A GREEN STREET IN A SOUTHERN MILL TOWN COMMUNITY: FAIRMONT NEIGHBORHOOD, GRIFFIN, GEORGIA

by

CHENGQUEZHUONI SHEN

(Under the Direction of Ron Sawhill)

ABSTRACT

This thesis examines Green Streets design principles and how to apply them to a community street redevelopment plan in Griffin, Georgia. The question being researched is: How can a Green Streets design be best incorporated into a southern mill town community? Taking the Fairmont community in Griffin, GA as the studied site, the thesis proposes a Green Street design based on design principles from literature and related projects, focusing on the incorporation of combined Low Impact Development strategies. Projective design strategies and descriptive strategies will be used to summarize, interpret, adapt, and apply these principles. Evaluation of the design is based on the results of the National Green Values Stormwater Management Calculator. Results indicate applying suitable Stormwater Best Management Practices (BMPs) helps the site achieve its stormwater reduction goal.

INDEX WORDS: Landscape architecture, Green Streets, mill town design, ecological sustainability, ecosystem service, neighborhood based design, the city of Griffin

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DEDICATION

To my beloved mom and dad, grandparents, best friends for their love and accompany, Sony the old laptop, and Xiaoxue Qiu.

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CHAPTER 1

INTRODUCTION

Encouraging and enabling sustainable lifestyles for urban inhabitants can be fostered by developing sustainable urban neighborhoods. Green initiatives targeting community streets offer a unique opportunity to combine environmental outcomes with civil infrastructure functionality. A Green Street is a street project designed or retrofitted to use a natural systems approach to enhance stormwater management, restore watershed health, and provide green corridors for automobiles and other types of transportation.

Numerous Green Streets projects have been successfully implemented in large cities across the United States. Leading the trend of achieving sustainable design, Seattle, New York, and Chicago have become the gold standard for this adaptation and application. This thesis will explore the criteria of Green Streets design application in an early 20th century mill town setting based on literature review and case studies; examine one community access plan with those criteria; then use an evaluation tool from the Center of Neighborhood Technology to measure performance for the proposed design.

Background

The Fairmont neighborhood in Griffin, Georgia, is located in a historically agricultural region that supported the textile industry (CCDP 2013). The neighborhood provides housing and community services for vulnerable populations, such as the unemployed, single mothers, and the elderly. The 2010 Fairmont Community Urban

Redevelopment Plan has a stated mission to bring resources, education and connection to this underserved neighborhood. Understanding the needs for revitalizing Fairmont, particularly to enhance the current circulation and connections and to increase the environmental appearance of the site, this thesis will propose a site plan to incorporate Green Streets design into this neighborhood. With a highlight on reclaiming the historical mill town characteristics, the proposed design aims to connect the historic school with public green space and the surrounding residential areas to create a sense of community and improve the identity of the site.

Problematic

The Thomaston Mill Company constructed the Fairmont neighborhood in the early 1900s. For several decades the neighborhood provided housing for low and moderate-income working class families. In 2013, the Center of Community Design and Preservation (CCDP) at the University of Georgia held a 3-day design charrette exploring conceptual designs and ideas for the redevelopment of the community. The proposed design focused on the rehabilitation of the historic Rosenwald School as a public educational center; the redevelopment of the open space adjacent to the Rosenwald school together with some nearby schools; the connections to the school complex, the Fairmont public housing, and Fairmont Park; and overall circulation improvements of the community (CCDP 2013). One of the projects' goals is to create plans to preserve the remaining mill town atmosphere in the site, while, at the same time, promote walkability and social interaction by reclaiming public green space. Field work identified two major existing problems: discontinuous sidewalk conditions; and a lack of on-site stormwater management facilities.

Many streets in the neighborhood have insufficient sidewalks, while those that do exist are in a state of disrepair. A sidewalk inventory map presented in Chapter 5 shows that a majority of streets are underserved by the sidewalk system, causing inefficient and unsafe pedestrian circulation in the neighborhood.

Figures 1.1 - 1.2 Residents walking on streets that have no sidewalks. (Photo by author)

At the same time, the high amount of under-utilized impervious surface, mainly large asphalt parking lots and streets, produces high rates of stormwater runoff, which results in low ecological service values. Existing streetscapes include large trees, lawns, and grass strips, providing a certain amount of greenness for the site, while offering limited capacity for storing and infiltrating runoffs. Water quality issues exist especially on those areas within floodplain (Figure 1.3). Direct runoff rushing from the street to the adjacent creek potentially brings contaminates to the local water. The community is currently using only conventional stormwater pipe system, however, which was reported to be in a poor condition (Planning and Development Services Department 2007). Thus, there is an opportunity to incorporate Low Impact Development (LID) techniques to provide better stormwater management for the site, and lower the pressure on the conventional sewer system.

Figure 1.3 Surface runoff on North 3rd Street (Photo by author)

Figure 1.4 - 1.5 Grass strip buffers between sidewalks and driveways (Photo by author)

The Research Question and Its Purpose

Due to the existing site problems listed above, the project goals are as follows:

- To manage the stormwater run off on-site
- To improve pedestrian circulation
- To enhance the overall connectivity of the community

- To form a site redevelopment plan that respects site history by maintaining the mill town characteristics.

A Green Street design provides a better environmental performance and more attractive landscape features than traditional designs while maintaining transportation functionality. It also prioritizes pedestrian circulation over motor transportation by applying pedestrian facilities such as multi-use paths, bike lanes, and side paths. Therefore, Green Streets design offers an opportunity to improve connectivity for Fairmont and solve its the stormwater management issues and connectivity improvement for Fairmont. Many Green Streets projects were successfully implemented in large cities such as Portland, Chicago, and Seattle, where the Green Streets design was initially developed. However, adapting it to a mill-town community in Middle Georgia is a new issue that this thesis will address. Thus, the research question is: "**How can Green Streets design be best incorporated in the Fairmont Community of Griffin, GA?**" (figure 1.6).

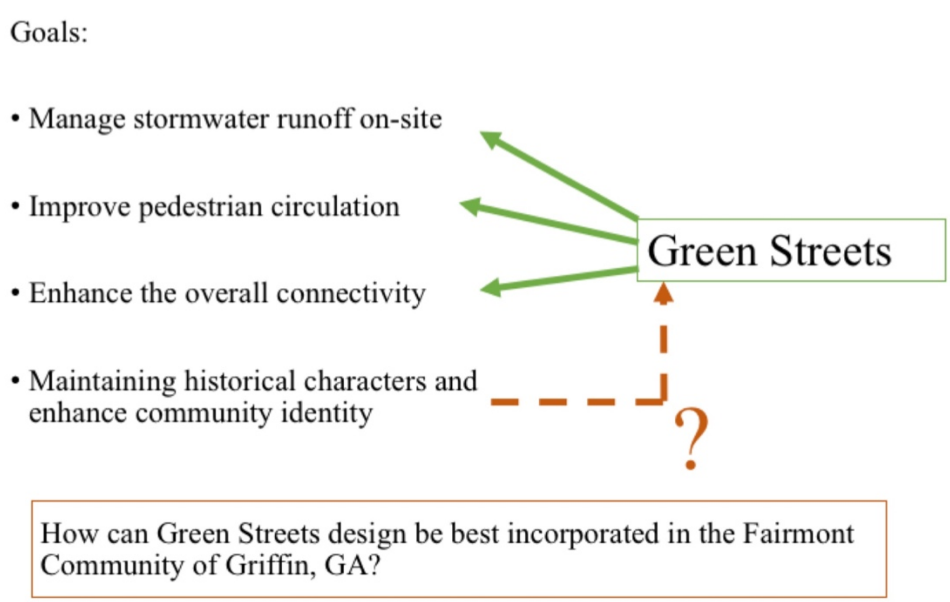


Figure 1.6 Project goals and research question

The purpose of this thesis is to investigate the ability of Green Streets design to increase the stormwater management capacity of Fairmont, promote overall connectivity and accessibility for both vehicular and pedestrian users, and function as an ecologically sustainable infrastructure for the community.

Based on case studies and a literature review, this research explores application strategies for Green Streets and their sustainable benefits and applies these insights to the incorporation of Green Streets design at the neighborhood scale in Fairmont. This thesis will discuss what design principals from other Green Streets projects are appropriate for application in Fairmont, what are those principals aren't appropriate and why, and what principals should be adjusted and applied in Fairmont, as well as other Southern mill town communities in Georgia.

Delimitations

The spatial scale of the street to be studied in this thesis is delimited to two to three blocks. However, related studies have been conducted at various scales. For instance, the Atlanta Beltline project is centered on transit oriented development in a large region of Atlanta, GA. It aims to bring the surrounding neighborhoods together by expanding public green spaces and reconstructing multi-use trails. Some of the concepts used in regional-scale designs will be referenced in following chapters, but, for the purposes of this thesis, the focus will be on community-scale design.

Another delimitation for this research is the choice to focus only on ecological and social outcomes. While recognizing the "triple bottom lines" for a sustainable design, the proposed design should aim to achieve the balance of economic, environmental and social sustainability. However, this thesis will not cover the economic analysis when evaluating the feasibility of design plans.

Research Methodology

The overarching research strategy of this thesis is projective design. Some secondary strategies will be used to help answer the secondary questions:

- What are the guiding principles of Green Streets design?
- What are the characteristics of a mill town neighborhood?
- What are the strategies for incorporating a Green Street design specifically in the Fairmont community in Griffin, Georgia?

To answer the first question, a literature review focusing on the historical development of Green Streets will be performed. The second question will be answered by the projective design strategy. First, design principles will be stated by summarizing peer-reviewed literature and interpreting case studies. Then, the Center for Neighborhood Technology's Stormwater Management Calculator will be used to calculate the stormwater management performance of both the site's baseline and the proposed design. Site inventories and a measured baseline will be used for analysis and consideration of the design proposal. The last part of this thesis will be an evaluation of the predicted changes provided by the proposed site design elements.

Using the National Stormwater Management Calculator, provided by the Green Values Stormwater Toolbox, the existing condition baseline data of the Fairmont community will be compared against calculations from the proposed plan, in order to determine the proposed design's ecological benefits.

Thesis structure

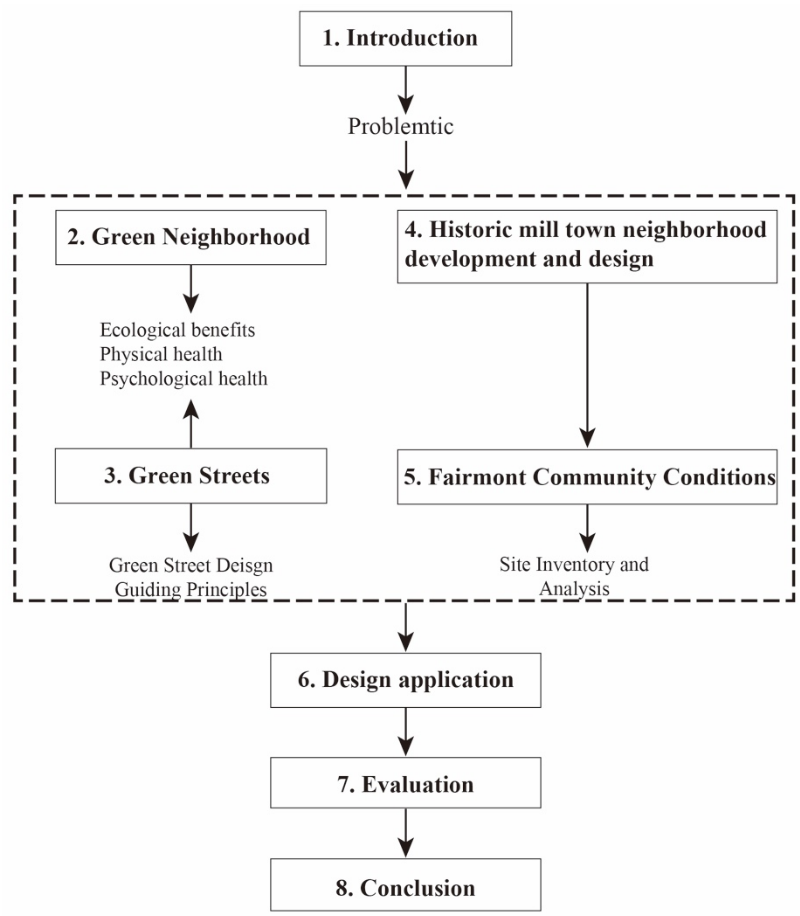


Figure 1.6 Thesis Structure

CHAPTER 2

GREEN NEIGHBORHOOD

Defining "Green Neighborhood": A Brief History

The term *neighborhood* is commonly understood as a local community within a larger city or rural area. This definition doesn't specify the population size or the civic function of a neighborhood but merely sets it as a sub-division of a populated area. This understanding of the term "neighborhood" is used in this thesis in the spatial sense of sharing a common proximity and boundary formed by the daily occupations of people, a space that should support daily walking to shops, schools, parks, and other living needs.

A neighborhood can also be defined as a linked network pattern; containing four categories: gray fabric, gray networks, green fabric, and green networks. Gray fabric is comprised of traditional land use divisions such as residential, commercial, and industrial, while gray networks are the streets that serve these land uses. Green fabric is public open space, and green networks are the open space corridors– such as natural streams and floodways– connecting the open spaces (Girling 2005). A network of these corridors and spaces assembled from ecocentric, anthropocentric, and mixed components effectively makes a city less dependent on its local resources for water and waste disposal. This kind of network is the ultimate goal for a sustainable neighborhood.

The concept of *green neighborhoods* in city planning began with Clarence Perry's prototypical neighborhood unit, which was mainly concerned with social interactions between residents and their living environment (Perry, 1929). According to Perry, the preferable size for a neighborhood unit is approximately 160 acres bounded by major streets and developed at a density of ten households per acre to support an elementary school. The neighborhood shape should be such that all households fit within a quarter-mile (five minute walk) circle from the center (Figure 2.1). The interior streets should not be wider than required for their specific uses and give easy access to local shops and the community center. Due to the fact that Perry's neighborhood unit was designed under a generation that relied far less on automobile traffic than current generations do, it is based mainly on standards of walking distance and pedestrian scale. As a result, the prototype presents a fairly connected network of narrow streets which provides more pedestrian and bicycle connectivity to the mixed-use blocks in the neighborhood (Perry 1929).

Figure 2.1 Clarence Perry's (1929) prototypical neighborhood unit

Figure 2.2 Plan of the residential districts, Radburn N.J. (Stein, 1957, 43)

Radburn, New Jersey, “the town for the Motor Age," was created by Clarence Stein and Henry Wright in 1929 (Stein 1951). The Radburn plan followed the school-centered neighborhood pattern of approximately a half-mile radius with emphasis on linear open space and pedestrian and bicycle accesses within a half mile from the center (Figure 2.2). By providing easy connections among residents, the idea successfully brought green living close to homes. The focus of the community access plan was largely on addressing children’s safety, and pedestrian-vehicle conflicts. However, Radburn never became a Garden City in the intended sense of its planners. From a present-day perspective, the center block was not a complete enough green belt to serve the entire community.

Nevertheless, the successful aspects of Radburn simultaneously serves presentday requirements of good and safe neighborhood living.

The Radburn Plan helped form Stein's basic philosophy of Greenbelt Towns that he followed in his subsequent planning designs: Chatham village, the Greenbelt town, and Baldwin Hills Village. In these designs the community school, located at the center of the town's planning pattern, not only functioned as part of the regular region's educational system, but also served as a town gathering place. Thus, community activities and the school were closely bound together. These designs added the essential elements of the Green Belt Town model:

- a superblock in the center of the community development, often populated with institutional buildings such as schools and community centers.
- an interior park connecting other open spaces to the center
- all homes facing the central green
- pedestrian walking systems completely separated from automobile circulation
- streets with parking bays and compounded garages

Stein, thinking spatially and practically, pictured a more convenient and orderly neighborhood. Unfortunately, the model of Greenbelt Towns was never completely built as it was planned. Both Perry and Stein's professional works on green neighborhood creation lacked principles addressing environmental factors.

Environmental Benefits

Peter Calthorpe developed the concept of transit oriented development (TOD) in the early 1990's, identifying open space and resource protection as keys to the contemporary prototypical green neighborhood (Griling 2005). As described earlier in this chapter, a neighborhood is composed of the natural (green) pattern and the functionally-built (gray) pattern. The green neighborhood took away the natural vegetated areas, which is considered as conventional green pattern, merging it with the remaining gray pattern and creating a new multi-functional neighborhood network. As a consequence, after this combination, natural areas are protected as important environmental assets, serving as pedestrian and bicycle corridors, and connecting different types and scales of public space-- such as parks, schools, and the town center (Griling 2005).

More recently, the developments of neighborhood theory have shifted emphasis to environmental sustainability (Luederitz et al. 2013, 40). An example of this shift is the Royal Avenue Plan in Eugene, Oregon, featuring an arterial street with drainage and infiltration in the center median and a stormwater wetland adjacent to the medium-density community. Urban forest conservation, natural drainage, impervious surfaces, and vegetation, promote ecological sustainability by mitigating air pollution, reducing urban energy costs, mitigating and filtering stormwater runoff, and providing wildlife habitat (Girling et al. 2000, 48-109).

