

Socioeconomic Variables and Optimal Site Locations for a Soccer Complex in Northeast Madison:

A GIS Analysis

Greg Grube

Michael Brunner

Charlie Shimeall

Andreas Karlsson

Capstone Statement

Though soccer is not the most popular sport in the United States, its global popularity is beginning to spread rapidly to its shores. In places like Madison, WI, indoor soccer already provides a year-round alternative to areas where in climate weather is frequent. However, the current locations of the two existing sites in the area are difficult to easily reach for the residents of the city who live east of the capitol, especially lower income populations. Building a new facility would be a boon to the entire community as they could be used for more than just soccer (Popke 2001: 45) As a result, we began this project to set out and find where the best locations for such a site might be. Our capstone statement sums up the main goals for the project: Identify and rank potential sites for an indoor soccer complex on the east side of Madison, WI. Two scenarios will be considered: one to provide the best access to all socioeconomic backgrounds and the other to provide access to the area's low income and high density of children neighborhoods.

Introduction

Our project was designed to analyze geographic data for the purpose of finding optimal site locations for a new indoor soccer complex in Madison, WI. This would be done by looking at both lot suitability and accessibility to determine the most successful sites. The areas west and south of Madison already have two indoor soccer complex sites that are close to the city: Keva Sports in Middleton (Keva 2011) and Breakaway Sports in Fitchburg. (Breakaway 2011). The goal was to find the best possible locations specifically to serve the eastern portion of the city while also locating the site within the Madison city limits. Our study area, therefore, was defined by the official city of Madison boundary east of the Wisconsin State Capitol. This region excludes all suburban areas such as Maple Bluff and Monona, and also small sections within the city that

are unincorporated (Figure 1). For our two scenarios, we designed one looking at the site selection problem from a private business point of view and the other with the needs of a community group in mind. Particularly, we looked at total population, population of children, and income within census blocks. These data were related to possible site locations for the soccer complex, which we derived from a land use layer of our creation (See metadata at end of document). Different socioeconomic variables needed to be compiled for each scenario, as each had different goals and concepts that reflected the purpose for their existence.

The first approach was designed to find the optimal site for a private business. The driving variable was sheer population – finding the site that reached the maximum amount of people within a certain travel time. To do this we implemented a road network analysis where drive-time by car was used to compile data for the high access population for each potential site.

The community based scenario was similar to the first in that we applied network analysis to find the high access population to each site. However, because this approach was designed to find the best sites explicitly for communities, we focused on devoting the analysis towards neighborhoods with lower income and higher youth population. This also meant basing the network on bus travel time instead of car in order to better model the travelling habits of these communities.

Conceptualization (Refer to Conceptual Flowchart for Details)

Due to various assumptions that must be made throughout, setting specific goals and understanding underlying concepts are important for any GIS project. For this project in particular, it meant considering the specific ways that private businesses and community groups perceive and target their markets of interest. With any organization or business, location is one of the most important aspects for success (Brown 2011). This is true because location differentiates

the area to which residents have high and low access to the complex. These ideas of access set the boundary for which residents are more and less likely to use the facility, and ultimately provide executive criteria for ranking the potential sites in both of this project's scenarios. In addition to accessibility, we also needed to consider suitability. By this we mean determining potential site locations that allow for the building of an indoor soccer complex by fitting the correct land use and size. Specifically, we decided to use sites that were atop commercial land because these locations would already be zoned for commercial use. We also needed to ensure that the lots would be large enough to hold multiple indoor size fields and a parking lot. This required us to limit the sites based on an appropriate size threshold, which was a 100,000 square foot lot size. This number was derived by looking at the total area of one of the preexisting indoor soccer facilities in the Madison area and setting that as a minimum size standard (Keva 2011).

Because a private business looking to build a soccer complex would want to have the highest proximity to the greatest number of people, we deemed that finding a location with access to the highest population of Madison residents, regardless of any demographic variables, was the most important concept for this scenario. Also, because the method of transportation for the majority of Madison residents is a personal vehicle, we used an analysis to find the high access areas for each potential site based on drive travel times within a road network. We realized that people may also take buses in this scenario, but since vehicle drive time would almost always be faster, it made sense to use the more comprehensive road network as a benchmark. When determining areas of high access, we decided it would be vehicle travel of less than 5 minutes. This decision on the definition of high access was one that we considered many solutions for. We researched other studies, but soon discovered that the concept of access is largely a local one and depends upon the destination. High access to reaching a professional sports event in Gold Coast, Australia gave us an idea of how we would approach the matter, but

the assigned values were not applicable in our case (Burke 2009). We considered a few other possibilities. One was to determine the mean travel time across our entire study area, and another was to use the mean travel time to work for residents as a benchmark. However, both of these yielded results that were so large that high access polygons created for each site would cover most of the study area. We decided instead to run scenarios with 5 and 10 minute travel times and see which one would give us the best variance between sites. The 10 minute time still covered almost the all of study area which did not give the variance we wanted. The 5 minute time covered about half of the study area, which seemed like a realistic number for travel in Madison and also was sufficient to be able to distinguish between individual sites (Figure 2).

Once we had determined access areas, we then wanted to find the total population of the blocks that were within the high access areas and add them up to get a total number. These totals would become the determinants for which sites were best for building a privately owned indoor soccer complex, and we then would rank them accordingly. Though we intended for any potential sites to be built within the study area boundary, we did not want to exclude populations outside of the boundaries of our study area from having access. Because a private business would not care about civic boundaries when attempting to reach the most people, high access census blocks that lied outside of the study area were also included in the analysis for determining total population.

For the community-based scenario, the same concepts of access and population were looked at. However, because in this scenario we meant to find a site that would appeal to a public community group instead of a private business, simply looking at total population and personal vehicle drive time would not prove as meaningful. We revised the public scenario to better fit the community-based approach by changing the travel method from personal vehicle to bus and looking at two main population group categories: total low income population and low income children population. We chose bus travel as our method of transportation because it

better reflected the travelling habits of residents with lower income. For bus travel, we determined high access travel time would be anything less than 10 minutes, which, like in the private business scenario, reflects the size of the study area while also being a realistic time to travel (Figure 3). We also wanted to look specifically at low income populations because a public community group would likely want to make sure all people on the east side of Madison had access. As the low-income populations would have the hardest time getting to one of the other existing indoor soccer complexes, it made sense to attempt to locate the site nearest to those populations.

When determining low income census blocks, we initially thought of using the poverty level of the United States, as this is a commonly accepted way to define 'low income.' However, after looking at the census figures, we found that in Madison very few of the census blocks actually had an average less than that number (U.S. 2000) As a result, we decided to use blocks with less than the median household income level of our study area (\$42,392), which would break up the population more evenly and allow a more meaningful analysis to take place. The low income population and the low income children population within the high access areas were derived from the census data at the block group level, as that is the lowest census division that median household income can be reliably compiled for. However, to get better accuracy, we took each block group income and assigned its value to the blocks that were contained within it.

We then needed four main data layers to begin and complete our project. First we needed a City of Madison land use map, which was originally in PDF form (City 2005). This was used to select potential sites for both scenarios. We also needed a census block layer with both population and median household income. The population was used for both scenarios but the median household income was only used in the public scenario (U.S. 2000). Each scenario had its own transportation layer. The private scenario used the City of Madison streets (Davis 2011) and the public scenario used the Madison Metro bus system. For the latter we used a point layer of

bus stops and created the network from them (Sobota 2011). We will talk more about these layers as we implement them into our project.

Implementation (Refer to Implementation flowchart & pseudo-coding for more details)

Most of the processes that we went through were different depending on the scenario; however, the process of finding our potential sites was something that was done for both our public and private options. We started with a City of Madison land use map, where all areas of the city were broken down into categories such as commercial, industrial, and residential. Because this was a vector PDF file, we had to import it into Adobe Illustrator and convert it to AutoCAD format. Then, using our roads layer as a base, we brought the land use polygons into GIS and geo-referenced it. With that done, we selected just the potential sites that were on the east side of Madison, which yielded 541 commercial sites. After applying our minimum standard of using sites that were 100,000 sq ft. or larger, we ended up with 172 potential building locations.

At this point, we began to look specifically at our private business approach. This scenario used the street network of Madison to help build the service areas for each of the 172 sites, allowing us to rank the total population within those service areas. One area that we needed to deal with before running network analysis was how to model stops at intersections. A stop sign layer was provided to us by the City of Madison Transportation Department, but after working with it, we determined that it was not accurate enough to be used effectively in our analysis. We decided instead to consider the average stop time at all intersections to be 2 seconds, which was the default setting given in network analysis. Considering that not all intersections have stops, and that some have stop lights, not stop signs, this number would seem to approximate average stop time fairly well. Like with defining high access, this number is highly dependent on local areas, and we had no better information on why to change it. Once that was complete, we ran service

area analysis on the 172 sites for five minute travel time and got our areas of high access.

The next step in our process was deciding at which census level to group the data. We considered using both census blocks and block groups. In the private scenario we are only dealing with population and population for census blocks is accurate. Since blocks are smaller than groups we will get more variance and precision in our sites if we use blocks. Since the block data we acquired was already encoded with population data, our next step was to spatially join our census blocks and high access polygons. This created a table with records for every block that is within every high access polygon. Once that was compiled, we summed the population of those blocks to determine the total high access populations. Those with the highest number are the best sites for our private business model (We will discuss more about this later in the results section of our paper).

For the community-based approach, we used the same 172 sites that we used for the private scenario. However, we are going to consider bus routes instead of the streets and we will count census block populations with a median household income under the study area median household income instead of the total population. To begin the process of creating a bus network, we used a bus route database from the City of Madison Transit in text format that had data for every bus route, stops and times for Madison Metro (Sobota 2011). We used that text file to create bus stop points for our study area using the Lat and Long fields provided in the table. To actually use the bus routes in network analysis, however, we needed to convert those to line features. To do that, we needed to separate those bus stop points into individual routes because each stop can have multiple buses that service that location. Each route may also have separate travel footprints depending on the time of day, which alters the areas that the route is able to access. Once we were able to separate those points into all possible trips that buses travel, we received help from Fei Du, our Teaching Assistant, to create a script that helped connect each stop for each route.

Since we wanted to run our analysis based on travel time, we needed to input the bus travel time for each line segment that was created. Originally we hoped to just get the travel time from bus stop to bus stop from the Madison Metro Transit bus schedule. Unfortunately, the schedule does not include every stop. Only major stops along the route are given and from that riders estimate the arrival time based on the closest major stops. Instead we decided to use the travel time of the entire trip, determining the proportion of distance for each segment in the trip and then assigning a time value in seconds that is equal to the proportion in distance.

Once we had all of the possible trips, we needed to decide how we would choose which ones to use. Unlike with vehicle travel, buses are not always available and they have multiple routes depending on day or time so we were not able to just take all of the bus lines and run service area analysis. We needed to look at a specific time to ride in order to have consistency for when people could expect the bus to arrive and where it would take them. Looking at both the Breakaway Soccer Complex on the south side of Madison, leagues tended to not to begin until early evening so we could rule out bus routes that only ran in the morning (Breakaway 2011). We also excluded weekend routes because these times have many fewer routes and those that do run often have very different stops. Considering adults tend to be at work until 5 PM and children are in school most times of the year and probably would need parental supervision, we decided to choose east Madison bus routes that ran at or around 6 PM. We were then able to narrow the bus system down to the 17 bus trips that ran around 6 PM on the east side of Madison. Using the 10 minute high access area that we mentioned earlier in our conceptualization, we were then able to run service area analysis on the bus routes for the 172 sites.

With our high access polygons completed, we had to overlay them with the census blocks to get the total low income population and low income children population. However, as stated earlier, when using the census blocks, we needed to consider the fact that the income data was not available at the block level. The concern with just using block groups instead is that we would

over-generalize and over-count the population numbers so, because block groups are made up of individual blocks, the median household income for each block then becomes the median household income of the block group that overlaps those regions. By working through the process this way, we eliminate the amount of overgeneralized that would have been taken up by the whole block group (Figure 4). Neither method is completely accurate but the block method is more accurate spatially as we are dealing with normalized income data whether we used blocks or block groups.

Once we completed the block group to block median household income conversion, we spatially joined these blocks to the high access bus regions. For this scenario, we selected only those blocks with a median household income under the average, a value of \$42,392, to perform our 'one to many' spatial join. Like in the private business scenario, it gave us a table of populations for both low income populations in general and for low income children population specifically. We then summed the populations of the blocks for each potential site and got the totals. We originally were planning on ranking both low income populations in order to give low income children a greater weight, but in the end, because of high correlation between the two population measurements, only the summed children population ended up giving us our rankings (Figure 5). (This ranking process is discussed later on in our paper).

