Planning a Prosperous City:
A Transportation and Open Space Study of Worcester

An Interactive Qualifying Project
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Abstract

In this study, Worcester's transportation and open space planning processes were compared to those of Cambridge, Lowell, and Springfield. This is used to identify informational or procedural gaps in Worcester's processes. Also, to satisfy a Massachusetts community betterment initiative (Executive Order 418), open space suitability and transportation accessibility GIS layer were generated. These layers will be used in early 2004 to complete Worcester's compliance with the Order.

1.0 Executive Summary

1.1 Overview

The intention of this report is to evaluate the city of Worcester's transportation and open space planning processes. This was done by comparing the city's planning process with three other cities within the commonwealth of Massachusetts. These cities were Cambridge, Lowell, and Springfield. The second aspect of this report is to use Geographical Information Systems (GIS) to evaluate Worcester's open space suitability as well as the city's transportation accessibility. The Executive Office of Neighborhood Services has sponsored students at Worcester Polytechnic Institute (WPI) to conduct this study through WPI's Worcester Community Project Center. This project intersects with two other projects also being conducted at the Worcester Community Project Center, which deals with housing and economic development. This report contains seven chapters including this executive summary.

The remaining six chapters are:

Chapter 2: Introduction
: This chapter describes the purpose of our project and explains the need for it.

Chapter 3: Literature Review
: This chapter provides a background for an understanding of the project. The literature review is broken up into two sections, transportation and open space. It also provides a brief explanation of Executive Order 418

Chapter 4: Methodology
: This chapter outlines the purpose of the report. It also identifies the objectives as well as the step by step process used to meet these objectives. The methodology describes the necessary data used for analysis as well as the means of collecting the data.

Chapter 5: Analysis
: This chapter describes what methods were used for analysis of data. It also describes how the methods were used to generate results. Main methods used for data analysis were content analysis and Geographical Information System maps. The GIS maps helped to provide open space suitability as well as transportation accessibility for the city of Worcester.

Chapter 6: Results and Conclusions
: This chapter describes the results and conclusions found from the completion of this project. This chapter addresses transportation and open space content analysis matrices. It also uses GIS maps to address open space suitability and transportation accessibility for the city.

Chapter 7: Recommendations and Contributions

This section makes recommendations to the city of Worcester. Again, it is divided into two sections: transportation and open space. It also describes the contributions that this report made to the city.

1.2 Key Findings

Transportation Content Analysis: From the content analysis study with other cities, it was found that Worcester's transportation planning process is similar to the other comparison cities. For this project these other cities were Lowell and Springfield. Numerical ranking of process found that all three cities were within one point of each other. For all of the cities, each criterion was met in some way. This would indicate that these cities utilize good transportation planning processes. Also four areas were determined in the study in which Worcester may want to consider in the future. These four areas were possible implementation of park & ride facilities within the city, promotion of bicycle use in the city, implementation of a non-motorized transportation committee, and lastly to revisit the trolley system Worcester used nearly fifty years ago.

Open Space Content Analysis: In comparing Worcester's planning process with other cities, Worcester was found to have an open space planning process that surpassed the others. This was primarily due to the fact that Worcester has a well documented planning process, while the other cities' are less formal. Even still, it was determined that Worcester may want to look at three possibilities to further enhance their planning process. The three possible enhancements were listing open space projects in their open space plan, making their open space plan easy to read, and finally, making their open space plan available on the internet.

Transportation Accessibility: It was found that the city of Worcester has a generally well placed transportation network that covers the majority of the city. There are a few places within the city where there are no major roads or public transportation which merit additional attention. Most of these areas could be greatly improved with the addition of a bus route through the region.

Open Space Suitability: The majority of the city has a small open space deficit based on the population of the region. Small neighborhood parks could easily balance and distribute recreation land through the communities solving the deficit and maintaining equality of open space among the city. One neighborhood was examined in close detail as to how the deficit could be reduced and the overall city could continue to remain at the leading edge of open space management.

2.0 Introduction

In order to produce economically stable communities, cities need to become deeply involved in the planning processes that will aid in the cities' continual development. These processes are used extensively to develop sustainability within a city, therefore producing communities that are both rich economically and in quality of life. A sustainable city is one that provides long term success through its planning processes. Continual success though planning provides future generations with the resources they will require to prosper in the years to follow. Successful planning processes address four major categories: economic development, housing, transportation, and open space. This study looked specifically at the processes used in transportation and open space planning.

Through a transportation and open space study, the shape of Worcester's current planning process, and how it could be improved, was determined. In conducting this study, the processes used in developing and selecting a plan were first determined. Next, by examining the history of these processes, revelations were made concerning how certain areas of planning have withstood the test of time while others have either been modified or altogether removed. Next, the way in which the city of Worcester ranks alternatives was determined, any informational or procedural gaps were identified, and current planning processes were developed and advanced. Finally, GIS maps were created in order to determine and display transportation accessibility and open space suitability.

In order to complete the more specific objectives of our study, the available transportation and open space planning procedures within the city of Worcester were studied. These procedures indicated the specific planning processes used in Worcester. Through the examination of current plans within the city, information and procedural gaps were determined. This was both a major objective of the study and of the sponsor. The sponsor can use the research results and recommendations to fill voids in the planning processes that currently detract from the betterment of the city. This kind of advancement will assist Worcester in becoming a more vibrant community.

3.0 Literature Review

3.1 Executive Order 418

In January of 2000, Executive Order 418 (E.O. 418) was issued. It is "a measure designed to help communities plan for new housing opportunities while balancing economic development, transportation infrastructure improvements and open space preservation." (Building Vibrant Communities, 2000). In this order, there is a call for studies of particular areas of interest to the city. Two of these areas are: Open Space and Resource Protection, and Transportation. Both of these are key elements for a successful community plan and are linked together in various ways.

3.2 Need for Transportation and Open Space

Transportation and open space are essential for a flourishing city. The development of much needed transportation infrastructure and the use of open space is not a decision that can be made quickly without a plan. In fact, planning has become crucial for the successful development of a city. In order to determine the state of Worcester's planning processes, it was important to have a good understanding of how these two planning processes operate. Therefore, in the sections that follow, a basic understanding of important planning process principles is provided.

3.3 Transportation Planning

When one thinks of transportation systems they think about roads and highways. However, good transportation systems also include pedestrian routes, bike paths, and public transportation alternatives (Becker & Kelly, 2000). Important aspects of transportation planning processes will be discussed in the sections that follow. These aspects include: measures of successful transportation systems, principles used by transportation planners, and the three phases of a transportation planning system.

3.3.1 Measure of Successful Transportation Systems

Good transportation systems are measured by their sustainability. A sustainable system is one which:

1 Provides access to goods and services in an efficient way for all inhabitants of the urban area.
2 Protects the environment, cultural heritage and ecosystems for the present generation.
3 Does not endanger the opportunities of future generations to reach at least the same welfare level of those living now, including the welfare they derive from their natural environment and cultural heritage.

- Black et al., 2002, p186-187

This definition accounts for not only present generations, but future generations as well. According to May, there are six objectives to achieving a sustainable transportation system: (1) economic efficiency, (2) livable streets and neighborhoods, (3) protection of the environment, (4) equity and social inclusion, (5) public safety, and (6) contribution of economic growth (Black et al., 2002). If these six objectives are met within the project, it is considered sustainable.

A transportation system is considered economically efficient when it provides adequate access to goods and services. The process used to promote economic efficiency should resemble a cycle. In one part of the cycle, people are able to provide their own goods and services. In another part, the same people are able to utilize the goods and services provided by others. Thus, the cycle continues as people use other services and goods in order to provide their own.

Public transportation is a good way to ensure livable streets and neighborhoods. There are many kinds of public transportation used in cities, such as commuter rail, busses and trolleys. By implementing public transportation into the residential sections of the city, the use of automobiles can be drastically reduced. By reducing the number of vehicles being used within the vicinity of residential housing, the amount of traffic flow is also reduced. With a lighter flow of traffic, the streets become less noisy, not to mention the amount of pollution being emitted into the neighborhoods is decreased. These changes allow for a better quality of life for the residents since they will be breathing cleaner air, will still have access to their jobs and major highways within the city, and they will worry less about the safety of their children due to reduced traffic flow on their streets.

There are various ways in which a transportation system can protect the environment. One example is the implementation and use of public transit. By reducing the use of automobiles and increasing the use of public transportation, the amounts of emitted pollution decreases resulting in a cleaner environment. Reduction of automobile emissions can also be achieved through the use of High Occupancy Vehicle (HOV) lanes. Boston uses these lanes to encourage carpooling. Transportation systems can also protect the environment through appropriate planning of new roads and other transportation routes. By looking at

all the alternatives, it is possible to choose routes that will not interrupt current environment protection projects.

Public interaction is essential to many aspects of transportation planning. Public transportation is a system that provides people access to their destination and an opportunity for social interaction (Sinha, 2003). The public also interacts during the implementation of new transportation infrastructure. If, for example, a proposal for a new road does not meet the public's needs, or disrupts their lives, they can voice their opinions. Community involvement is a crucial part of the development of a city. Without the input of the public, the city may begin to develop in a way that is not beneficial to its residents resulting in project failures. Public influence during the decision making process was evident in the Greater Worcester Access Improvement Project. The project proposal was never implemented due to strong public outcries of disapproval.

A major objective of transportation planning is public safety. When developing new infrastructure it is important to think about the impacts on public safety. Many streets have stop signs and traffic lights that provide the public with a set of rules to follow, inducing safer streets for those that utilize them. Some cities have roadside assistance vehicles and emergency call boxes that help stranded motorists. These services are made available to ensure the safety of the public while they are traveling.

Transportation systems aid in the economic growth of a city. The many routes and methods that make up the system allow for people to commute to and from their jobs. Because of the ability to get to a job, important economical developments are occurring. This growth is a key element in the overall success of a city. Transportation systems should also provide easy access to major shopping centers and entertainment establishments. This encourages the public to occupy these places and in return stimulates business and local economics.

3.3.2 Principles Used for Transportation Planning

Early transportation planning focused on getting people from one place to another and did not take into account many factors we deem important today. In the early twentieth century, variables such as noise and air pollution were not considered (Hutchinson, 1974). In fact, people were more concerned about having convenient highway access that aided in reducing vehicle operation costs.

A basic understanding of the economic status of a city is necessary when devising a plan for new or improved transportation infrastructure. The economic status of a city can be measured by the relationships between the economy, the housing market, transportation routes, and open space. Today, the nine principles outlined by Manheim & Suhrbier are observed when proposing new transportation plans (Dickey, 1974). These nine principles are: (1) operating

under a single multimodal transportation organization, (2) exploring alternatives and options, (3) examining effects, (4) use of analytical tools, (5) planning for uncertainties, (6) continual evaluation, (7) inclusion of public involvement, (8) using a clear decision making process, and (9) determining equity.

3.3.2.1 Operate Under a Single Multimodal Transportation Organization

A single multimodal transportation organization is in charge of all means of transportation within a community. Under this one organization, there can be subgroups or departments working on specialized areas, such as public safety, public transportation, and road maintenance. Nearly every city in the world has a transportation department that overseas most aspects of its transport system. This is a good way to make sure that all possible types of transportation available are utilized within the city.

In the city of Worcester there is no single multimodal transportation organization. The city of Worcester has a Department of Public Works that oversees the city's water, sewer, and transportation systems. One sub department is the Traffic Engineering Department. This department is responsible for planning and oversight of transportation in the city. They do not, however, have authority over the public bus system.

3.3.2.2 Proposal Alternatives and Options

When proposing new transportation routes, it is crucial to have many alternatives and options. These allow for a certain amount of planning flexibility. Each project proposal has a number of advantages and disadvantages. The availability of alternatives allows for the city to weigh the options of each plan, and therefore determine a suitable project. When determining a suitable project numerous aspects must be considered. A few aspects for consideration are: economics, the effect on the community, and the impact on the environment. By considering these factors, among others, it is possible to generate more alternatives and also separate feasible plans from unrealistic ones.

Sometimes building a new road is not the best option. This is why planners must also consider other transportation means such as utilizing busses, trains, and trolleys. In Worcester, for example, the Greater Worcester Access Improvement Project (GWAIP) was created by the Massachusetts Highway Department (Mass Highway). In this project engineers developed seventeen different alternatives to ease traffic congestion in southwestern Worcester (Mass Highway, 2001). Mass Highway ranked the alternatives based on various categories to eliminate and develop further options. Regardless of which method is used to select a final

plan there is a need for alternatives to choose from. This will ensure that the best fitting solution is selected.

3.3.2.3 Effects of Transportation Planning on the Community

When examining alternatives for new transportation needs, the effects of an implemented project on its surroundings must be studied. Cities work to maximize positive effects and to minimize negative effects. Positive effects may include relief of traffic congestion on neighborhood roads or a reduction in automobile travel through use of public transportation. Some examples of negative effects are demolishing houses to place new transportation infrastructure, noise due to a new nearby highway, or elimination of open space within a community (Hutchinson, 1974). This study of effects allows for the determination of benefits while weighing sacrifices made during implementation of the plan.

Planners need to be able to predict the future effects of a project on its surroundings, which is done with horizon year studies. A horizon year is a year in the future, usually twenty years, in which effects of the new plans are studied (Hutchinson, 1974). Some examples of what planners might predict via a horizon year study are traffic volume on a specific route, transit patterns, and changes in pollution for an area. Although it is impossible to predict the future planners use horizon year studies to give the best approximation of the effects and impacts of new developments.

3.3.2.4 Useful Analytical Tools for Transportation Studies

Analytical tools are used to assess the quality and outcomes of different plans. Mathematical models and equations are used to forecast travel demand, to observe when people are traveling, and to determine where and when accidents are occurring. Two specific analytical tools used by planners are the Urban Transportation Model System (UTMS) and the Level of Service (LOS) analysis.

Examples of data utilized by the UTMS are the number of trips and destinations, the means of transportation, and the routes traveled. This data can come from several sources such as surveys, manual traffic counts, and public records. With this data, in accordance with the UTMS, planners can establish traffic flow patterns in specific areas. Using the knowledge of traffic flow patterns, separate more specific models that assess land-use activity, urban transportation, and impact prediction can be utilized (Hanson, 1995).

The LOS uses many factors such as automobile volume, roadway capacity, traffic control devices, roadway types, and anticipated delays to rank roadway layouts from A through F (MassHighway, 2001). These alphabetical grades can

than be used to compare different alternative plans. Analytical tools are important in the transportation planning process because they give you a means of comparing different plans and justifying which plans will be the most beneficial to an area (Dickey, 1974).

3.3.2.5 Planning for Uncertainties

The inability for planners to predict the future is where the uncertainty becomes a problem in transportation planning. Although, horizon year studies are used to forecast future results, these studies offer a probable outcome, not an assurance of a specific outcome. Factors such as natural disasters, budget shortcomings, and unemployment can change the need for transportation infrastructure (Dickey, 1974).

3.3.2.6 Evaluation of Progress

Evaluation should occur often during the planning process (Dickey, 1974). The goals should be reviewed not only when the project is finished but also while the project is in progress so that deadlines are met. Frequent evaluations will identify where the project's weak spots are present, which make it possible for them to be addressed before they become major problems. Once implemented, the project must be reevaluated to determine its strengths and weaknesses so future plans can be modeled accordingly.

3.3.2.7 The Need for Public Involvement in the Decision Making Process

The public needs to be involved in the planning process because they are the people that the projects are going to be affecting. The public may be using the new modes of transportation or their homes may be in the way of a proposed road, regardless, they need the opportunity to express their opinions. This is done most easily through public meetings and focus groups, where the public can communicate their concerns for the projects proposed. It is important for public officials to listen to the public because they present different views that should be considered.

For a recent project in Massachusetts, the Central Massachusetts Regional Planning Commission (CMPRC) used a Public Outreach Plan to involve the public in the planning process. This plan uses public meetings to present current and ongoing projects, allowing the public to express views toward each. This allows for both the planners and the public to be heard during the decision making process.

3.3.2.8 The Planning Process

Many texts throughout the years have published general processes for transportation planning, however specific cities create their own plans based on specifications to their location and needs. Every three years in Massachusetts all of the regions have to complete a Regional Transportation Plan (RTP) which outlines the planning processes it employs. Worcester is located in the Central Massachusetts region and in 2003 the CMRPC created an updated RTP. Areas addressed in the RTP include the regional highway system, the regional public transportation system, the regional airport system, the regional freight railroad system, and regional bikeways, hiking trails and pedestrian facilities (RTP Executive Summary, 2003). Plans like these specify the decision making processes that are utilized in each city. Input from city officials, design firms, and the public all become a part of the decision making process. When this happens, everyone has the opportunity to develop better plans that may satisfy more people.