Furthermore, Charles Choguill developed sustainable neighborhood guidelines to help communities achieve their ecological, social, and economic balance. In terms of achieving the ecological and social goals, Choguill emphasized strategies preserving parks and other green spaces within the neighborhood, linking transportation networks to promote pedestrian circulation, and expanding public green spaces as a meeting place for residents (Choguill 2008, 44).

Triple Bottom Line

Sustainable neighborhood development not only focuses on environmental conservation and restoration, but also addresses social equity and economic feasibility (Calkins 2012). The design of a new neighborhood or retrofitting an existing one has direct impact on people's social life, daily activities, and physical and emotional health. The "triple bottom line" (figure 2.3) is the key to achieving a true sustainability (Calkins 2012). This thesis will focus on the environmental and social aspects of this framework.

Figure 2.3 "Triple Bottom Line" for sustainable development (Adapted from SITE2009)

Physical and Social Benefits

Besides the primary role of connecting green spaces, a neighborhood's multi-function green network should also contribute to people's physical health and social vitality. Numerous studies have concluded that natural environments promote physical health by encouraging outdoor activities such as running, walking, and exercising, far more than other environments (Bergman et al. 2009, 8;, 115-126; Schipperijn et al. 2010, 25-32; Gidlöf-Gunnarsson et al. 2007).

However, the frequency of outdoor activities depends on multiple factors, which can be classified into unobserved factors (individual interests, preferences, aspirations) and observed factors (socioeconomic and demographic traits, residential location and neighborhood conditions) (Doff 2010) The most influential factor in the use of public greenspace in a neighborhood, when considering the residential location and conditions, is the distance between the residents and the greenspace site (Schipperijn and Stigsdotter, et al. 2010). Walkability is valued as "the first green infrastructure requirement for the support of daily physical activity" (Austin 2014). Jan Gehl suggests in his book "*Life Between Buildings"* that 1000 feet is the maximum suitable distance for walking to a greenspace (Gehl 1987). An effective internal network such as a walking system and bicycle routes provides direct, safe, and flexible access to the green space, and links housing to commercial divisions and other communities (Girling et al. 2000). Additionally, more roadside plantings provide a satisfying environment that encourages regular physical activities (Austin 2014).

Whether it is a school, a park, or other highly utilized open space, the common meeting place in a neighborhood provides local neighborhood facilities and services (Choguill 2008), creating more opportunities for socializing, exercising and entertaining. Therefore, a well-connected public greenspace in a Green Neighborhood design encourages social activities, physically affecting people's day-to-day lives.

Psychological Benefits

As discussed above, public open space and urban forest are principal components affecting the use of space, sense of safety, and social contacts among neighbors (Girling et al. 2000, 32-47). Besides social and physical benefits, greenspace also contributes to people's psychological health. Researchers commonly report that well-designed public greenspace has such positive effects as stress reduction and attention restoration (Bodin and Hartig 2003, 141-153; Herzele and Vries 2011, 171-193; Mitchell 2013, 130-134).

Many of the psychological responses are related to the site conditions, for instance the amount of greenery, the proximity to natural features (trees, water) or wildness, and the presence of traffic and buildings (Agyemang et al. 2007; de Vries et al. 2013; Grahn and Stigsdotter 2010, 264-275; Kerr et al. 2006). The vegetation rate compared to the density of buildings in a community influences overall neighborhood satisfaction (Hur et al. 2010, 52-59).

Conclusion

Ultimately, a community plan should achieve economic, social, and ecological goals when working toward sustainability. With an emphasis on the livability of the community, the Green Neighborhood development approach gives city planners, designers, and people an ideal living environment to build. Figure 2.4 is a summary of the "Triple Bottom Line" benefits of Green Neighborhoods.

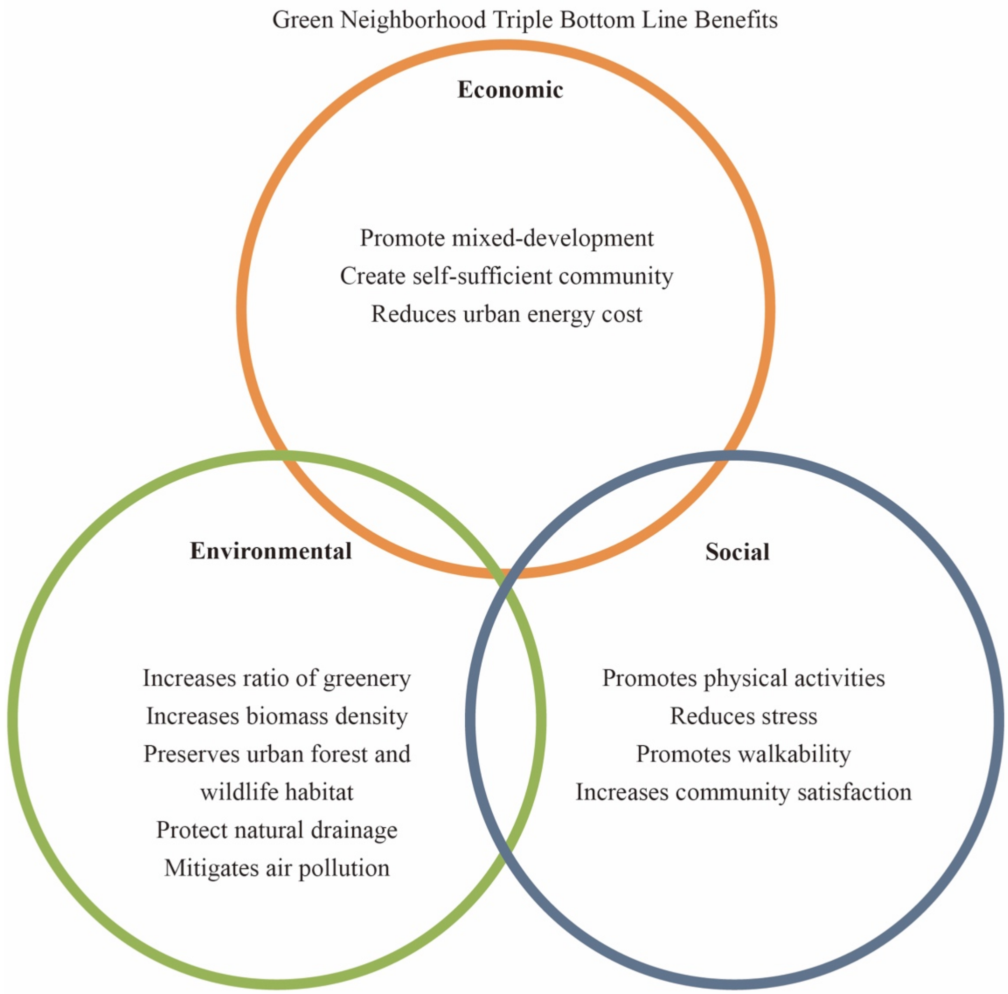


Figure 2.4 Benefits of Green Neighborhoods: Economic, Social, and Environmental

A guideline for Green Neighborhood design and planning is summarized from the literature review as follows.

1. Minimize the distance between people and the power of the community

A great physical and psychological distance between people and their community center forms unfriendly relationships between them. Keeping the population of the community at around 5,000 - 10,000 people within a 2,000-ft walking distance circle will close the sensory distance. Locations of government, schools, and other significant buildings of the town should be easily recognizable.

Necessary complete community services that include sufficient commercial venues, public facilities, leisure spaces, and social gathering spaces will increase the satisfaction of residents with their neighborhood.

2. Create a subculture for the neighborhood

Subculture boundaries help people define the neighborhoods they live in. Mark each neighborhood boundary by using natural geographic and historical boundaries or, alternately, by man-made railroads, parks, schools, and housing (Alexander 1977). Control the character of the local environment using the regional or local zoning code, building stories limits, parking spaces, and demographic development. Identifiable characteristics, such as historic buildings, parks, greenways, and other attractions should be protected reasonably when any redevelopment occurs. The visibility of these features will create a sense of belonging in the neighborhood. Also, provide access to natural resources within or near the neighborhood, such as streams, lakes and urban forests. Preservation and restoration of these natural resources are necessary if reconstruction projects are involved.

3. Build efficient connections within the neighborhood

The overall circulation plan should provide easy access to the major services, facilities, and open spaces in the neighborhood, whether by travel on foot, bicycle, or automobile. Commercial areas, educational institutions, and green space are critical connecting points in the plan. Enhance connections to these areas that decentralize community services gives local residents the maximized connections for their needs.

Great connectivity reduces traffic volume and congestion on through streets (Griling 2005). A web of public transportation, can increase alternative travel methods. Consider the proximity to transit: the neighborhood should be located on an existing or planned mass transit line or on a feeder bus route within ten minutes' transit travel time to the line stop (Calthorpe 1993). In addition, separate pedestrian paths and bike ways are preferred for a walkable community as they stimulate pedestrian activities and provide economic incentives (Calthorpe 1993).

4. Plan an environmentally conscious neighborhood

Being conscious of ecological balance in an urban network gives green neighborhood planning an additional merit over conventional community development. There are multiple perspectives on this topic that focus on new or revitalized community projects. To meet the ecosystem service needs of the neighborhood, a site inventory can help indicate existing on-site ecological problems, including stormwater management issues, air quality improvement, and urban forest quality. Good environmental services for a community not only reduce environmental disruptions caused by human activities, but also enhance the physical and mental health of residents by encouraging physical activities and establishing the sense of a community.

CHAPTER 3

GREEN STREETS

This chapter establishes the guiding principles for important factors of a Green Street design. Starting with a literature review of the development of the Green Street design concept and an introduction of some implemented examples, this chapter describes what a Green Street project is and how it brings environmental values to a site. Then, it presents a detailed introduction and interpretation of the design strategies of Green Streets with site layout strategies and a stormwater facilities "toolbox." Suggestions are given on site locations for the proposed design, strategies to reduce the site's impervious surface, and selecting stormwater best management practices (BMPs) according to their individual characteristics. A case study of the SEA Street in Seattle, WA is presented to explain more about these criteria. Finally, this chapter discusses the "Triple Bottom Line" benefits of Green Streets and summarizes the design principles.

The Origin of the Green Streets Concept

The concept and mapping of Green Streets originated in the City of Seattle 1985 Land Use and Transportation Plan for Downtown Seattle (City of Seattle 2012, 135). For the municipal purpose of intensifying desired land use and transportation patterns, Green Streets functionally act as a "street right-of-way" that prioritizes pedestrian circulation and public open space. Landscaping, traffic calming, historic features, and other pedestrian-oriented features are all identified as unique design elements that a Green

Streets project involves (City of Seattle 2012, 135). Some policies attempt to lower traffic volume by dictating the design of Green Streets, and using street design features that tend to reduce vehicular travel speeds.

Compared to sewer pipes and regular traditional methods of street-scale stormwater treatment, Green Streets transforms impervious street surfaces into landscaped street-side planters or swales, and convert stormwater from a liability into a resource for communities. Thus, they have the capacity to collect stormwater runoff and restore the infiltration process, as well as filter pollutants using plants and the soil ecosystem (Faha and Kummer 2009, 39). For this reason, incorporating a Green Streets design into a neighborhood's overall plan has the potential for enabling communities to realize holistic sustainability, and their physical and psychological health objectives.

Green Streets at Neighborhood Scales

In terms of ecological values, natural corridors play various roles at the metropolitan and neighborhood scales. At the metropolitan scale, the green network of elements such as natural streams and wildlife corridors interconnect existing functioning natural areas (forest, agricultural products, urban green space), and relink fragmented urban green patches together. At the neighborhood scale the various forms of drainage corridors may include greenways, bikeways, and other linear parks with the potential to support urban alternative transportation systems, as well as repair the environmental performance of the natural areas as a whole. According to Cynthia Girling's book "*Skinny Streets and Green Neighborhoods*" (Girling 2005), in a neighborhood network, "Green Streets provide a secondary green network for the neighborhood" (Girling 2005). As designed, the curb-less pavement achieves full accessibility for stormwater draining to adjacent infiltration swales, allowing the natural processes to occur within and along these corridors and networks (Girling et al. 2005). Consequently, a finely-scaled green network in a neighborhood performs environmental services that protect the region's ecological structure, and has a significant effect on the health of the metropolitan ecosystem. (Figure 3.1)

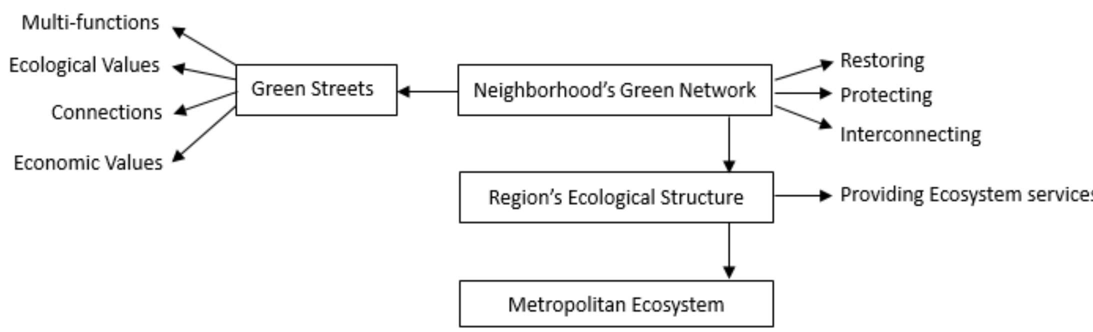


Figure 3.1 How Green Streets benefit as a Green Network (by author)

Chicago's Green Alley project was a response to flooding caused by impervious surfaces in the city's alleys. Aiming to address the flooding issues in alleys and adjacent properties, the Green Alley program looked at sustainable solutions that especially target stormwater management, heat reduction, material recycling, energy conservation, and glare reduction (Byrne 2010). Instead of adding connections to the city's sewer system, the program improved alley drainage through proper pitching and grading, using permeable and high albedo pavements, and integrating the design with rain gardens, rain barrels, green roofs, and naturalized detention areas (Buranen 2008, 50). This innovative program began in 2006, and through 2010 more than one hundred Green Alleys have been installed, collecting and treating up to 80% of the stormwater from surrounding impervious areas (Byrne 2010). For adjacent properties, recycling, composting, and native landscaping programs were suggested to improve the quality of the project's deliverables. Taken as a whole, the project has become more than just a solution to urban flooding issues, also providing energy efficiencies and urban heat island reduction (Buranen 2008, 51).

Retrofitting Gray Networks with Green Streets

Conventional street paving represents the largest significant portion of impervious surfaces, followed by buildings and parking lots, all of which contribute to pollutant spread and runoff. In addition, most urban areas require 6-inch curbs along streets for safety reasons, placing constraints on directing water to roadside swales (Choguill 2008). As a consequence, those conflicts require a design of the street system that concentrates on on-site stormwater management, and a reduction of the most problematic pollutants in the drainage area.

The Green Streets program in Portland, OR was initiated in 1999, first with a focus on stream restoration, but later as a broader program to promote on-site stormwater management and restoration of the region's watershed health (Kloster 2002). Several Green Street projects were designed to meet the regional environmental requirements for streets and access ways. A Green Streets design handbook was developed to provide guidelines for street design in the Portland region, establishing a number of recommendations for BMP solutions for new or reconstructed streets, utilizing a the perspective of urban watershed protection and restoration goals (Metro 2002).

Figure 3.2 Green Street Project (North East Siskiyou Street) in Portland, OR with stormwater curb extensions (Source: City of Portland 2014 Stormwater Management Manual)

Considering green infrastructure as a complementary gray infrastructure strategy to improve watershed health by managing stormwater, Portland, OR adopted a five-year "Grey to Green" initiative program in 2008 (Rosenbloom, 2013). The project emphasized tree plantings, setting a goal for 40% tree canopy cover over the region. In addition, as part of the program, the improvement projects also integrated the stormwater treatment medians within existing street conditions. The program was a success, taking clear advantage of Green Street technologies to support, promote, and finance green infrastructure programs and projects (Rosenbloom, 2013).

Beginning in 2007, a green infrastructure program was undertaken in New York City to retrofit existing streets and sidewalks. A series of pilot Green Streets projects were implemented and monitored during the initial program period. Furthermore, the diverse site conditions of each pilot location presented certain design and implementation hurdles throughout the project. The stormwater management technologies along and within the retrofitted streets were devised and chosen to fully respect existing site characteristics. The design features include bio-retention facilities, curb cuts, trench inlets with cover, check dams, gravel reservoirs, right-of-way bio-swales, flush curbs, and gravel diaphragms. Each project was designed to promote the natural movement of water by collecting and managing stormwater runoff from 5,000 sq ft to 1 acre of impervious catchment areas (ASLA). According to the projects' stormwater reduction performance analysis, each implementation has disconnected some10, 000 sq ft of impervious surface from the combined sewer system (ASLA). Managers of this ongoing project have used these measurements as strong data supporting identification of problems in order to predict adjustments in future projects with relatively similar conditions.

As the project examples from Portland and New York City demonstrate, retrofitting conventional streets using Green Street specifications holds great potential for serving a complex set of infrastructure functions, while also providing aesthetic and ecological services (Girling et al. 2005).