Results and Discussion

Looking at our results, we see similar trends in both our public and private scenarios. Due to the use of blocks for our enumeration units and the nature of our high access areas, each of the 172 sites has places where many of the blocks are the same. Especially in places where the sites are very close to each other, the population totals tend to be very similar to each other. This makes sense, and when attempting to classify the sites into groups, zones of similar values begin

to emerge. The classification process is inherently problematic and biased, but we decided to use Jenks Natural Breaks because it takes into consideration places where there are gaps in the data and would provide a better separation of values. Regardless, almost all of the classification schemes that we tried gave us similar zonal groupings, so this phenomenon is not based solely on our classification choice.

Looking specifically at the private soccer complex scenario, the areas of highest population tend to be in two distinct regions (Figure 6). One is located in the central portion of the study area, near an area of major road confluence. This makes sense logically because you would be able to make it further in 5 minutes using major roads and this area would likely have more population as a major link in the city. The other major area is located near the capitol. This also makes sense because of the density of the population in that area, as well as the presence of a large amount of the UW-Madison student population within a 5 minute drive of most of the sites located on the east side. The population amounts tend to decrease as you move outward from these zones.

We also ranked the top ten private sites, and then mapped them using an aerial image background just to get an idea what types of sites would be selected. Four of the best 5 sites are located around the American Family Insurance complex at Stoughton Rd and Aberg Ave. (Figure 7). Though the main insurance building would not likely be a feasible target for construction, one of the smaller sites could be potential locations. The sites located near the capitol are of various types (Figure 8). The third-ranked site is located only a block from the capitol, and would probably not be the easiest site to build at due to its highly sought location. Interestingly, one of the top ranked sites is already the location of an athletic field, Breese Stevens Field, showing that a sports complex at one of these sites is not out of the realm of possibility.

For the public soccer complex scenario, the areas of largest populations were mostly located in one large region located north and west of where the best private site locations are

(Figure 9). This area had a relatively high amount of total population as evidenced by the private scenario, but the presence of lower income populations, both adults and children, makes this the area the best for a public site. This area is still pretty well centralized within the study area, and also benefits from good access to the bus routes. Compared to the road network, which allows access to almost any area of the study area, the bus network is more limited, with some sites not easily accessible due to their distance from the bus lines. As a result, it would be possible some of those areas that were eliminated had high low income populations, but after comparing the sites that were ranked the highest to those with the highest low income populations, it turns out that our model actually does a good job of surrounding those areas with low income children (Figure 10).

Looking at those areas ranked in the public scenario top ten, the sites are located near a major road, which makes sense considering that bus routes would be along major roadways (Figure 11). It's also not surprising when you look at where the blocks with the highest density of low income children are located. All of the top 10 sites in this scenario are in the same part of the study area as these blocks.

Overall, the results closely represent the kind of output we planned when starting the project. However, like any project, there were stumbling blocks and hurdles that we needed to consider as we tried to get from conceptualization to final product. Some of these limitations were technical, such as not understanding initially the type of output that network analysis would provide us, and some were simply data collection and entry, where we weren't able to get the data we wanted or we had to manually enter data into tabular form. A few of these were important parts of our project and require some further discussion.

The first major limitation that we encountered was trying to find a zoning data layer. We looked at various resources online and found that a zoning data layer existed from the Dane County Land Information Office, but that it cost \$200. Not willing to pay this amount, we continued to look around for data, eventually finding a land use map which was only in PDF form.

We got around this problem by geo-referencing the map, but it was land use and not zoning like we originally were looking for. The other limitation with using land use that we wanted to find the areas that would be available for building on, but besides areas that were already commercial land use, we were not sure what other sites would be available to build on, such as vacant lots. We decided to not use vacant lots because we did not know if they had commercial zoning, needed to still be zoned in the first place or something else.

Another major issue that we encountered was using a ranking system for the public scenario. We decided originally that we wanted focus on low-income populations for the public site, but that we in particular wanted to reach the low-income children population. As a result, we created a ranking system that gave a one to five ranking (5 being the highest) to low income population sites, and a one to five ranking to low income children population sites. After that, we would combine the numbers to determine the best low income site overall. Essentially, this system would double count the children population and give them more weight. Once we compared our weight ranking to the total low income children population, we realized that they both were selecting the same sites, which makes sense given that low income parents would naturally have low income children. As it seemed redundant, we decided when creating our map to just consider the low income children population as our standard to simply the result.

Perhaps our biggest hurdle was attempting to use the bus network to come up with high access areas in the public scenario. The first issue that we needed to address was how to count bus travel: specifically, could we count transfer times between buses and the time it took to walk to and from the bus stop? We decided that incorporating transfers into our model would be extremely difficult because of the uncertainty involved in wait times between buses, and considering the small amount of time that we thought was 'high access,' it would not make much sense for passengers to transfer. When considering the walking time, it was difficult to determine a set amount of time that individuals would walk to each bus stop, and almost as hard to

determine how far they would be willing to walk from the bus to the soccer site. As a result, we did not take walk time into consideration when establishing bus travel time, as unrealistic as that is. We did need to create a buffer from individual sites to the road in order to run network analysis (300 meters), but this is not included in the time.

The other major hurdle with the bus network was trying to negotiate the realities of the Madison Metro bus system. As mentioned earlier, each bus route has different trips based on time of day and then also completely different routes on weekends as well. In order to simplify the process, we decided that the 6 PM weekday routes would limit the routes to both a manageable number and avoid the problem of the same route having multiple travel footprints. We wanted to avoid situations where we would have to guess which route a passenger would want to take to the potential site.

Many of the other issues that we had were previously discussed in the implementation, such as difficulty evaluating income at the block level and difficulty defining high access, also caused us issues and bear repeating here as well. Some of these issues that we had may have been handled differently if we had more time to analyze them, better access to data and more money and resources. As a result, this project was by no means comprehensive and leaves much room for future research opportunities.

Most of the improvements that we could make on this project deal with refining our processes. For example, we could attempt to model bus transfers and walking times and include them in our analysis, as well as looking at all bus routes regardless of day of the week or time of the day. However, there are also some conceptual changes that might make our scenario more realistic to actually construct. First, we could do more demographic research in order to find out if there is a certain segment of the population that would want an indoor soccer complex the most, and specifically target them in our analysis or give higher weight to those groups. In addition, we might also want to consider looking only at those sites that are available to be purchased or look

at building site costs in order to determine which place would be the most feasible to build at while still reaching the most people.

Conclusion

After performing all of our analyses and looking at our results, we accomplished the main goals that we set out to do. By using service analysis on roads and looking at census block populations, we were able to determine locations where the highest amount of people could get to. With the doing service analysis on bus routes and comparing those areas to places of low income population, we were able to define sites to build a soccer complex if we wanted to reach underprivileged populations on the east side of Madison. The ranking of sites based on total population and low income population, helped to provide a clear idea to where we would be most successful in reaching the largest target population groups. Though there were some unexpected problems that we encountered when actually running the implementation portion of the project, overall we were able to stick to the main themes of our project. The processes that we ran in the project provided some additional insight to the capabilities of service area analysis, the importance of good data layers and data layer management, and the necessity of conceptualizing project ideas ahead of time to avoid problems once processing actually begins. Though we were not able to look at building costs that it would take to construct an indoor soccer site, our project allows a glimpse at places on the east side of Madison that would be best suited for such a site, whether the goal was to turn a profit or simply provide an indoor alternative for soccer players in underrepresented areas.

Bibliography

Breakaway Sports Center. "Summer Leagues."

http://breakawaysports.com/summer_adultindoor.asp (Last Accessed 12 May 2011).

Brown, Kenny. "The Effect of Business Location to the Business Success." *The Houston Chronicle*.

<http://smallbusiness.chron.com/effect-business-location-business-success-3260.html>. (Last Accessed 11 May 2011)

Burke and Evans. 2009. Public Transport Access to Proposed Stadium Sites. *Journal of the Eastern Asia Society for Transportation Studies*, Vol.8.

City of Madison Department of Planning and Development, 2005. "Current Land Use."

http://www.cityofmadison.com/planning/ComprehensivePlan/dplan/v1/chapter2/v1c2_1a.pdf. (Last Accessed 04 April 2011).

Davis, David A. GIS Manager, City of Madison Engineering Division. "Madison Roads." (Received by E-mail, 20 March 2011)

Keva Sports Center. "Company Events and Meetings."

<http://kevasports.com/Company%20Events>. (Last Accessed 11 May 2011)

Popke, Michael. 2001. Mixing It Up. *Athletic Business Magazine*. Page 45 and 46.

Sobota, Tim. Transit Planner, Metro Transit of Madison, WI. "Bus Stop Points." (Received by E-mail 12 April 2011).

U.S. Census Bureau. 2000. American FactFinder.

<http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. (Last Accessed May 1, 2011).

East Madison Commercial Sites Metadata: Original Data Layer

Identification_Information:

Citation:

Citation_Information:

Originator: University of Wisconsin Madison, Department of Geography, Geog 578
Publication_Date: May 10, 2011
Publication_Time: Unknown
Title: East Madison Commercial Sites
Edition: 1st
Geospatial_Data_Presentation_Form: vector digital data
Online_Linkage: \\discovery\classes\g578\DBs\SoccerComplex\SoccerComplexLocation_Test.gdb

Description:

Abstract: This dataset shows the locations of Commercial Land Use sites on the east side of Madison, WI. There are 541 different polygons, of which 172 were over 100,000 square feet and ultimately eliminated by query.

Purpose: This dataset was created in order to find the number of commercial sites that exist on the east side of Madison. Of these sites, 172 were over 100,000 square feet and used for analysis. The other sites were ultimately eliminated by query. The selected commercial sites were used in service area analysis to find high access areas for road and bus travel in the city. These high access areas coincided with blocks and were used to determine populations that had high access to each commercial site.

Supplemental_Information: Original land use data is from City of Madison Department of Planning and Development, Planning Unit

Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:
Calendar_Date: January 2005
Time_of_Day: unknown

Currentness_Reference: publication date

Status:

Progress: Complete
Maintenance_and_Update_Frequency: None planned

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -89.394958
East_Bounding_Coordinate: -89.266721
North_Bounding_Coordinate: 43.161821
South_Bounding_Coordinate: 43.038775

Keywords:

Theme:

Theme_Keyword_Thesaurus: Reference to a formal thesaurus
Theme_Keyword: Commercial Land Use

Place:

Place_Keyword: Madison, WI

Access_Constraints: No restrictions on access

Use_Constraints: Data can be used for educational and reference purposes, though user should note data is based on georeferencing and therefore should not be assumed to be 100% spatially accurate.

Point_of_Contact:

Contact_Information:

Contact_Organization_Primary:
Contact_Organization: University of Wisconsin Madison, Department of Geography, Geog 578
Contact_Person: Greg Grube
Contact_Position: Student

Browse_Graphic:

Data_Set_Credit: City of Madison Department of Planning and Development, Planning Unit provided the original PDF, of which the data was extracted.

Security_Information:

Security_Classification: Unclassified

Native_Data_Set_Environment: Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcCatalog 9.3.1.1850

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report: Area in Square Feet and Land Use type accuracy are correct and all other attributes fields are not as important when using the data.

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report: Data georeferenced to current roads network in Madison, WI. Georeferencing process done by visualization, so data may not be perfectly accurate.

However, great care was taken to make sure polygons lined up with roads and so error was minimized. Scale of data extent is 1:73,274

Vertical_Positional_Accuracy:

Vertical_Positional_Accuracy_Report: No vertical information used.

Lineage:

Process_Step:

Process_Description: Dataset copied.

Source_Used_Citation_Abbreviation:

\\DISCOVERY\Classes\g578\DBs\SoccerComplex\SoccerComplexLocation_Test.gdb

Process_Date: 20110406

Process_Time: 16080300

Process_Step:

Process_Description: Dataset copied.