3.3.2.9 Fairness and Equity to Those Affected by New Plans

Equity is a way to compensate people for hardships they have to incur due to the execution of a project to be. For example, if people have to be exposed to excess pollution from automobiles traveling on a new road, they should be repaid for their deprivation of clean air (Dickey, 1974). This is considered fair since some people will be required to make sacrifices for the benefit of the entire community. It is difficult to evaluate exactly the right amount of compensation someone should receive for these inconveniences. This is an area that is receiving additional attention from planners in hopes of determining a way to calculate the proper amount of compensation.

3.3.3 Phases of the Transportation Planning Process

The transportation planning process has three major phases: preanalysis, technical analysis and postanalysis (Hanson, 1995). Each phase has specific tasks that must be accomplished. The preanalysis and technical analysis phases transpire before a new project is implemented. The postanalysis phase occurs prior to, during, and following the implementation of the new project to evaluate its success and its planning process.

3.3.3.1 Preanalysis Phase

The preanalysis phase entails identification of the goals and objectives, the collection of data needed specific to each goal, and the development of methods and alternatives used to achieve the goals. When identifying possible objectives,

it is vital to look at the broad picture and not at specifics. This is important because tunnel vision could miss possible solutions to the problem (Hanson, 1995). For the Greater Worcester Access Improvement Project, one major issue focused on the fact that from southwestern Worcester, there was no easy access to the Interstate Highway System (Mass Highway, 2001). Other issues that may be identified in the development of transportation plans are safety, providing people with sufficient access to goods and services, and relieving traffic congestion in areas where high traffic volumes cannot be tolerated (Hanson, 1995).

The formulation of goals and objectives is a fairly simple method used to keep the project focused. The objectives of the project result directly from the problem that inspired the project, while the goals will pave a path to the solutions of previously identified issues. Objectives provide a set of tasks to be completed in order to reach the specific goals of the project (Black, 1981). Objectives should be met throughout the project, not just at the end. By setting and meeting objectives throughout, one is ensured the project is advancing in a timely fashion. In transportation planning, some goals could be to reduce the number of highway accidents or to increase the number of people using public transportation within community.

Once the issues, objectives, and goals for a specific project are identified, data is collected. Data can be gathered from maps, public transportation records, and surveys. In Worcester, maps can be found using the available GIS system. Public transportation records and surveys can be found at the Massachusetts Highway Department, the Central Massachusetts Regional Planning Commission and the Department of Traffic Engineering. These locations would have this information since they have done numerous studies and would therefore have all the data necessary for executing a planning study.

Important information that these departments hold include current travel patterns, population growth, economic activity, employment, income, car ownership, housing, and travel preferences (Hanson, 1995). By surveying the public, planners can develop individual travel patterns that will include information such as when people are traveling, and the modes of transportation they are utilizing (Hanson, 1995).

3.3.3.2 Technical Analysis Phase

Once all the data is collected, the technical analysis phase of the process can begin. This phase involves the study and critical examination of the accumulated data using the analytical tools mentioned earlier. These tools create ways to compare the different alternatives generated during the preanalysis phase. For the Greater Worcester Access Improvement Project, each alternative presented was rated to determine which would be the most feasible. Ratings were made

for various categories: effects on open space, school buildings, commercial buildings, and residential areas, among others (Mass Highway, 2001). The effects on each category were rated from one to ten and then tallied with the lowest scores representing the plans most reasonable for further study.

This phase also involves horizon year projections and mathematical models, which account for safety, traffic congestion, and many other factors. With the numbers generated from these mathematical models, planners have a basis of comparison for alternatives, which is then used to choose the plan most appropriate for the given situation (Black, 1981).

3.3.3.3 Postanalysis Phase

The final phase of the planning process is the postanalysis phase. This phase involves the further study of plans selected through the technical analysis phase and indicates the one plan that will implemented. Town or city officials, involved design firms, and the public all participate in the selection process. There are structured models that provide assistance for this process. Protocols from past plans can also be applied.

The ways in which the implementation of a new project will impact the future need to be considered when making the decision. Most transportation studies rely on the horizon year projection to predict the future success rate of the project (Hutchinson 1974). Models for future impact of new roadwork will use this 20 year projection to fast forward and examine the plan's effects on community economics. These projections tend to include impacts on the environment, people living in the vicinity, and traffic solutions. Once the decision for the plan is approved, there are two procedures before the final implementation process. These are to:

1 Make sure the plan is in accordance with all local and state requirements
2 Make a timetable for when certain aspects of the project will be completed

- Hanson, 1995, p60

The first procedure is needed to ensure that the plan is on target with standards set by cities and states which everyone has to follow. These standards are useful for protection of the environment, safety of the public, as well as consideration of future generations. The timetable ensures that the project is completed in a sufficient amount of time and within budget. The Big Dig in Boston is a recent case of timetables for new projects being ignored. The result

of ignored guidelines included angry residents, financial loss, and even termination of many employees. Once the decision is finalized and the project passes through these two procedural measures, the project can then be implemented.

There are similar ties between transportation planning and open space planning. Both are important to a successful city, have similar misconceptions, and rely on a planning process. In similar fashion to transportation planning the following section will discuss open space in terms of what is it and why is it important. It will also introduce key principles of open space planning.

3.4 What is Open Space?

When people think of open space, they usually equate it with green space. Green space is a form of open space, but open space encompasses many other types of areas. Open space is a broad term that incorporates many different types of lands. These lands can be used in a variety of ways, be it functional or natural. Various types of open space include parks, recreational areas, wetlands, forest lands, and just undeveloped lots in an urban setting (Garvin 1997). A natural area might be a conservation land that has an intact ecosystem with the various plants and animals that would exist in this area. A developed open space might be a park or playground for a neighborhood. These developed areas do not have a preserved ecosystem and are generally referred to as squirrel parks.

3.4.1 Need for Open Space in an Urban Setting

Open space is necessary for an urban setting to be sustained. Open space, if used creatively and with good planning, can become an asset to the city for many generations. Parks and playgrounds can bring communities together. A strong community can reduce other problems such as litter and other troubles faced by less connected areas. This is an example of some of the social value to open space. Economic value can come in many forms. A market square can provide both social value and economic value since small businesses and shops would be encouraged. This would also increase transportation needs in that area, possibly bolstering other curbside businesses and adjusting focus to pedestrian traffic rather than commuter traffic. Aesthetic value is harder to see when it is present, but it is equally important. People who are able to relax and enjoy a quiet stroll through a nature trail or other natural surroundings will appreciate the value of how the cement and glass landscape is both broken and enhanced by these open spaces.

3.4.2 Measurement of Successful Open Space Areas

While transportation systems are easily measurable in terms of sustainability and use, open space is harder to measure. There are nominal statistical methods for determining proper open space levels from various national organizations, such as the American Planning Association, but these offer only a limited measurement. Statistical measurement of open space plans can include things such as acres of parkland or conservation land per unit of population, percentage of total open space land, as well as other numerical city wide values. These can be combined with census data, and therefore an analysis can be done on a neighborhood based level.

The use of an open space plan is necessary for the measurement of open space in general. Most cities have open space plans, and are required to revise them. The process of how open space is determined, maintained, and designed is very important to having a successful land use program. Theoretical best practices, as determined by text books and open space planning handbooks, provide some framework to evaluate how well a city's plan meets the goals of an ideal situation. The theoretical best practice criteria allow for selection of cities that provide the real world embodiment of these practices. Determining the process by which a city proposes, designs, and maintains an open space area is essential to the success of individual projects and their interaction as a whole.

3.4.3 Open Space Planning Ideas

There are many principles that planners must consider when working on expanding or revitalizing the open space of the city. First, the city must determine where open space is most needed. They must consider the distribution of parks and other resources throughout the city, so that all the space is not concentrated in one area as a single massive park. When sites are selected, the planners must find ways of ranking the options for utilizing the space. The area might best be utilized as open grassland for community sports, a playground for younger children, a quiet sanctuary where people can go for privacy and introspective time, or numerous other possibilities. The book *Urban Parks and Open Space* principally from Garvin does a good job of clearly stating some of the main principles of park planning, but these can be applied to the many other open space planning processes as well.

Involvement of the neighborhood is clearly necessary for good open space planning. For example, an elderly neighborhood would probably not want a children's playground. Garvin states that a project with a high level of community involvement will have a larger chance of success and sustainability. "While some park developers may privately complain that neighborhood involvement holds up the development process, residents ultimately feel more of a sense of ownership when they have been active participants in park development"

(Garvin, 1997, p36). A planning process that includes public input will be more successful than a closed system, since it will more closely focus on public needs rather than what administrators believe to be necessary.

Another key aspect is designing with a vision. This involves factors such as location, layout, and transportation. Utilizing open space as a focal point or landmark in the city will help to incite interest and also provide organizing elements to the urban sprawl. This also assists in providing safety, in part due to a high level of activity. Dangerous activities are less likely to be done when there are larger amounts of onlookers, plus if there is a sense of pride, community members will also assist in crime prevention.

Creative funding is a necessary practice when planning open spaces, especially in times of economic trouble. Nowadays, when budgets get tight, funding for open space is among the first items to suffer. Creative funding can both save parks, and relieve stress on city budgets. For example, a city could place a park on top of an underground garage and use the profits from it to supplement the city's budgeted open space funds. When creative funding does not seem applicable, there is always the option of tapping into state or federal funds to help cover revitalization costs.

3.5 Summary

This project evaluated the sustainability of planning in the city of Worcester. It was important to express the ways that a sustainable system is achieved. This literature review described the various ways of attaining sustainability within a city.

This review was broken into two similar sections: transportation planning and open space planning. The criterion for a successful plan is outlined in both sections by using measures of sustainability. Then, key principles used by planners were determined and discussed. These principles were used as model cases during the development of the best case planning process for both transportation and open space.

For the main analysis of the project the ideas developed in this section were used to study Worcester's transportation and open space plans. One goal was to find room for improvement in Worcester's plans by comparing them to the ideas previously discussed, as well as to the planning processes of various cities comparable to Worcester. Another goal was to display the information revealed by the above mentioned planning ideas through GIS layers and, more importantly, various improved GIS maps.

4.0 Methodology

4.1 Introduction

After learning about general transportation and open space planning processes, it became time to start thinking about engaging with the problem of continued development and sustainability within the city of Worcester. Since transportation and open space are the focus aspects of this development, it became necessary to find the best case planning processes, case studies that evaluate plans in other cities, and specifically Worcester's plan. In order to acquire these plans, the methods needed to locate and collect the data were determined. Analytical methods were determined for analyzing the data and then this data was converted into a usable format. From there suggestions were made for improvements to Worcester's transportation and open space planning processes.

4.1.1 Project's Purpose

Transportation and open space are an important part of a city's economic development. Through a transportation and open space study, it is possible to determine what shape Worcester's planning process is currently in and how, if at all, it can be improved. This analysis was developed by providing an overview of the history and significance of transportation and open space, and by determining the processes used in developing and implementing them within the city. Once this information was acquired, it became possible to develop and advance current suitability frameworks, identify any informational or procedural gaps, develop GIS layers, and determine how the city of Worcester ranks the alternatives for project implementation.

4.1.2 Transportation and Open Space Objectives

4.1.2.1 Objective One – Theoretical Best Case Criteria

Determine the theoretical best case planning processes. In order to have a more accurate idea of what cities are really capable of accomplishing, it was necessary to determine what the best case process criteria entailed, therefore providing the most beneficial guideline for the development of a city's specific planning process. Transportation and open space planning processes have some very different needs that prohibit the exclusive use of generalized planning. The variances in needs required the theoretical best case planning processes specific to each to be found. To do this, a list of general practice criteria, identified in texts from background research, was compiled (Appendix A). The criteria are

organized by general headings. Under each main heading there are more specific criteria that break it down into its main components. For example, public transportation was expanded into its different forms: busses, light rail, rapid transit, etc. Similar practices were grouped together for ease during the analysis phase of the project. However, it is important to realize that since this process is theoretical, it is likely it won't be attainable. Even still, it provides a goal to be working toward and provides the baseline for improvement recommendations to the city.

4.1.2.2 Objective Two – Other Cities' Processes

Determine what other cities are doing in terms of planning. There are many cities throughout the United States that have already implemented successful planning processes. Some of these cities are similar to Worcester in that they were founded at about the same time, are around the same size, and are developing economically in similar fashions. By acquiring the planning processes for transportation and open space development from other cities, a knowledge base of good planning techniques was created.

The purpose of this objective was to identify which criteria from our theoretical best case each city accomplishes, and how well they accomplish it. In order to do this, twenty five cities were contacted (Appendix B). These twenty five cities were recommended to us because of their good planning practices and their similarities to Worcester. Sixteen of the cities agreed to answer a questionnaire regarding transportation and open space planning processes. Only one response was received. This response came from Brownsville, Texas. Therefore, it was determined that the project would now focus on Brownsville, Texas, Providence, Rhode Island (which was highly recommended by Worcester's City Planner) due to its striking similarities to Worcester, as well as the cities dealing with EO418: Cambridge, Massachusetts, Lowell, Massachusetts, and Springfield, Massachusetts.

4.1.2.3 Objective Three – Worcester's Processes

Determine the planning processes in Worcester. Since Worcester is the main focus, it is crucial to know what processes are currently used in Worcester. The steps the city is using during their planning processes are what will determine its sustainability in the future. If the current plans are not adequate, future generations may not have a well balanced city to live in. Therefore, information was gathered relating to the processes of planning used in Worcester. Identification of exactly how Worcester uses its planning processes is important to improve the quality of life within the city. Worcester's planning processes were extracted by examining past proposals. Projects, like the Greater Worcester Access Improvement Project, demonstrated the steps taken by the city to try to solve a problem. Interviews with the Massachusetts Highway Department and Worcester's Traffic Engineering Department uncovered how proposals evolve

and the processes they follow before implementation. The Broad Meadow Brook Sanctuary provided the process for open space planning in Worcester. Also, the equivalency documents the city used to obtain the standards set by E.O. 418 were acquired, therefore providing information about the cities current processes. By comparing Worcester's transportation and open space plans to those of other cities, as well as the best case, adequate criteria for new or improved plans can be developed.

4.1.2.4 Objective Four – Information Gaps and Improvements

Determine where information gaps occur and then improve the planning processes. In order to make suggestions for improvements to Worcester's current planning process, it was important to be able to make comparisons between theoretical best case processes, other cities' processes, and Worcester's current processes. After acquiring the information for the three areas of interest (best case, other cities, and Worcester), the information was compared and analyzed to find gaps that occur in Worcester's processes. Through these comparisons, it was possible to determine Worcester's strengths and weaknesses, along with any information gaps. Once these were determined, improvement suggestions were established. These improvements will become extremely important to the overall success of Worcester and eventually will become a major factor in the city's sustainability.

4.1.2.5 Objective Five – GIS Layers

Generate GIS layers to assist in the planning process. There are several layers showing information such as current demand on the transportation infrastructure, the capacity at which a road is operating, tracts in the city that have an abundance (or deficit) of parks and recreational areas, and potential suitable parcels for future open space zoning. These layers show, at a glance, what regions of the city require attention to stay accessible through the transportation system, what areas are good for development based on available transportation capacity, as well as what neighborhoods suffer from a lack of readily available park and recreational land. In the process of gathering information and generating these layers, gaps in information and procedures were found. Identification of these gaps assisted in completion of the other objectives.

4.2 Transportation and Open Space Roadmaps

4.2.1 Information Required to Fulfill the Objectives

In order to fulfill the requirements and meet the project objectives, information specific to each objective was required. This information came from a variety of sources. In order to determine where this information came from, the specific data needed to complete each objective was identified.

4.2.2 Information Needed to Determine Best Case Criteria

Determine the theoretical best case planning process criteria. Information regarding transportation and open space planning was acquired from existing sources. As stated previously this information was obtained from published materials including text books and reference guides produced by various organizations relating to transportation and open space. The information included items that were determined to be critical to developing sustainable cities, such as how the public is involved and determining proper land usage. The theoretical case criteria provide a set of goals for a city to strive to achieve.

4.2.3 Information Needed to Determine Other Cities' Processes

Determine other cities' planning processes. Other cities processes were extracted from a planning questionnaire, along with relevant information from their websites, such as their Regional Transportation Plan. By using these two data collection techniques, information regarding topics such as public transportation use and open space were addressed for several comparable cities. With this information, and Worcester's planning processes, it became possible to make recommendations for improvements to the city.

4.2.4 Information Needed to Determine Worcester's Processes

Determine the planning processes in Worcester. Information about transportation and open space planning in Worcester was first identified and then gathered. Much of this information was available from city officials, Worcester's planning departments, the Regional Transportation Plan, and the E.O. 418 equivalency documents.