Design Guiding Principles

Before considering any specific stormwater facilities, a new or redeveloping Green Street project should be built around the premise of respecting the existing hydrologic functions of the land and eliminating unnecessary impervious area (EPA, 2008). Low Impact Developments (LIDs) seek a way to foster land development while maintaining essential hydrologic functions. Particular design features in a Green Street project are influenced by site factors such as existing natural assets, parcel ownerships, and a city's development regulations. Thus, according to the idiom "one size does not fit all," the unique characteristics of the site should be factored into any suitable design proposing to use a LID approach (Kloster 2002).

A comprehensive site survey helps designers to understand site conditions and identify a project's challenges and issues, processing and addressing the necessary pre-context of the project. The site survey should include, but isn't limited to, existing impervious surfaces, topography and slope analysis, hydrology analysis, and soil surveys. These elements are critical for determining the selection of specific BMPs, as well as sizing for the selected features.

When applying stormwater facilities in a Green Street design, the following guiding principles should be taken into consideration:

1. Identify land feasibility and space availability

Local government codes and standards are potential barriers to the implementation of Green Street projects. The codes affect the shape, size, and layout of the street design, especially the BMPs used to enhance the stormwater treatment capability of the streets (Table 3.1). In particular, local road width and sidewalk requirements specify the minimal standard for the layout of road sections to ensure travel safety. Identification of existing zoning and codes helps to determine proposed LID approaches in a way that satisfies local requirements.

Table 3.1 Identified Zoning Components related to Green Street Projects (PGDER 1999)

Road Layout Requirements	
Road width	Ensure vehicular and pedestrian safety and avoid rights-of-way public facility burdens
Road turnarounds	Prevent undue fire safety hazards; provide adequate fire safety vehicular access.
Sidewalks and pedestrian walkways	Ensure vehicular and pedestrian safety and avoid access public facility burdens.
Residential and commercial development	Ensure vehicular and pedestrian safety and avoid access public facility burdens.
Common or shared facilities	Prevent environmental or safety hazards from unmaintained facilities such as shared septic systems or driveways.
Drainage and Grading	
Curbs/gutters and storm drains	Prevent undue burden of development on off-site water, streets, and buildings
Stormwater quality and quantity Structures	Prevent undue burden of development on off-site water, streets, and buildings
Grading to promote positive drainage	Prevent soil erosion problems due to drainage

2. Design with respect to the existing natural conditions

Natural factors are critical criteria for implementing stormwater BMPs. As described earlier in this chapter, different types of stormwater BMPs require various conditions for site slope, soil infiltration rates, and vegetation, as well as concerns about the implementing locations and sizing on the street. Therefore, design features should fit into the site's natural setting in an optimized way for effective stormwater management. Further discussion on the site soil and slope criteria are as follows:

a. Soil conditions

The site's soil profile indicates whether conventional stormwater runoff infiltration processes would be efficient in the area. Thereby it affects whether or not the location needs LID applications.

Hydrologic Soil Groups (HSGs), which are A, B, C, and D, are classifications of soil types to indicate the soil's infiltration rate and its transmission rate (Table 3.2).

Table 3.2 Hydrologic Soil Groups (Source: wetlandstudies.com/)

HSG	Soil textures	Infiltration rates (in/hr)	Relative Runoff Potential
A	Sand, loamy sand, or sandy loam	High (>.30)	High
B	Silt loam or loam	Moderate (0.15-.30)	Moderate
C	Sandy clay loam	Low (0.05-0.15)	Low
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay	Very Low (0-0.05)	Very Low

HSGs A and B provide the most permeability for infiltrating runoff into the underlying soil. Therefore, these areas should be preserved undisturbed or incorporated into an undisturbed or vegetated open space (AMEC 2001). Conversely, HSGs C and D are less permeable soils that should be used for impervious surfaces and buildings.

BMPs such as stormwater planters and vegetated swales are designed to treat runoff and provide infiltration before it runs through the underlying soils. Compared to the soil's natural infiltration rate, a 7-inch deep stormwater planter raises the infiltration rate to approximately 4 inches per hour (SW 12th Avenue Green Street Project, Portland, Oregon). In order to restore the soil's natural capacity for runoff infiltration, street improvements of retrofitting impervious surfaces with stormwater BMPs should be located where the underlying soil has moderate to high infiltration rates. A site with

HSGs C and D should be avoided in any types of rain gardens that do not include an underdrain to limit the volume of runoff entering the site's soil.

b. Site terrain and slope

Generally speaking, site development on a steep slope with a grade of 15% or greater potentially causes future structural problems, excessive soil erosion, and increased stormwater runoff (AMEC 2001). In rolling terrain, design features should be placed following the natural contours to avoid requiring more clearing and grading. Figure 3.3 illustrates the placement of roads along the ridge line to preserve the natural drainage ways on the site. In addition, the placement of roadside swales helps to treat stormwater runoff from roadways before entering the natural drainage way.

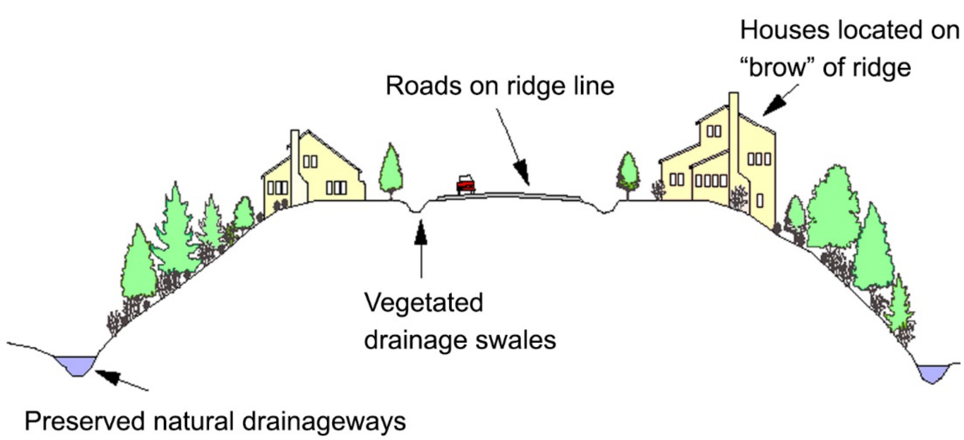


Figure 3.3 Streets and roadside swales placed along ridge line to preserve natural drainage ways (adapted from Sykes 1989)

The Georgia Stormwater Management Manual Vol. 2 provides a matrix that indicates the overall applicability for general stormwater structural control of different site slope conditions. It notes that a moderate slope (2%-4%) is preferred for implementing most of the stormwater facilities (AMEC 2001). Table 3.3 is an excerpt from the matrix containing information about site applicability of slope conditions for different structural control categories. It shows that incorporating stormwater facilities into a high-relief area in the Georgia Piedmont may have limits on the selection of stormwater facilities if they require more gently graded areas.

Table 3.3 Structural Control Overall Applicability (Part) (Source: Georgia Stormwater Management Manual Vol. 2)

Structural Control Category	Site Slope
Stormwater Ponds	15% max
Stormwater Wetlands	8% max
Bioretention	6% max
Sand Filters	6% max
Infiltration	6% max
Enhanced Swales	4% max

3. Incorporating opportunities for alternative transportation

Green Streets not only address stormwater management issues but also provide walkable streets and promote alternative transportations. Pedestrian walkways, bike lanes, and multi-use paths should be considered for incorporation with the Green Street design to promote alternative circulation of the site.

4. Minimize the total impervious area of a site

Stormwater strategies should be applied based on two goals: addressing stormwater management at the source and at the surface. Addressing at the source means that a site should be designed efficiently to maximize potential landscape area and minimize impervious areas, therefore reducing the potential amount of stormwater generated by impermeable surfaces. The following comprise a strategies "toolbox" for reducing impervious area:

a. Reduction of street width

The Transportation Growth and Management Program of Oregon developed the *Neighborhood Street Design Guidelines* (Oregon 2000), a guide for reducing street widths, recognizing in this guideline that narrow streets have the values of minimizing impervious pavement and controlling traffic speeds in the neighborhood context. Thus, when adopting Green Street design at a site where a reduction of impervious surface is desired, the designer should take into consideration reducing the street width, while coordinating available space for pedestrians, street trees, stormwater facilities, and on-street parking if necessary.

However, modifying street width possibly conflicts with development restrictions in areas such as registered historic preservation neighborhoods or properties. In such neighborhoods, reducing the parking lot size with vegetated areas, adding more canopy trees, and using permeable paving can be considered as alternatives for decreasing the impervious surface of the site.

b. Reduction of parking lot size

Along with roofs and street pavements, parking lots make up the third large source of impervious surfaces. Reduction of parking lot footprints can effectively minimize overall imperviousness by providing street-side parking, trading impervious pavement with permeable materials, and adding stormwater treatment of runoff from the parking lot (AMEC 2001). Parking lot stormwater "islands", such as filter strips, rain gardens, and bioretention swales, help break up the continuous impervious area, directing stormwater runoff for temporary restoration and filtration.

c. Landscape design

Street trees help intercept and slow rainfall with their canopies, provide shade for street travelers, contribute to streetscape aesthetics, and create open space around their bases where runoff can be infiltrated. Adding significant tree canopy can reduce the total amount of impervious surface of a site (Nevue Ngan Associates 2011). Additionally, native plants with rich root systems can help promote media permeability while requiring low maintenance and less overall costs (Davis 2009). The choice of the vegetation species used in BMPs should be in accordance with native materials.

5. Selecting stormwater facilities that fit the site

As stated in the preceding paragraphs, Green Street projects install green infrastructure facilities at conventional street edges, transforming the impervious surface to pervious surface, thereby increasing the capability of street-scaled stormwater treatments. The key elements of stormwater facilities currently in use in Green Street projects include, but are not limited to, stormwater planters, bioretention swales (vegetated swales), stormwater curb extensions, and rain gardens.

a. Stormwater planters

Stormwater planters are structured stormwater control facilities designed to intercept, store, and filter stormwater runoff from impervious surfaces. They provide ponding, infiltration, and evapotranspiration functions to reduce stormwater runoff volumes. When applied on a site with low infiltration rate soil as, for example, the hydrologic soil groups (HSG) C and D, an underdrain structure can be included in the planter design to limit the volume of water that infiltrates to the soil (Calkins 2012) (Figure 3.4).

Due to the flexibility in shapes and sizes, stormwater planters are suitable for placement next to buildings, parking lots, and streets, where available space is typically limited. They provide an extremely urban feeling with their neat tight look, and fit well in high-density developed urban areas. However, construction of the planters is generally costly due to their extra hardscape structures (Nevue Ngan Associates 2011).

Pros:

- suitable for applying in tight, high-density development areas
- flexible in shape and size, can fit into limited available space
- provide opportunities to incorporate street elements with the planters, such as street trees, signage, and pedestrian lightings

Cons:

- relatively expensive in cost due to increased hardscape infrastructure;
- only contextually appropriate for ultra-urban settings.

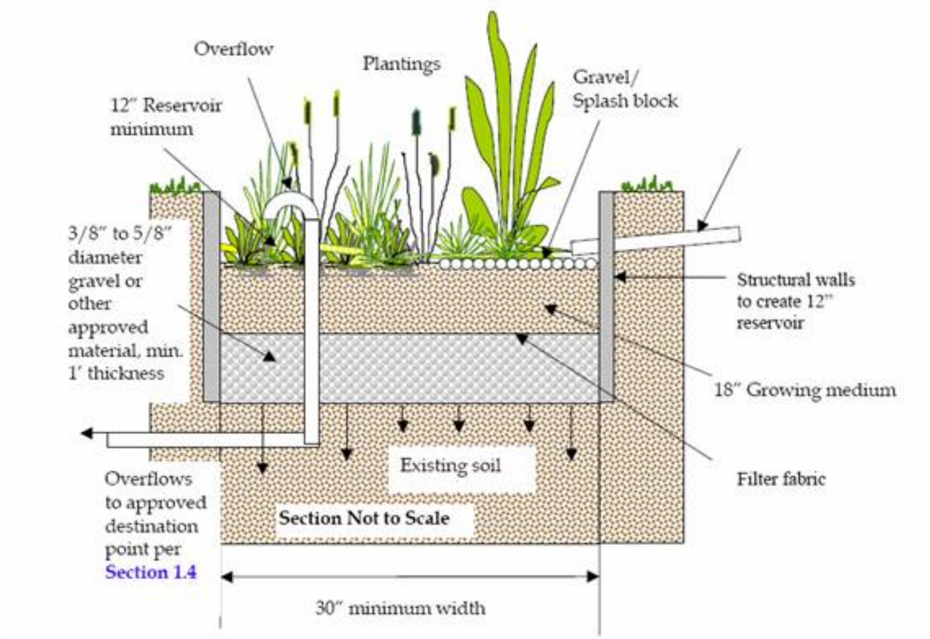


Figure 3.4 Typical profile of stormwater infiltration planters with an overflow pipe connected to the storm drain (Source: City of Portland 2004 Stormwater Management Manual)

Figure 3.5 Stormwater planter with curb cut on 12th Avenue Green Street Project in Portland, OR (Source: www.portlandoregon.gov)

b. Vegetated swales

Vegetated swales are shallow ditches with dense native vegetation and are often laid with various growing mediums, such as prepared aggregate and imported soil layers (see figure 3.6 for typical bio-swale section details). They are designed to capture and convey large stormwater runoff volumes by providing ponding, infiltration, and evaporation functions. They can be adopted as an alternative to conventional curbs and gutters to direct runoff entering the vegetated area, while providing aesthetic elements for the site.

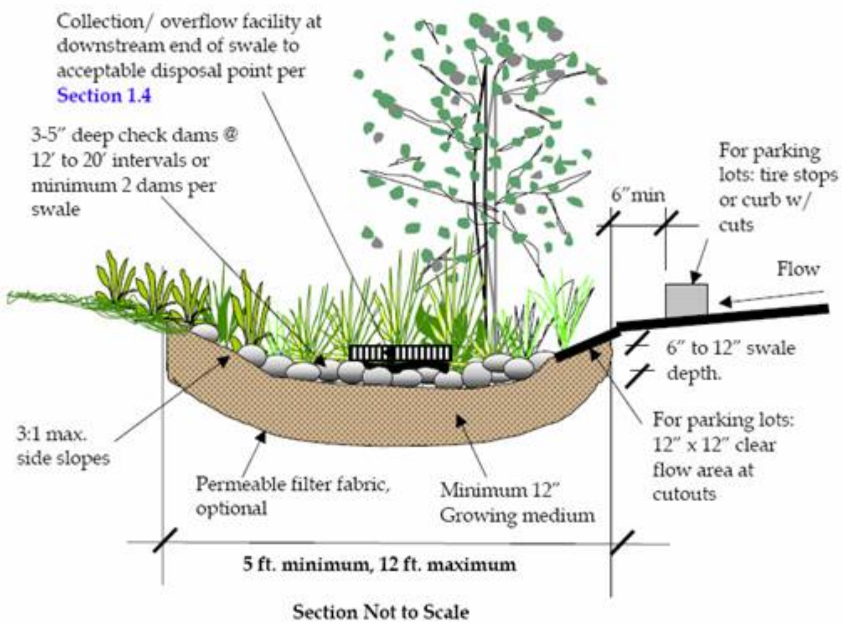


Figure 3.6 Typical vegetated swale section details (source: City of Portland 2004 Stormwater Management Manual)

Vegetated swales are generally adaptable to various conditions, are flexible in design and layout, and are relatively low maintenance and low-cost. They can be adapted within street medians on new streets, and within the interior or along the edges of parking lots. Moreover, they can be retrofitted within existing landscape buffers on existing streets (Figure 3.7-3.9).

Left:Figure 3.7 Roadside swales on an arterial street

Right: Figure 3.8 Roadside swales on a residential street

Figure 3.9 Swales on parking lots can absorb runoff from the large amount of impervious lot surface

(Figure 3.7-3.9 source: Nevue Ngan Associates 2011)

Applying vegetated swales often requires more open and continuous area than other stormwater facilities. A flatter slope below a 2:1 ratio is preferred when installing vegetated swales (Calkins 2012). Moreover, it is difficult to incorporate other site design elements within the swale area, such as street lights and signage. Thus, swales are generally more applicable in town and rural areas, or urban developments with a low to medium density.

Pros:

- the most commonly acceptable stormwater strategy
- suitable to apply within the medians and along the edges of various types of streets
- suitable to apply within the interior and along the edges of parking lots
- contextually fits towns and neighborhood areas

Cons:

- requires a continuous long linear corridor for implementation, which might be hard to find in an urban retrofitting site
- difficult to incorporate street elements (lightings, signage)

c. Stormwater curb extensions

Stormwater curb extensions are landscape areas within street parking zones that capture and treat stormwater runoff from the streets and sidewalks. Since curb extensions occupy spaces usually used for on-street parking, designers should take into consideration the context of the right-of-way and adjacent properties. This stormwater strategy is commonly applied within parking zones along lightly trafficked commercial streets or low-density residential streets, where a loss of street parking could occur. Curb extensions store stormwater runoff before it goes to the city's sewer system while creating vegetated

Figure 3.10 This street incorporates an angled stormwater curb extension, providing an ADA-compliant ramp for pedestrian access to the sidewalk (source: City of Portland, OR)

areas for plantings and street trees. In addition, stormwater curb extensions decrease the overall street width by retrofitting parking spaces. Thus, they can potentially be applied to where a reduction of impervious surface is desired (NACTO 2016). Lastly, by bumping out the existing curb, curb extensions narrow pedestrian crossing distance and increase visibility for sidewalk users.