Source_Used_Citation_Abbreviation:

\\DISCOVERY\Classes\g578\DBs\SoccerComplex\SoccerComplexLocation_Test.gdb

Process_Date: 20110406

Process_Time: 17012000

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Vector

Point_and_Vector_Object_Information:

SDTS_Terms_Description:

SDTS_Point_and_Vector_Object_Type: G-polygon

Point_and_Vector_Object_Count: 541

Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Planar:

Map_Projection:

Map_Projection_Name: Lambert Conformal Conic

Lambert_Conformal_Conic:

Standard_Parallel: 43.069516

Longitude_of_Central_Meridian: -89.422222

Latitude_of_Projection_Origin: 43.069516

False_Easting: 811000.000000

False_Northing: 480943.886000

Planar_Coordinate_Information:

Planar_Coordinate_Encoding_Method: coordinate pair

Coordinate_Representation:

Abscissa_Resolution: 0.000328

Ordinate_Resolution: 0.000328

Planar_Distance_Units: survey feet

Geodetic_Model:

Horizontal_Datum_Name: D_North_American_1983_HARN

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: 0.000100

Altitude_Encoding_Method: Explicit elevation coordinate included with horizontal coordinates

Entity_and_Attribute_Information:

Detailed_Description:

Entity_Type:

Entity_Type_Label: East_Commercial_Sites

Entity_Type_Definition: All Commercial Sites on East side of Madison

Attribute:

Attribute_Label: OBJECTID

Attribute_Definition: Internal feature number.

Attribute_Definition_Source: ESRI

Attribute_Domain_Values:

Unrepresentable_Domain: Sequential unique whole numbers that are automatically generated.

Attribute:

Attribute_Label: Shape

Attribute_Definition: Feature geometry.

Attribute_Definition_Source: ESRI

Attribute_Domain_Values:

Unrepresentable_Domain: Coordinates defining the features.

Attribute:

Attribute_Label: FID_

Attribute:

Attribute_Label: Land_Type

Attribute_Definition: Type of Land Use Characteristic
Attribute_Definition_Source: City of Madison Department of Planning and Development,
Planning Unit
Attribute:
Attribute_Label: Shape_Length
Attribute_Definition: Length of feature in internal units.
Attribute_Definition_Source: ESRI
Attribute_Domain_Values:
Unrepresentable_Domain: Positive real numbers that are automatically generated.
Attribute:
Attribute_Label: Shape_Area
Attribute_Definition: Area of feature in internal units squared.
Attribute_Definition_Source: ESRI
Attribute_Domain_Values:
Unrepresentable_Domain: Positive real numbers that are automatically generated.
Attribute:
Attribute_Label: Area_SqFt
Attribute_Definition: Total Area of Polygon in Square Feet
Attribute_Definition_Source: Calculated in Data Table
Distribution_Information:
Resource_Description: Downloadable Data. To be used as an appendix for Soccer Complex Report.
Not for intended for public distribution.
Metadata_Reference_Information:
Metadata_Date: 20110510
Metadata_Review_Date: 05/10/11
Metadata_Future_Review_Date: Unknown
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: University of Wisconsin Madison, Department of Geography, Geog 578
Contact_Person: Greg Grube
Contact_Position: Student
Contact_Address:
Address_Type: physical address
Address: 550 North Park Street
City: Madison
State_or_Province: Wisconsin
Postal_Code: 53706
Contact_Voice_Telephone: 608-417-0098
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
Metadata_Time_Convention: local time
Metadata_Access_Constraints: None
Metadata_Use_Constraints: None
Metadata_Extensions:
Online_Linkage: <http://www.esri.com/metadata/esriprof80.html>
Profile_Name: ESRI Metadata Profile



Goals

1. Identify and rank potential soccer complex sites on the east side of Madison based on equal access to all residents
2. Identify and rank potential soccer complex sites on the east side of Madison based on socioeconomic data



Key Concept

Determine Optimal Site Location using Lot Suitability and Accessibility.



Scenario 1: Variables

- Lot Suitability
- 1- Land Use Type
 - 2- Lot Size
- Accessibility
- 3 - Travel Time
 - 4 – Total Population



Scenario 1: Operationalize

1. **Zoning Type:** 'Suitable' zoned as commercial
2. **Lot Size:** Greater than 100,000 square feet
3. **Travel Time:** High Access < 5 minutes
4. **Total Population:** Find area with most people within high access areas



Scenario 2: Variables

- Lot Suitability
- 1- Zoning Type
 - 2- Lot Size
- Accessibility
- 3 - Travel Time
 - 4 – Population below median household income
 - 5 – Population of children below median income



Scenario 2: Operationalize

1. **Zoning Type:** 'Suitable' zoned as commercial
2. **Lot Size:** Greater than 100,000 square feet
3. **Travel Time:** High Access < 10 minutes
4. **Low Income Total Population:** Census blocks with median income < 42,392
5. **Low Income Children Population:** Census blocks with high amount of children

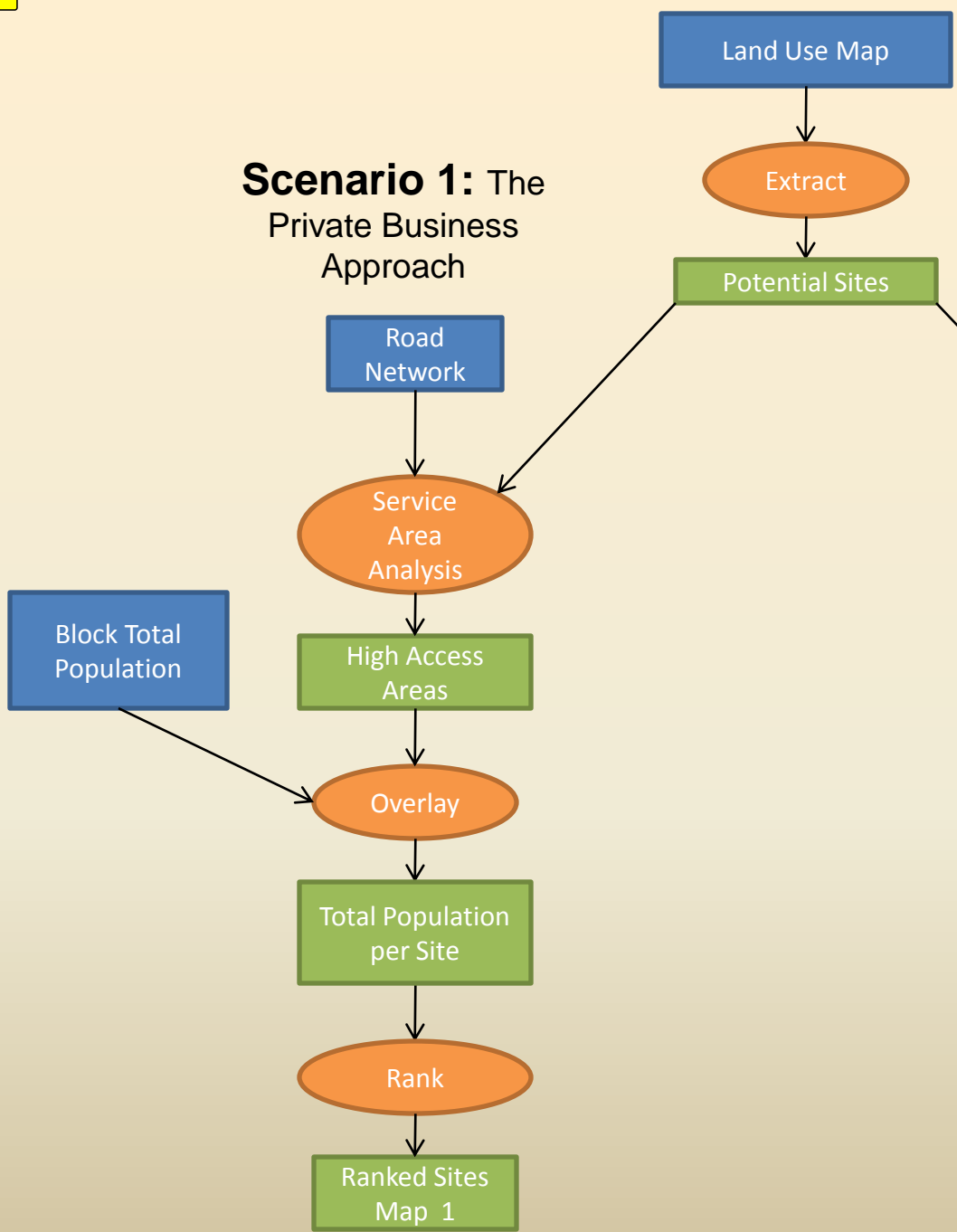


Data Layers

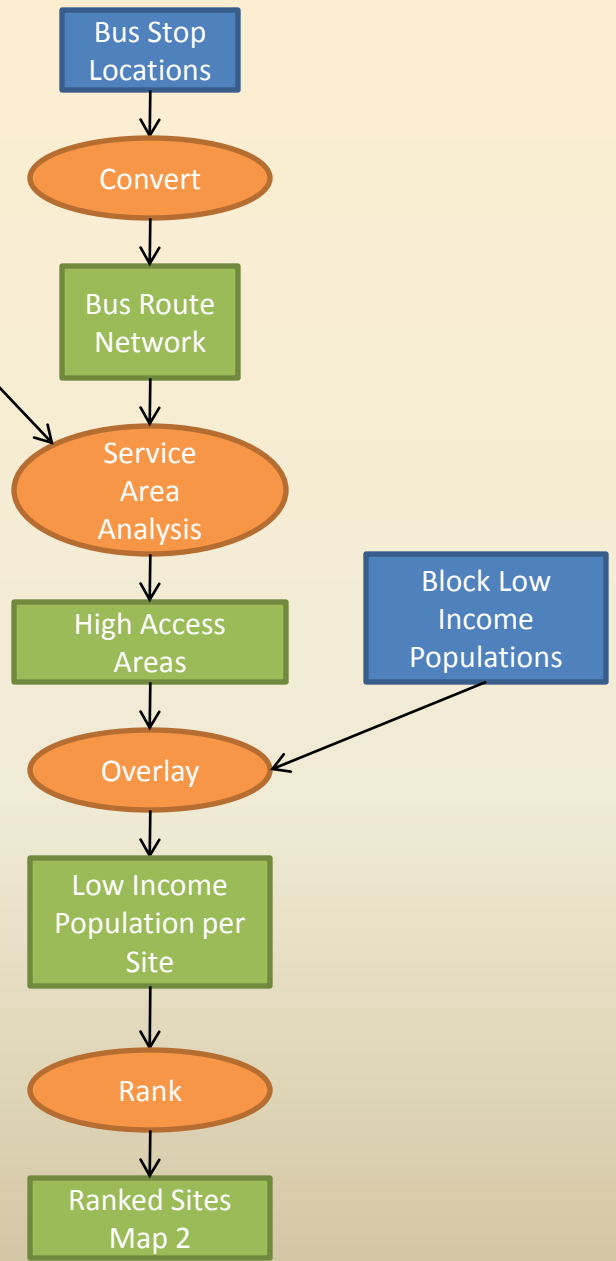
Land Use Areas, Population data, economic data and demographic data, Madison Roads / Highways, Bus Stop Locations



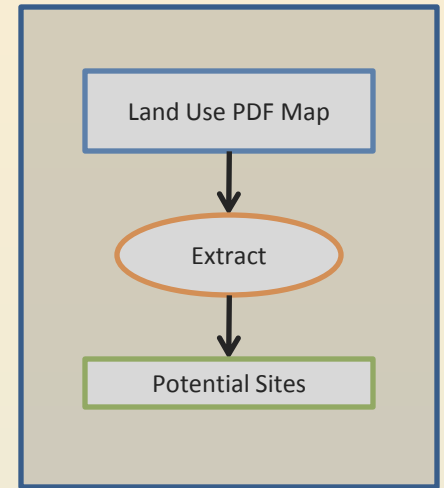
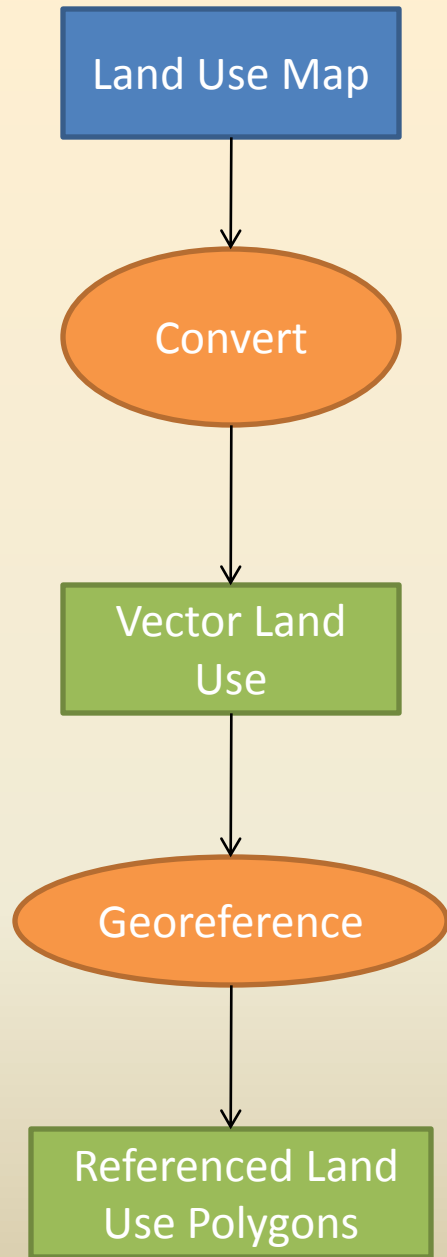
Scenario 1: The Private Business Approach