4.2.5 Information Needed to Determine Information Gaps and Formulate Improvement Suggestions

Determine where information and procedural gaps occur and then suggest improvements for the planning processes. In order to complete this objective, all the information needed for the previous objectives was collected, along with the content analysis techniques as described in section 4.1.

4.2.6 Information Needed to Develop New GIS Layers

Generating the GIS layers requires a host of different data. The data needs for the objective came from existing sources or, in cases where no source was found, more generalized data was used. It was impossible for this project to produce data specific for roads. The department of public works provided most

of the information such as road capacity, current traffic volume, and traffic flow patterns. The other GIS layers also provided spatial information such as location of green and blue spaces, census tracts that can be used to breakdown the city, and location of roads.

4.3 Data Collection Methods

This project will use three data collection methods: reading planning handbooks and guidelines, interviews with city planners, and calculating from GIS layers. Each method is described in detail along with any validity threats and other possible methods for colleting the same data.

4.3.1 Reading Planning Handbooks and Guidelines

To determine the best case planning process, planning handbooks and brochures that give planning guidelines were read. First a list of sources was created for planning guidelines, for example: Mass. Audubon Society, American Planning Association, and the US Department of Transportation. Planning handbooks were sometimes acquired from the same places as planning guidelines. No single piece of literature contained the best case planning process, however, they provided basic principles that strive toward best case planning. Many of the handbooks and guidelines may have biased views of the planning process. Therefore, it is necessary to compare many handbooks in order to develop a set of unbiased criteria.

4.3.2 Interviews with City Planners

Interviewing city planners was another of the data collection methods used. This was the major method used to find the transportation and open space planning processes for Worcester and other target cities. This method consisted of an electronic interview followed by a phone interview when additional information was required.

4.3.2.1 Electronic Interviews

Before electronic interviews were conducted, it was helpful to have background information about the cities' planning processes. This information was acquired by examining the plans available on the cities website so it was possible to formulate both intelligent and specific planning questions. Two questionnaires were developed, one for open space planning and one for transportation planning (Appendix C). Once these questionnaires were formulated, they were reviewed by Worcester's city planner and then sent to the participating cities.

4.3.2.2 Follow Up Phone Interviews

If additional information was needed from what was provided in the questionnaire, the city contact was called back in order to set up a follow up interview. A list of specific questions was generated for each additional interview in order to acquire the appropriate information.

Speaker phone was used when conducting an interview so that more than one group member could hear the responses to the questions. This was appropriate since otherwise, some important points could have been lost in the translation. Also, during the interview, detailed notes were taken, therefore creating an accurate transcript.

4.3.3 Calculating from GIS Layers

Spatial data is stored mostly in GIS layers. These layers were provided by the city of Worcester and have spatial data and fixed variables stored within them. Information such as building footprints, square footage of a park, and length of a road are all values already contained within these layers. New variables can be generated based on current values or combinations of values such as calculating population density by using formulas and storing the results in a table which can then be used in a similar fashion.

4.3.4 Methods Used to Complete Objectives

4.3.4.1 Steps for Determining Best Case Criteria

Determine the theoretical best case planning process criteria. The best case plan was devised from published textbooks that have general transportation and open space plans. These textbooks were read during the background research phase of the project. Criteria were then selected from the readings, therefore providing goals the city should try to achieve. These criteria were identified by key phrases such as ‘planning principles’ and ‘planning lessons’, and were then compiled to form the best case planning process. The best case planning process criteria provided goals the city should try to achieve.

4.3.4.2 Steps for Determining Other Cities’ Processes

To collect data for the other cities’ planning processes, target cities were first identified. This was done by obtaining a list of twenty two target cities with traits similar to those of Worcester. These cities we also identified as best practice cities. Additionally, two cities in Massachusetts, that had already obtained E.O.

418 equivalence, were added to the list. These cities were Springfield and Lowell. Finally Providence, Rhode Island was added to the target list because of its similarities with Worcester. All together there were twenty five identified target cities (Appendix B).

The next step was to acquire contact information for all of these cities. The list of twenty two cities contained links to their websites. These websites provided contact numbers for the city planner's office, the park development office, and the transportation department. For the cities not on the list, the other groups provided the appropriate web site information, from which the contact information was located. The phone numbers were recorded and phone calls were made.

Each phone call was logged into a data base. Over a period of two days every city was contacted. The initial contact requested that each particular city provide answers to questions about transportation and open space planning processes. During the initial phone call stage, nine cities were eliminated from the target city list for reasons such as the city didn't compare well with Worcester or lack of contact with personnel with appropriate knowledge.

Before the sets of questions were sent out, Joel Fontaine reviewed them. After Mr. Fontaine approved the questions, the transportation set was sent to Worcester's Department of Public Works and the open space set was sent to the Parks and Recreation Department of Worcester. This was an initial test used to get feedback and to make any appropriate changes.

The finalized questionnaires (Appendix C) were sent out to the appropriate people in the corresponding contact departments for each city (Appendix D). A deadline was set for return of the questionnaires. When the deadline was reached, only one response was received. In order to utilize available time it was determined that the study would focus on five cities. The cities used were Brownsville, Texas (the only response), Cambridge, Massachusetts, Lowell, Massachusetts, Springfield, Massachusetts, and Providence, Rhode Island. The three Massachusetts cities were chosen because they were dealing with EO418 and they were local which provided easier communication access. Providence was chosen because it was highly recommended, by Worcester's City Planner, due to its very similar traits to Worcester. Once it was determined that only five cities were being used for the study, follow up phone calls were made regarding the questionnaires. Also Regional Planning Commissions for each city were contacted in order to obtain documentation for our study.

4.3.4.3 Steps for Determining Worcester's Processes

Determine the planning processes in Worcester. The information for current transportation and open space planning processes in Worcester were gathered from available documents and informal interviews with city officials. The

documents used were the Central Massachusetts Regional Transportation Plan 2003, information from the Greater Worcester Access Improvement Project, and Worcester's Open Space Plan. City officials that were contacted included representatives from the Massachusetts Highway Department, Worcester City Planners Office, Worcester Traffic Engineering Department, and Worcester Engineering Department. From these sources, Worcester's planning processes were extracted and pieced together. Coding was performed in order to extract Worcester's processes and then compare its processes to those of other cities.

4.3.4.4 Steps for Determining Information Gaps and Formulation of Improvement Recommendations

Determine where information gaps occur and then improve the planning processes. Once we gathered all the information for conducting various analyses that were important for determining our recommendations, we developed content analysis matrices.

4.3.4.5 Steps for Developing New GIS Layers

In generating the new GIS layers, data was gathered from existing GIS layers, city departments, and previous studies. The GIS layers provided mostly spatial data, with some statistical data. There are existing layers that show parks, ponds, and streams, which allow for calculations to be performed such as finding the area in square feet. City departments and previous studies produced numerical data covering variables such as rider-ship of bus routes, current volume of major arteries throughout the city, and road capacity.

5.0 Analysis of Data

With the data collected, we completed our data analysis. Three methods of analysis were used: content analysis, open space suitability, and transportation accessibility. Each of these is explained in detail in the sections that follow.

5.1 Content Analysis

Content analysis is a method used to evaluate and compare non-numerical data. "Content analysis is a summarizing, quantitative analysis of messages" (Neuendorf, p10, 2002) meaning that for any message, irrelevant of form, there is a way to score certain variables that will allow for the core of the message to be analyzed in quantitative methods. Generally, there are four steps taken when completing content analyses. According to Singleton and Straits, the steps involved are:

> 1 identify the categories into which the ads are to be coded (e.g. male versus female; body positions—standing, sitting, recumbent)
> 2 define the categories according to objective criteria that can be applied by anyone
> 3 systematically select and then code the advertisements in terms of these objective criteria
> 4 report the frequency of the categories into which the ads have been coded.
>
> - Singleton and Straits, 1999, p. 384

When dealing with spoken or transcribed interviews, the main way to bring the important data forward from the surrounding words is done by a process known as coding. This is simply a method used to convert textual information into the categories chosen prior to beginning the analysis. By selecting categories that highlight process decisions and allow the process framework to be found, content analysis will allow the different cities to be scored according to these various points. The theoretic best case information will provide the categories that will be used as the foundation for the content analysis.

This method is appropriate since when done properly it follows standard scientific method approaches. This means several things: the scoring criteria should be exhaustive without overlap between scoring areas, the ranking of the various cities must be objective, and there must be a reliable and consistent method used for scoring regardless of who is actually scoring the many variables. If

done properly, the context of the document is maintained and the important parts are highlighted, and thus, are able to be used as numerical data.

The main validity threats that a process like this can encounter stem from inconsistent scoring among people, by losing context or meaning of a document, and by missing information or documents. The first threat was easy to dismiss as it was possible to have more than one person score a document, after which their scores were combined to obtain better approximate scores for each criteria. We had two members of our team perform the analysis on each document such that no single person was responsible for a particular document. This eliminated most of the threat of inconsistency. The second validity threat was made insignificant though proactive and reactive techniques. Selecting exhaustive categories as part of the research design beforehand assured that content areas would not be dropped from the final numerical data. This is known as the proactive technique. A reactive technique is one that has a non-scoring member of the team read the document and verify that the selected categories did not eliminate the document's tone or meaning.

There were a few other techniques that may have been appropriate for the analysis of qualitative data for comparison. Key word counting and similar statistical methods can eliminate the meaning or tone of a document which is important to the analysis of a process. These techniques were not appropriate for this research design but may have worked well in other situations.

Content analysis was the key method for evaluating the state of Worcester's planning process. One of our goals was to identify Worcester's strengths and weaknesses, as well as procedural gaps.

5.1.1 City Selection

Content analysis matrices were constructed in order to make comparisons to the city of Worcester. To complete these matrices, it was necessary to identify which cities would be suitable for comparison. As mentioned in section 3.1.2.2, the five cities to be studied included Brownsville, Texas, Providence, Rhode Island, Cambridge, Massachusetts, Lowell, Massachusetts, and Springfield, Massachusetts.

Once the studies were underway, it became apparent that the responses to the transportation questionnaire from Brownsville, Texas (Appendix E) were not specific enough to aid in conducting the content analysis matrices. Therefore, Brownsville, Texas could not be included in the continuation of the study. Also, Providence, Rhode Island was excluded from the study since the information requested was not provided.

The remainder of the analysis was conducted using information provided by Cambridge, Massachusetts, Lowell, Massachusetts, and Springfield,

Massachusetts. Due to poor response from each city's transportation planning department, it was recommended that the focus for transportation planning be turned to each city's Regional Planning Commissions. These organizations provided Regional Transportation plans that aided in the completion of the content analysis matrices.

The gathering of planning information came from various documents. Table 5.1.1.1 displays the planning documents used to complete the transportation and open space content analysis matrices.

Table 5.1.1.1: Documents Used for Extracting Planning Processes

City	Open Space Plan Provided	Transportation Plan Provided
Cambridge	Green Ribbon Open Space Report March 2001	NA
Lowell	NA	Regional Transportation Plan Update 2003
Springfield	Open Space & Recovery Action Plan 2002 – 2007	Regional Transportation Plan Update 2003
Worcester	What's Left: A 1998 Update on Worcester's Open Space	Regional Transportation Plan Update 2003

Therefore, as Table 5.1.1.1 verifies, the open space matrix compared Worcester to Cambridge and Springfield only and the transportation matrix compared Worcester to Lowell and Springfield only.

5.1.2 Content Analysis Matrices

In order to make comparisons between Worcester's and other cities' transportation and open space planning processes, content analysis matrices were constructed. These matrices were created based on information found during the literature review study. The criteria in these matrices focus on the planning principles listed earlier in the literature review. The matrices were filled in by using different documents provided by the cities that were studied. It is important to understand that the documents provided were the only documents considered in this study.

Throughout the study the matrices were altered in order to provide more specific information about the planning processes. No major changes were made, just some regrouping of the minor criteria under each major heading. From doing this study, it was easy to determine practices used by other cities that were not used within the city of Worcester. It also identified practices that Worcester follows, but other cities do not.

The other aspect of the study was a ranking system which allowed Worcester's planning processes to be compared to the other cities in a numerical fashion. The matrices had major, bolded headings. Under the major headings were more specific criteria that were identified to make it simpler to assign numerical values to these major headings. The ranking system in the matrix assigns one point for each criterion met within each city. The score for each major heading is listed next to it in the matrix. The scores from each major heading were then tallied and the total scores were found.

Two matrices were completed. These included the transportation matrix (Table 5.1.2.1) and the open space matrix (Table 5.1.2.2). Table 5.1.2.1 indicates there are some criteria that one city has and Worcester does not. These practices or features were further examined to determine if it may be feasible for Worcester to incorporate into their planning processes.

Table 5.1.2.1: Transportation Content Analysis Matrix

Criteria	Worcester	Springfield	Lowell
Population	172648	156983	105167
Area (sq. mi)	37.56	33.04	13.77
Alternatives to Driving Alone (PT)	6	7	7
Bus lines	WRTA (Worcester Regional Transit Authority)	PVTA (Pioneer Valley Transit Authority)	LRTA (Lowell Regional Transit Authority)
Commuter rail	MBTA	MBTA	MBTA
Street car	No	No	Trolley System
Other means for elderly/disabled	Paratransit	Paratransit	Paratransit
Carpools & vanpools	CARAVAN	CARAVAN	CARAVAN
Park & ride	Outside of the city	5 - Town plaza	Outside of the city
Pedestrian routes	Yes	Yes	Yes
Bike paths (Master Plan?)	Yes	Yes	Yes
Other		Rack and Roll, Bicycle Commute Week	
Futuristic Thinking (Methods)	4	4	4
Protects environment & ecosystems	Travel Demand Model (TMD) The Footprints Roads Program	Travel Demand Model (TMD) The Footprints Roads Program	Travel Demand Model (TMD) The Footprints Roads Program
Long term plans?	2020 Growth Strategy, Regional Transportation Plan 20 year horizon	Identifies 2020 and 2025 plans, Regional Transportation Plan 20 year horizon	2020 Strategy, Regional Transportation Plan 20 year horizon
Effects of Surroundings	5	5	5
Reducing traffic	Congestion Management System	Congestion Management System	Congestion Management System
Public safety	List of top 1000 accident locations, Crash History Analysis	List of top 1000 accident locations, Crash History Analysis	List of top 1000 accident locations, Crash History Analysis
Pollution	Travel Demand Model (TDM), CO emission tests	Transportation Demand Model (TDM), CO emission tests	Transportation Demand Model (TDM), CO emission tests
Public Involvement	6	5	4

Public participation program	Yes	Yes	Yes
Meetings	Yes	Yes	Yes
Citizen groups	Transportation Planning Advisory Group, Environmental Justice Strategic Planning Task Force	Joint Transportation Committee, Non-Motorized-Transportation Committee	Transportation Management Association
Surveys or comment sheets	Comment sheets	Comment sheets	Comment sheets
Education	Developing "Layman's Guide to Planning & Programming"		
Alternatives/Options	5	5	5
Methods	Transportation Analysis Zones (TAZ), Level of Service (LOS) analysis, Trip Generations	Transportation Analysis Zones (TAZ), Level of Service (LOS) analysis, Trip Generations	Transportation Analysis Zones (TAZ), Level of Service (LOS) analysis, Trip Generations
Models	Travel Demand Forecast	Travel Demand Forecast	Travel Demand Forecast
Prioritizing alternatives	Transportation Improvement Program (TIP)	Transportation Improvement Program (TIP)	Transportation Improvement Program (TIP)
Planning for Uncertainty	2	2	2
Models	Travel Demand Forecast	Travel Demand Forecast	Travel Demand Forecast
Studies	Traffic Monitoring	Traffic Monitoring	Traffic Monitoring
Processes	4	4	4
Decision making	Unified Planning Work Program (UPWP), Regional Transportation Model (RTM)	Unified Planning Work Program (UPWP), Regional Transportation Model (RTM)	Unified Planning Work Program (UPWP), Regional Transportation Model (RTM)
Evaluation process	Travel Demand Forecast	Travel Demand Forecast	Travel Demand Forecast
Advanced practices	Intelligent Transportation System	Intelligent Transportation System	Intelligent Transportation System
Total Score	**32**	**32**	**31**