Pros:

- flexible in shapes and sizes to fit with site conditions
- contextually appropriate for applying along both commercial and residential streets, especially low-density residential areas
- can be applied for reducing the road width, bringing traffic calming benefits

Cons:

- requires a loss of on-street parking, which might be a conflict for streets with a high need for parking space;

d. Rain gardens

Rain gardens are landscaped shallow depressions that are designed to collect, slow, and infiltrate a large amount of runoff, delaying discharge into the natural watershed system. They are capable of collecting runoff from a variety of sources depending on the placement locations. Unlike vegetated swales and stormwater planters, rain gardens are not connected to an underdrain structure. Rain garden applications require the soil to have a minimum of a 0.5 in/hr infiltration rate (Calkins 2012).

Due to their versatility in size and shape, they can be adapted to use leftover spaces adjacent to parking lots and streets. Rain gardens provide the greatest stormwater control benefits if large in size, but may not be able to collect and manage all of a site's runoff if small in size (Nevue Ngan Associates 2011). Compared to vegetated swales and stormwater planters, rain gardens may require more maintenance if large in size, which limits their applicability in a more densely developed area or in urban retrofitting projects.

Figure 3.11 A large rain garden implemented in a parking lot space (source: Nevue Ngan Associates) 2011)

Rain gardens add a significant amount of vegetated area to a site. Depending on different landscaping forms, they can create either an organized form or a more loose and natural look to fit contextually with urban or rural settings.

Pros:

- flexible in shapes and can easily fit within the leftover space adjacent to streets and parking lots
- easy to incorporate with site features, add a significant greenness to the site, and create a natural look that contextually fits both rural and urban settings
- provide the greatest stormwater control if large in size
- provide opportunities to disconnect roof downspouts next to buildings

Cons:

- Requires more space and more maintenance when applied in as a large square area.

Table 3.4 summarizes the appropriate locations for applying stormwater management facilities according to their individual characteristics.

Table 3.4 Choosing stormwater BMPs that fit the site context
(Adapted from Nevue Ngan Associates 2011)

	Stormwater Planter	Vegetated Swale	Stormwater Curb Extension	Rain Garden
Low-Density Residential		√	√	√
High-Density Residential	√		√	
Commercial Main Street	√	√ (site dependent)	√	√ (site dependent)
Arterial and Boulevard	√	√	√	
Parking Lots	√	√		√

Case Study: SEA Street Project, Seattle, WA

The Seattle Street Edge Alternatives (SEA Street) project was established with the mission to green conventional streets, reduce the amount of street flooding, and create a connected network dedicated to environmentally conscious development (Matsuno 2001). Planners from Seattle's Public Utilities (SPU), in conjunction with local communities, completed this project in Spring 2001.

The SEA Street project was considered the first Green Street implementation in a low-density residential area with a shortage of sidewalks and drainage infrastructure. The

660foot long, two-block project site was located in northwest Seattle (NW 117th and NW 120th Street on 2nd Avenue). Due to a lack of maintenance, the existing street in this neighborhood negatively affected not only the residents' lives but also the ecological system. One issue was street flooding, increasing the risk of accidents especially at street intersections, eroding road surface, and sewer infrastructure. The project goal was to reduce the stormwater event (1.68-inch) peak runoff rate and volume by combining hydraulic engineering with soil science and botany to provide a Natural Drainage System (NDS) that more closely mimics the natural environment prior to installation of conventional piped systems (Matsuno 2001). To accomplish this, design features such as bioswales, porous paving, rain gardens, and detention ponds were applied. See figure 3.12 for the before and after construction picture.

Figure 3.12 The before and after of the SEA Street project (Source: courses.umass.edu)

The project made a significant ecological contribution by reducing the impervious surface to 11 percent lower than a traditional street, adding over 100 evergreen trees and

1100 shrubs, and providing surface detention in swales (Matsuno 2001). The monitoring program showed that after two years of application, the SEA Streets project reduced the total volume of runoff from the street by 98 percent (source: seattle.gov).

The curvilinear road, as the most prominent feature of the project, was built wide enough for two standard cars passing through. For the concern of emergency vehicles, the flat curbs and structural grass on each side of the road provide extra space to accommodate special traffic loads. Compared to the hard edges of traditional streets, the natural, soft-edged street provides more comfortable environment for walking and biking as well as traffic calming benefits.

To accommodate the two original at the ends of the streets, the SEA Street maintains the two lane access at both ends of the road while narrowing the entry width. The curb-less street edge also contributes to the drainage system, as well as providing tight control of the final paving elevation. Sidewalk stalls only on one side of the street; a planting belt and the swale completely separate the pathway from the drive. This strategy helps to minimize extra impervious surface added by the design and improve the safety of the sidewalk. The applied roadside swales took over the space used by the existing parking lot. To address the loss of parking space, the design proposed angled parking stalls to be accommodated between swales and the driveways, fitting with the retrofitted sidewalk. The number of the proposed parking lots was determined based on a parking survey to meet residents' needs. See figure 3.13 for the concept design.

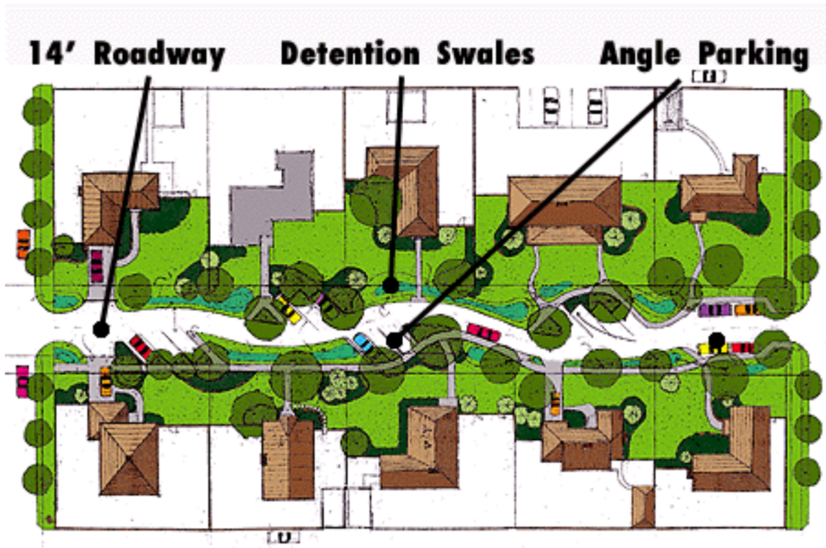


Figure 3.13 A concept of the SEA Street project shows the 14 foot-wide roadway, swales, vegetation and diagonal parking areas. (Source: www.djc.com)

To summarize the the SEA Street project:

- Located at a low-volume residential street, the project has more flexibility for modifying the street layout for applying stormwater facilities;
- The stormwater swales and cascades provide efficient stormwater control adjacent to the road, and accommodate the adjusted street edges without losing parking capacity
- Additional trees and landscape areas and using porous pavements significantly contribute to the reduction of the total amount of impervious surface, while beautifying the community
- Adapts a sidewalk within the right-of-way, providing a feasible solution to enhance pedestrian circulation on the street.

Conclusion

Green Street design offers an alternative to help a community achieve its sustainable goals. Figure 3.14 below shows the corresponding factors in Green Street design that benefit achieving the sustainable "Triple Bottom Line" for a community.

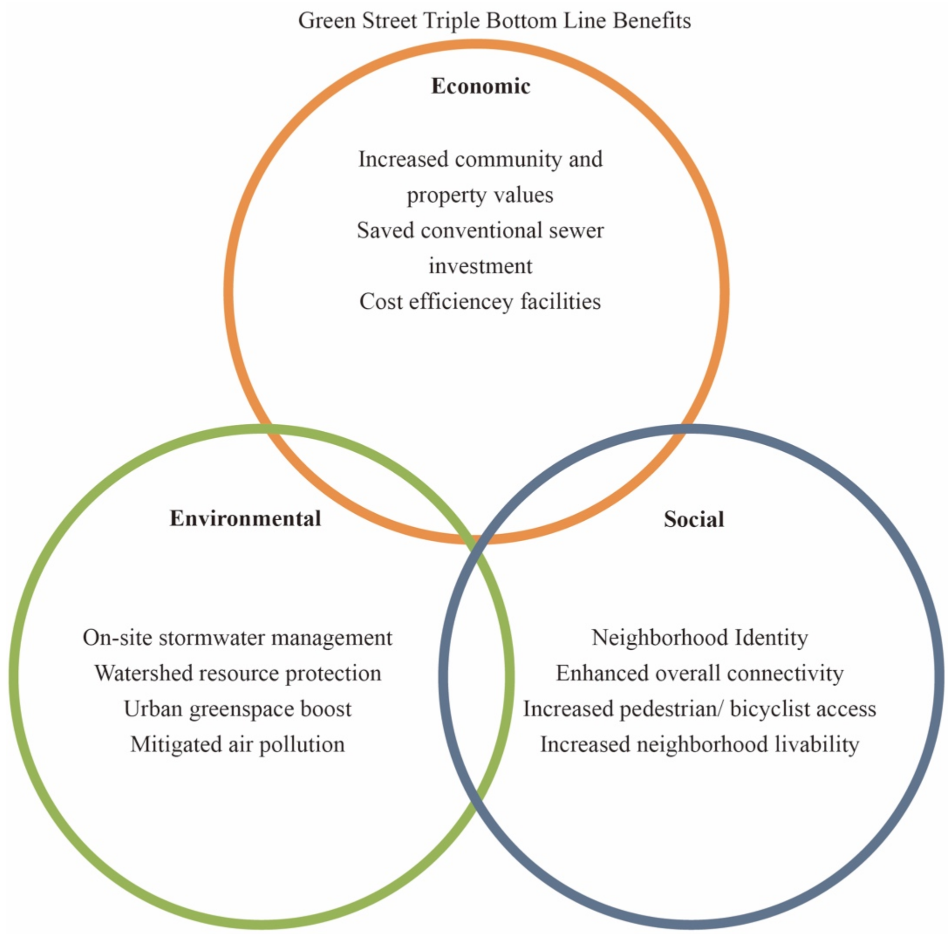


Figure 3.14 Benefits of Green Streets: Economic, Social, and Environmental

A successful Green Street project should be an attractive demonstration of integrating vegetated stormwater facilities into the current site streetscape to provide direct environmental benefits. Selecting the appropriate location, site layout design strategies, and the suitable stormwater BMPs are critical for the Green Street design process. Figure 3.15 presents the Green Street design process diagram that the author will use in the design process.

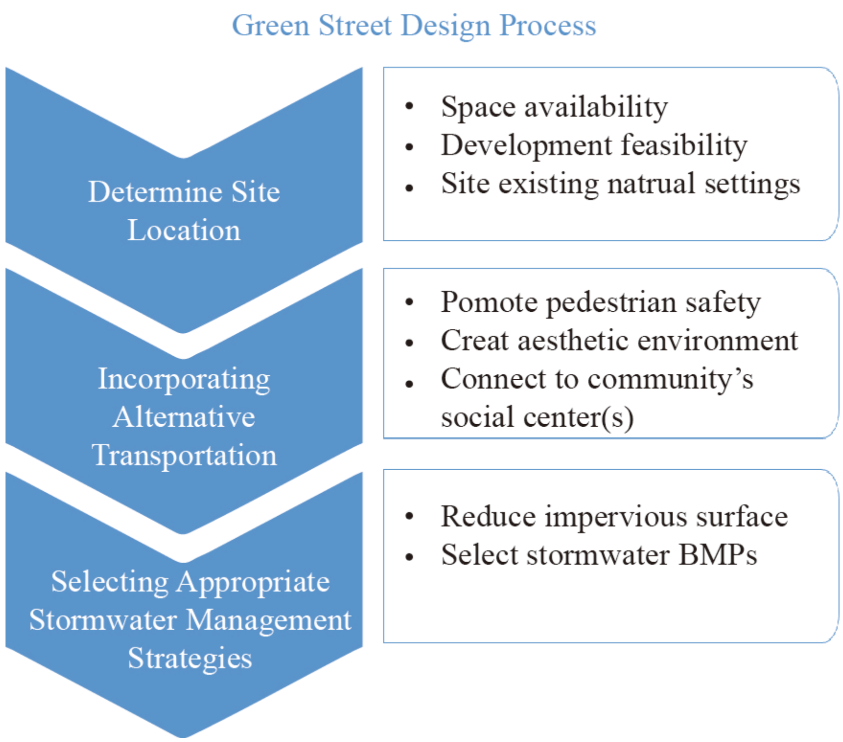


Figure 3.15 Green Street Design Process (By author)

Building on the descriptions of various stormwater facilities, this chapter introduced the following guiding principles for a Green Street design: first, identify land feasibility and space availability helps to determine the suitable location for applying Green Street design in a community or an urban mixed-use area. Second, design with respect to the site's existing natural settings. Soil and topography impact the drainage conditions of the site and the selection of stormwater BMPs. As shown by the case study and literature review, site locations and its geometric conditions have the largest impact on the outcome of the applied BMPs. Site factors should be considered as follows:

- Street slope no greater than 6% for implementations of stormwater swales and planters

- Moderate to high infiltration rate of soil conditions are preferred for applying the majority of the stormwater BMPs
- Available space for pedestrian activities, street trees, and multiple stormwater facilities if needed
- Avoid disturbance of the existing large canopy trees. Set back the design location from the 25foot stream buffer if possible

Third, apply LID strategies to reduce the total amount of the existing impervious surface, addressing stormwater management at its source and surface. Reduction of street width and parking lot sizing, application of stormwater BMPs adjacent to streets and parking lots, and provision for landscaped areas in the site are suggested as efficient strategies for Green Street design. Last, incorporate design features to promote alternative transportation. Introducing Green Street design in a neighborhood should improve the overall connectivity by enhancing pedestrian travel efficiency and safety.

Selecting the most suitable stormwater management strategies to fit the site layout and context is another important factor for Green Street design. Stormwater BMPs should be chosen based on the analysis of the topography, available space, and the street context. Proposed designs should also utilize the site's existing public green infrastructure, including trees, to meet the stormwater reduction goal. Finally, the design should consider tying in the existing public green space to provide direct connection benefits for its current users as well as planned future development areas.

CHAPTER 4

HISTORIC MILL TOWN NEIGHBORHOOD DEVELOPMENT AND DESIGN

The Historic Characteristics of Mill Town Neighborhoods

In the 1900s, the southern cotton textile industry boom led to the construction of factories close to centers of cotton production in order to reduce the transportation cost. Since the factories provided opportunities for local employment at the same time that crops were becoming less profitable for farmers, many people moved from farm to factory for the sake of a steadier paycheck and better lives. As a consequence, mill towns were established by the mill companies for the mill workers and their families.

Mill towns directly reflected the increasing economic and social elements of the cotton industry as well as the lives of the mill workers. At the time, the majority of the workers were poorly educated, economically insecure, and socially restricted (Crawford 1995). For them, a paying job and a better physical environment were important. However, instead of providing higher wages, the mill town owners used housing incentives to attract steady workers: low rents, furnished housing, community amenities, and/or subsidized housing (Crawford 1995). In the basic business model for a mill town neighborhood, the company offered houses or duplexes for rent, an arrangement that commonly included a school, churches, and a company store within walking distances to the community. To help the workers cope with job-related stress, the mill usually provided social work assistance, and recreational and educational activities. In general, the more decent facilities the town had, the better its public image was, making it possible to attract and retain greater number of workers.

Mill towns typically were laid out on a gridiron street pattern, with an artificial buffer, such as a freeway, between industrial and residential areas. In this way industry was kept isolated from the residents. This separation often extended to the residents themselves, effectively segregating black workers from white (Crawford 1995).

During the boom years of the 1910s and 20s, Charlotte, NC, as the hub of the textile industry, anticipated an improvement in community conditions, and expanded welfare to raise the mill families to mid-class standards (Crawford, 1995). John Nolen, the Olmsted Brothers, and Earle S. Draper all practicing partners and landscape architects were successively employed to redesign the Charlotte textile mill town (Crawford 1995).

Directly inspired by Ebenezer Howard's Garden City concept, planners found a new solution for urban industrial residents in 1900s. John Nolen, as a mill town planner, took a page from the Garden City and established a set of criteria for the new company town. His town planning practice emphasized the town's affiliated facilities with shopping and recreational areas (Crawford 1995). The Olmsted Brothers focused on the overall street plan, changing the straight streets to curving tree-lined streets following existing topography. They also provided suggestions for the landscape design of a typical city block.

The preparation of preliminary studies for the full scale plan and landscape design of Charlotte was a collaborative work between Nolen, the Olmsted Brothers, and Draper (Hanchett). The Civic Survey was completed by Nolen in 1917, aiming to guide the study, providing map data for various categories of inventory, such as the existing land uses, demographic patterns, transportation corridors, drainage patterns, and green space. The Olmsted firm helped with the topography survey, which became a valuable source highlighting existing natural conditions. The comprehensive preparations were the background for Draper's full-scale planning work (Hanchett).

