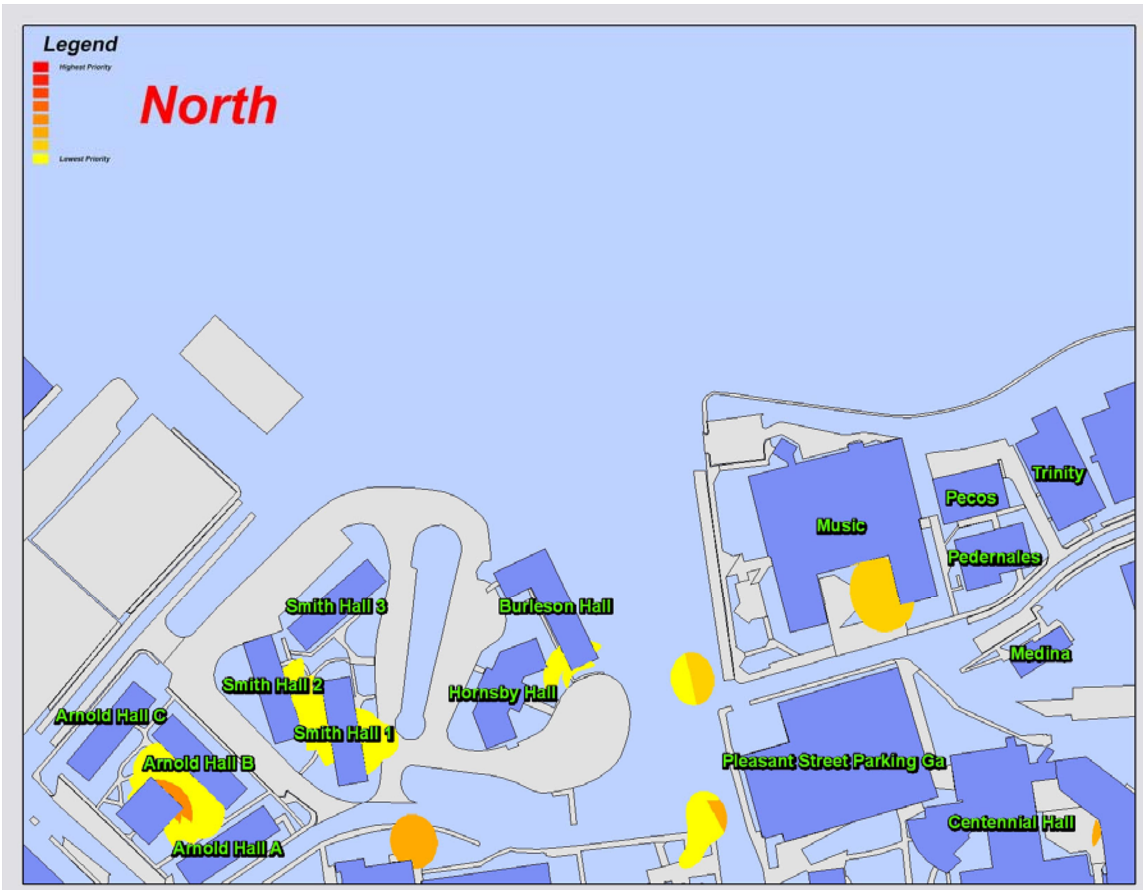
In summary, based on our analysis of the data, GeoSolve recommends a minimum of twelve recycling bins to be minimally effective in collection. These "Dirty Dozen," at $750 each, will cost $9,000 and include the following sites: (1) Blanco Hall, (2) the northwest side of LBJ Student Center, (3) the southeast side of LBJ Student Center, (4) at the entrance to Alkek Library, (5) at the Paws N Go, (6) the north side of Evans Liberal

Arts, (7) the quad side of Derrick Hall, (8) in the central court of Smith Hall(s), (9) the northwest corner of Flowers Hall, (10) south side of Centennial, (11) the bus stop in the parking lot of Strahan Coliseum, (12) and the bus stop in the parking lot of Bobcat Stadium. However, for best use, GeoSolve recommends placing twenty-four bins at $750 each for a total cost of $18,000. In addition to the "Dirty Dozen" listed above, bin locations should include: (13) an additional receptacle at Alkek Library, (14) the north side of The Tower, (15) one at Arnold Hall, (16) one between Hornsby and Burleson Halls, (17) one on the south side of Jackson Hall, (18) a bin at the southeastern side of the Health Science Center, (19) one in between Elliot Hall and the McCoy Business Building, (20) in front of the south entrance of Taylor-Murphy History building, (21) the south side of Hines Academic Center, (22) at the main entrance to the Music Building, (23) the southeast corner of Lantana hall, (24) and between the Outdoor Center in Sewell Park and Jowers Building.