Table 5.1.2.2: Open Space Content Anaylsis Matrix

Criteria	Worcester	Springfield	Cambridge
Population	172648	152082	101,335
Area (sq. mi.)	37.56	31.7	6.4
Population density (people / sq. mi.)	4596.59	4797.54	15837
Amount of open space			
Open space sites	52 (1996)	168	77 sites
Acres of open space	1261.55 (1996)	2812.52	672 acres
Public involvement and awareness	**2**	**2**	**0**
Decision making	Information Sheets, Neighborhood groups to determine need	"Workshop" of ten neighborhood citizen councils and seven volunteer civic associations	
Methods of information	Public Participation Hearings, Information Sheets	Neighborhood plans for each of the 17 neighborhoods in the city	
Safety			
How to Determine Need	**2**	**0**	**1**
Within a neighborhood	Neighborhood groups		Between 1/4 mile and 1/2 mile; 5-10 acres in size
Determination of neighborhood size			
Per capita determinations	List of priority open spaces		
Site Selection	**5**	**0**	**0**
Public owned land			
Eminent domain	Yes		
Donation	Gifts of Land, Private, Non-Profit Land Trust		
Privately own or managed	Tax Title Properties		
Least cost	Bargain Sales		
Acquisition Process	State and Federal Matching Grants		
Present Thinking	**3**	**0**	**0**

Encouragement of open space preservation	Cluster Development Ordinance, Expanded Site Review, Subdivision Control, Transfer of Development Rights, Non-Zoning Wetland Protection By-Laws, Overlay Zoning Districts (Water Resources Protection, Airport)		
Land use regulations	Impact Fees, Environmental Impact Assessment, Phased Growth, Area of Critical Concern designation, Scenic Roads, Conservation Restrictions and Easements, Local Tax Incentives		
Growth possibilities	Reuse and Renovations of underutilized and vacant buildings, Infill Housing, Fiscal Impact Analysis, Negotiation		
Futuristic Thinking	**3**	**3**	**3**
Acquisition of new open space	Identify 10 sites as most critical	Acquire 1-3 proposed conservation per year, Survey 1-3 areas for endangered species	Large parks unrealistic, invest in tot and neighborhood parks, recommended city have a permanent committee to advice on open space issues.
Preservation of existing open space	Identify 10 sites as most critical	$48.2 million in proposed park renovations outlined for 5 year period with souces of funding	"Rebuild" to make for better more desirable uses
Documentation	What's left	5 year action plan	None
Other	**5**	**3**	**1**
Funding	State and Federal Matching Grants	Community development block grant, Federal land and water conservation fund, Self help program, Urban self-help program, Urban parks and recreation recovery program, Rivers and harbors programs,	
Organizing elements	10 sites identified as most		

	critical open space sites		
Programming			
Cleanliness of open space			
Utilization of GIS	Yes		
Master plan	What's Left: A 1998 Update on Worcester's Open Space	Open space and recovery Action Plan 2002 - 2007	
Open Space per 1000 People	7.31	18.49	7.01 acres
Totals	**20**	**8**	**5**

5.2 Open Space Suitability

Half of objective five was to determine the suitability of each parcel to be used for a form of open space. This required the determination of general criteria and then the generation of detailed matrices for each criterion. Once the matrices had been formed, the information could be calculated by using existing layers in the GIS system. Through a series of selection and update queries in the database, the detailed suitability was determined for each of the three land uses chosen.

5.2.1 Types of Open Space

Three generalized types of open space were selected. These are city park, neighborhood park, and conservation land. This allowed for some distinction between different types of open space without the burden of numerous variations. A city park is a large parcel of land, or several contiguous parcels that provide recreation value to a large region. This would be a park that might include some type of swimming area, perhaps a sports field, and would be worthwhile for a longer walk or even short drive. A neighborhood park, sometimes referred to as a pocket park, would be targeted to the individual needs of the surrounding community. This might be a playground, a place for quiet relaxation, or numerous other possibilities. A neighborhood park is small in nature, and provides the use of facilities to patrons who live within walking distance. The third type of open space land considered was conservation land. Conservation lands are larger parcels of land that are left undeveloped or have protected uses. This sort of land is difficult to predict on a map, since there are several other important factors to consider, such as ecological integrity and the types of plants and animals present. This suitability assisted in narrowing the number of parcels that would require further inspection and site surveys.

5.2.2 Criteria Selection

There are several criteria that were used in developing the suitability matrices. Some of the criteria had clear selection purposes. These included: the size of the parcel, ownership, value of the land, the slope of the land, the zoning of the parcel, and water presence on the parcel. Another criteria was needed to determine if the parcel was contained within a census block group that had an open space deficit. The National Recreation and Parks Association (NRPA) recommend that there be 10 acres of open space per 1000 people. If there was a deficit of open space, then there was more need for open space in that area.

There are some criteria that should have been included, however, it was not possible to include them in the completion of this study. These criteria included: proximity to brown fields, and contiguity to existing open space areas.

5.2.3 Detailed Suitabilities

Once the major criteria were determined, expanded matrices had to be developed showing various categories. The system used was a simple one to five ranking system, with a higher score indicating a greater suitability. Some of these were simple to rank, such as the parcel size, which is shown in Table 4.2.3.1 below. As indicated by the table, larger parcels are more suitable for city parks and conservation lands, and smaller parcels are more suitable for neighborhood parks. All detailed matrices are available in Appendix F. To compute the final score for each land type, the individual suitability values were summed.

Table 5.2.3.1: Suitability by Parcel Size

Size of Parcel (SqFt)	City Park	Conservation Land	Neighborhood Park
0 – 5000	1	1	5
5000 – 7000	2	2	4
7000 – 9000	3	3	3
9000 – 13000	4	4	2
13000+	5	5	1

5.2.4 Calculations

Once the matrices were selected, it was time to calculate all of the necessary values. Provided in GIS layers from the city and the CMRPC, were maps of the parks, parcels, ponds, streams, and census block groups. Items, such as area, can easily be calculated for each parcel using tools available within the GIS software. One of the more complicated columns was calculating the open space deficit. First, the areas of ponds, parks, and conservation lands for each census block were summed to determine total open space. Secondly, based on the 2000 census data, the amount of suggested open space within each block group was calculated. By subtracting the actual open space from the recommended open space, the deficit for the block group was found. The deficit was then transferred down to the parcel level for addition into the parcel based suitability analysis.

5.3 Transportation Accessibility

The second half of objective five was to determine the accessibility of a parcel. This numerical value will reflect proximity to existing transportation infrastructure. The various types of transportation had to be defined, and buffers were used to determine how close each parcel was to the various transportation routes. The parcel based accessibility can be used as a guide for two different purposes. In one case, it can aid

in the future development of transportation infrastructure. For example, this would allow for the implementation of a new transportation route to decongest a busy shopping area. The other case would aid in the placement of new economic developments. For example, a new business would want to be placed in an area where is can be easily accessed without aiding in traffic congestion.

5.3.1 Types of Transportation and Criteria Selection

There are various types of transportation, most of which relate to roads. Nearly every parcel has access to a road. For the sake of this study, major arteries were defined as those that had traffic counts available. These generally corresponded with the highways within the city limits. Interstates were considered as being their own type of major road. Another type of transportation was access to bus routes and bus stops. The criteria used to determine transportation accessibility were distances from the various transportation routes to parcels. Major artery (highway) buffers were placed in one-eight mile increments, interstate buffers were generated in half mile increments, and the bus route buffer was a one-eighth mile increment. Bus routes were only given one buffer since they must be within walking distance from a parcel.

The numerical ranking system is also based on a one to five system (for consistency), with higher numbers representing closer proximity to road infrastructure. The bus information required a different approach. Being within a bus stop buffer scores a five, within the buffer for a bus route, but not within a bus stop is worth a three. Since being within walking distance from bus stop is the best situation, being along the route is also good. A stop could be added to increase accessibility to the immediate surroundings.

6.0 Results and Conclusions

6.1 Transportation Content Analysis Results and Conclusions

From the transportation content analysis matrix, Table 5.1.2.1, two things were concluded. First, from the ranking system it was determined that Worcester's transportation planning process is right on par with the comparison cities of Lowell and Springfield. The final numbers for the ranking system showed that Worcester and Springfield had the same amount of points, 32, and Lowell, at 31 points, trailed by only one. Second, this means that, more or less, all three cities have a similar transportation planning process. For all of the cities, each criterion was met in some way. This would indicate that these cities utilize good transportation planning processes.

Although the ranking system used in this report verifies that all cities have a similar process, it does not reflect the efficiency of utilization of specific aspects of the process. For example, all three cities have public bus systems. There was no feasible way to compare the public bus ridership on these public busses for the different cities. Different ways were explored, but specific ridership information for Springfield and Lowell were not obtained. This comparison could have shown which city was doing the best job of promoting its public transportation system. Another example is the Travel Demand Model (TDM). All three cities utilize this analytical tool. This study had no way to predict how each city uses their TDM. One city may have an updated model that is more accurate than another city. This would result in better travel demand projections and would make for a more efficient transportation planning process. It would be helpful for future studies to try and access plans from best practice cities throughout the United States and compare their processes to those of Worcester.

The Regional Transportation Plans studied in this report were found to be very similar. One reason for this is because the Commonwealth of Massachusetts, as well as the Federal Government, has many programs and regulations that it imposes (Appendix G). The matrix displays many of these programs which all of the cities employ. For example, all three cities are required to have a Congestion Management System. This is required for cities that do not attain the minimum Carbon Monoxide emission levels.

There are several similarities between these cities, but there are some features in which these cities differ. Worcester was found to do something that the others didn't. The Region is developing a "Layman's Guide to Planning and Programming" which is meant to educate the public about planning procedures. With E.O. 418 currently in use in the state of Massachusetts, most cities are putting together documents to gain equivalence and to receive the subsequent funding. Because the cities are in the process of completing this work, the finished documents were not available for this

study. In future studies, it will be important to incorporate these E.O. 418 equivalency documents.

This analysis also identified four practices or programs that Springfield and Lowell used that Worcester did not. Worcester may want to consider these for future improvements to their planning processes. These four practices were park and ride facilities, promotion of bicycle use, possible implementation of a non-motorized transportation committee, and taking a look at bringing back the trolley system. Section 6.1 expands on these practices and programs.

6.2 Open Space Content Analysis Results

From the open space content analysis matrix, Table 5.1.2.2, two conclusions can be made. First, from the ranking system it was determined that Worcester is at the forefront of open space planning relative to the comparison cities of Cambridge and Springfield. Worcester received a total of 20 points, while both Springfield and Cambridge scored significantly lower, eight and five points, respectively. Secondly, a number of practices were identified that are not used by all three cities. For example, Worcester and Springfield have similar methods of informing the public on open space issues. Both use community groups to present their open space plans and ideas. Another example would be Springfield's extensive documentation of its open space projects. Springfield consistently documents a list of its proposed projects with the estimated costs, the fiscal year the project will be worked on and the project's source of funding. Worcester, on the other hand, examines the ten most urgent projects, while Cambridge simply proposes to invest in 'rebuilding parks.

The three Open Space plans studied for the completion of this matrix were very different in format, yet were all recently completed by their corresponding cities. Springfield put out a very user friendly and informative plan. Worcester put out a plan that requires an understanding of planning to comprehend it but contains very useful information. Cambridge's plan provides very little information about their plans for acquiring and updating open space within their city. The reasons for the differences in the open space plans stems from there being few guidelines from the state as to how to document the plans. The only guideline provided by Massachusetts is one that requires all municipalities to update their open space plan every five years. This is what allows them to receive state funding.

The ranking system employed for this matrix is the same as that employed for the transportation content analysis matrix. The open space content analysis matrix shows Worcester as having a much better process than Springfield and Cambridge. However, it does not show how effectively each specific aspect is implemented. For example both Worcester and Springfield use public groups for public involvement. There is no way for this project to determine which uses public groups more effectively. It is also important to realize that the results from this analysis come directly from the documents that each city provided. This study would be worth

revisiting when more effective documents become available. Some such documents would be the E.O. 418 equivalency documents.

There is a vast difference between Worcester's score and the scores of Cambridge and Springfield. One reason for this is that this project focused on documented process. Worcester has a very well documented process, whereas Springfield's and Cambridge's are very informal. For each city, the city's planners provided their open space plans. No other documentation could be found to dissuade the conclusions in this section.

6.3 Suitability Analysis Results & Conclusions

The suitability of each parcel was calculated for the various types of open space. Each parcel has a suitability ranking number. This number was the summation of scores based on the detailed tables contained in Appendix F. The scores from the eight tables used, since contiguity was not counted in this study, would provide a score from eight to forty, given that each criteria used a one to five ranking system. Each parcel would receive a value for each of the three types of suitability. Some parcels are, of course, more suitable than others. This provides a guide that can be used to conduct further research and enable a site survey to be performed on the most suitable locations. Some criteria that need to be examined are the presence of buildings, power lines, or other inhibiting factors that do not show immediately on each parcel. Figure 6.3.1 below shows the suitability for the city parks for each parcel in the city. The ranges below are common to all of the suitability maps shown in Appendix H. Parcels with a ranking of above 23 are the most suitable. As the numerical value for each parcel decreases, so does its suitability for that specific land use type. This is displayed by the use of the various colors, the deeper the green the more suitable, and the shades of red are less suitable. Suitability maps for all of the open space types (city park, neighborhood park, and conservation land) can be found in Appendix H. Also, contained within Appendix H are suitability maps with the less suitable parcels removed for readability.

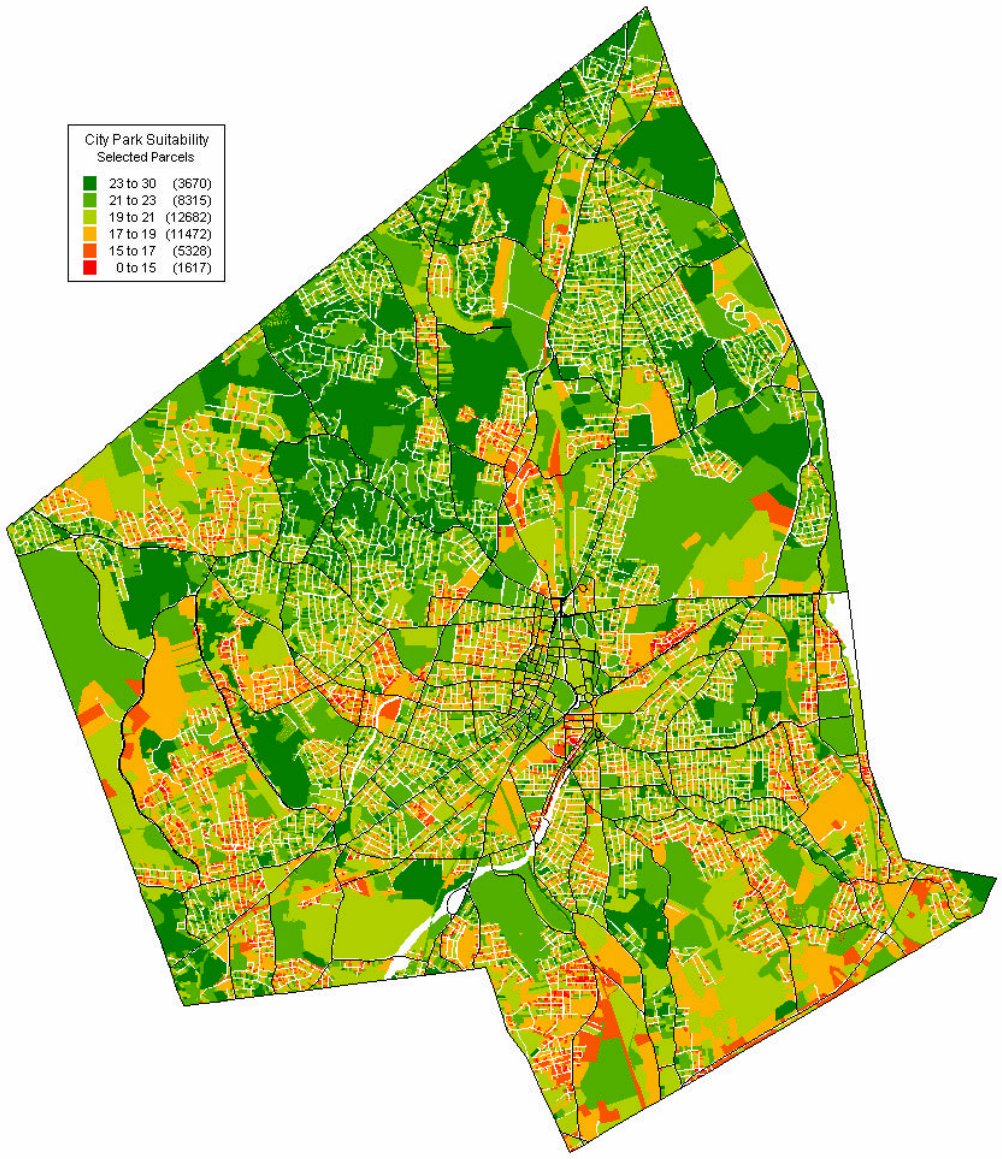

Figure 6.3.1

The second major analysis performed was an open space deficit calculation. Using the national standard, 10 acres of open space per 1000 people, there were 39 census block groups that had zero open space deficit. This comprised about 23% of Worcester, the remaining area having some deficit. There are some parks, such as Green Hill Park that are considered to be large city parks. These types of open space serve the entire region, and would assist in countering the deficit in some areas. This countering effect is minimized in Map 1 in Appendix H, but qualitatively can be included when examining the map. One key region to be examined is in the northeast corner of the city. Census block group 2 within census track 7304.01 was of particular interest. It contained the second largest deficit within the city and the regions surrounding it are also suffering from a deficit. This means that there are not parks

abutting the census block group that will balance the deficit. Figure 6.3.2 below shows this region and its deficits.