Earle S. Draper, the Southern Mill Town Planning – Chicopee Mill Village, GA

Beginning his mill town planning career with Charlotte, Earle Draper eventually completed nearly one hundred and fifty mill village and mill village extension designs in the southern states of Virginia, North Carolina, Tennessee, South Carolina, Georgia, and Alabama (Fig 4.1).

Figure 4.1 Mill villages designed by Earle Draper (Source: Crawford 1995)

The Garden City concept inspired Draper, although in a different rural perspective. Called “the finest mill town”, Chicopee, now a part of Gainesville, Georgia, established a new model of the “adaptable community planning in a social intentions and economic basis of the textile industry” (Crawford 1995). Figure 4.2 is the original full scale plan of Chicopee in 1927. Reconfiguring the mill (identified by the brown-colored boundary in Figure 4.3) as the basic symbol of a typical mill town, Draper relocated it to the town quadrant (Crawford 1995).

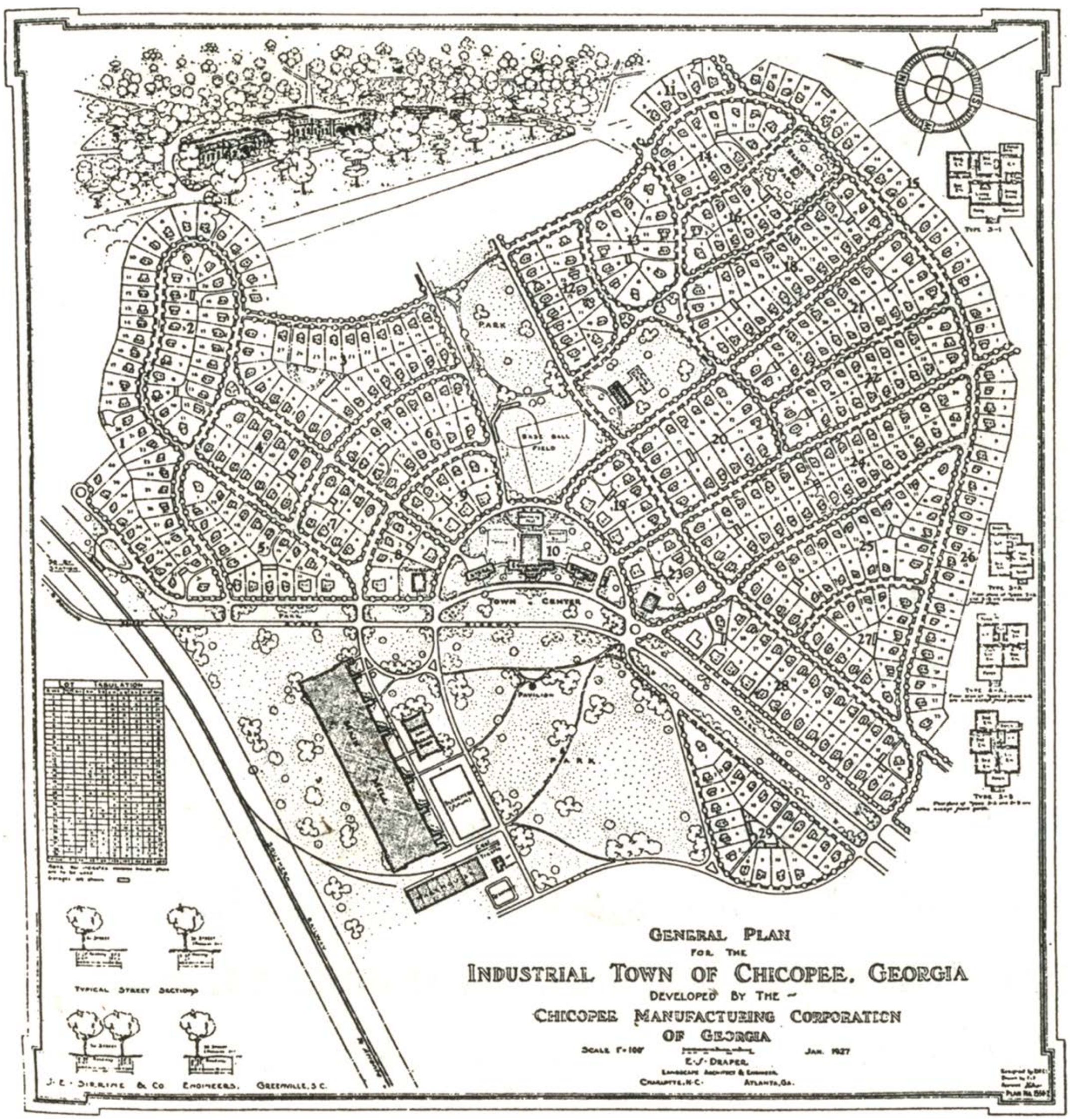


Figure 4.2 Historical Picture of the Plan of Chicopee, Georgia, 1927 (Source: Crawford 1995)

Draper made architecture a secondary priority to the abundant green space and a protective green belt. The entrance highway that ran from the west to the east through the village was lined by a green belt. The planting belt and the shady trees on both sides of the highway served as a natural buffer between the community and the textile mill. Aiming to increase the amount of public green space in the neighborhood, Draper incorporated various green lands into the park system. Public facilities such as churches and a community center were surrounded by open space with the large park in the center of the community providing further recreational opportunities. Most importantly, these facilities and their affiliated green spaces became consolidated gathering places for residents, making the town more centralized and replacing the mill as the heart of the community.

Draper ultimately took the existing topographical conditions and native vegetation from the regionally specific settings of the industrial mill town as the organizing elements of his plan. He realigned the grid into curving tree-lined streets; this new street network was laid out in accordance with the topographical features of the Piedmont. Figure 4.3.c shows the curving streets network pattern, offering a completed travel route within the community with no dead-ends or missing connections.

A pedestrian circulation system with fine landscaping, as well as a new park system, reconnected the mill residents to the natural environment of the Piedmont. Figure 4.3.d presents the walking paths (dashed lines) and the separated sidewalks adjacent to the streets (solid lines). The sidewalks are distributed along either one or both sides of the roads within the residential areas, differentiating pedestrian circulation from the winding automobile roads using wide sidewalks. The walking paths form an effective pedestrian-orientated system, leading residents to the central park and other public facilities.

Figure 4.3 Analysis Diagrams of Chicopee, GA (Map source: Crawford, 1995, map redrawn by author)

Figure 4.4 Site photo of the separate sidewalks in Chicopee,GA (Source: Google map)

Lessons Learned

Draper's work played a significant role in southern mill town design and development, as he successfully achieved a balance between his planning profession principles, the priorities of mill owners, and civic concern for improvement (Crawford, 1995). Dealing with the unique natural conditions of the Piedmont mill, Draper incorporated the Olmsted brothers' tradition of design with nature and Howard's Garden City concept into his planning and landscaping of specific mill villages. In lieu of copying existing mill town examples, Draper explored an adaptable method for planning the southern textile town to accommodate its function and economy, which included local materials use, and maintaining local cultural characteristics.

Compared to highly urbanized cities, mill town neighborhoods create a small town feeling by having narrowed streets, which conveys a human-scale environment. Well-connected sidewalk systems provide walkable environments that benefit its residents. The connectivity supports a centralized social area within the community, whether this area is a school, a public park, a historical church, or a complex of various social areas. Applying these historically proven design characteristics to contemporary community redevelopment projects should be considered, with special emphasis on enhancing connections to public spaces, in addition to providing opportunities for existing green space expansion.

CHAPTER 5

FAIRMONT NEIGHBORHOOD CONDITIONS

This chapter establishes a foundation for the applied design in Chapter 6. It begins with the history of the neighborhood's design and planning in the age of Earle Draper, with an emphasis on the primary historical properties in the neighborhood. Then it moves to a systematic review of the existing site conditions and assessment of each category: land uses, demographics, transportation and circulation, watershed and drainage conditions, soil survey, and existing green space. Based on the interpretation of literature in Chapters 2 and 3, prospective advice for future development is given at the end of this chapter as a guide for recommended design techniques.

Neighborhood Background

The Fairmont neighborhood is located northeast of the city of Griffin, Georgia, and is approximately 430 acres. See figure 5.1 and 5.2 for its boundaries. Fairmont is bordered to the north by Kentucky Avenue, to the east by Jackson Road, to the south by East Broadway Street, and to the west by North 5th Street and Pool Road. Adjacent to the Fairmont neighborhood is the old Thomaston Mill neighborhood (Figure 5.1 and 5.2).

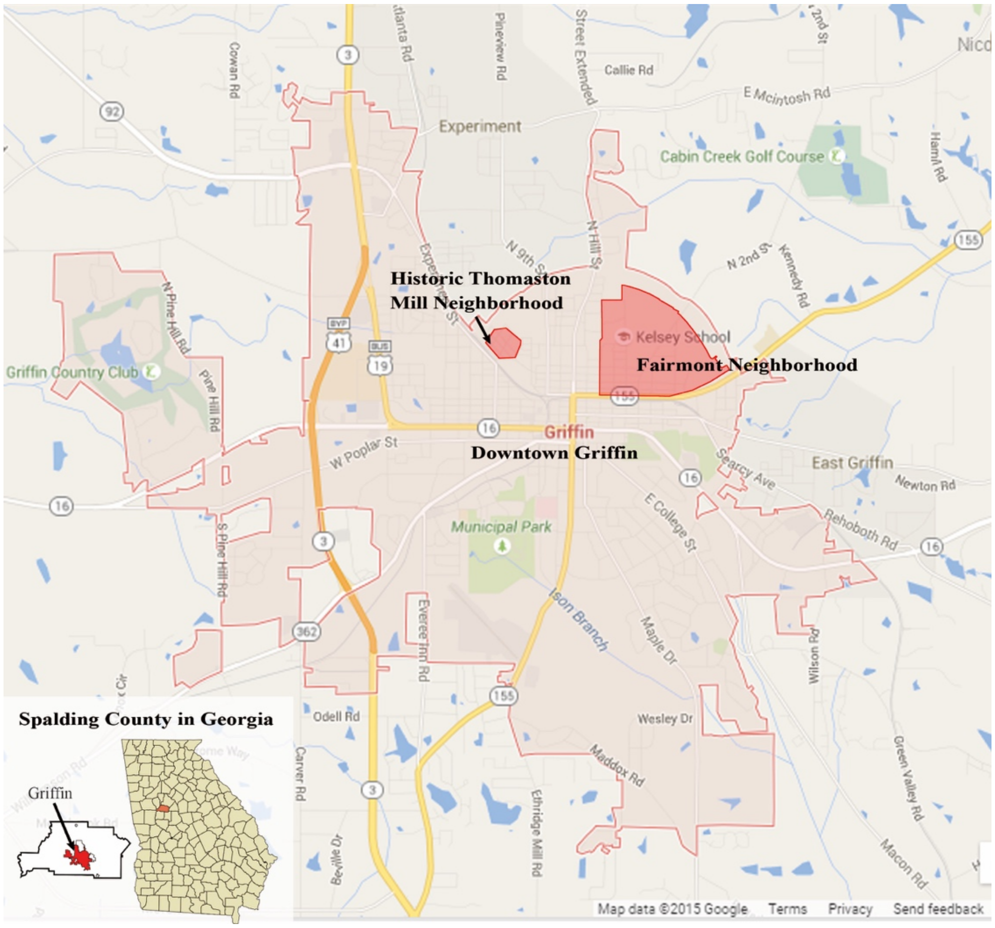


Figure 5.1 Location Map (Source: commons.wikimedia.org; Google Maps; map redrawn by author)

Figure 5.2 Fairmont Neighborhood Boundary Map (Boundary defined by The Griffin Board of Commissioners 2007)

Historical Background

The city of Griffin has a rich history of its economic transition from agricultural to manufacturing in the early part of nineteenth century. The booming textile industry constructed mill neighborhoods to provide housing and community services for mill workers and their families (CCDP 2014). The Thomaston Mill neighborhood, designed by Earle Draper, was funded and built by the owner of the Thomaston Mill in the early 1900s. For over 30 years, the neighborhood provided housing for mostly white working class families to live in close proximity to their jobs. Common household incomes were low to moderate for that time. During the 1950s and 60s, many of the neighborhood residents moved to the south side of downtown Griffin (CCDP 2013). The “white flight” of the 1950s and 60s, as well as the targeted construction of a segregated African American housing project contributed to the predominantly African American population in the area today (Planning and Development Services Department 2007).

Just east of the Thomaston mill homes is Fairmont neighborhood. Although there is no mill located in the community boundary, Fairmont has a very similar function as a mill neighborhood, providing additional housings for the mill workers (Planning and Development Services Department 2007). The neighborhood surrounding the old Fairmont School contains 80 housing units serving low-income African American families (Planning and Development Services Department 2007).

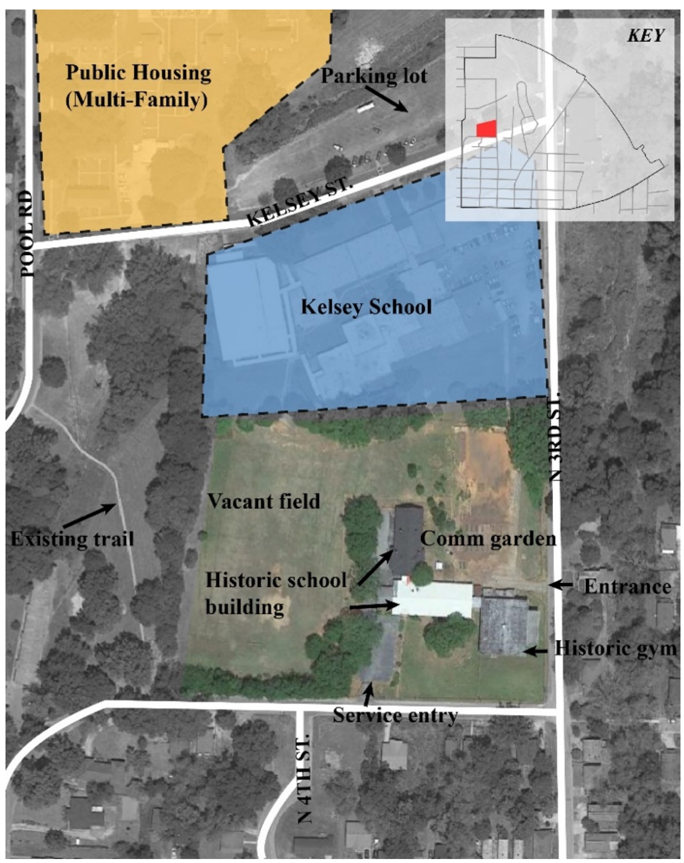


Figure 5.3 Rosenwald School location and context map (By author)

Figure 5.4 Vine covered façade of the historic school (Photo from Center for Community Design and Preservation @ UGA)

Figure 5.5 Historic gym (Photo by author)

The Griffin Vocational School, also known as the Rosenwald School, located near the center of the Fairmont community (see index map in Figure 5.3), served as a center of activities in the Fairmont neighborhood and remains a public symbol for residents. The oldest portion of this school was built in 1928 using money provided by the Rosenwald Funds. Between 1912 and 1932, the Rosenwald schools program built 5,300 schools for African -American children across the southern United States. The Griffin Vocational School, as it was originally known, was the 50th Rosenwald School built in Georgia (CCDP 2013). Multiple wings and a gymnasium were added to the original Rosenwald School building to accommodate the increasing number of students. These buildings and facilities are no longer in use and currently remain in a deteriorated condition. Physical damage is apparent in current photos of the gym and on the windows of the old school building (Figure 5.4 and 5.5).

The Rosenwald School has the potential to be revitalized as a historical resource. Griffin's 2014-2034 comprehensive plan values the Rosenwald School as "a historically significant landmark that reflects the roots of a self-sufficient African American community" (Jordan 2004). The Fairmont Community Urban Redevelopment Plan proposed the preservation and renovation of the school's historical gymnasium as an education center for the community (Planning and Development Services Department 2007). Classrooms, meeting rooms, and multi-use activity rooms were planned by utilizing the existing building shell and revitalizing the interior structures. The school complex and its surrounding open space offer the potential to double as a venue for educational events, community programs, festivals, and a public gathering place for entertainment.

Site Condition Assessment and Potential Advice

This section is a review of the site inventory of land uses, parcel ownership, demographic information, circulation, site topographic and hydrologic conditions, soils, and green space locations. The author will present an existing inventory either from her own observation or compiled from various sources as noted. Then an assessment will be given for each subject for future LID application according to the implementation strategies devised in Chapter 3, as well as the development suggestions in Chapter 4.

1. Land Uses, Ownership, and Local Zoning Codes

There are approximately 731 parcels located in the Fairmont neighborhood, 7 of which are public (governmental) owned (Figure 5.6). Publically-owned properties in the community include green space, government public housing, and educational institutions, which are generally located in the northwest corner of the community.