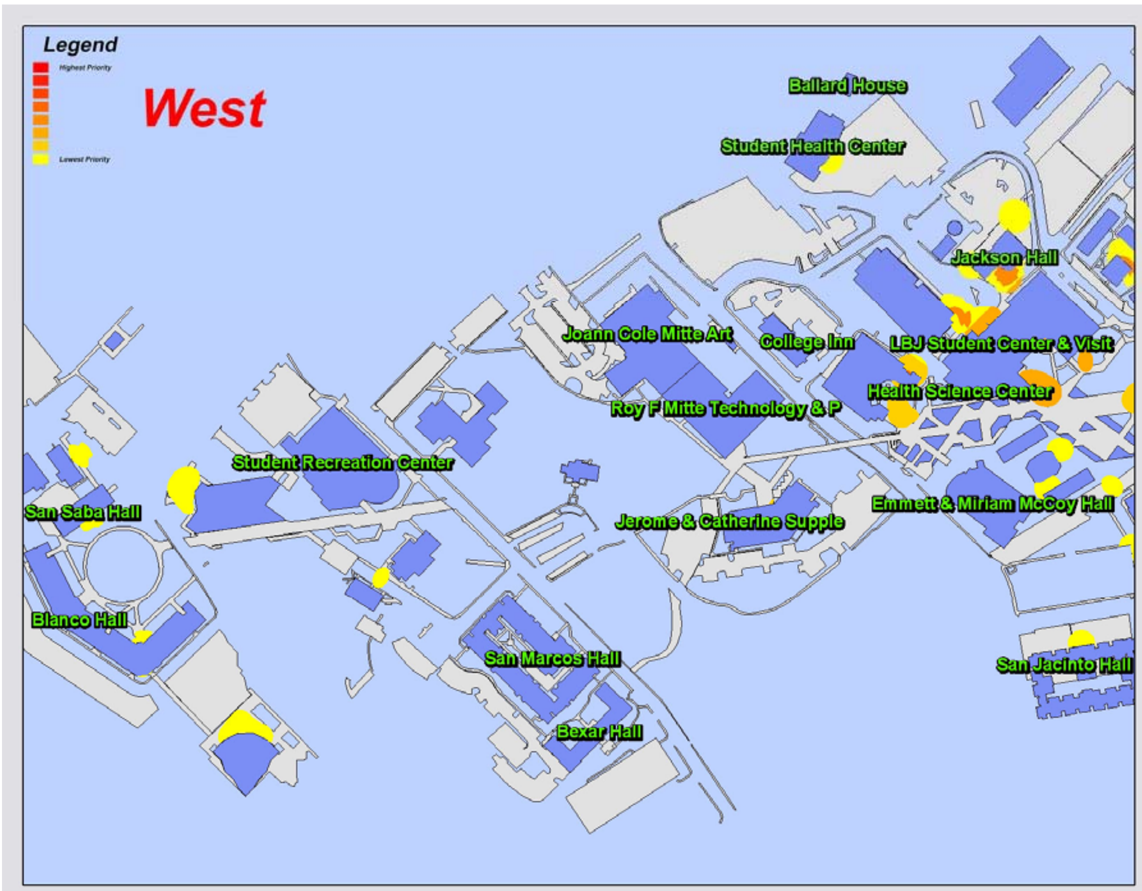
APPENDIX I. FINAL MAPS



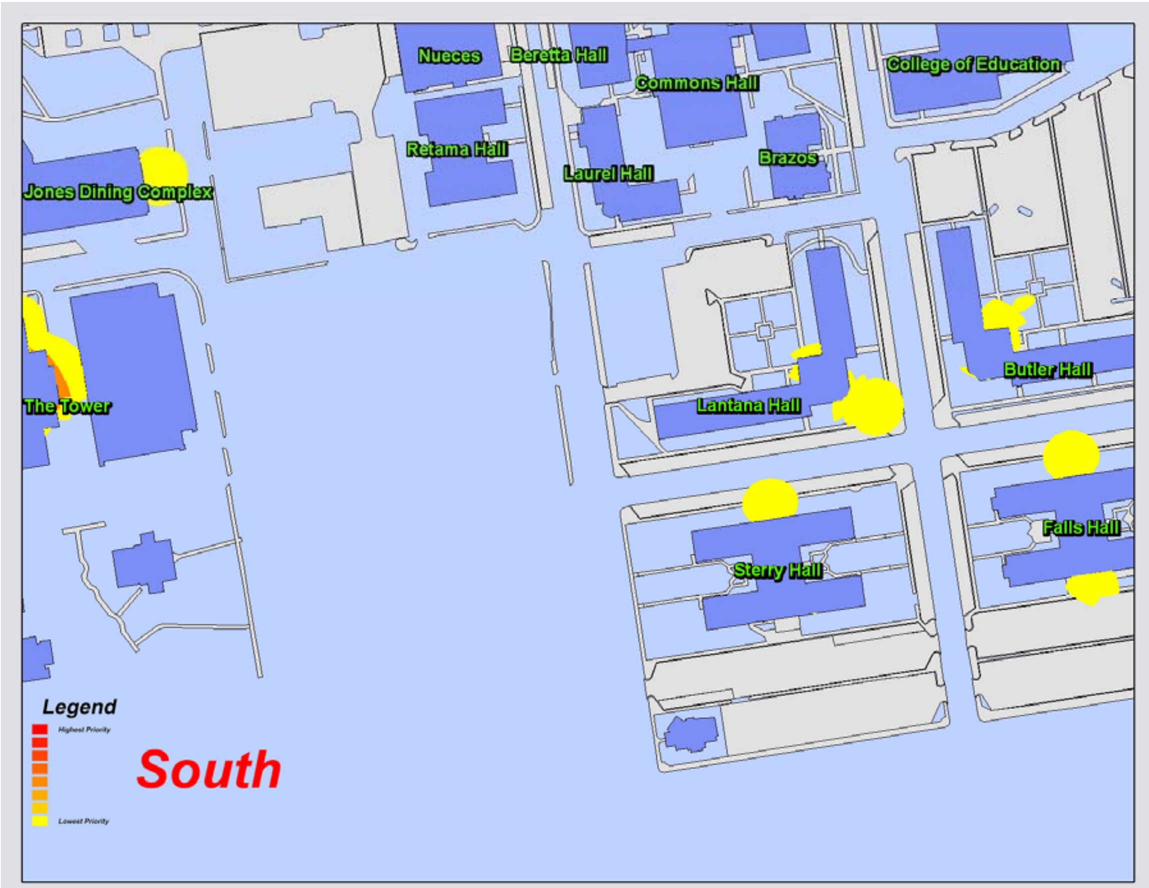
TEXAS STATE UNIVERSITY - Central Campus



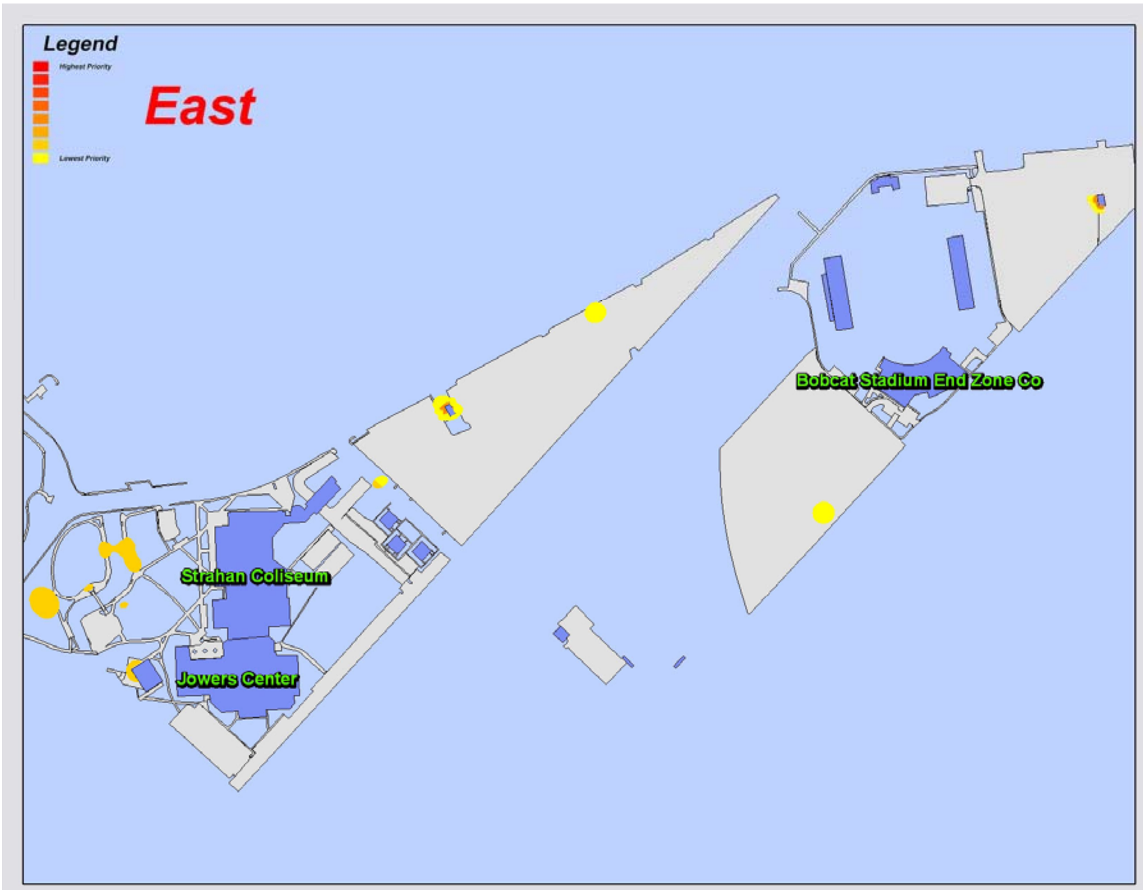
TEXAS STATE UNIVERSITY – North Campus



TEXAS STATE UNIVERSITY – West Campus



TEXAS STATE UNIVERSITY – South Campus



TEXAS STATE UNIVERSITY – East Campus

APPENDIX II. Metadata

DOQQ
Identification_Information:
  Description:
    Supplemental_Information:
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      Coverage Area: One USGS quarter quad of 664 covering 10496
  Status:
    Progress: Complete
    Maintenance_and_Update_Frequency: Last Update: February 2002
  Spatial_Domain:
    Bounding_Coordinates:
      West_Bounding_Coordinate: 3054994.000000
      East_Bounding_Coordinate: 3076210.000000
      North_Bounding_Coordinate: 9950070.000000
      South_Bounding_Coordinate: 9925998.000000
  Point_of_Contact:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Capital Area Planning Council, GIS Department.