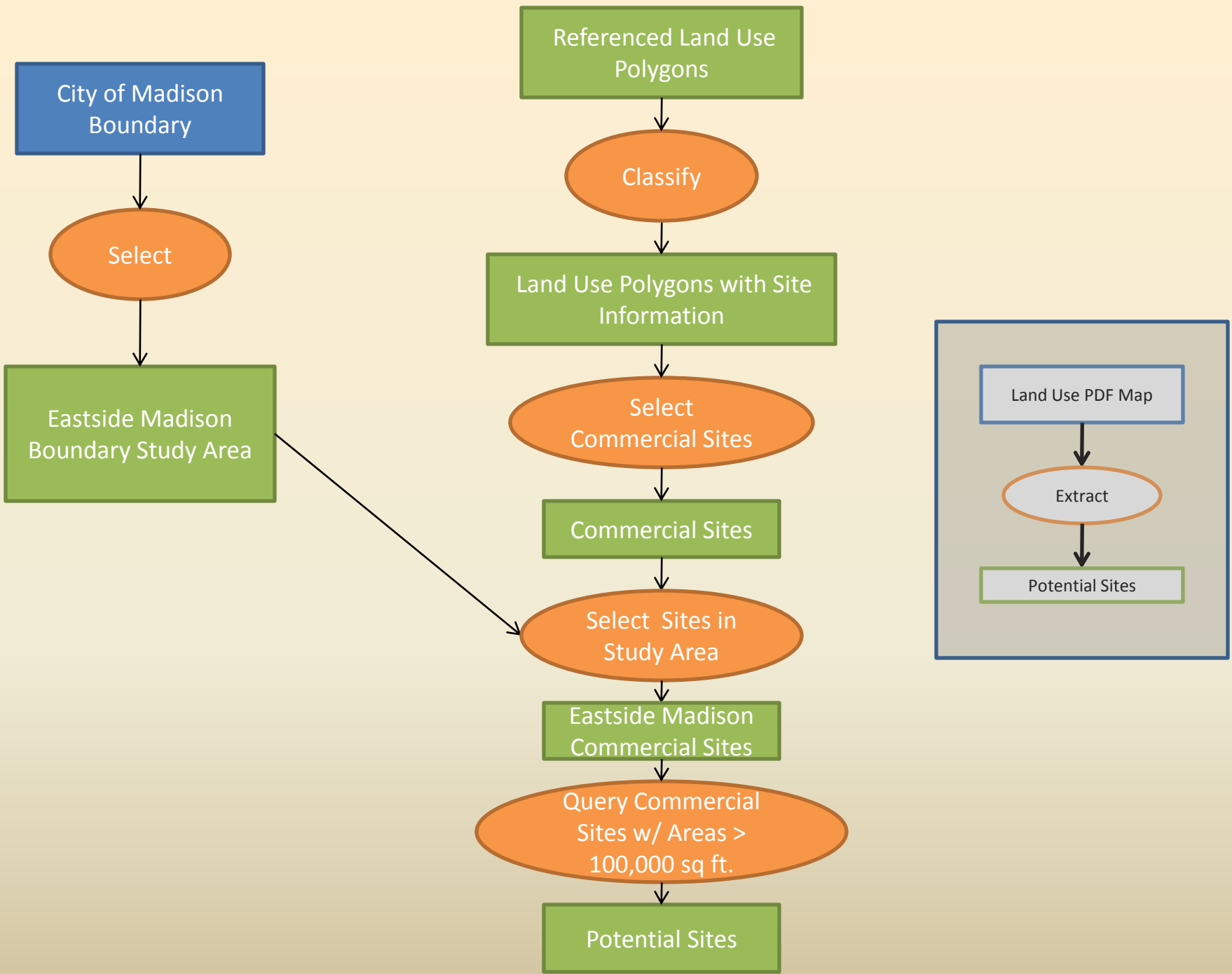


Scenario 2: The Community-Based Approach

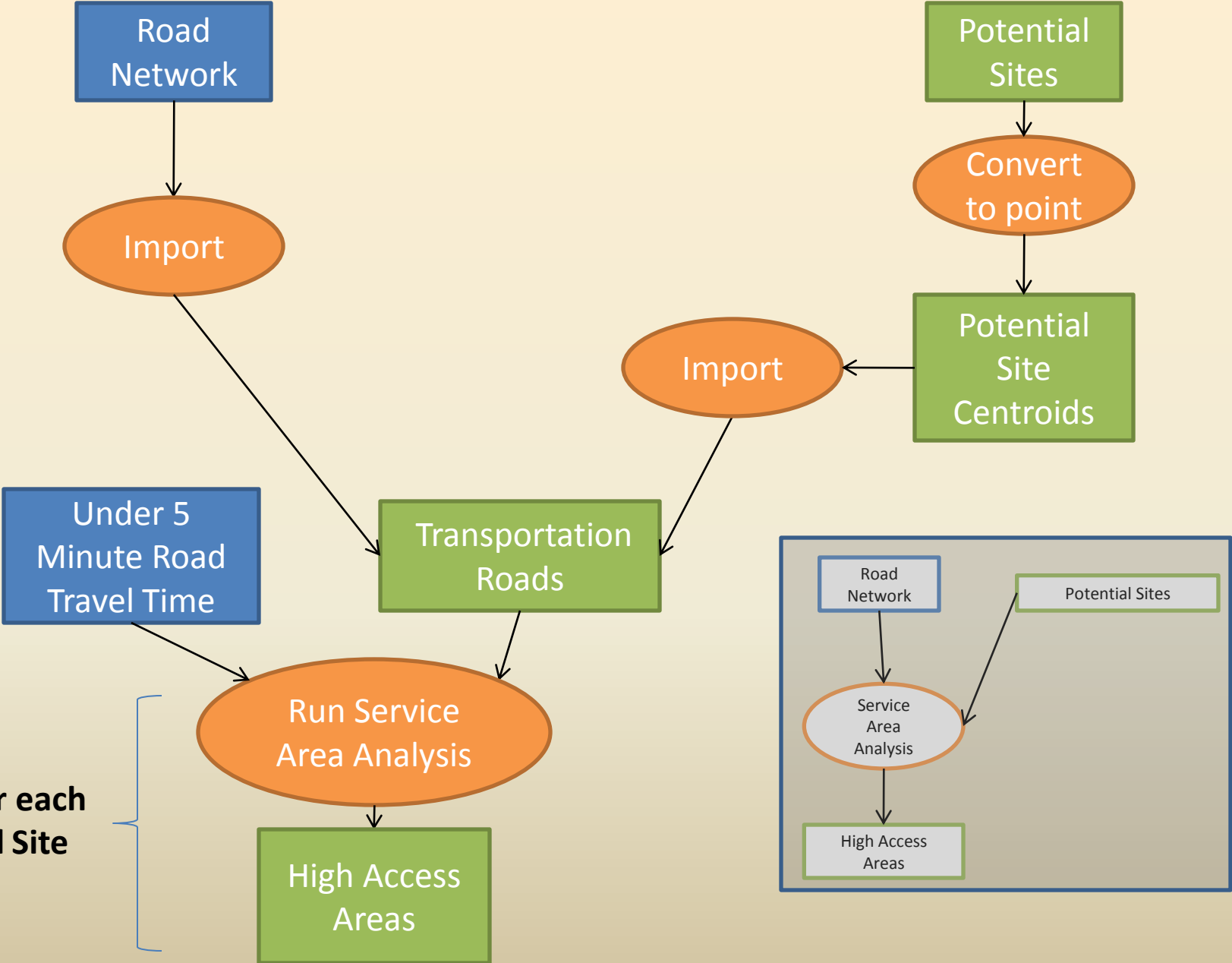


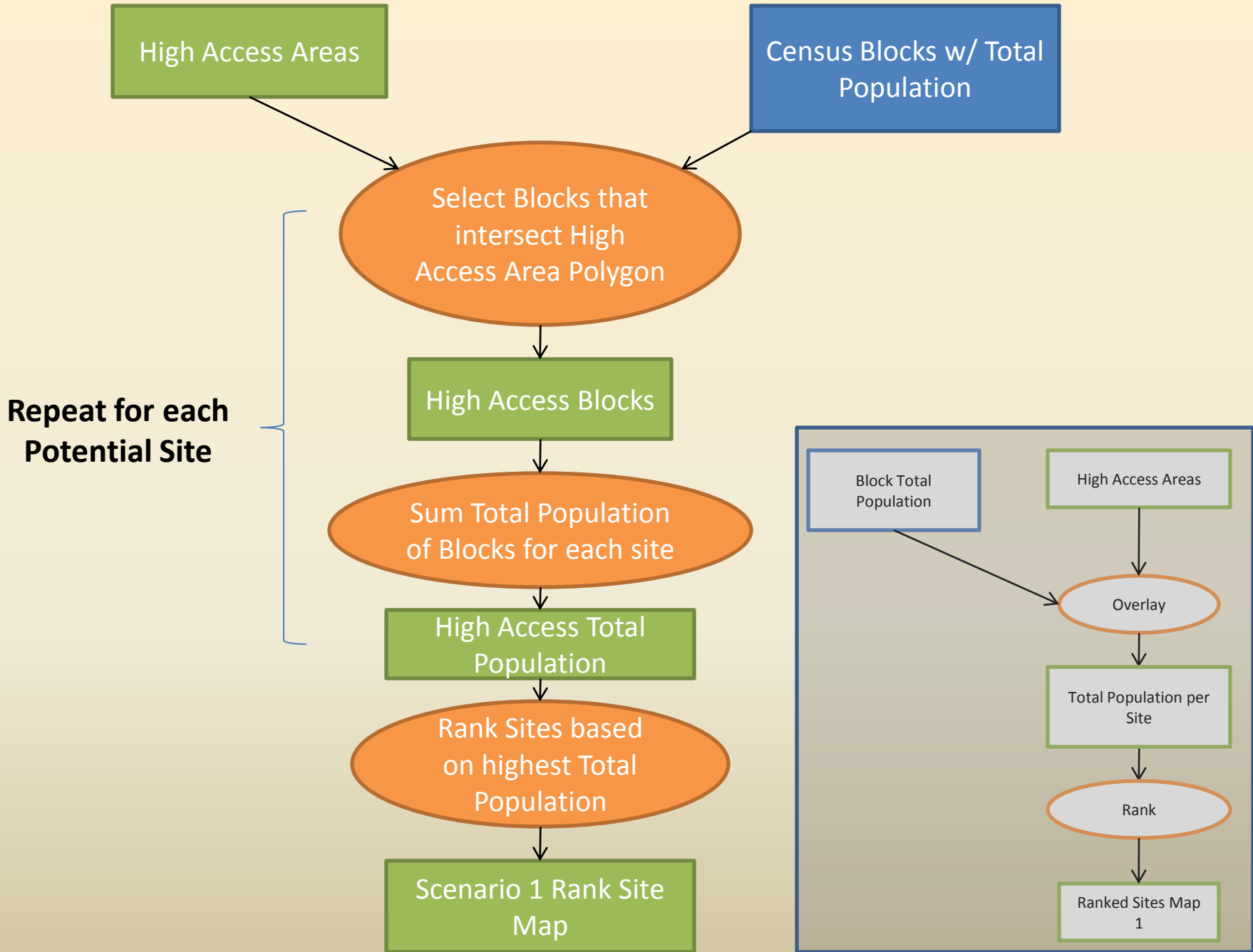
Pseudo-Coding:



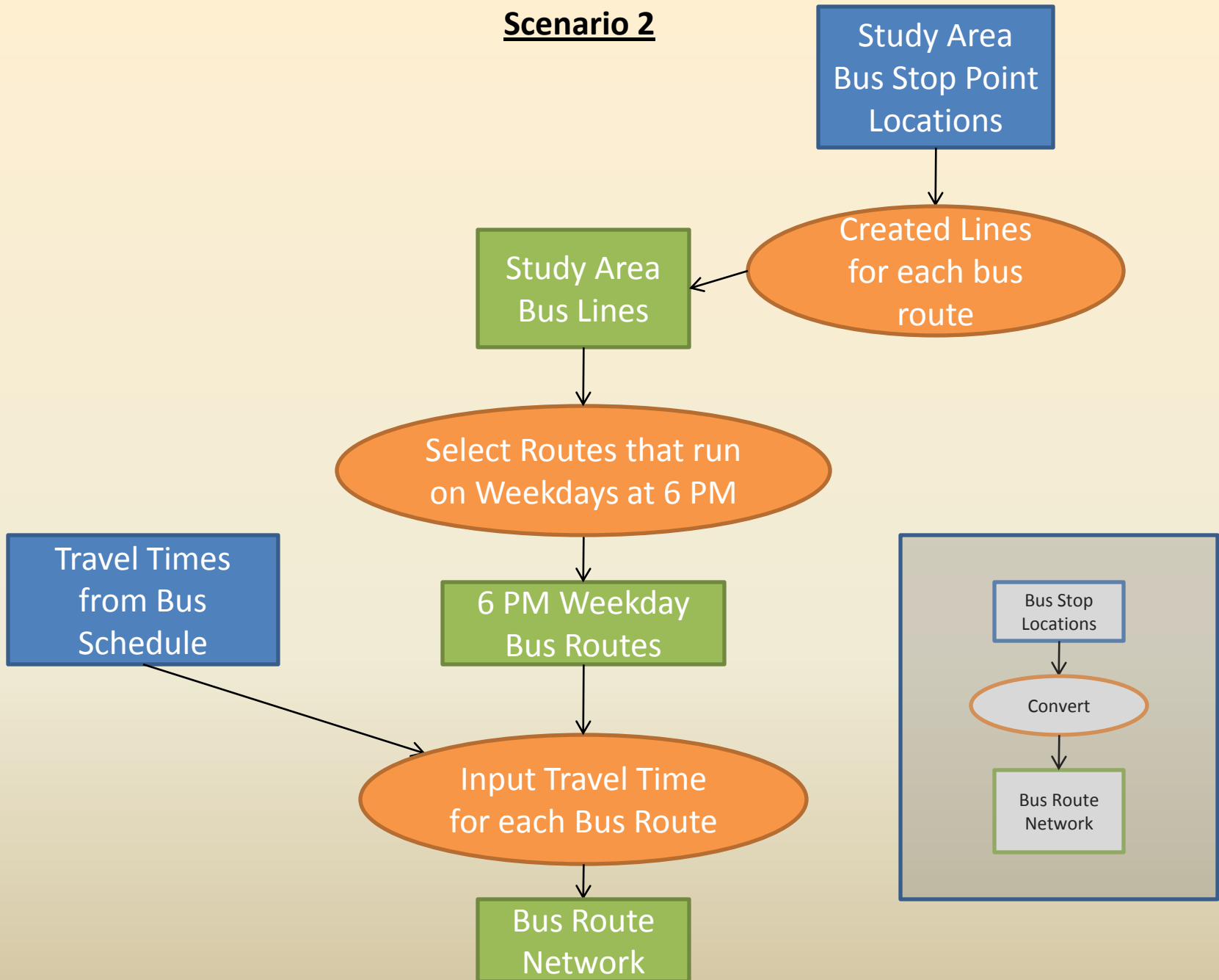


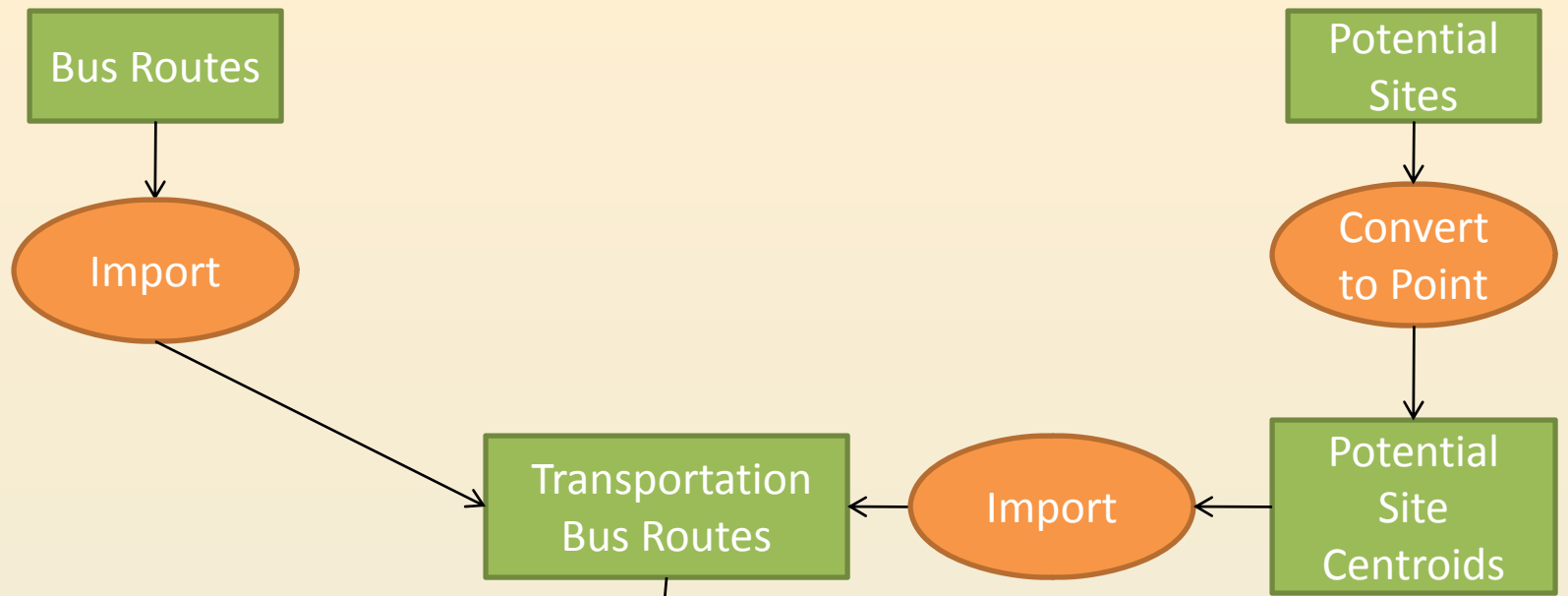
Scenario 1:





Scenario 2

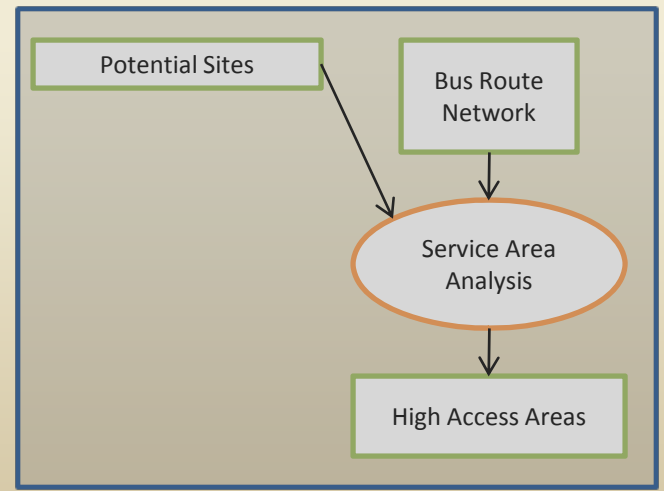
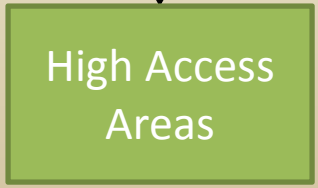




Under 10 Minute Travel Time



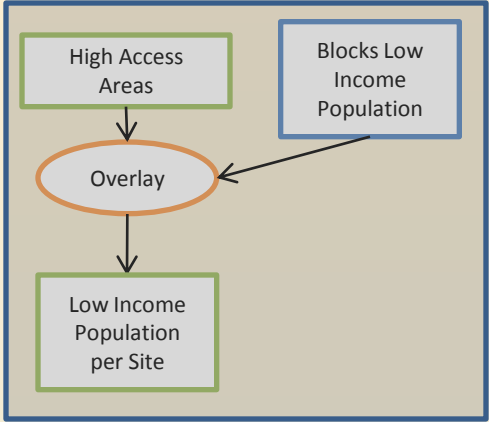
Repeat for each Potential Site



High Access Areas

Census Blocks w/ Total Population

Select Blocks using centroids within High Access Area



High Access Blocks

Repeat for each Potential Site

Total: Population in blocks with median income under the study area median

Total: Children in blocks with median income under the study area median

Low Income Children Population

Low Income Total Population

Low Income Children
Population

Low Income Total
Population

**Repeat for
each
Potential
Site**

Ranking into 5
categories using
Natural Breaks

Ranking into 5
categories using
Natural Breaks

Low Income Children
Ranked Sites (Rank of 5
is highest)

Low Income Total
Population Ranked
Sites (Rank of 5 is
highest)