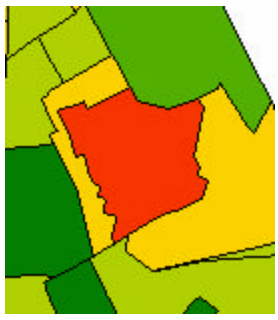

Figure 6.3.2

Within this region there are 37 parcels of land that are more suitable than average for development into parkland, this is depicted in Figure 6.3.3 below. This is the first step in determining where a park might be developed. Once the parcels that are the most suitable are found further analysis is possible. Examining which parcels do not contain any buildings will allow for the most suitable few to be selected before any site surveys must be done. In the example provided below three parcels are circled in red. These indicate where we suggest further examination to determine if it would be possible to place a park on any of these sites. On these parcels there are no buildings, they are located in accessible areas, and close to the surrounding residential areas.

Figure 6.3.3

This sort of analysis will save time and money since it is numerically possible to identify areas that are suitable for consideration for future development. To continue the example we performed a site survey of the area. The first parcel on the left was less suitable since the road was not completed behind it. This would present an accessibility problem. The site on the right had a house located on it, this makes it not suitable after further investigation. The site in the middle however had a small stream located on it, was mostly wooded, and there was a bank downward from the road. We believe this is the most suitable and would warrant further investigation from the city. The steep bank would allow for a good buffer from the roadway, clearing of the underbrush would make it possible to place some benches and

recreation equipment without negatively impacting the trees in the area. This site can be seen below in figures 6.3.4 and 6.3.5.

Figure 6.3.4

Figure 6.3.5

6.4 Transportation Accessibility Results & Conclusions

Transportation was approached in a different fashion as discussed in the analysis. For each parcel the accessibility figure was calculated based on the proximity to various types of transportation. The city's transportation accessibility is illustrated in Figure 6.4.1 and included in Appendix H. The area of the city most lacking in transportation is along the western edge of the city. There are no major roads, bus routes, or interstates in that region of the city which leave lesser streets being the primary transportation infrastructure. In general Worcester's transportation network appears to be adequate based on proximity alone.

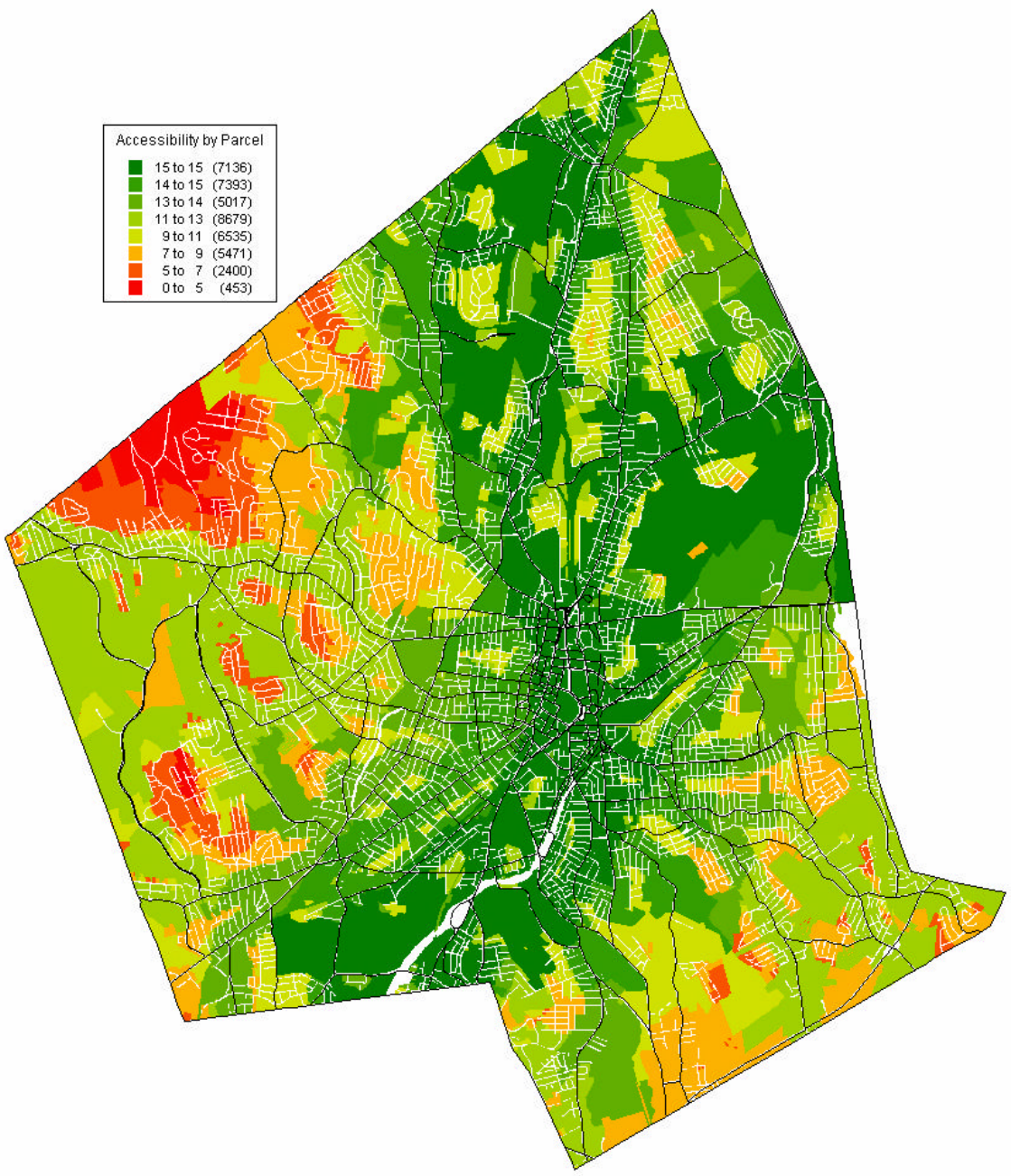

Figure 6.4.1

The downside of only having proximity based information is the fact that road volume and capacity can not be considered. Some of the roads that provide a high accessibility to parcels have no available capacity based on common knowledge of the area. A more detailed analysis of the transportation infrastructure would include the available capacities of the major arteries. By adjusting the size of the buffers around a road based on its remaining capacity a more accurate picture of the transportation system in Worcester could be developed.

7.0 Recommendations and Contributions to Worcester

Through an examination of how Worcester performs its planning process, in comparison to other cities, we were able to make recommendations to Worcester planners. The planners can use these recommendations to improve the way designs are developed for this city. This could have a host of effects, such as improved efficiency of city workers, better involvement and buy in of citizens, and generally better success of projects. The city officials will be able to see, in summarized form, the strong and weak aspects of the city, allowing for marketing of the strong points and correction of the weak. This type of research could also be applied to other cities or areas of planning. The processes used for this specific project can be repeated in a completely different contextual area to aid in the improvement of another aspect of city development.

7.1 Transportation Related Recommendations

The transportation content analysis identified four practices that Springfield and Lowell employ, which, at this point, Worcester does not. These four practices are park and ride facilities, promotion of bicycle use, possible implementation of a non-motorized transportation committee, and taking a look at bringing back the trolley system.

7.1.1 Implementation of Park and Ride Facilities

The city of Springfield has the Five Town Plaza Park & Ride facility. This is a free parking lot where commuters can park and then take the Pioneer Valley Transit Authority Busses. The facility provides 89 parking spaces. The surrounding region of Springfield has 4 additional park & ride facilities. The Worcester region only provides one such facility in Berlin, Massachusetts. Worcester could promote the use of the Worcester Regional Transit Authority (WRTA) by creating a park & ride facility to reduce automobile traffic in the heart of the city and also improve ridership on the WRTA busses.

7.1.2 Promotion of Bicycle Use

Springfield also takes measures to promote bicycle use in the city. These are the “Rack and Roll” plan and Bike Commute Week. The Rack and Roll plan promotes the use of bicycles, by putting bike racks on public transit busses. This encourages bicycle use as well as public transit use. Worcester has bike racks on public transit busses, however, the city does not promote it. The Bike Commute Week is one week a year in which employees are encouraged to take their bicycles to work. Both of

these programs are useful to reduce automobile traffic, therefore reducing emissions. They also promote exercise by bicycling, as well as increased use of public transportation. Any city would benefit from these programs. Worcester is no exception and it would be helpful for the city to look at these programs and other similar programs to improve transportation within the city.

7.1.3 Implementation of a Non-motorized Transportation Committee

In Springfield there is a committee that deals with non-motorized transportation. The committee promotes pedestrian travel and bicycle use. They maintain the city's Pedestrian and Bicycle plans. Although Worcester has similar Pedestrian and Bicycle plans, a committee that continues the development of these documents and promotes non-motorized transportation could be implemented.

7.1.4 Revisiting the Trolley System

Currently, Lowell has a trolley system that they are looking to renovate. There are several benefits to a trolley system. The most important is the historic value that an old fashioned system would bring back to a city. Residents and officials of the city of Lowell rave about the city's trolley system. Since Worcester still has rail spurs (due to the trolley system that was eliminated over fifty years ago), Worcester could bring back its trolley system. Worcester should explore this alternative for future implementation. It may be worth conducting studies to analyze the public interest, its feasibility, the effects on the economy, and its aesthetic value.

7.2 Open Space Related Recommendations

The open space content analysis identified three practices that Springfield and Cambridge employ, which, at this point, Worcester does not.

7.2.1 Detailed Project List

Springfield's open space plan contains a detailed list of proposed projects. This list gives an estimated cost of the project, the fiscal year in which the project will be developed, and a brief project description. This provides a simplified look at how the city is spending its open space budget. Worcester should include this in their plan to help maintain better project documentation.

7.2.2 Electronic Plans

In Cambridge, Open space plans are made available to the public via the internet. Springfield and Worcester only have theirs available in hardcopy. The internet, in

general, is very accessible by the public. People are more likely to be informed of open space plans if they can access them from their homes. Therefore, Worcester should consider utilizing electronic documents and making them available to the public via the internet.

7.2.3 Simplified Documentation of Plans

When reading through the different open space plans, it became apparent that some required a significant understanding of planning techniques in order to comprehend them. Worcester and Cambridge were two such plans. Springfield's plan on the other hand was written in a way that made an understanding of planning unneeded. Since the general public would not have an understanding of planning, Worcester's and Cambridge's plans would have been very difficult to understand. If Worcester adopted a style of writing similar to Springfield, the public would be more likely to understand what the city is trying to do with open space.

7.3 Contributions to the City

This project has contributed several things to the city of Worcester. The transportation and open space content analysis matrices provided Worcester with a comparison to other cities' planning processes. The matrices also showed some programs and practices that were done in other cities. These practices and programs were recommended to Worcester. Worcester may want to investigate these options for future implementation. The GIS portion of this project provided the city with suitability and accessibility maps. For open space, areas that were suitable for open space, parks, or conservation land, were identified. For transportation, areas that are accessible to major highways and public transit were determined. These maps also allow for a visual representation of areas where there is a lack of transportation accessibility.

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Appendix A: Best Practice Criteria

Transportation Criteria	
Population	**Public Involvements**
Area (sq. mi.)	Public participation program
Alternatives to Driving Alone (PT)	Meetings
Bus Lines	Citizen groups
Commuter Rail	Surveys or comment sheets
Street Car	Education
Other means for elderly/disabled	**Alternatives/Options**l
Carpools & vanpools	Methods
Park & ride	Models
Pedestrian routes	Prioritizing alternatives
Bike paths (Master Plan)	**Planning for Uncertainty**
Other	Models
Futuristic Thinking Methods	Studies
Protects environments & ecosystems	**Processes**
Long term plans	Decision making
Effects of Surroundings	Evaluation process
Reducing traffic	Advanced practices
Public safety	
Pollutions	

Open Space Criteria	
Population	**Present Thinking**
Area (sq. mi.)	Encouragement of open space preservation
Population density (people / sq. mi.)	Land use regulations
Amount of Open Space	Growth possibilities
Open space sites	**Futuristic Thinking**
Acres of open space	Acquisition of new open space
Public Involvement and Awareness	Preservation of existing open space
Decision making	Documentation
Methods of information	**Other**
Safety	Funding
How to Determine Need	Organizing elements
Within a neighborhood	Programming
Determination of neighborhood size	Cleanliness of open space
Per capita determinations	Utilization of GIS
Site Selection	Master Plan
Public owned land	Open space per 1000 people
Eminent domain	
Donation	
Privately owned or managed	
Least cost	
Acquisition process	

Appendix B: Initial City List

1 Albuquerque, New Mexico	14 Lowell, Massachusetts
2 Anchorage, Alaska	15 Milwaukee, Wisconsin
3 Arlington, Texas	16 New Haven, Connecticut
4 Berkeley, California	17 Orlando, Florida
5 Boulder, Colorado	18 Pittsburgh, Pennsylvania
6 Brownsville, Texas	19 Providence, Rhode Island
7 Cambridge, Massachusetts	20 Santa Barbara, California
8 Charleston, South Carolina	21 Santa Cruz County, California
9 Chattanooga, Tennessee	22 Scottsdale, Arizona
10 Cleveland, Ohio	23 Springfield, Massachusetts
11 Howard County, Maryland	24 Tampa, Florida
12 Lincoln, Nebraska	25 Wilmington, North Carolina
13 Loudoun County, Virginia	

Appendix C: Transportation and Open Space Questionnaires

Transportation Planning Process Interview Questions

1 Is there a single organization that oversees all transportation sub-systems (public transport, roads, rail,etc.)?

   a. If so, what is it and how can it be contacted?

   b. If not, what departments are involved? How do the different departments communicate with each other? Do they follow a structured communication plan or do they follow ad-hoc meetings and methods?

2 Is there a specific process followed when analyzing the feasibility of new project proposals?

   a. When a new plan comes in what studies are required (e.g. traffic studies)?

When a new plan is proposed what impacts are studied (on environment, residents, communities, etc.)? What analytical tools are used? Do the tools used differ by project type?

   b. What short term and what long term effects are considered important when analyzing a proposed plan? Are these effects considered when predicting the future success of the project? How far into the future are they predicted?

3 Describe the specific decision making process used in developing and implementing new projects? Are models or benchmarking used?

4 Is there mitigation for those affected by new projects? If so, who or what process determines the mitigation?

5 How is the public involved in the planning process (focus groups, community groups, public meetings, hearings, surveys, etc.)?

6 How is public transportation incorporated into the transportation infrastructure?

   a. Are there any incentives used to encourage the development of public transportation?

b. How are public transportation routes determined?

c. Are the public transportation companies controlled by the city or private companies?

c. How is the public transportation alternative considered when determining alternative plans/priorities?

7. How do you define or rank the importance of a project? Who determines the important criteria for projects (public, hired engineers, public officials, etc.)?

8. How are the needs for new transportation routes determined?

9. Worcester is in the process of implementing an executive order, E.O. 418, which provides standards the city must attain in order to provide for their future. Does your city have any similar documentation?

10. Finally, do you feel that your city has something within your transportation plan that is more sophisticated than other cities'? Is there something that sets your process ahead of others?

Open Space Planning Process Interview Questions

1 How is need for open space in your city determined?

2 How is the public involved in the open space planning process (focus groups, community groups, public meetings, hearings, surveys, etc.)?

3 How is funding created to secure open space (open space projects, park development, acquisition of land, etc)?

4 Is there a specific decision making process in the acquisition of new open space?

5 Is there a process used for the acquisition of open space?

   a. Who has the final say when determining the budget for new open space acquisition?

6 How are the needs of open space areas determined?

   a. Are the needs determined on a neighborhood by neighborhood basis?

   b. Is it solely targets of opportunity?

   c. Are land tracts sought out specifically?

7 Worcester is in the process of implementing an executive order, E.O. 418, which provides standards the city must attain in order to provide for their future. Does your city have any similar documentation?

8 What techniques are used to preserve your cities current open space areas?

9 Do you feel that your city has something within your open space plan that is more sophisticated than other cities'? Is there something that sets your process ahead of others?