      Contact_Address:
        Address:
          2512 IH 35 South, Suite 200
          78704   Texas
        City: Austin
      Contact_Voice_Telephone: 512-916-6000
      Contact_Facsimile_Telephone: 512-916-6001
      Contact_Electronic_Mail_Address: gis@capco.state.tx.us
  Native_Data_Set_Environment: Tiff
Data_Quality_Information:
  Attribute_Accuracy:
  Positional_Accuracy:
    Horizontal_Positional_Accuracy:
      Horizontal_Positional_Accuracy_Report: +/- 4'
Spatial_Data_Organization_Information:
  Raster_Object_Information:
    Raster_Object_Type:
      Raster format: MrSID
      SDTS raster type: Pixel
      Number of raster bands: 3

      Origin location: Upper Left
      Has pyramids: TRUE
      Has colormap: FALSE

Data compression type: Wavelet
Display type: pixel codes
Row_Count: Number of cells on x-axis: 10608
Column_Count: Number of cells on y-axis: 12036
Vertical_Count: Number of cells on z-axis: 1
Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geographic:
Geographic_Coordinate_Units: US survey feet
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1983
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137
Denominator_of_Flattening_Ratio: 298.257
Planar:
Grid_Coordinate_System:
State_Plane_Coordinate_System:
Lambert_Conformal_Conic:
Local_Planar:
Local_Planar_Description:
COORDINATE SYSTEM: US State Plane
STATE PLANE ZONE: Texas Central
STATE PLANE FIPSZONE: 4203
PLANAR DISTANCE UNITS: Survey Feet

Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Resolution: 2
Altitude_Distance_Units: feet
Altitude_Encoding_Method: 1=3000
Entity_and_Attribute_Information:
Overview_Description:
Entity_and_Attribute_Overview:
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Type of object: Table
Number of records: 256
Attributes
ObjectID
Alias: ObjectID
Data type: OID
Width: 4
Precision: 0
Scale: 0
Definition:
Internal feature number.