Sum Ranks
with equal
weighting

Scenario 2 Ranked
Site Map

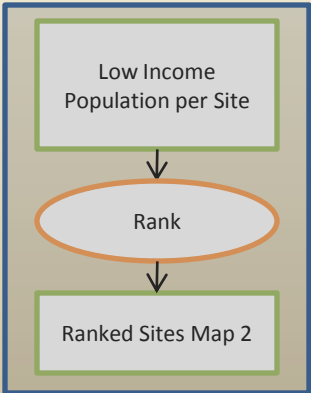


Figure 1

Indoor Soccer Facilities in Madison, WI

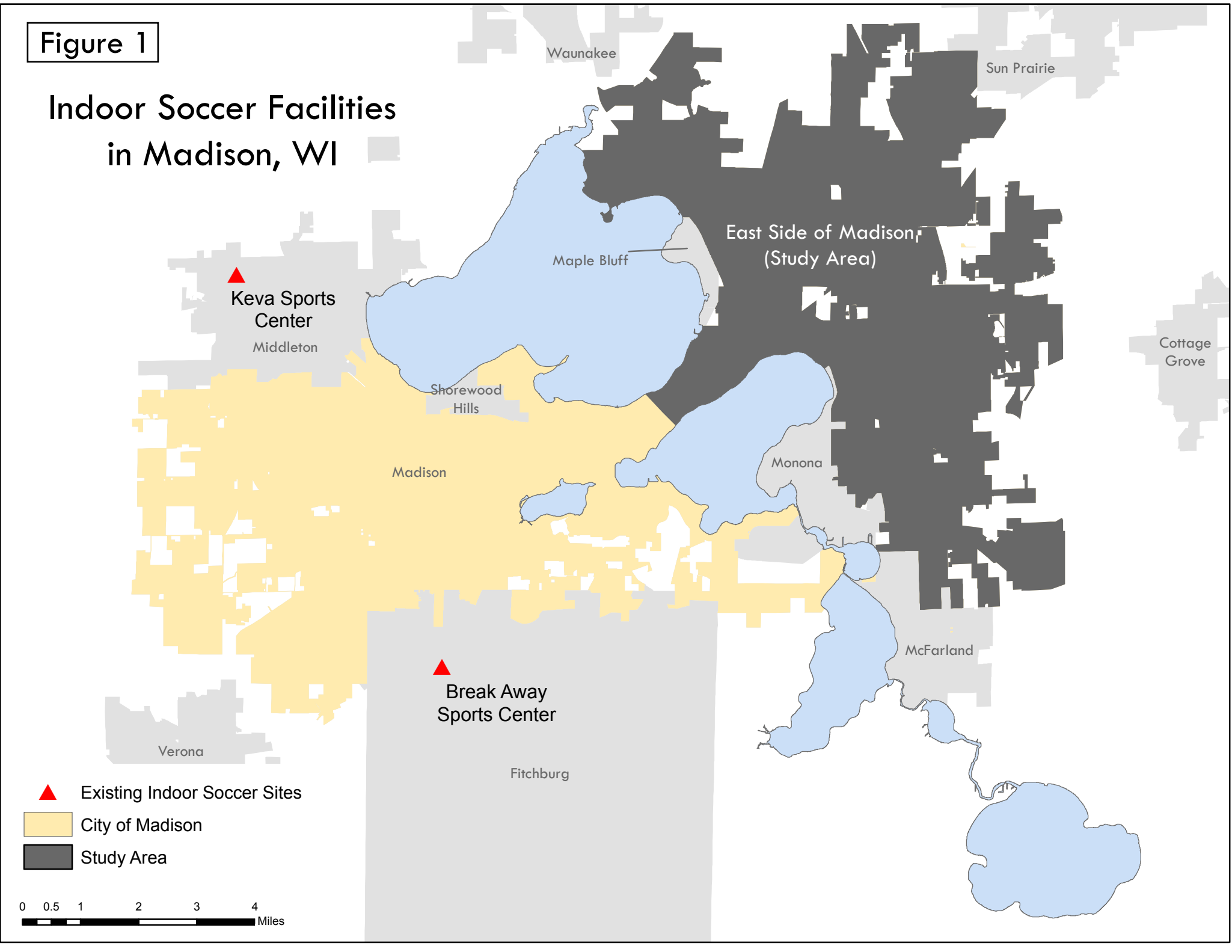


Figure 2

Top Private Site
with 5 minute service Area
and Census Blocks

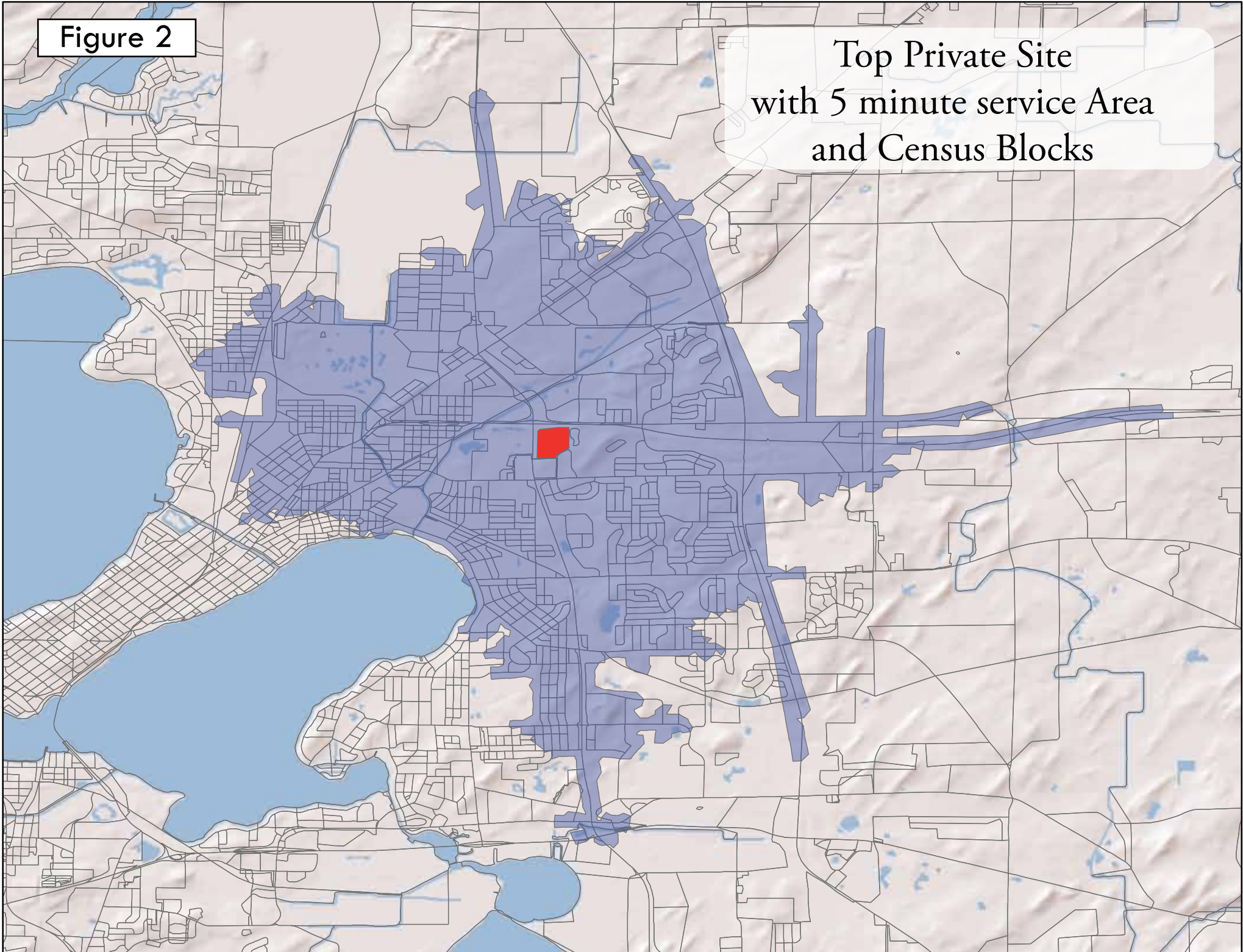


Figure 3

Top Public Site
with 10 minute service Area
and Census Blocks

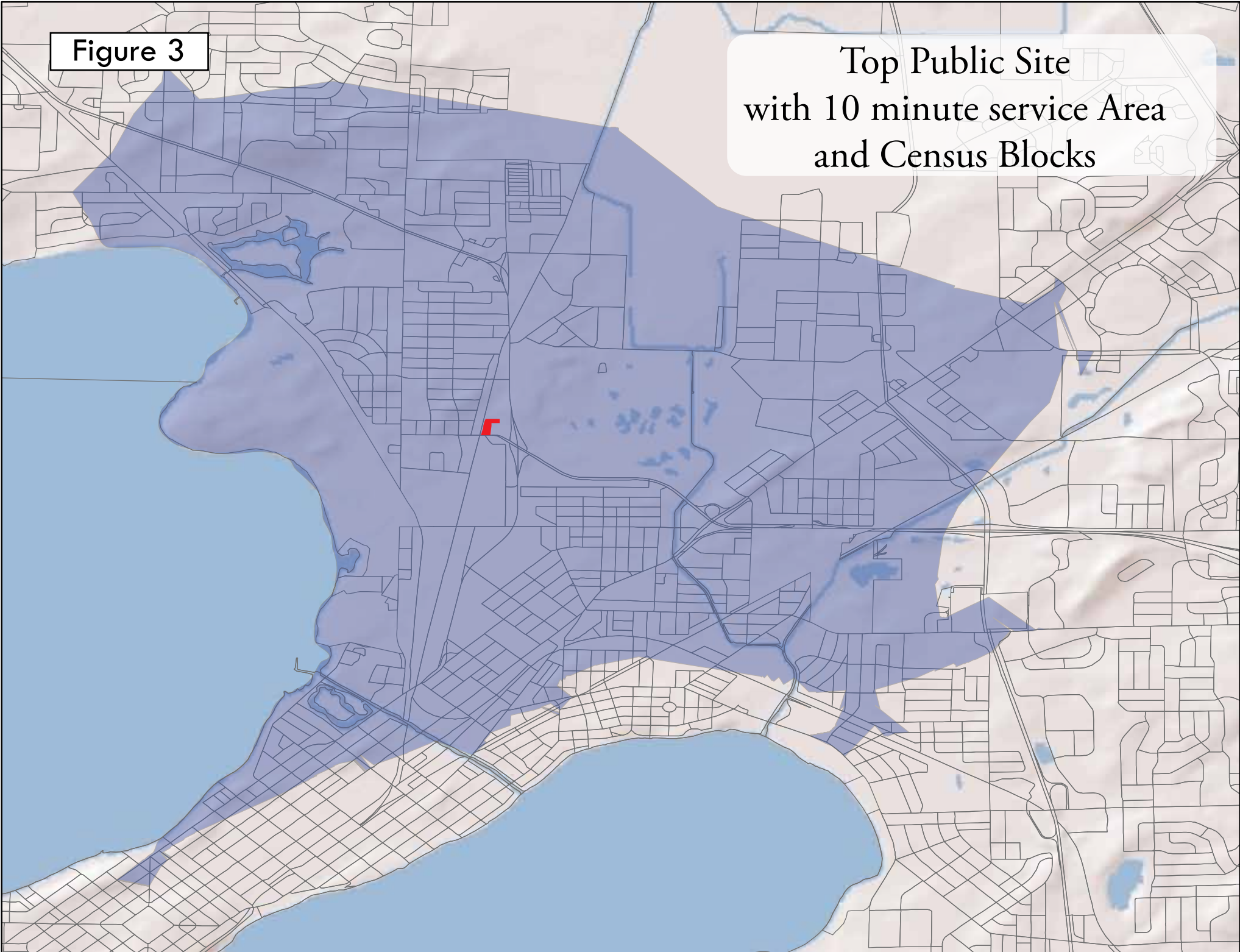
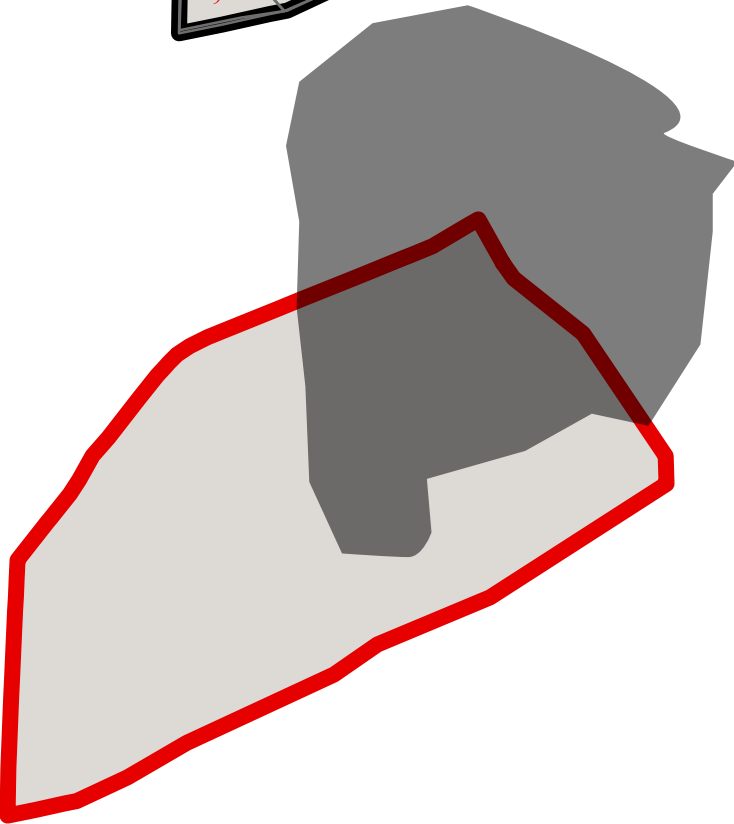
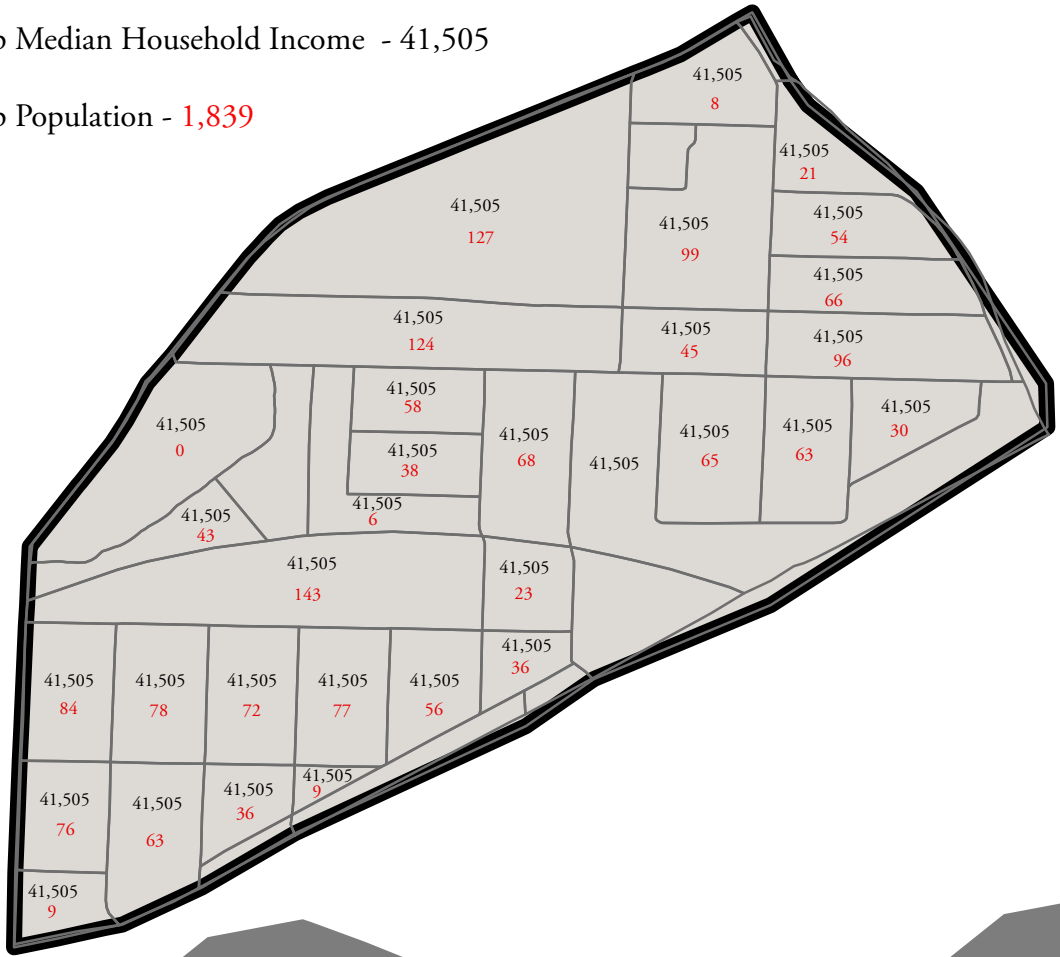