10 Does your city have a standard for the amount of open space per 1000 people or distance from a residential area to the closest open space?

Appendix D: Participating Cities

City Name	Contact Name	Contact Number	Planning Dept	Email
Boulder	Sweeney, Mike	303-441-3162	Transport	sweeneym@ci.boulder.co.us
Brownsville	Lund, Mark	956-548-6150	Transport	bmpo@cob.us
Arlington		817-459-6652	General	planningdevelopment@ci.arlington.tx.us
Chattanooga	Hayes, Greg	423-757-0558	Open Space	Hayes_greg@mail.chattanooga.gov
Chattanooga	Rhondes, Karen	423-757-0558	Transport	Rhondes_karen@mail.chattanooga.gov
Howard County	Balser, Carl	410-313-2350	Transport	cbalser@co.ho.md.us
Lincoln	Brienzo, Mike	402-441-6369	Transport	mbrienzo@ci.lincoln.ne.us
Lincoln	Genrich, Terry	402-441-7939	Open Space	tgenrich@ci.lincoln.ne.us
Loudoun County	DuCharm, Diane	703-777-0246	General	dop@loudoun.gov
New Haven	Piscitelli, Mike	203-946-7814	Transport	mpiscite@NewHavenct.net
Pittsburgh	Hassett, Patrick	412-255-2256	Transport	patrick.hassett@city.pittsburgh.pa.us
Pittsburgh	Wilson, Wanda	412-255-2223	Open Space	wanda.wilson@city.pittsburgh.pa.us
Santa Barbara	Hennon, Bettie	805-564-5470	General	bhennon@ci.santa-barbara.ca.us
Scottsdale	Iverson, Aaron	480-312-7637	Transport	aiverson@scottsdaleaz.gov
Tampa	Ataya	813-274-8333	Transport	
Providence	Ozbeck, Jon	401-351-4300	Transport	jozbeck@providenceri.com
Providence	McMahon, Robert	401-785-9450	Open Space	rmcmahon@providenceri.com
Lowell		978-970-4252	General	
Cambridge	Jennings, Taha	617-349-4603	General	tjennings@cambridgema.gov
Springfield	Petrella, Linda	413-787-6020	General	lpetrella@springfieldcityhall.com

Appendix E: Brownsville's Responses to the Transportation Questionnaire

1. No. There are several organizations. For example, the City of Brownsville, the City of Los Fresnos, the Ranch of Rancho Viejo, and Cameron County, as well as TxDOT all maintain different roadway segments. The rail involves freight…..via the Union Pacific Railroad Co. and the Rio Grande International Railroad Company, which serves as an arm of the Port of Brownsville.

   Sometimes the different entities communicate directly, or in some cases there are adhoc committees formed to discuss various issues. Also, due the international trade issues…..some of our most critical discussion involve the U.S. Customs, other federal agencies, int'l bridge owners, trucking interests, and other interested parties (customs brokers), including Mexican [equivalents] upon occasions. The MPO does not always participate in these discussions, although MPO staff do attend on some occasions.

2. The MPO uses the Travel Demand Model (computer model of base year and forecast year networks) to assess or "test" the utility of proposed (new) improvement (roadway) projects. Also, local knowledge and common sense influences our (MPO) selection of which new projects merit listing in the MTP or long-range plan.

   c. No particular studies are required…..the review of potential environmental/social-cultural fatal flaws is very important. You cannot develop a new roadway corridor that would traverse thru wetlands or an old ranch cemetery….in some cases the public involvement process brings new (comments)info to the MPO to help us make better decisions on these matters.

   d. MPO response: The tools are used later with the preparation of Environmental assessments for particular corridors. We don't do exhaustive analysis at the early stages. We won't exclude such detailed info at the early stage of MTP formation, but it is impossible to do comprehensive analyses of very rough corridors

   e. The vast majority of our citizens and local leaders view transportation improvements as positive for our future growth. In other words…almost all growth is considered good. So there is less debate in this community about whether or not to proceed; or what are the potential drawbacks re: development to consider… or to be analyzed……IN OTHER WORDS….if the improvement can be implemented….then there is likely to be strong support for implementing the improvement. Of course, there are folks who want growth, but not in their neighborhood. As the rural

areas change towards urban densities….we do find folks who ask lots of questions about how the pot. Improvement will affect/impact their neighborhood. While there are technical (value neutral) answers to these questions…..the answer about whether or not a new proposal is good or bad may be answered differently by different individuals. Given that the overall metropolitan area will continue to grow…..the answers pertaining to proposed improvements outlined for particular roadway corridors will be addressed sometimes by the "no-build" scenario….which means that congestion increases are likely for that corridor and nearby roads if no improvements are undertaken. Usually the MPO faces these types of questions……our choices involve which corridor should get immediate attention and which other corridor can wait until later. We don't have a large enough transit (bus) system to accommodate large amounts of trips via other modes. So….much of .the analysis of short term versus long term has all ready been addressed by the fact that the citizens generally want and accept growth in our community. This does not preclude some projects being cancelled at later stages of development, which has happened here. It means that few proposals are killed at the very early stage of initial identification. Under our generous public involvement policies…citizens can put whatever factors out into the discussions at the earliest stages…. at whatever level of detail that they deem wise.

3. How is the public involved in the planning process (focus groups, community groups, public meetings, hearings, surveys, etc.)? We distribute (mail) a free MPO newsletter to anyone who is interested (3-4 xs per year). We hold public meetings to take questions and hear comments. We place ads in the legal section of the newspaper prior to taking action on matters of substance. We circulate comment sheets via the newsletters and distribute them at meetings for those folks who don't like to speak out in public. We also get a lot of input from the Transportation Committee of the Brownsville Chamber of Commerce. Any civic group that will invite us (Rotary, Lions, and/or Kiwanis) to lunch will get a presentation on the pending work of the MPO and we take questions and comments from those in attendance. If we suspect that a particular improvement project and/or corridor study will impact residents and/or property owners ….then we invite them to look at what we are doing and ask them to react to the various potential decisions that might arise in connection with the proposals. Sometimes people want to know whether we think a particular project is a good or bad thing… we refuse to get into the endorsement "trap" and explain that our role is to bring folks into the process….and that their involvement is likely to produce a better product as a result. After an initial pause…most folks get the idea. Some are willing to share their thoughts. Many are quiet and leave once they realize that the project or the proposal will not impact them for many years

4. It varies on the individual project or individual roadway corridor

5. Please see the above responses for more information about the decision-making process. As I cite above….this community is generally pro-growth. There are few factors (eg. Impact fees and other tools) used to slow or divert growth to particular sectors or geographic areas.

6. We have a small, effective Bus system named Brownsville Urban System or BUS. About ten bus routes exist in our urbanized area, [population] is approx. 150,000.

    a. Federal programs (JARC, and commuter credits) exist and help encourage such use of this other mode.

       It is the primary mode for some sectors of our community. It is a secondary choice for most others.

    b. By studies of route utilization and after opportunities for public input is made available.

    c. The [City] of Brownsville operates BUS. There are also taxis and other private (City to city) bus companies

    d. Not usually….cannot recall that it is has ever been considered in this role.

7. It takes time to obtain a FONSI.
    a. Sure, but timelines get disrupted.
    b. The City or TXDOT follows their own priorities, although the MPO allows for discussion, revision and setting of prioroities.

8. See above

9. [no answer]

10. Texas has an Economically Disadvantaged County program by state law….. thanks to legislation sponsored by leaders from El Paso. It helps rebate development monies for projects that receive FONSIs. This is very important for our area, as we were the poorest medium sized city in the US in the 1990 Census.

Appendix F: Detailed Suitability Matrices

Table H.1: Open Space Zone Suitability			
Zone	City Park	Conservation Land	Neighborhood Park
Unknown	3	3	3
A-1	1	1	1
BO-1.0	1	1	1
BO-2.0	1	1	1
IN-S	3	2	3
BG-2.0	2	2	2
BG-3.0	2	2	2
BG-4.0	2	2	2
BG-6.0	2	2	2
MG-2.0	1	1	1
MG-0.5	1	1	1
MG-1.0	1	1	1
ML-1.0	1	1	1
RG-5	3	3	5
IN-H	2	2	2
BL-1.0	3	3	3
ML-0.5	1	1	1
ML-2.0	1	1	1
RL-7	3	3	4
RS-10	4	5	3
RS-7	3	3	4

Table H.2: Open Space Water Suitability			
Contains Water	City Park	Conservation Land	Neighborhood Park
Stream	4	5	2
Pond	3	5	1
Both	3	5	1
None	1	3	5

Table H.3: Open Space Ownership Suitability			
Ownership	City Park	Conservation Land	Neighborhood Park
Public	5	5	5
Private	1	1	1

Table H.4: Open Space Land Slope Suitability			
Land Slope	City Park	Conservation Land	Neighborhood Park

1	5	5	5
2	5	5	4
3	4	4	2
4	3	3	1

Table H.5: Open Space Contiguity Suitability			
Contiguous Type	City Park	Conservation Land	Neighborhood Park
City Park	5	1	1
Conservation Land	1	5	1
Neighborhood Park	1	1	5

Table H.6: Open Space Parcel Value Suitability				
Upper Range	Lower Range	City Park	Conservation Land	Neighborhood Park
100000	0	5	5	5
130000	100000	4	4	4
150000	130000	3	3	3
180000	150000	2	2	2
999999999	180000	1	1	1

Table H.7: Open Space Parcel Size Suitability				
Upper Range	Lower Range	City Park	Conservation Land	Neighborhood Park
5000	0	1	1	5
7000	5000	2	2	4
9000	7000	3	3	3
13000	9000	4	4	2
999999999	13000	5	5	1

Table H.8: Open Space Proximity to Existing Suitability				
Upper Range	Lower Range	City Park	Conservation Land	Neighborhood Park
1	40	1	1	1
40	2000	2	2	2
2000	4000	3	3	3
4000	6000	4	4	4
6000	2E+09	5	5	5

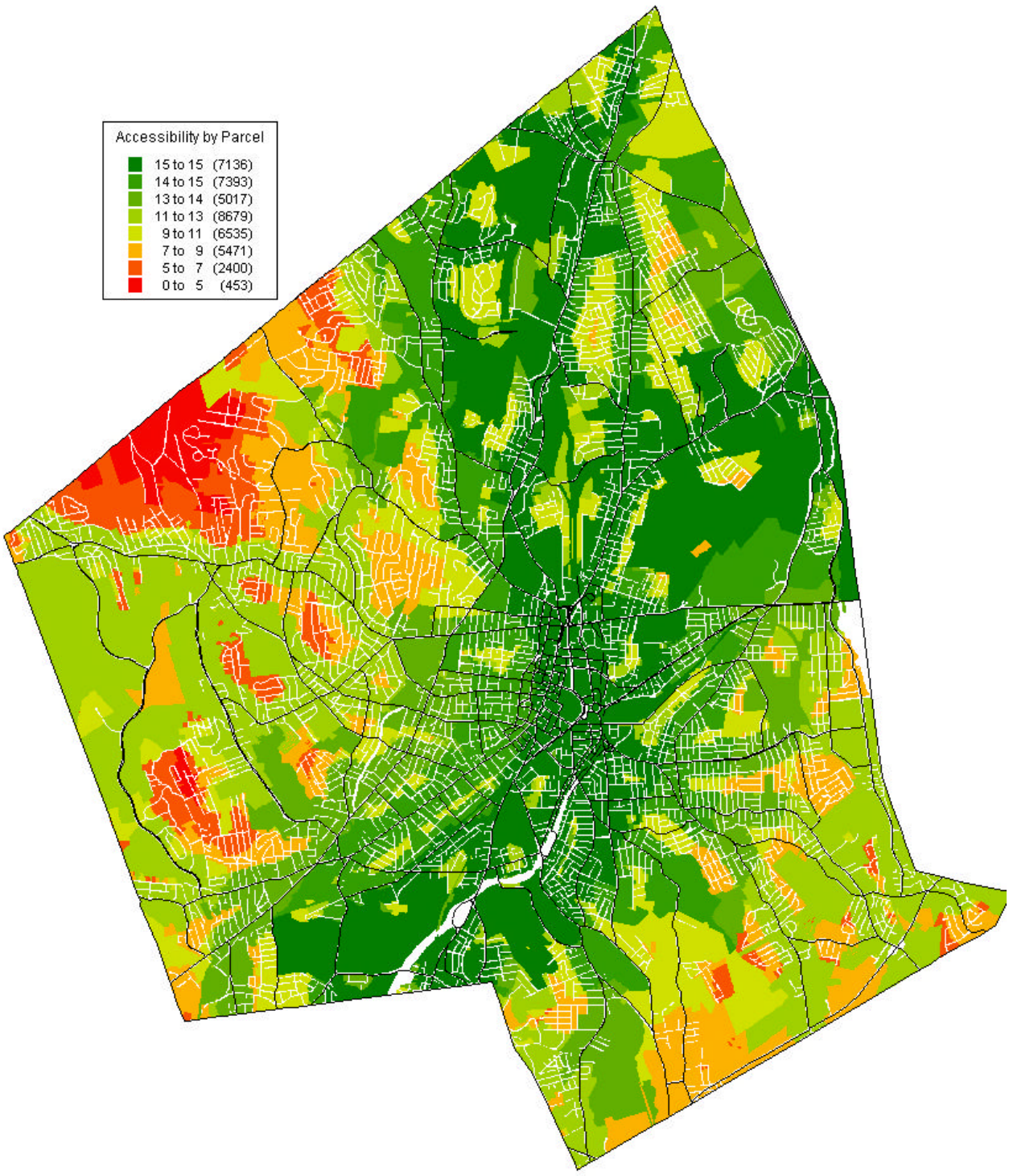
Table H.9: Open Space Deficit Suitability				
Upper Range	Lower Range	City Park	Conservation Land	Neighborhood Park
999999999	1295000	5	4	1

1295000	1110000	5	4	1
1110000	925000	5	4	1
925000	740000	5	4	1
740000	555000	5	4	1
555000	370000	4	3	3
370000	185000	4	3	4
185000	0	3	2	5
0	-999999999	1	1	1

Appendix G: Examples of State and Federal Programs covered in the Regional Transportation Plan

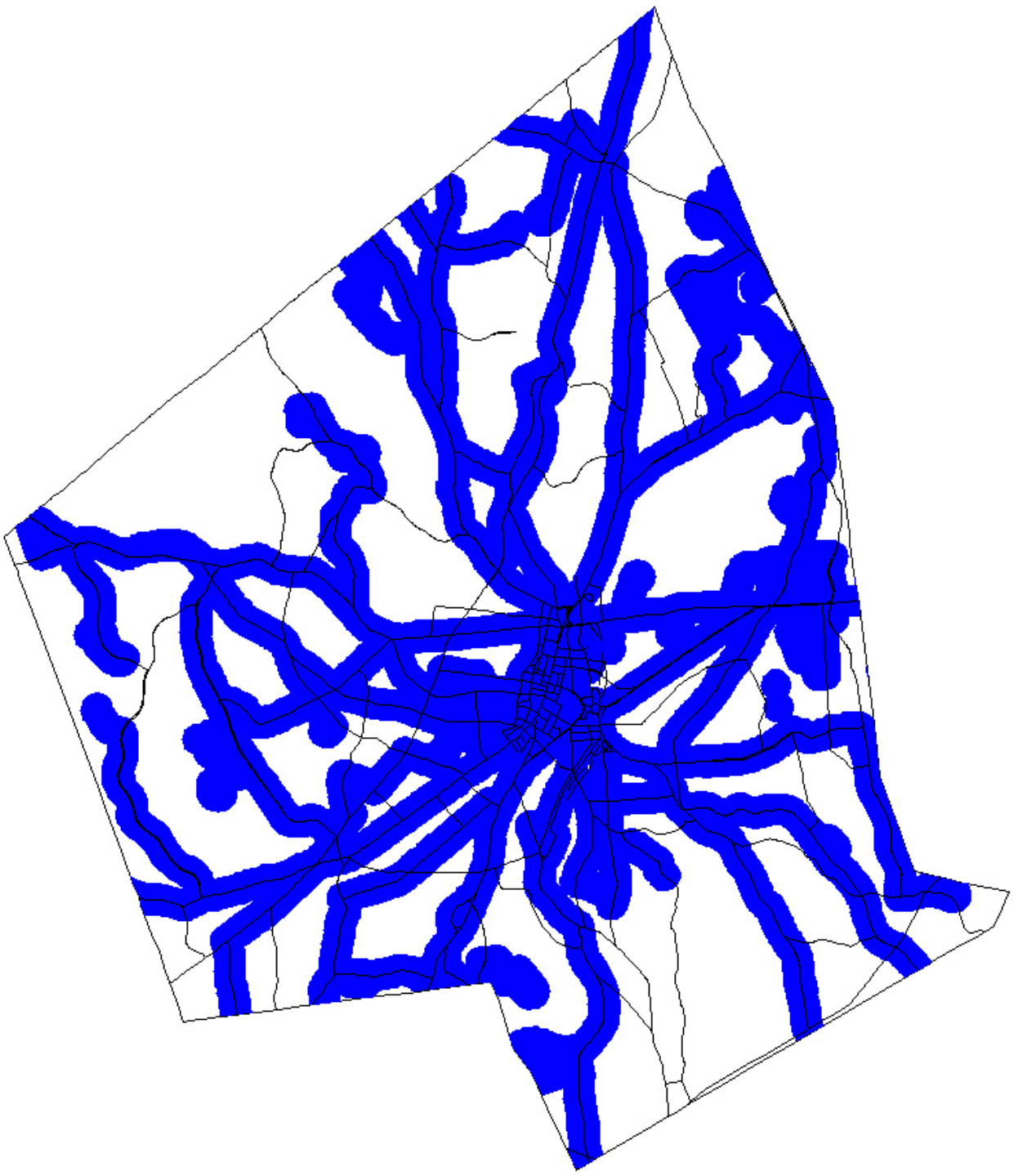
Statewide Program	**Description**
Bridge Management System	Listing of every highway bridge including year of construction and/of year of most recent reconstruction
CARAVAN	Provides transportation services to commuters and employers to encourage alternatives to driving alone
Massachusetts Rideshare Regulation	Major employers must provide on-site commuter services
Massachusetts Pedestrian Transportation Plan	Develops a more pedestrian-focused statewide transportation system
Massachusetts Bicycle Transportation Plan	Develops policies and practices to improve conditions for bicycling
Congestion Management System (CMS)	Required for all metropolitan areas in air quality nonattainment
Safety Management System (SMS)	Statewide program conducted by MassHighway, includes listing of top 1000 accident locations
Fix it First	Gives priority to repair of existing road infrastructure
Communities First	Protects and enhances community
Regional Transportation Plan (RTP)	Provides inventory of major modes, identifies needs, and provides recommendations to address needs
Federal Program	**Description**
Emissions Testing	Required testing 2007, 2015, 2025 by Environmental Protection Association
Transportation Improvement Program (TIP)	Federally required document lists all transportation projects