Definition Source:
ESRI

Value
Alias: Value
Data type: Integer
Width: 0
Precision: 0
Scale: 0

Count
Alias: Count
Data type: Integer
Width: 0
Precision: 0
Scale: 0

Details for Band_2
Type of object: Table
Number of records: 256
Attributes
ObjectID
Alias: ObjectID
Data type: OID
Width: 4
Precision: 0
Scale: 0
Definition:
Internal feature number.
Definition Source:
ESRI

Value
Alias: Value
Data type: Integer
Width: 0
Precision: 0
Scale: 0

Count
Alias: Count
Data type: Integer
Width: 0
Precision: 0
Scale: 0

Details for Band_3
Type of object: Table
Number of records: 256
Attributes
ObjectID
Alias: ObjectID
Data type: OID
Width: 4
Precision: 0
Scale: 0
Definition:
Internal feature number.
Definition Source:
ESRI

Value
Alias: Value
Data type: Integer
Width: 0
Precision: 0
Scale: 0

Count
Alias: Count
Data type: Integer
Width: 0
Precision: 0
Scale: 0

Distribution_Information:
Distributor:

Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
: Capital Area Planning Council
Sanborn Mapping
1935 Jamboree Drive, Suite 100
Colorado Springs, CO 80920
Contact_Electronic_Mail_Address: Available via the internet at www.capco.state.tx.us under GIS Data
Metadata_Reference_Information:
Metadata_Date: 04/03/06
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person:
Richard Bolton: Data analyst
GeoSolve
rb1044@txstate.edu
Metadata_Use_Constraints: cost: free

Trashcan data

Identification_Information:
Description:
Purpose: Coordinate locations for trashcans on Texas State University at San Marcos
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: March 12, 2006
Ending_Date: March 15, 2006
Currentness_Reference: Current for spring 2006
Status:
Progress: Complete
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: West: -97.953655
East_Bounding_Coordinate: East: -97.923322
North_Bounding_Coordinate: North: 29.892028
South_Bounding_Coordinate: South: 29.885623
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Richard Bolton
Contact_Organization_Primary:
Contact_Organization: GeoSolve
Contact_Position: Data Analyst

Contact_Address:
Address:
Department of Geography:
601 University Dr.
San Marcos, TX 78666
Contact_Voice_Telephone: 512-767-4580
Contact_Electronic_Mail_Address: rb1044@txstate.edu
Contact_Instructions: Best to contact by email. Can also contact Chris Reynolds at cr20@txstate.edu/512-245-9177
Data_Quality_Information:
Attribute_Accuracy:
Attribute_Accuracy_Report: Data was gathered by hand and then checked with orthophoto of area. Points could have been missed by collectors, leading to loss of accuracy.
Spatial_Data_Organization_Information:
Point_and_Vector_Object_Information:
SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type:
ESRI feature type: Simple
Geometry type: point
Point_and_Vector_Object_Count: 258
Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geographic:
Geographic_Coordinate_Units: US Survey Feet
Planar:
Map_Projection:
Map_Projection_Name:
Horizontal coordinate system
Projected coordinate system name:
NAD_1983_StatePlane_Texas_South_Central_FIPS_4204_Feet

Grid_Coordinate_System:
State_Plane_Coordinate_System:
Lambert_Conformal_Conic:
Standard_Parallel: 28.383333
Standard_Parallel: 30.283333
Longitude_of_Central_Meridian: -99.000000
Latitude_of_Projection_Origin: 27.833333
False_Easting: 1968500.000000
False_Northing: 13123333.333333
Local_Planar:
Local_Planar_Description:
COORDINATE SYSTEM: US State Plane
STATE PLANE ZONE: Texas Central
STATE PLANE FIPSZONE: 4203

PLANAR DISTANCE UNITS: Survey Feet
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abscissa_Resolution: 0.00016
Ordinate_Resolution: 0.000016
Planar_Distance_Units: survey feet
Local:
Local_Description:
Bounding coordinates
In projected or local coordinates
Left: 2300069.995470
Right: 2309661.863953
Top: 13873375.272869
Bottom: 13871133.103520
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1983
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137.000000
Denominator_of_Flattening_Ratio: 298.257222
Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Resolution: 0.000001
Altitude_Encoding_Method: Explicit elevation encoding method included with horizontal coordinates
Depth_System_Definition:
Depth_Resolution:
Vertical
Minimum elevation: 0.000000
Maximum elevation: 817.269750
Entity_and_Attribute_Information:
Overview_Description:
Entity_and_Attribute_Overview:
Details for Trashcans
Type of object: Feature Class
Number of records: 258
Attributes
FID
Alias: FID
Data type: OID
Width: 4
Precision: 0
Scale: 0
Definition:
Internal feature number.
Definition Source:

ESRI

Shape
Alias: Shape
Data type: Geometry
Width: 0
Precision: 0
Scale: 0
Definition:
Feature geometry.
Definition Source:
ESRI

ObjName
Alias: ObjName
Data type: String
Width: 10

Metadata_Reference_Information:
Metadata_Date: April 4, 2006
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Same as persons listed above
Metadata_Time_Convention: Central Standard Time
Metadata_Language: English

Vending Machine data

Identification_Information:
Description:
Purpose: Coordinate locations for vending machines on Texas State University at San Marcos
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: March 12, 2006
Ending_Date: March 27, 2006
Currentness_Reference: Current for spring 2006
Status:
Progress: Complete
Spatial_Domain:

Bounding_Coordinates:
West_Bounding_Coordinate: West: -97.952359
East_Bounding_Coordinate: East: -97.923344
North_Bounding_Coordinate: North: 29.892055
South_Bounding_Coordinate: South: 29.888693
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Richard Bolton
Contact_Organization_Primary:
Contact_Organization: GeoSolve
Contact_Position: Data Analyst
Contact_Address:
Address:
Department of Geography:
601 University Dr.
San Marcos, TX 78666
Contact_Voice_Telephone: 512-767-4580
Contact_Electronic_Mail_Address: rb1044@txstate.edu
Contact_Instructions: Best to contact by email. Can also contact Chris Reynolds at cr20@txstate.edu/512-245-9177
Data_Quality_Information:
Attribute_Accuracy:
Attribute_Accuracy_Report: Data was gathered by hand and then checked with orthophoto of area. Points could have been missed by collectors, leading to loss of accuracy.
Spatial_Data_Organization_Information:
Point_and_Vector_Object_Information:
SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type:
ESRI feature type: Simple
Geometry type: point
Point_and_Vector_Object_Count: 13
Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geographic:
Geographic_Coordinate_Units: US Survey Feet
Planar:
Map_Projection:
Map_Projection_Name:
Horizontal coordinate system
Projected coordinate system name:
NAD_1983_StatePlane_Texas_South_Central_FIPS_4204_Feet

Grid_Coordinate_System:
State_Plane_Coordinate_System:

Lambert_Conformal_Conic:
Standard_Parallel: 28.383333
Standard_Parallel: 30.283333
Longitude_of_Central_Meridian: -99.000000
Latitude_of_Projection_Origin: 27.833333
False_Easting: 1968500.000000
False_Northing: 13123333.333333
Local_Planar:
Local_Planar_Description:
LCOORDINATE SYSTEM: US State Plane
STATE PLANE ZONE: Texas Central
STATE PLANE FIPSZONE: 4203
PLANAR DISTANCE UNITS: Survey Feet
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abscissa_Resolution: 0.00016
Ordinate_Resolution: 0.000016
Planar_Distance_Units: survey feet
Local:
Local_Description:
Bounding coordinates
In projected or local coordinates
Left: 2300470.603370
Right: 2309654.884080
Top: 13873388.675320
Bottom: 13872249.374186
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1983
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137.000000
Denominator_of_Flattening_Ratio: 298.257222
Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Resolution: 0.000001
Altitude_Encoding_Method: Explicit elevation encoding method included with horizontal coordinates
Depth_System_Definition:
Depth_Resolution:
Vertical
Minimum elevation: 0.000000
Maximum elevation: 774.387690
Entity_and_Attribute_Information:
Overview_Description:
Entity_and_Attribute_Overview:
Details for Vending Machine

Type of object: Feature Class
Number of records: 13
Attributes
FID
Alias: FID
Data type: OID
Width: 4
Precision: 0
Scale: 0
Definition:
Internal feature number.
Definition Source:
ESRI

Shape
Alias: Shape
Data type: Geometry
Width: 0
Precision: 0
Scale: 0
Definition:
Feature geometry.
Definition Source:
ESRI

ObjName
Alias: ObjName
Data type: String
Width: 10

Type
Alias: Type
Data type: String
Width: 15

Metadata_Reference_Information:
  Metadata_Date: April 4, 2006
  Metadata_Contact:
    Contact_Information:
      Contact_Person_Primary:
        Contact_Person: Same as persons listed above
  Metadata_Time_Convention: Central Standard Time
  Metadata_Language: English

APPENDIX III. Contribution of Each Team Member

As the project manager and in addition to coordinating the efforts of the group toward project completion, Braden Warns collected GPS points, contributed to all presentations and reports, communicated with on-campus sources to coordinate gathering of secondary data, and finalized all reports.