Figure 4

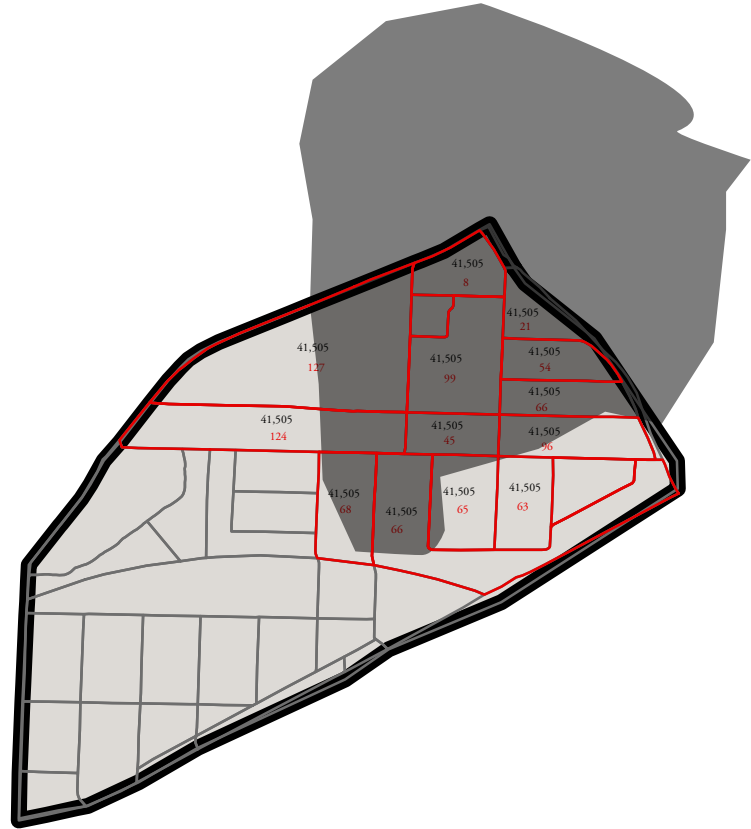
Block Groups vs. Blocks

Block Group Median Household Income - 41,505

Block Group Population - 1,839



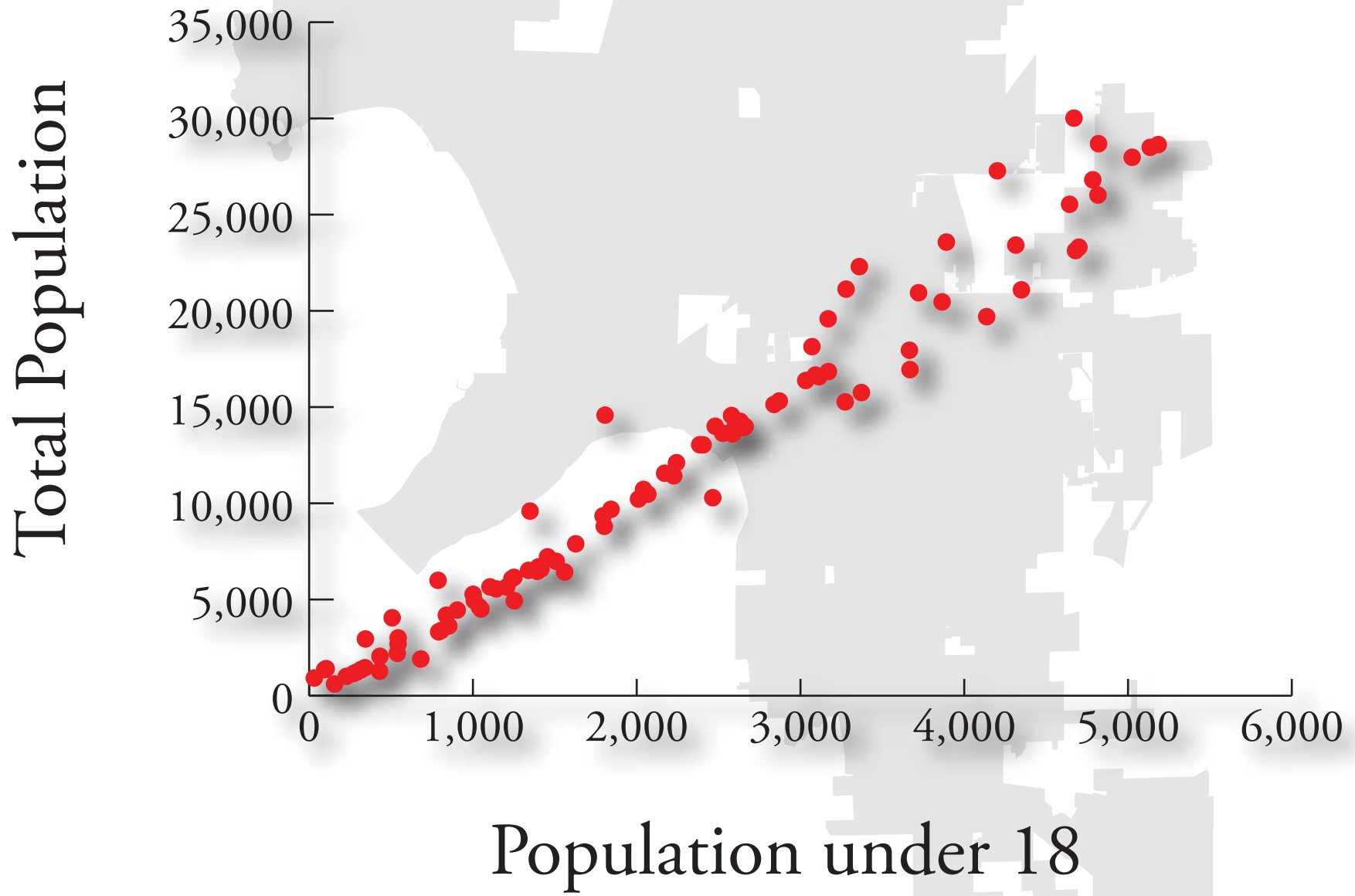
Selected Population - 1,839



Selected Population - 902

Figure 5

Correlation Between Total Population and Population of Children



Potential East Side Soccer Complex Sites - Private Scenario

Figure 6

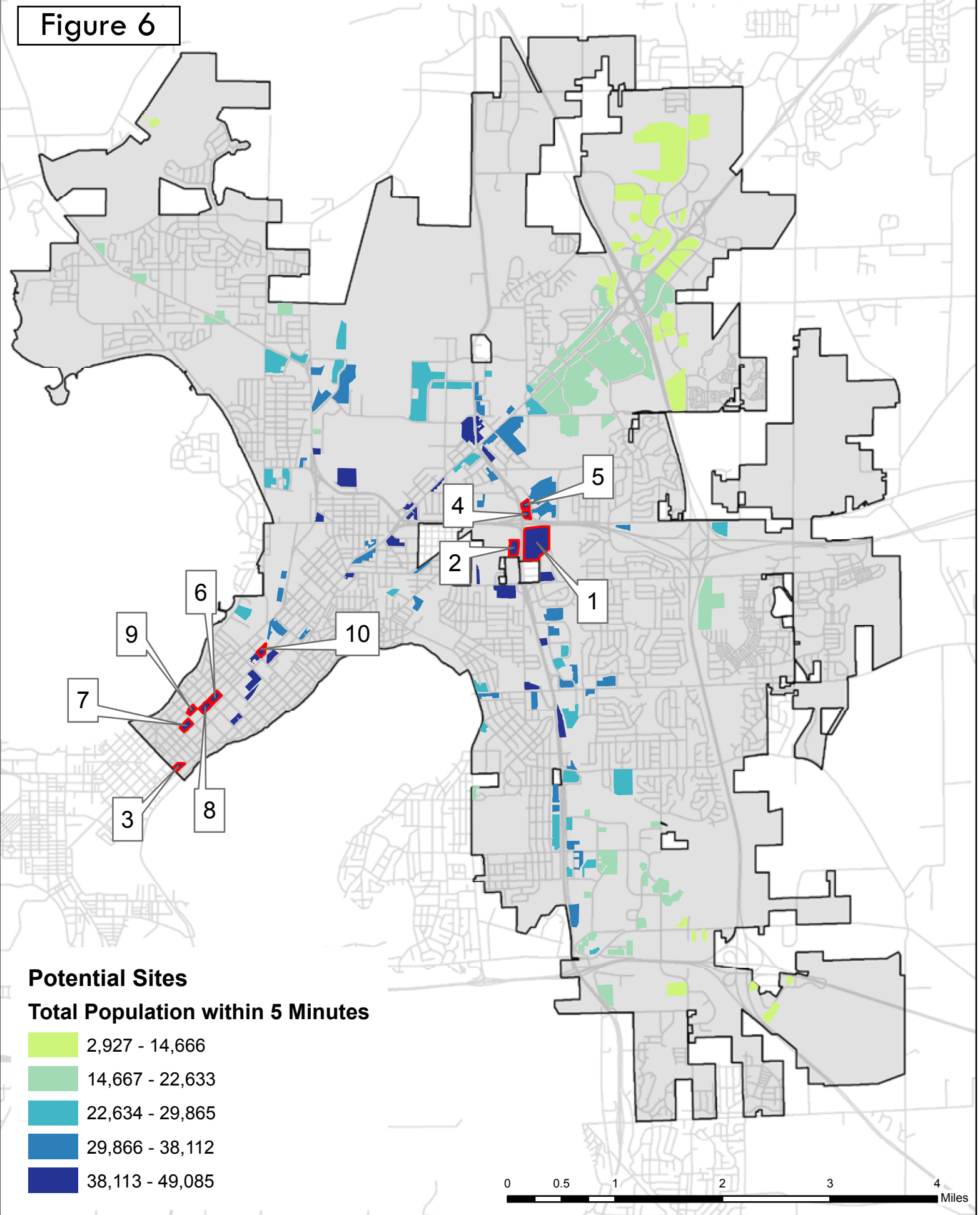