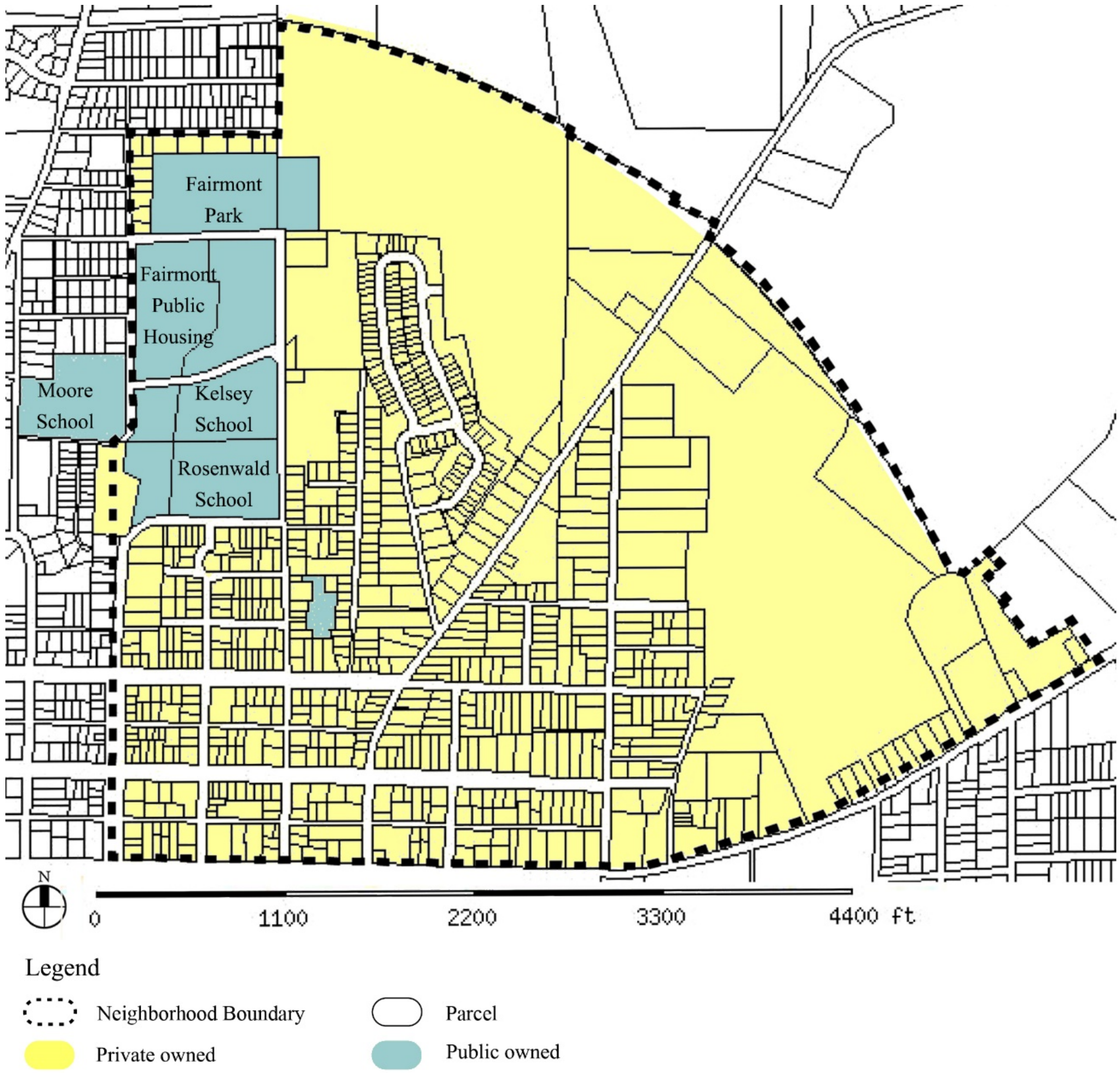


Figure 5.6 Parcel ownership map (Data from Spalding County Parcel Map; map redrawn by author)

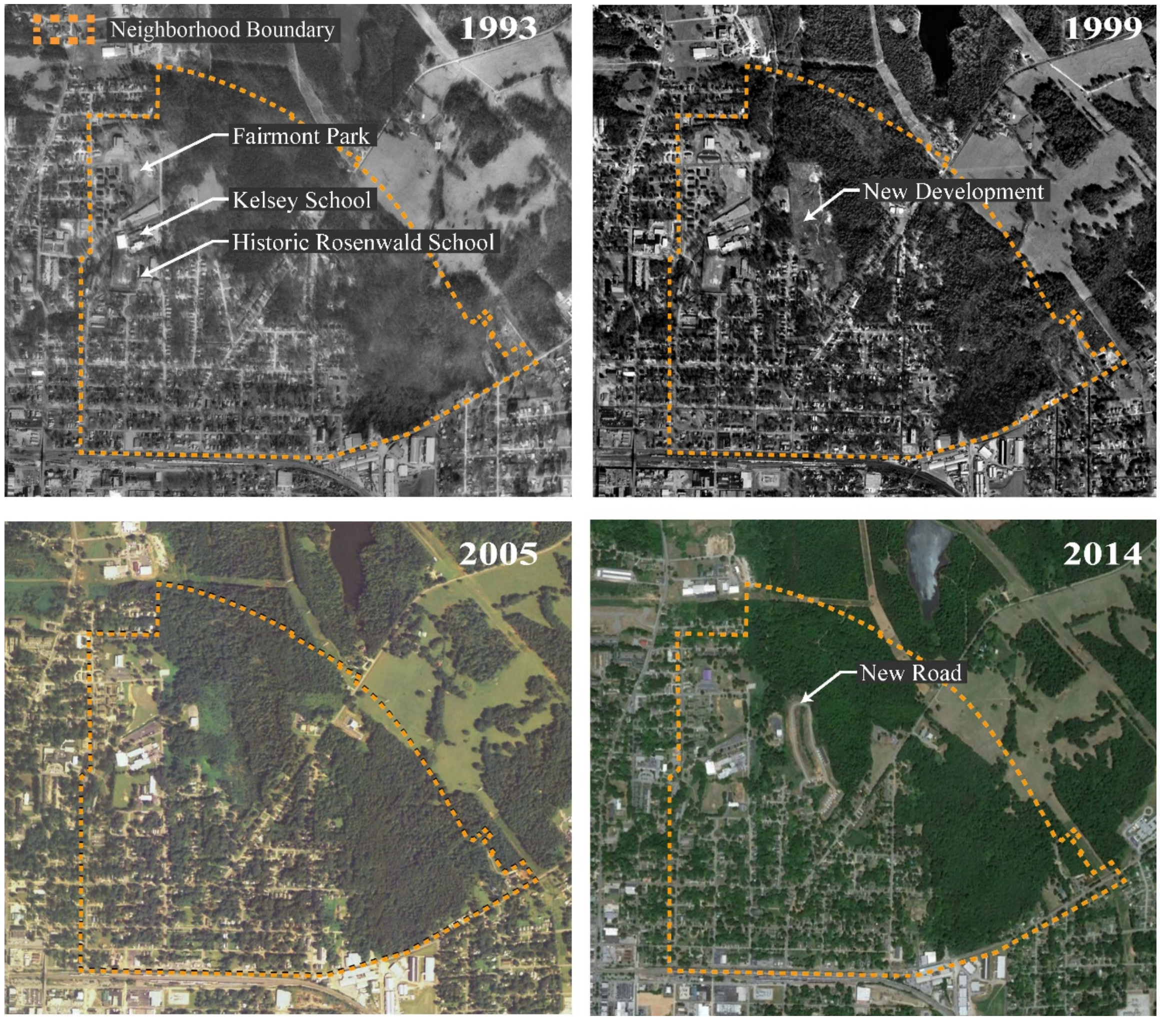


Figure 5.7 Historic Site Map (Source: Google Earth)

As shown in the historical site map (Figure 5.7), the Fairmont neighborhood development as a whole tended to be a school-centered development during previous decades. Streets were laid in a grid pattern from the middle to the southern edge; dense development of this area was primarily residential. Houses typically have a compact front yard and narrow side yards. Small residential expansions occurred in the northeast of the community. A new roadway loop can be seen on the 2014 map. According to the future development map (Fig. 3.9), this area is planned as a low to mid-density residential development. Therefore, it should be noted that this currently undeveloped land is not considered as green space for future public development in the proposed design presented in this thesis. In addition, although only a few residential buildings have been added, an increase of population is predicted. Thus, the development plan for this area should take into consideration the need to connect the expanded neighborhood to the community public facilities.

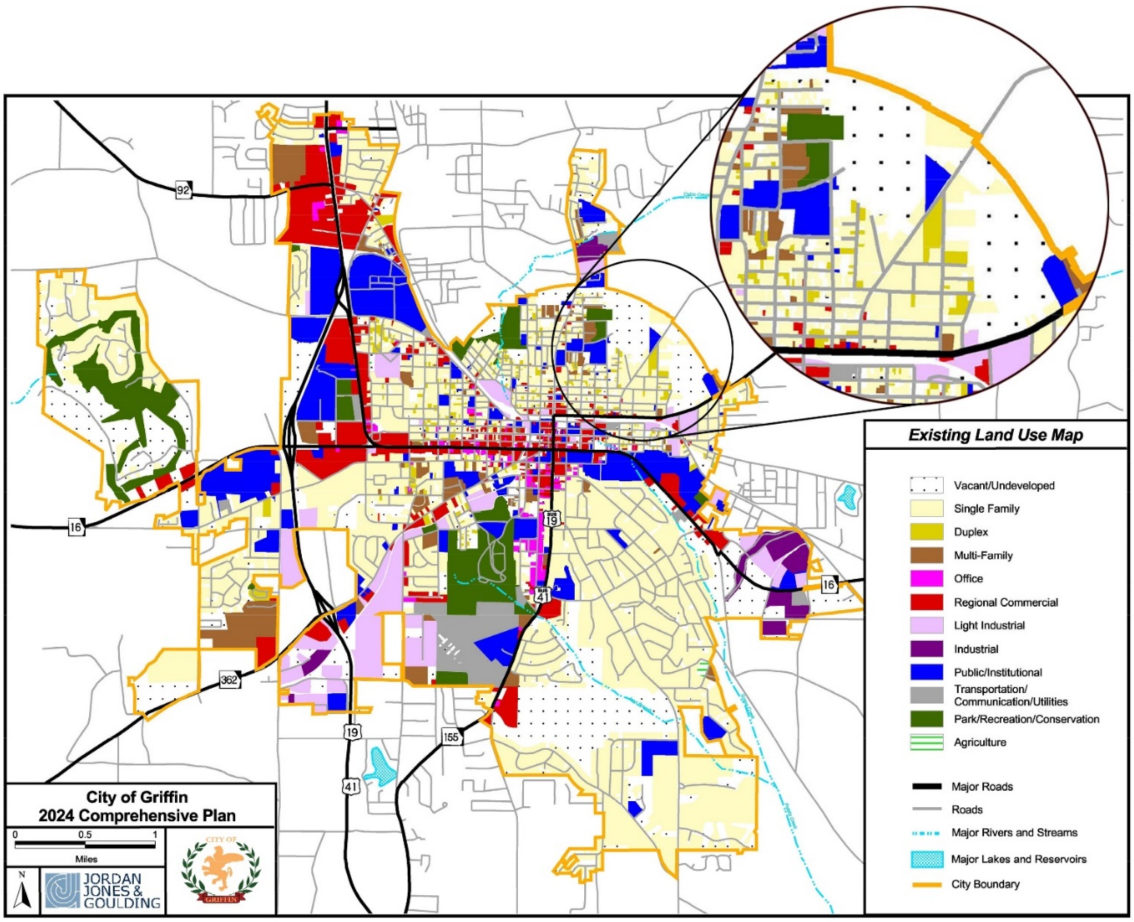


Figure 5.8 Existing land use map (Source: City of Griffin 2024 Comprehensive Plan; map redrawn by author)

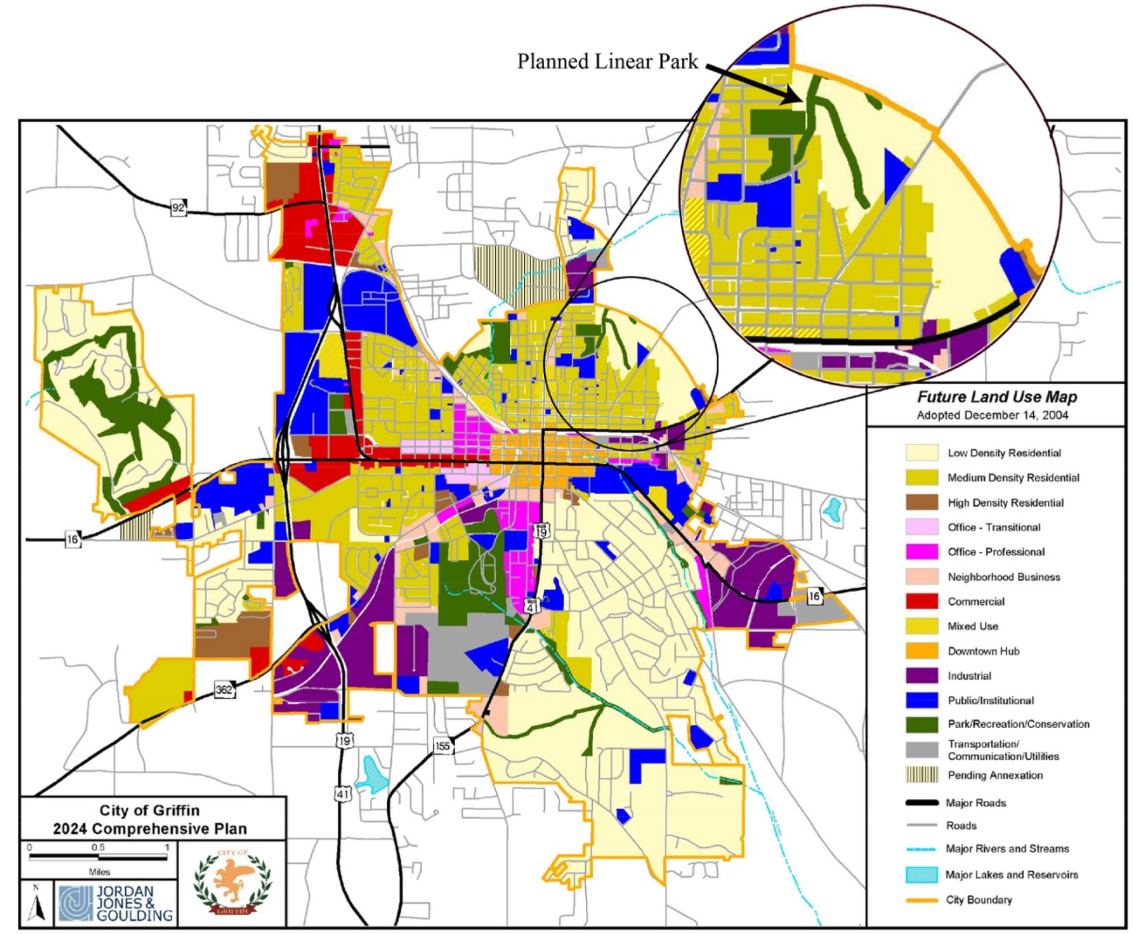


Figure 5.9 Future land use map (Source: City of Griffin 2024 Comprehensive Plan; map redrawn by author)

Comparing the existing land use map (Fig. 5.8) and the future land use map (Fig.5.9) provided by the City of Griffin 2024 Comprehensive Plan reveals that a linear green space is planned along the creeks, which run through the Fairmont neighborhood. The proposed linear recreational area will connect the existing Fairmont Park with the future residential area on the east side of this neighborhood.

Additionally, the future land use map shows that the area where the Griffin Vocational School is located, together with the other school complexes, becomes an educationally focused development zone. The 2014-2034 Griffin Comprehensive plan has also set up goals for the redevelopment of the Fairmont neighborhood area, focusing on the transformation of the school zone:

> The Griffin Public Housing Authority plans to partner with UGA-Griffin, Southern Crescent Technical College, and Griffin-Spalding School Systems to transform the area into an educational workforce development training facility. The Fairmont community can serve as a model for other small neighborhoods. An Educational Prosperity Zone (EPZ) will emphasize further educational opportunities (post-secondary or training programs). (Three Rivers Regional Commission 2013)

The decision to include educational community programs in the historical school area represents the community's desire to bring attention and activities to this area and provide public services for its residents. These under-going programs provide a unique starting point for introducing future redevelopment projects to this area.

2. Demographics and housing

In 2013, the city of Griffin had a population of 23,344, a decrease of 0.5% since 2000. Based on 2010 data, African Americans account for 51.9% of the total population (source: city-data.com). Fairmont is predominately an African American (99.9%) single-family neighborhood (Planning and Development Services Department 2007). The Fairmont neighborhood is shown with the red border in Fig. 5.10 and 5.11.