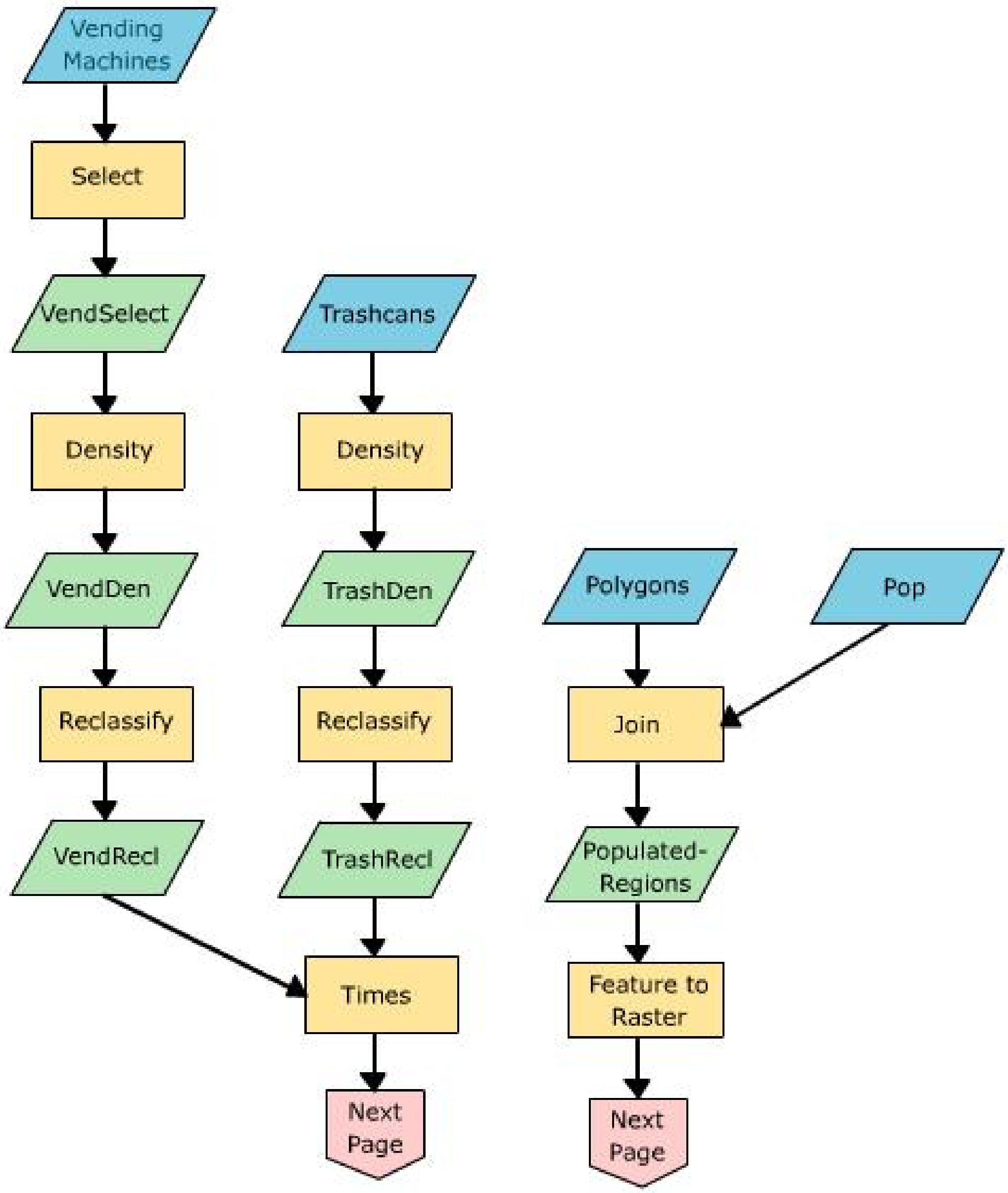
Heather Hilbert, serving as assistant manager, helped gather primary data on number and type of vending and soda machines in buildings, maintained the group's focused on the tasks at hand, worked heavily in the analysis of the data, and compiled the budget and timetable in addition to valuable contributions to the presentations and reports.