Appendix H: GIS Maps

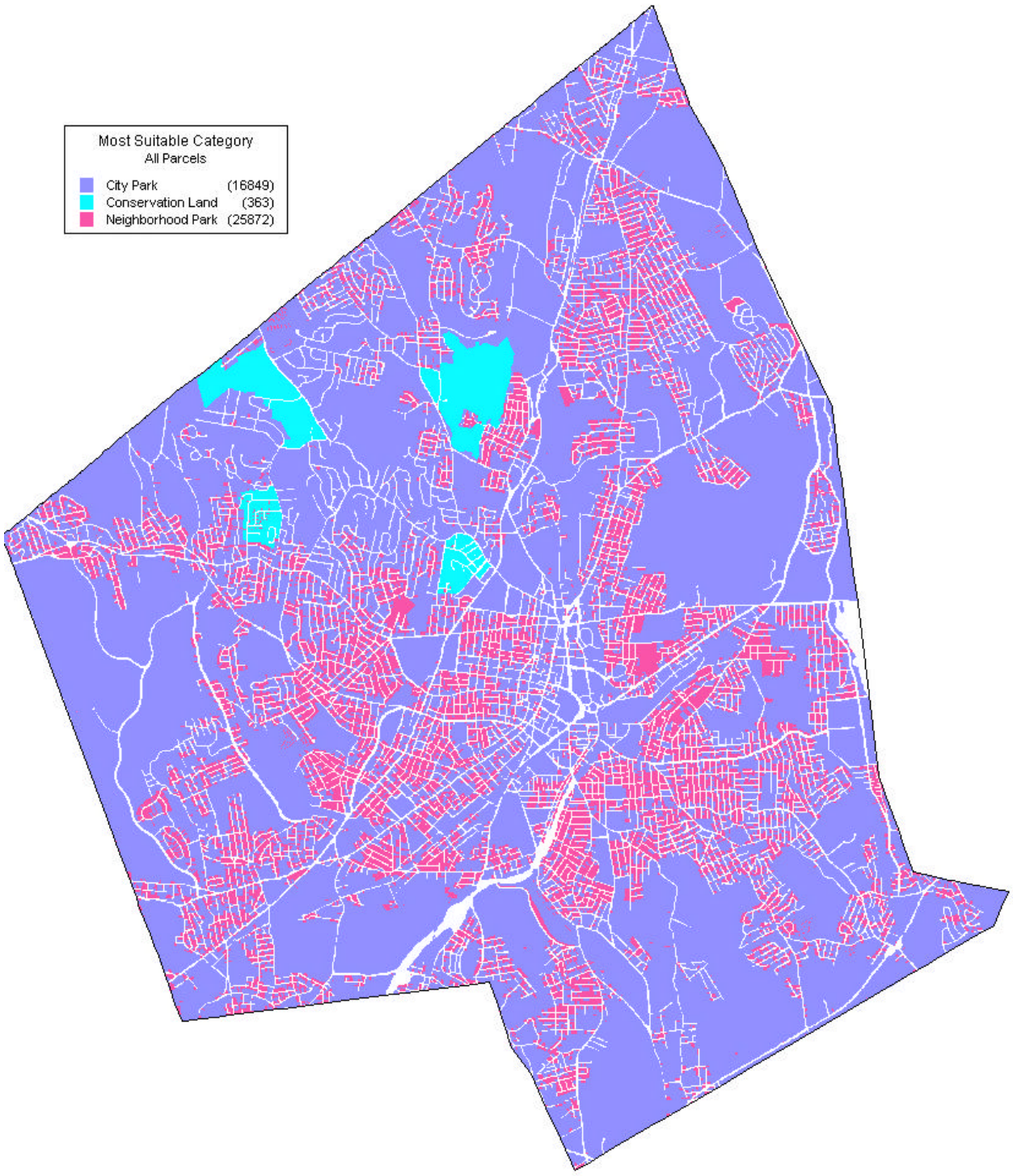


Map 1 – Accessibility of All Parcels

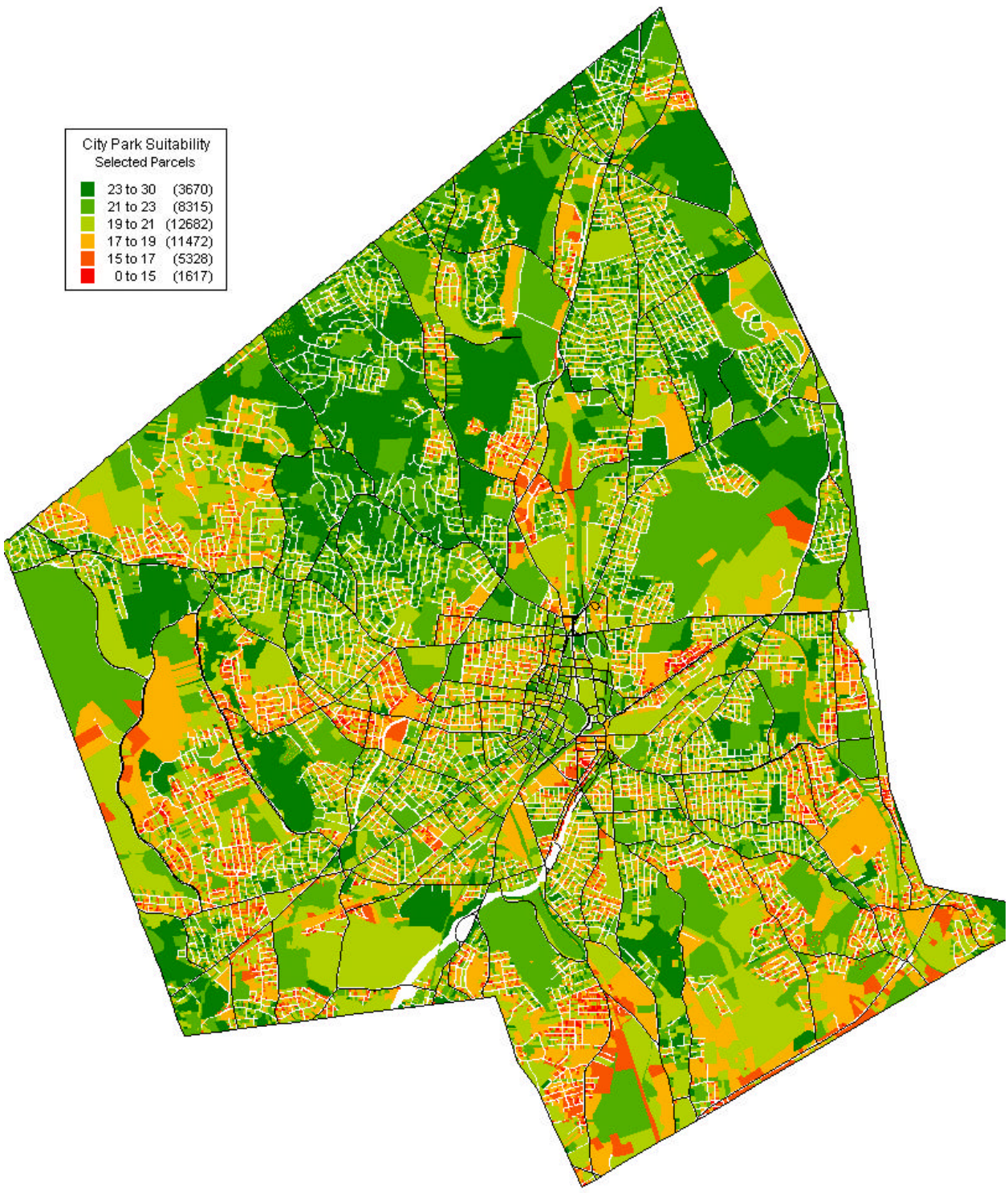
Map 2 – Major Roads



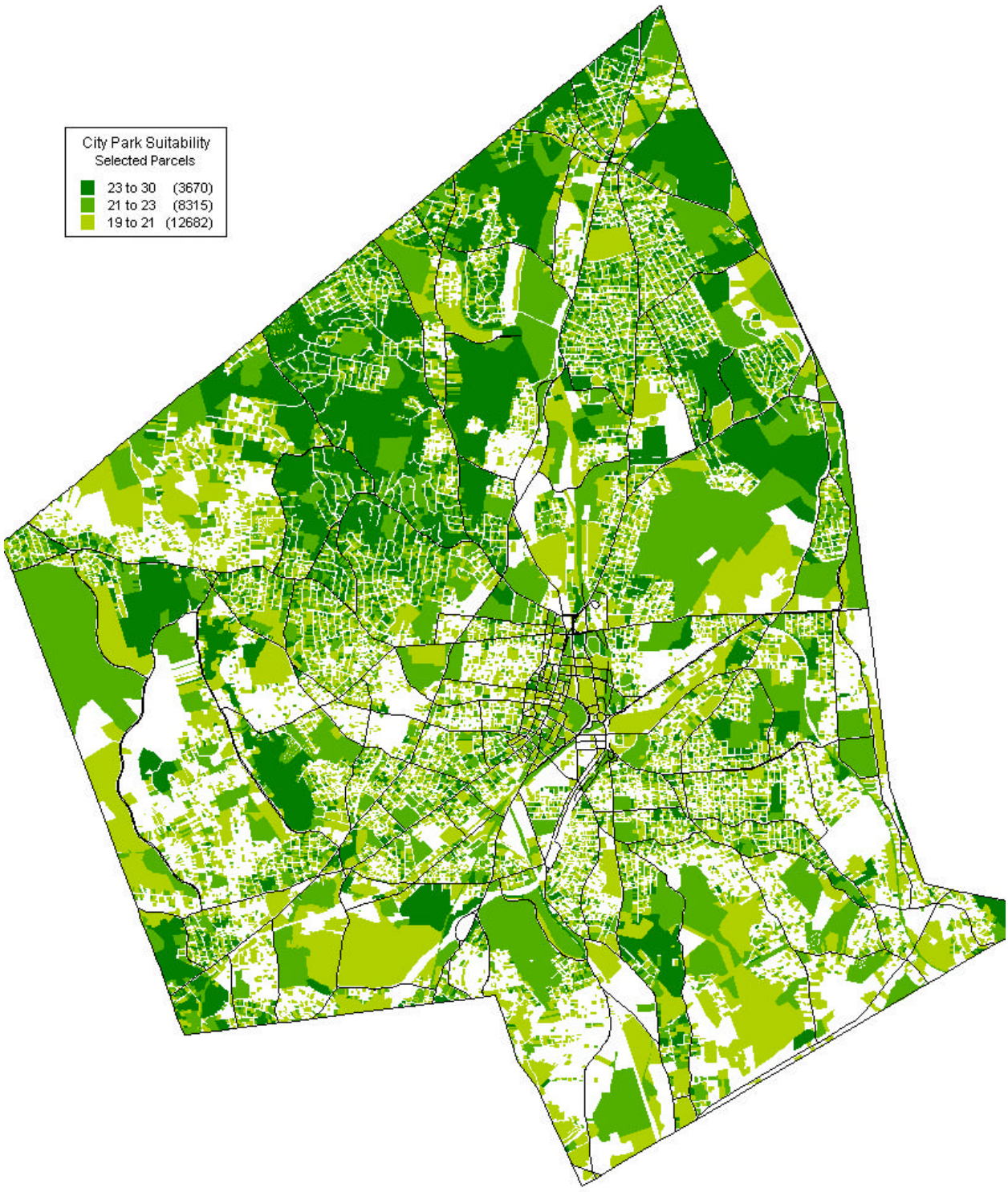
Map 3 – Major Roads and Bus Routes



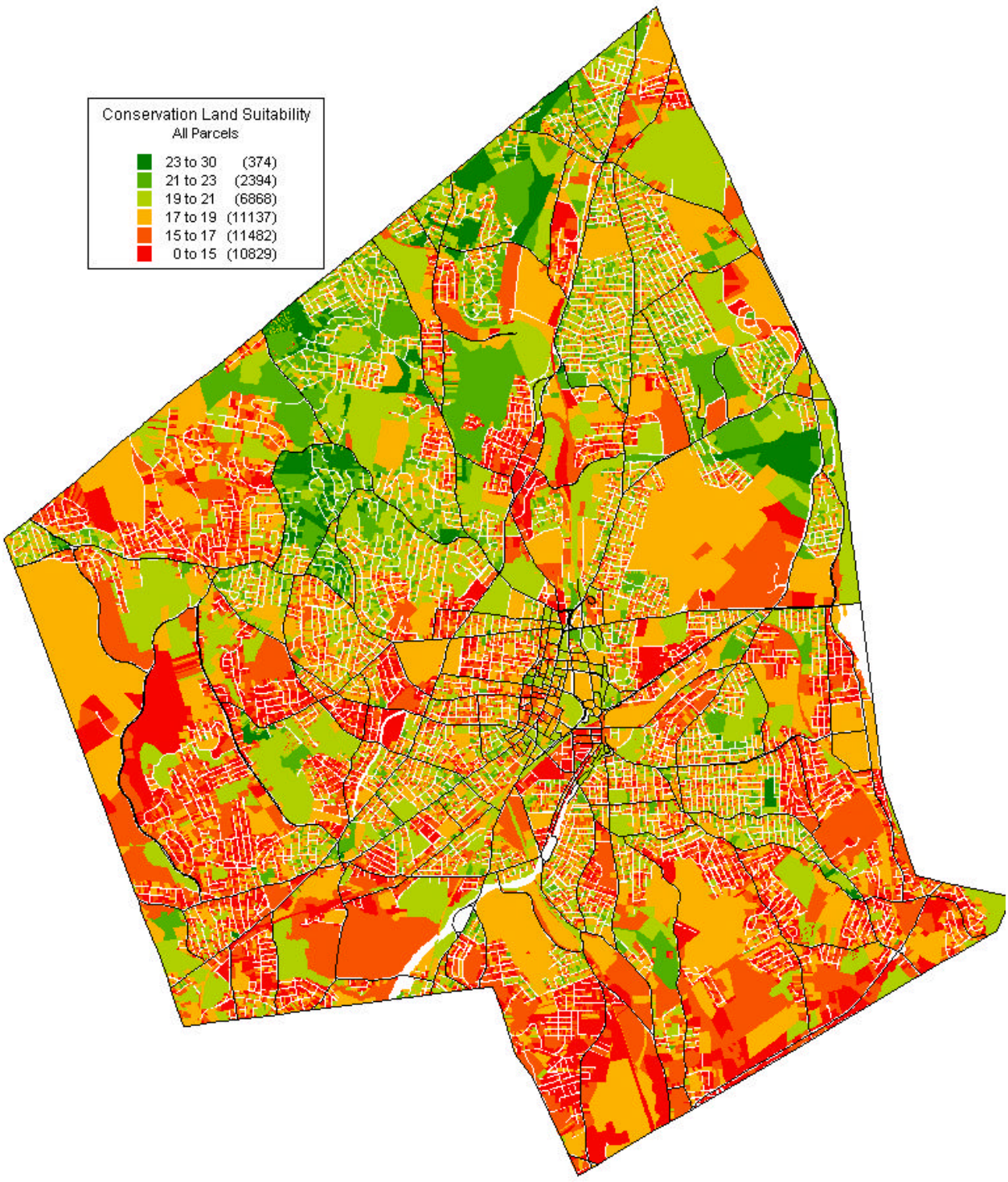
Map 4 – Most Suitable Open Space Land Use for All Parcels