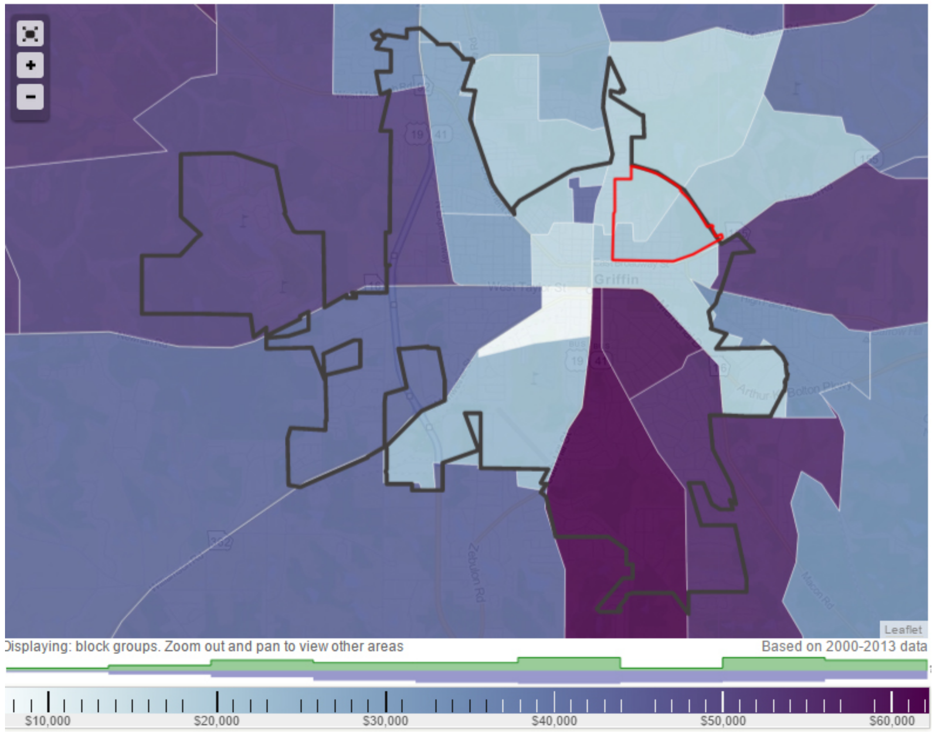


Figure 5.10 Griffin Median Household Income ($) (Source: City-Data 2010)

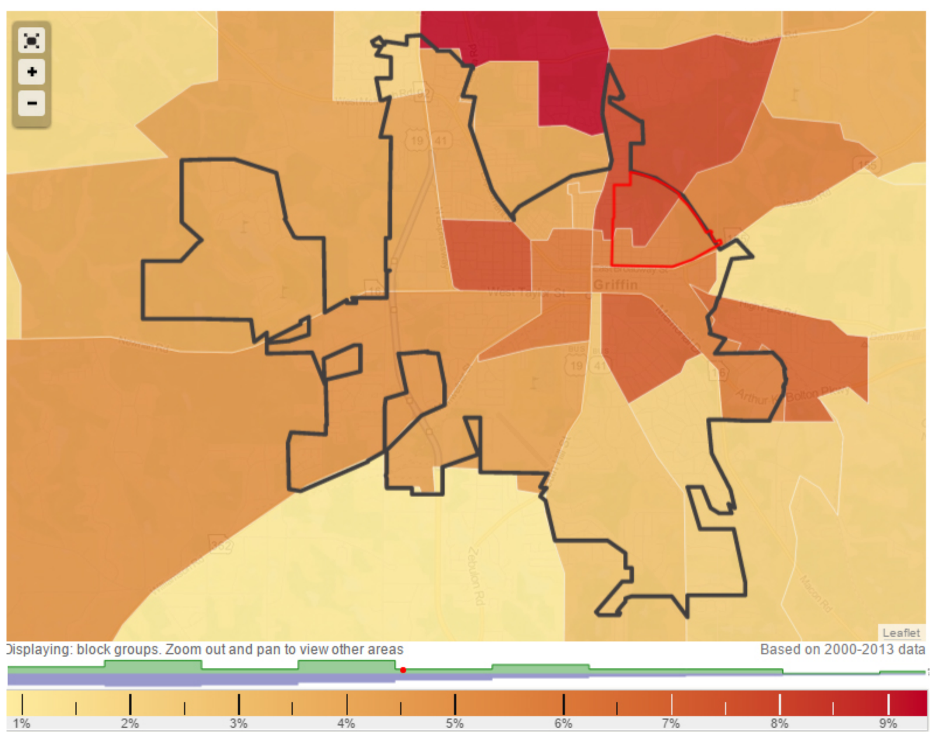


Figure 5.11 Griffin Unemployment (%) (Source: City-Data 2010)

The median household income in Fairmont Community is around $20,000, which is lower than the city's average of $ 29,119, and below the state of Georgia's average of $25,427 as of 2010-2014 (source: USA.com). According to data from 2013, about 30% of the residents in Fairmont had an income below the poverty level. About 80% of these families are single-mother families (source: City-Data). In addition, as shown in Fig. 5.11, the percentage of unemployment within Fairmont (5.8% to 7.8%) is relatively high.

The charts in Figure 5.12 present a data summary of current housing conditions in the neighborhood.

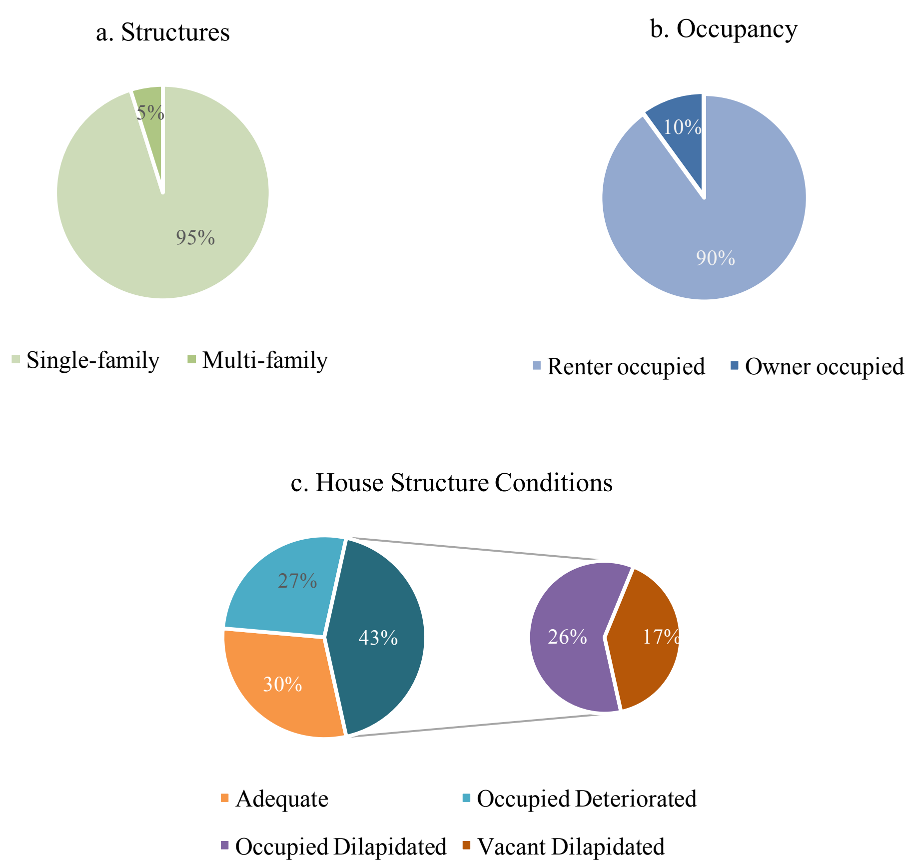


Figure 5.12 Housing Conditions Charts (Data source: Planning and Development Services Department 2007; charts drawn by author)

The neighborhood is considered a primarily single-family residential area, with occupancy consisting of 95% single-family and 5% multi-family (Figure 5.12.a). The typical single-family residential structures were built in the mid-1950s. Today, rental occupancy represents over 89.9% of the housing stock, while owner-occupied housing represents only 10% (Figure 5.12.b) (Planning and Development Services Department, 2007). The majority of the rental occupancy tends to serve transitional renters, those who move among renter units frequently and are therefore less invested in the community. The houses vacated by those transitional renters are in decline and in greater need of revitalization. Appendix 1 shows more detailed research on the housing records from the Fairmont Community Urban Redevelopment Plan 2007.

To summarize, high poverty rates and the vulnerable population composition (such as unemployed and renters) contribute to an unstable environment in the Fairmont neighborhood. It is critical to apply physical improvements in this neighborhood, providing a safer and more livable environment for Fairmont residents, and improving the living standard of the whole community.

3. Circulation Conditions

Streets throughout the neighborhood are paved with concrete and asphalt in sections. The south part of the neighborhood is built on a well-connected street grid with primarily residential use on both sides. Moving north, the streets network becomes more suburban, containing more fragments and dead ends, which are mostly used for local and private transporters. Figure 5.13 represents the major roads inventory map of Fairmont. The unconnected streets are marked with red dashed arrows pointing out the potential connecting directions.

Figure 5.14 is an inventory of the existing pedestrian circulation in Fairmont. The map shows that large number of streets are underserved by the sidewalk system, particularly in the north and west of the neighborhood. Compared to other mill neighborhood roads like Chicopee, Fairmont needs a more complete and consistent travel network to access public spaces, schools, and community and establishes the overall pedestrian connectivity and walkability within the neighborhood.

Safety and comfort are critical for streets and sidewalks to support walking. In order to make the neighborhood's resources more accessible to residents, design suggestions for the transportation and circulation in the neighborhood should include: (a) proposed road connections to fix identified street discontinuities and to complete the street pattern; (b) priorities given to repairing and/or installing sidewalks on the identified deteriorated and non-existent sidewalks streets; and (c) the construction of a pedestrian-friendly environment throughout the community consisting of separated sidewalks with safe intersection crossings.

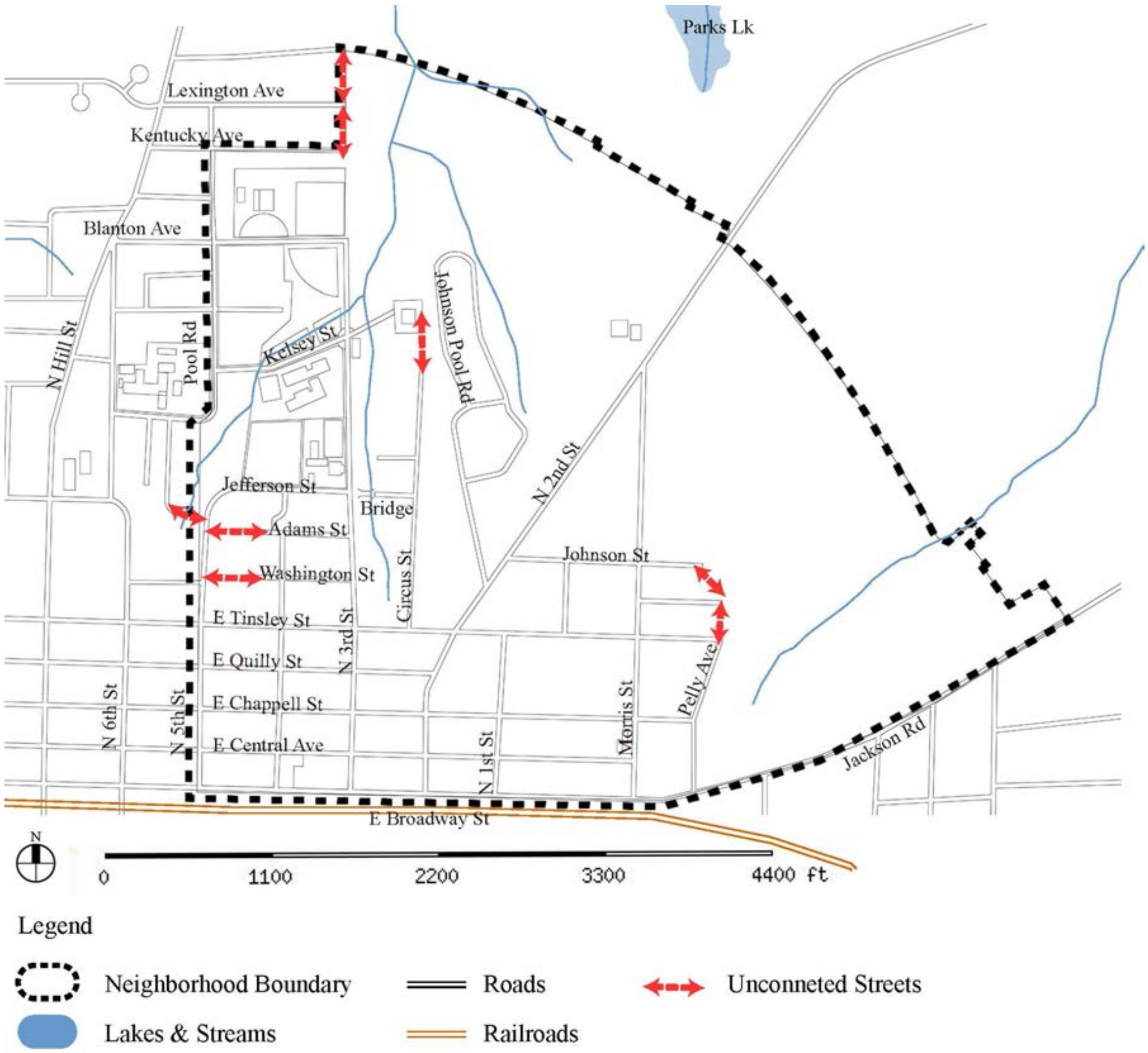


Figure 5.13 Street System Map (Data from Spalding County Parcel Map; map redrawn by author)

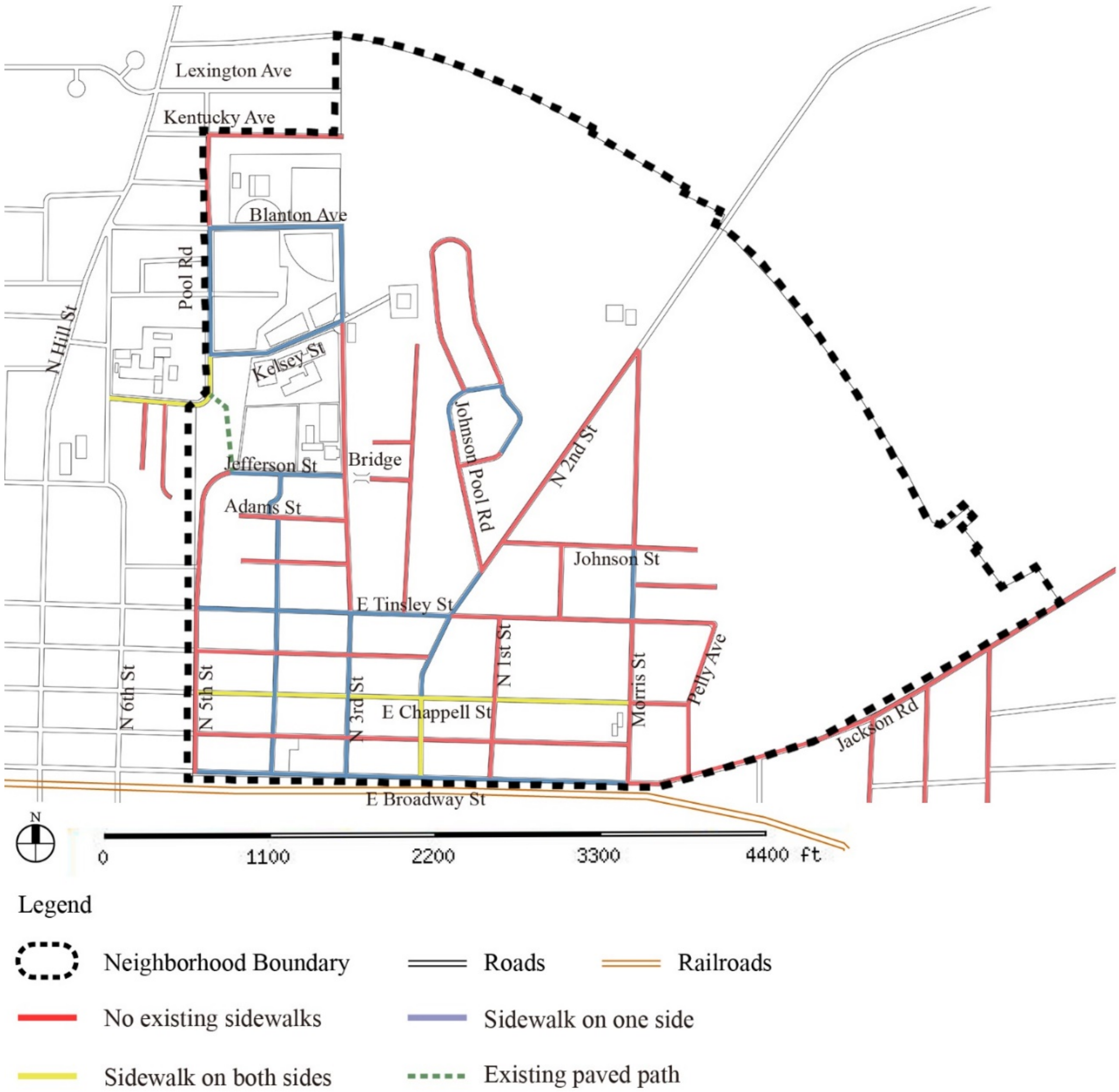


Figure 5.14 Existing Sidewalk Conditions (By author)

4. Watershed and topography

The stormwater gutter system along the streets is in poor conditions (Planning and Development Services Department 2010). During rain events, stormwater runoff flushes through the roads into the two creeks that cross over the neighborhood, which potentially brings contaminants to the creeks. Besides sewer service and watershed protection, green infrastructure offers alternative solutions to improve the stormwater management in this area.