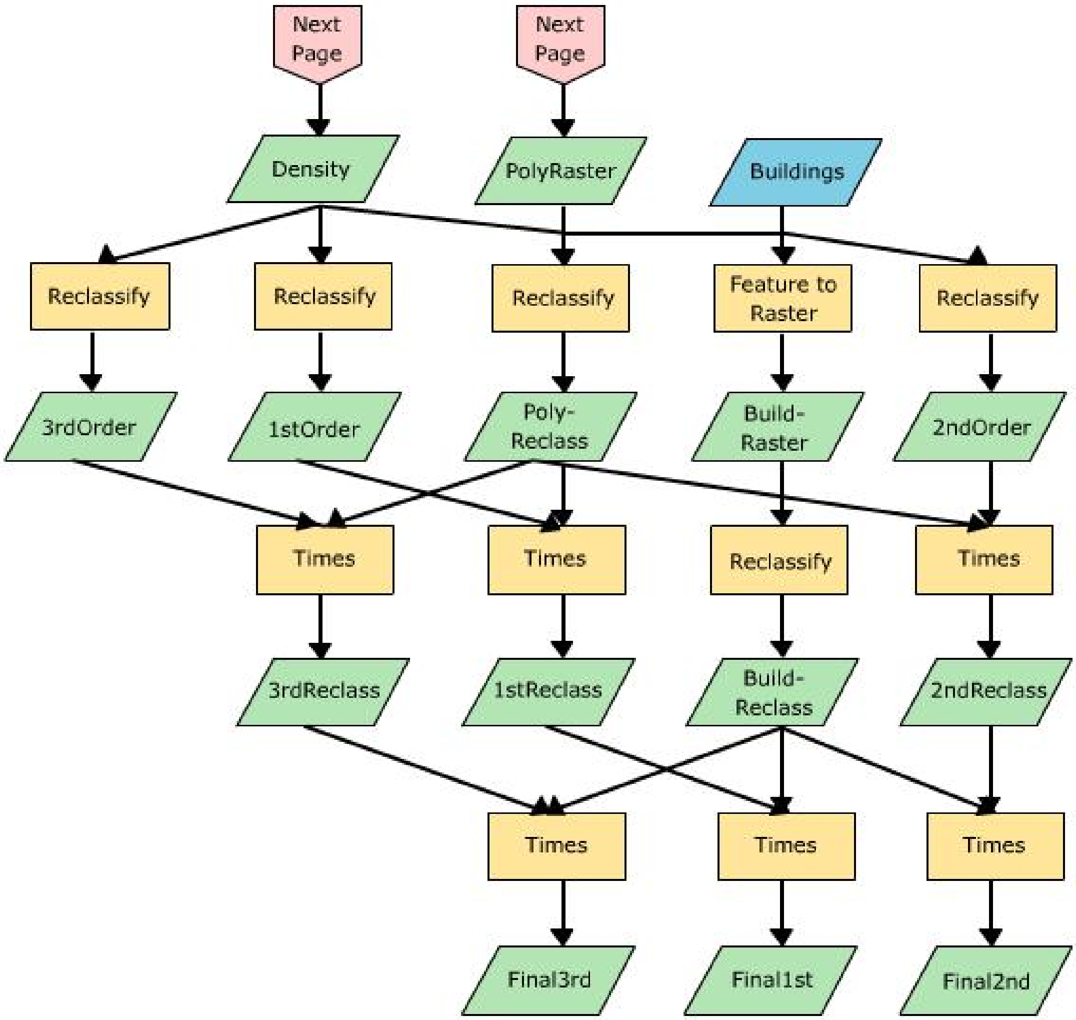
Richard Bolton helped gather building data on number and type of vending and soda machines, introducing and detailing the problem in our reports, and waded through all our data to compile the metadata.

Sadaharu "George" Koshitani also gathered primary data on vending and soda machines, helped analyze the data to come up with a functioning model, created the CD with final deliverables, and designed the poster layout.

Seth Clark gathered and compiled primary data on number and type of vending and soda machines per building, assisted in editing final versions of reports, and created the website for GeoSolve.

APPENDIX IV. Flowchart





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Density
PolyRaster
Buildings
Reclassify
Reclassify
Reclassify
Feature to Raster
Reclassify
3rdOrder
1stOrder
Poly-Reclass
Build-Raster
2ndOrder
Times
Times
Reclassify
Times
3rdReclass
1stReclass
Build-Reclass
2ndReclass
Times
Times
Times
Final3rd
Final1st
Final2nd