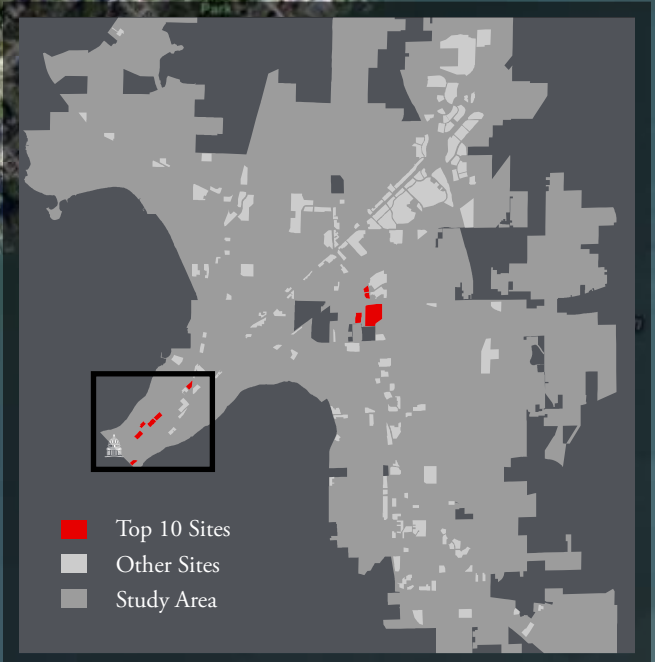
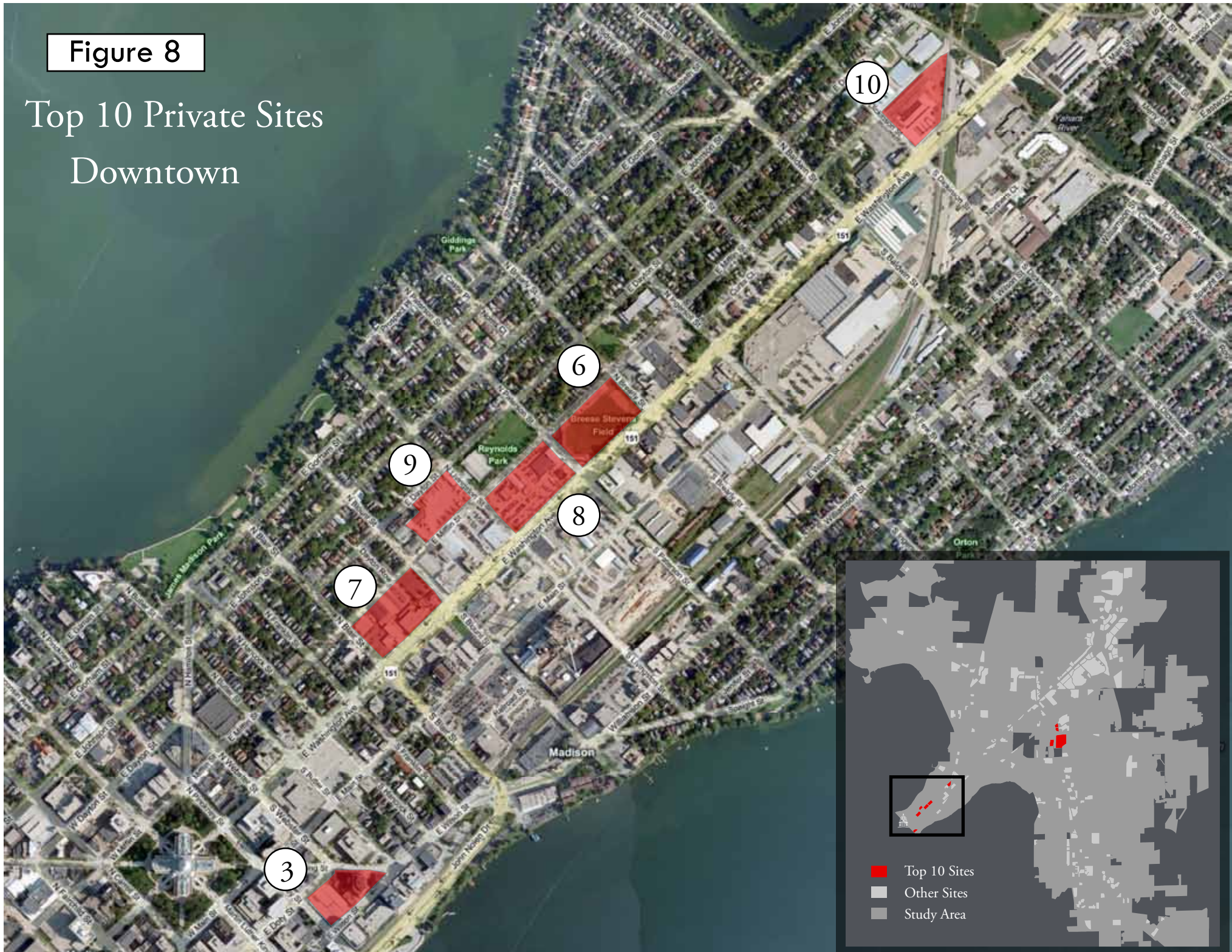
Figure 7

Top 10 Private Sites Stoughton Rd and Aberg Ave



Figure 8

Top 10 Private Sites Downtown



Potential East Side Soccer Complex Sites - Public Scenario

Figure 9

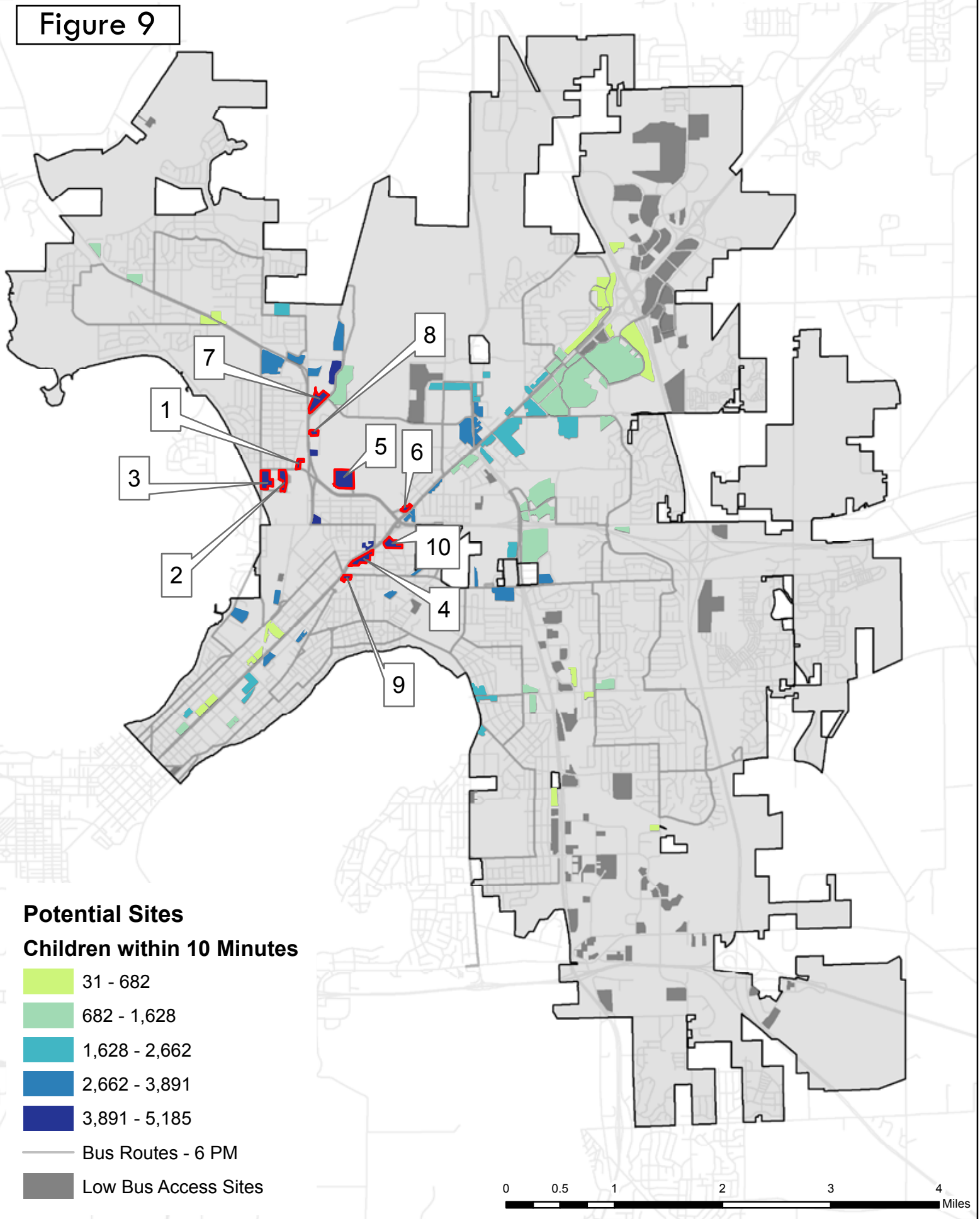


Figure 10

Top 10 Sites in relation to Blocks with a high density of low income Children

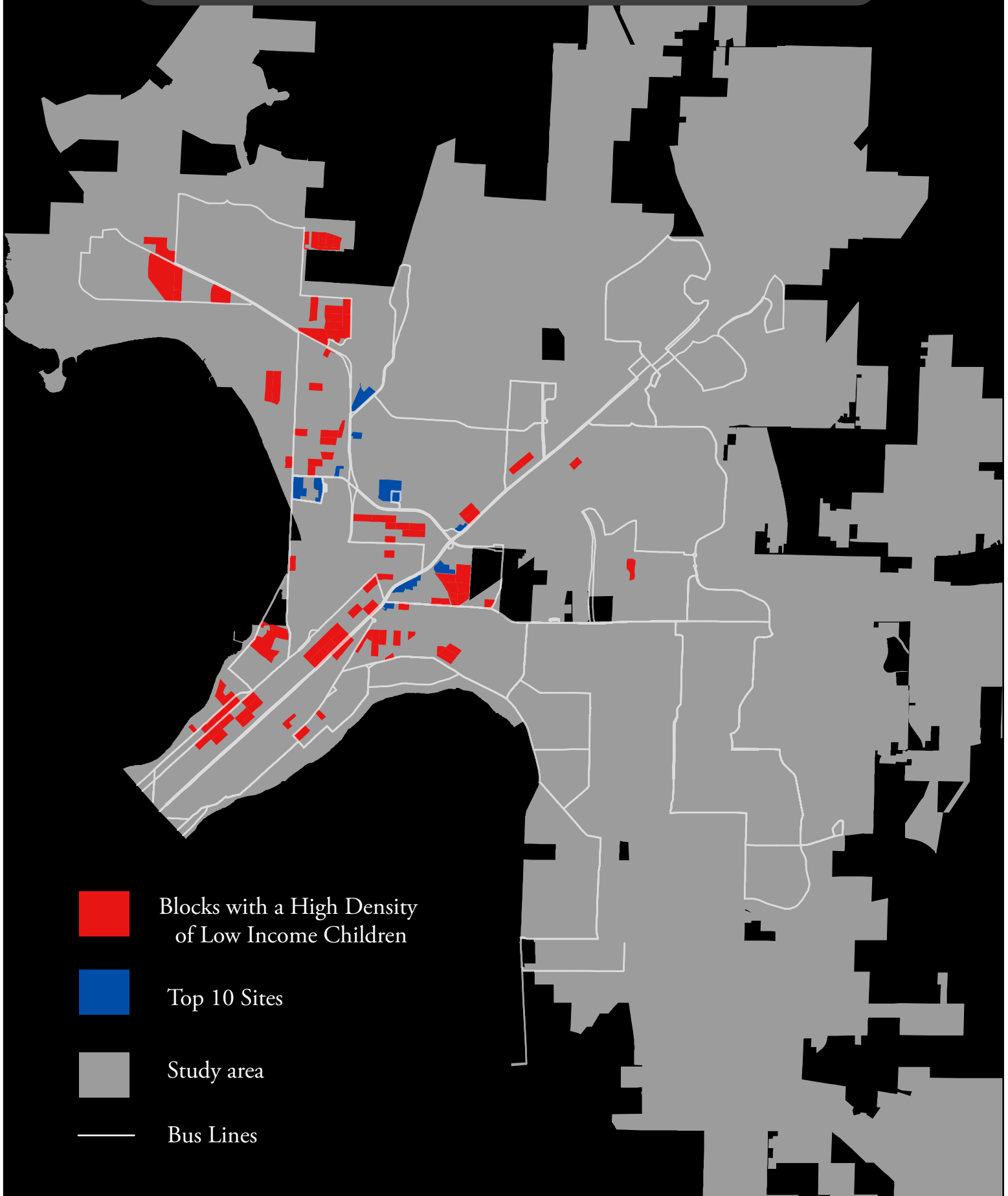


Figure 11

Top 10 Public Sites