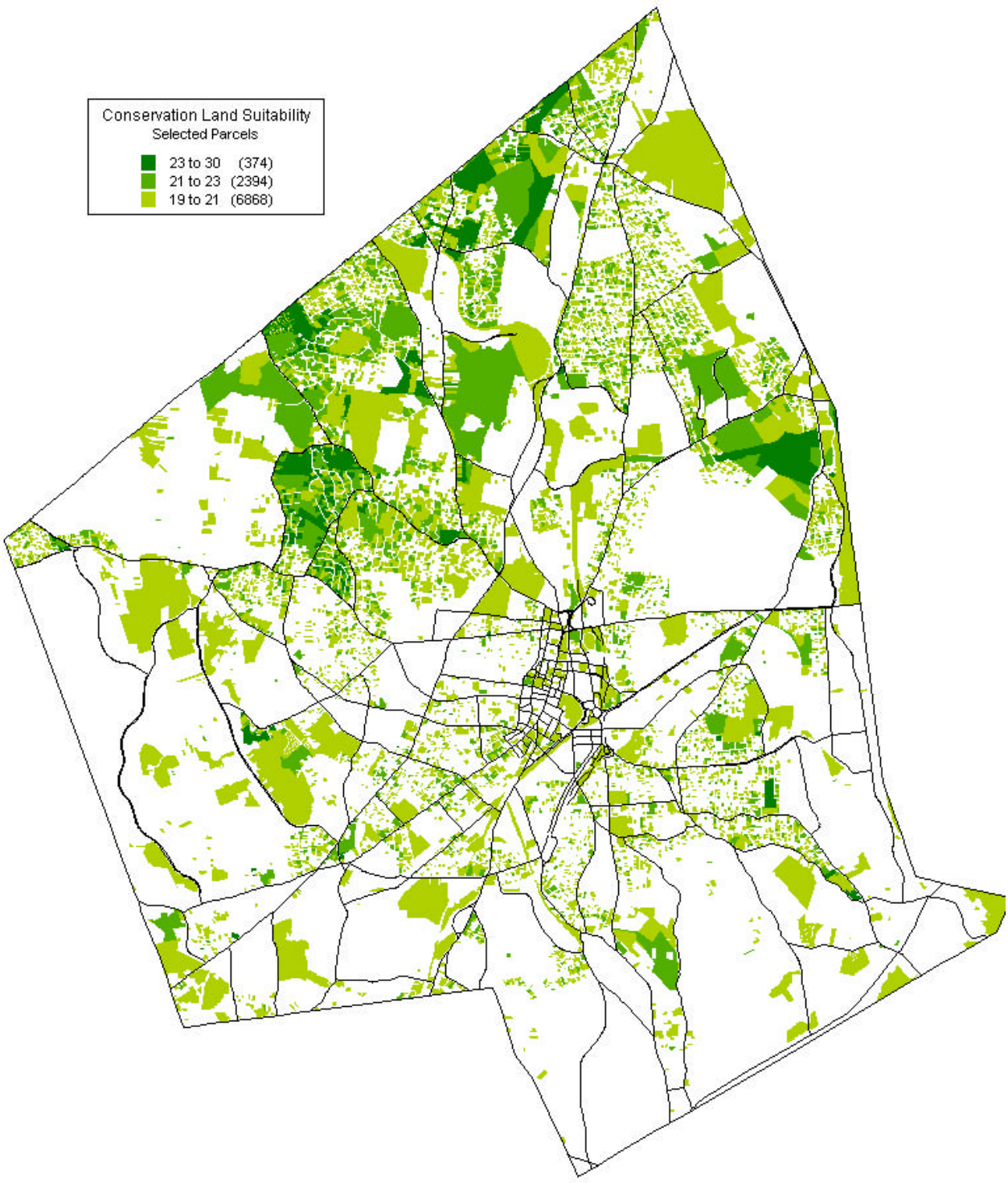
Map 5 – City Park Suitability for All Parcels



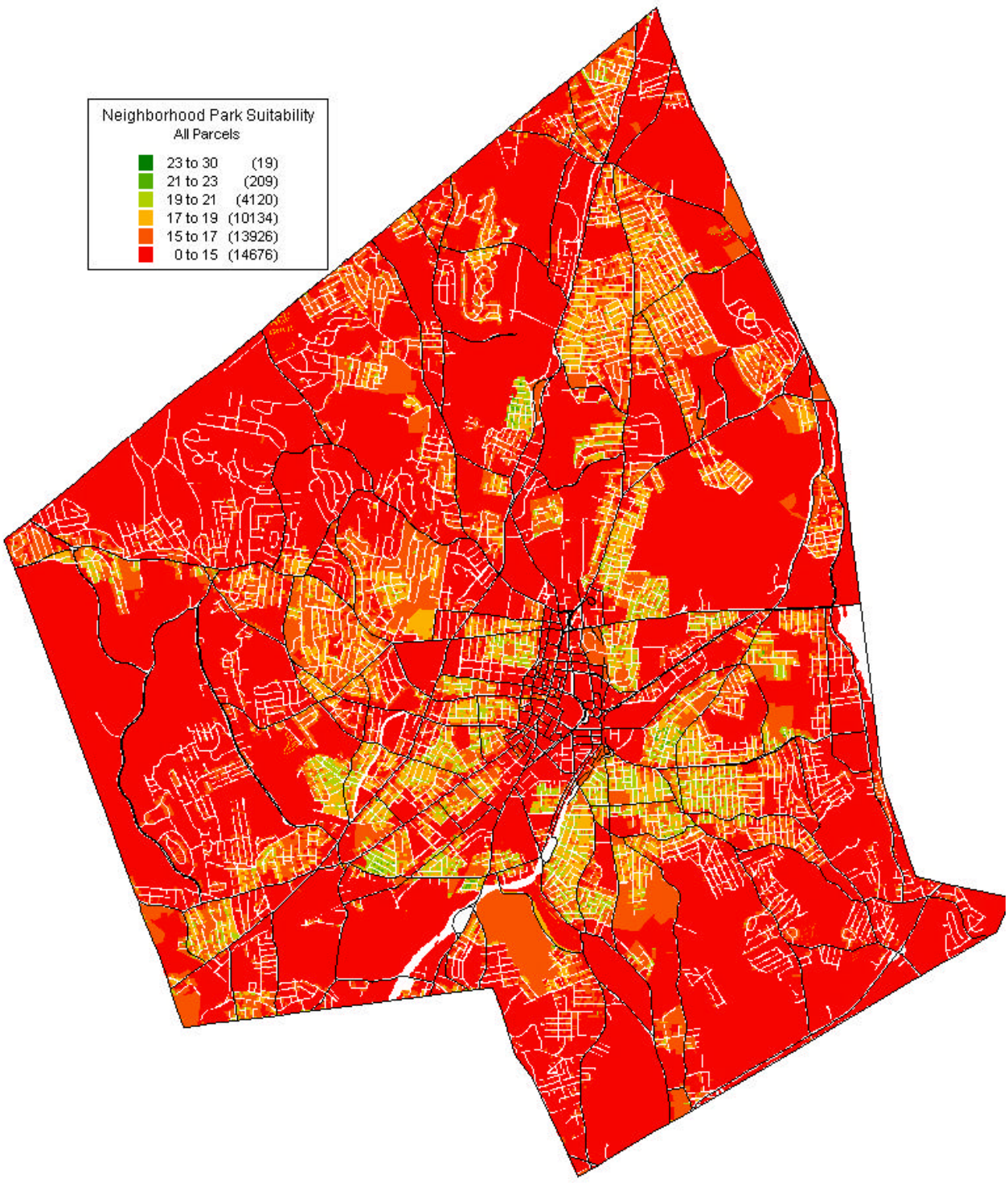
Map 6 – City Park Suitability for Most Suitable Parcels



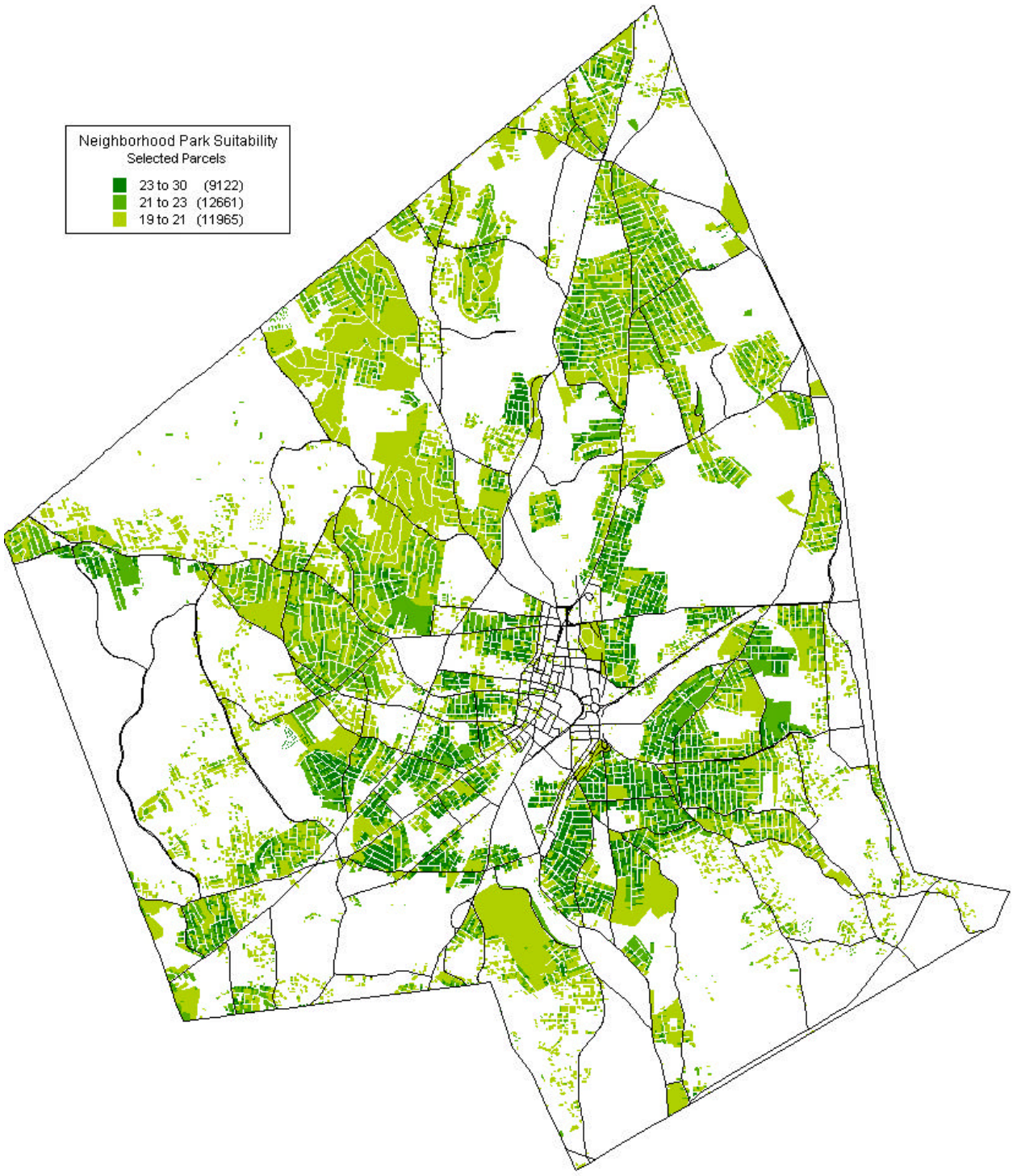
Map 7 – Conservation Land Suitability for All Parcels



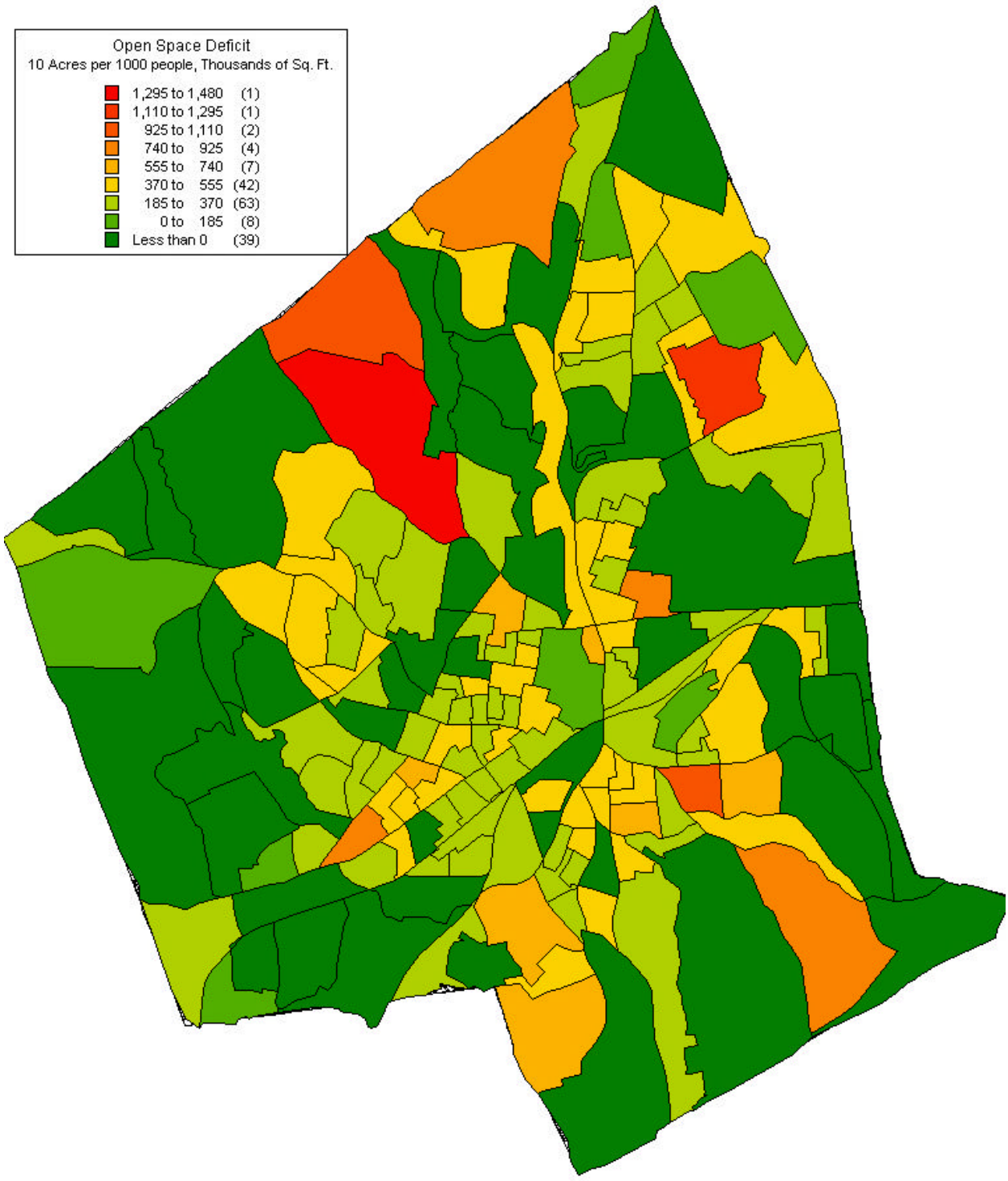
Map 8 – Conservation Land Suitability for Most Suitable Parcels



Map 9 – Neighborhood Park Suitability for All Parcels



Map 10 – Neighborhood Park Suitability for Most Suitable Parcels



Map 11 – Open Space Deficit with 10 acres per 1000 people

Map 12 – Parcel Suitability within Census Block Group 2 of Tract 7304.01