According to the City of Griffin's 2012 watershed protection plan, the Fairmont Community area is located in the in the Cabin Creek watershed. As shown in Figure 5.15, according to the topography and creek data the community area is divided into two watersheds of two tributaries (named Cabin Creek tributary A and B by the author for study purposes). Approximately 75% of the community area is located in tributary A's watershed while the rest is located in tributary B's. Generally comparing the two watershed's existing conditions, it is easy to see that the denser development occurred within tributary A's watershed, making this the more desirable site for the proposed Green Street project.

Looking further into the topographic conditions in this area, the south regions of the Fairmont community consist of medium to high elevation areas that are fairly flat. Many of the commercial and medium-density residential areas are in the highland area. The northern portion of the community has a lower elevation and is partially within the 100-year floodplain zone. Segments of the Cabin Creek's tributaries flow through this area, composed of extremely steep slopes. The overall slope conditions of the streets in the north-west portion of Fairmont are about 4%, with some steep slopes along North 3rd Street adjacent to the old Rosenwald school properties.

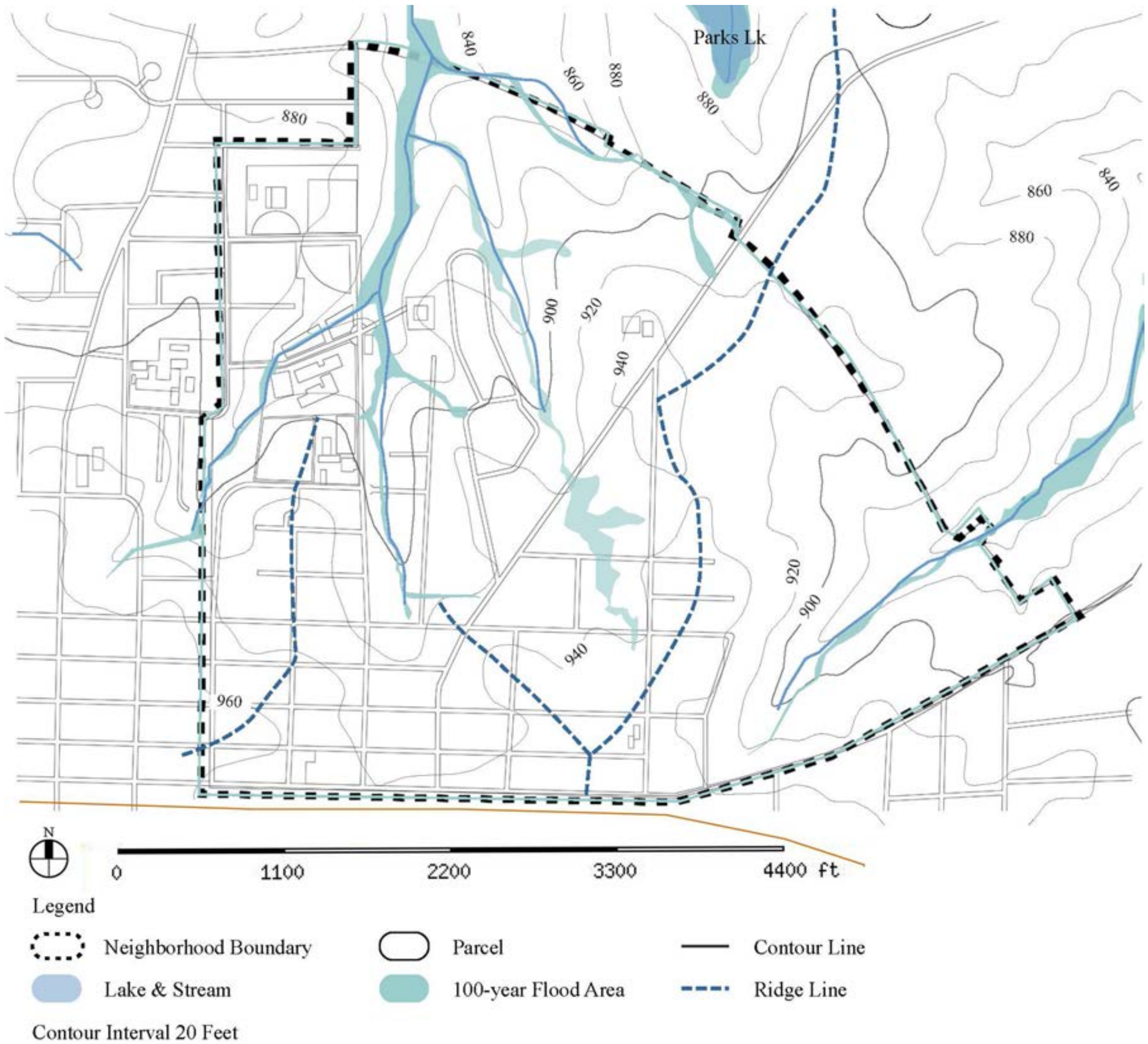


Figure 5.15 Floodplain and Topographic Condition (Data from Spalding County Parcel Map; map redrawn by author)

5. Soil Survey

The soil survey and the summary table below were generated from the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) SSURGO database. The area of interest (AOI) in the survey was defined as the Fairmont community boundary.

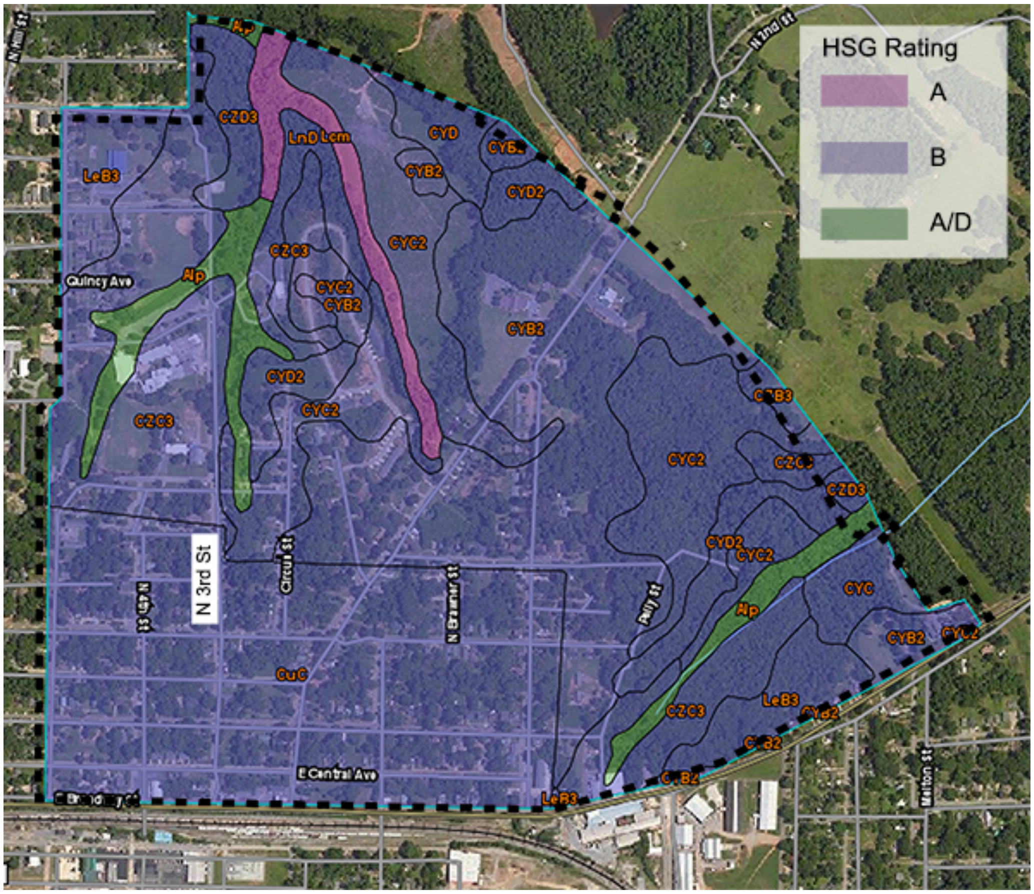


Figure 5.16 Hydrologic Soil Group Map (Source: SSURGO database)

As shown in Table 5.1, HSG group B (shown in blue in Figure 5.16) represents a total of 93.4% of the area, while group A (shown in red in Figure 5.16) is 2.3%. The 11.4-acre area along the existing stream on the north of the community, with a buffer zone of approximately 50 to 100 feet from the stream, is classified as Group A/D in the survey (shown in green in Figure 5.16). Group A/D is a dual class to indicate that the soil in the drained areas is classified as Group A, and the soil in the un-drained areas is rated as Group D. This joint classification usually requires sub-surface drain pipes to drain off groundwater and to minimize water logging the soils. In other words, the soil will function as a Group D soil if sub-surface perforated drain pipes are not employed.

Therefore, development should avoid applying any type of BMP that are applicable for an underdrain structure, such as rain gardens.

Table 5.1 Fairmont Hydrologic Soil Group Summary by Map Unit

Summary by Map Unit — Spalding County, Georgia (GA255)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Alp	Alluvial land, moderately wet	A/D	18.1	4.3%
CuC	Cecil-Urban land complex, 2 to 10 percent slopes	B	108.4	25.7%
CYB2	Cecil sandy loam, 2 to 6 percent slopes, eroded	B	93.9	22.3%
CYC	Cecil sandy loam, 6 to 10 percent slopes	B	6.5	1.5%
CYC2	Cecil sandy loam, 6 to 10 percent slopes, eroded	B	63.0	14.9%
CYD	Cecil sandy loam, 10 to 15 percent slopes	B	5.9	1.4%
CYD2	Cecil sandy loam, 10 to 15 percent slopes, eroded	B	16.6	3.9%
CZB3	Cecil sandy clay loam, 2 to 6 percent slopes, severely eroded	B	1.9	0.4%
CZC3	Cecil sandy clay loam, 6 to 10 percent slopes, severely eroded	B	62.2	14.7%
CZD3	Cecil sandy clay loam, 10 to 15 percent slopes, severely eroded	B	7.7	1.8%
Lcm	Local alluvial land	A	9.8	2.3%
LeB3	Lloyd clay loam, 2 to 6 percent slopes, severely eroded	B	20.2	4.8%
LnD	Louisburg sandy loam, 10 to 15 percent slopes	B	7.6	1.8%
Total for Area of Interest			421.8	100.00%

Based on the HSG classification definition given in Chapter 3, the majority of the soil within the Fairmont community is classified as HSG B, which has a moderate infiltration rate and a moderate transmission rate. Applying stormwater BMPs in this area will increase the infiltration rate and provide a more efficient stormwater treatment. In addition, avoiding impervious development on the protected soil zone (Group A) is also an important criterion to protect the hydrological performance in this area.

6. Green space

The green space is particularly defined as public owned land dedicated for public use. The major public open space in the Fairmont neighborhood is Fairmont Park, which was donated by a local major property owner (CCDP 2013). In accordance with the school-centered design for most mill towns, Fairmont Park serves as a central green space in this area. The park is located at Blanton Avenue, to the north of the Kelsey school, and is approximately 14 acres (Figure 5.17). The undeveloped areas at the west side of this community are not included in this category even though they are currently vegetated urban forest, because they are privately owned and planned for residential use.

Even though it is located on the edge of the neighborhood, Fairmont Park has become one of the community's popular gathering places, providing various sports facilities and public programs. Blanton Avenue splits the park into halves. The north part has a community center, which features a gymnasium, meeting rooms, and concessions. The northern half of the park also offers many outdoor activity facilities: a pavilion for rental, a playground, horseshoe pits, and a basketball court. The southern half of the park contains a 3-acre softball field. According to the author's site survey, the open field between the softball field and the south parking lot is currently underused and in an undermanaged condition.

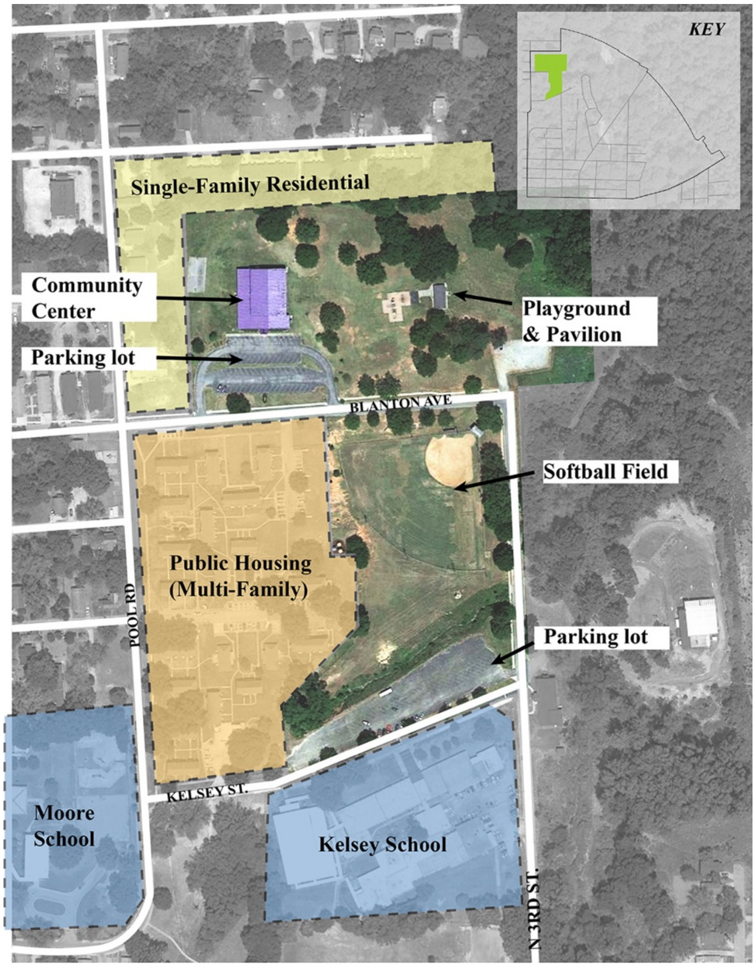


Figure 5.17 Fairmont Park Site Context Map (by author)

Figure 5.18 Existing park conditions (photos by author)

Left: a playground and a pavilion at the northeast side of the park

Right: Fairmont park entrance sign

Compared to the green space ratio in Chicopee - over 21% (36 acres to 170 acres) - Fairmont has a public green space ratio of only 3% (14 acres to 430 acres). According to the Georgia Planning Department, every city should set aside 20% of its land to be green space, including parkland, greenways, pedestrian and bike paths, and preserved natural areas (Georgia Community Greenspace Program 2003). If the city-wide open space standard was applied to this neighborhood, the Fairmont neighborhood suffers a green space deficiency. Due to the attribution as a popular public green space in the neighborhood, this park serves as a starting point to focus redevelopment efforts.

Fairmont Community Urban Redevelopment Plan

Following the closing of two major mills within the City of Griffin, a massive loss of jobs, concerns about safety, and a decrease in quality housing negatively impacted the mill neighborhoods (Planning and Development Services Department 2007). A decade later, the mill communities continue to suffer from declining population, high unemployment rates, substandard housing, and high crime rates. The City of Griffin is increasingly concerned about the adverse influences that have emerged as a result of the deteriorating communities.

Development strategies for green neighborhoods are mentioned on in the Fairmont Community Urban Redevelopment Plan (FCURP). Prepared by the Planning and Development Services Department in Griffin, it defines the necessary redevelopment activities in the designated Urban Redevelopment Area, and presents the existing conditions and recommended revitalizing strategies for the neighborhood. Additionally, the assessment of substandard conditions throughout the plan area will inform a decision agenda to assist future revitalization actions. The initiatives identified by FCURP as fostering a livable, safe, beautiful, and economically viable neighborhood include:

- Affordable Housing – Develop standards for infill housing and encourage the upgrading of deteriorating structures of substandard housing so as to establish a character for the block and neighborhood.
- Land Use and Zoning – Improve community aesthetics, encourage infill and redevelopment within the plan area, preserve the sense of a small town and enhance community pride.
- Circulation – Utilize sidewalk funds in the city budget to develop a sidewalk installation program within the plan area and surrounding neighborhood, and enhance the road conditions to create a safe, walkable, accessible, and green street network.
- Infrastructure – Protect and restore the watershed area, clear and clean the creek and stream beds, assist with flow reduction, and improve on-site stormwater management capacity within the plan area and surrounding neighborhood.
- Property management – Increase the existing trash and solid waste pickup frequency. Clear and clean the vacant properties, cut and clean overgrown lots to create a safe, healthy and vibrant neighborhood.

These initiatives, to a certain extent, present an initial image of how Green Neighborhood development can help a community's progression towards sustainability. However, many of the suggestions--for example the circulation improvement--were not detailed down to a practical level. This thesis will provide reference and solutions to infill new development in the neighborhood.

Summary

Historic influences and the mills' decline have posted tremendous challenges for the mill towns in their attempt to recover their economic losses, population drop, and physical decay, as well as the damages to their ecological systems. Based on comparisons to the successful mill town, Chicopee, an analysis of the existing conditions and the planned documents of the Fairmont community are summarized below to guide the proposed Green Street design:

1. Historical Characteristics

Historic mill houses have shaped the character of mill towns and embodied an image of the old mill town. Due to the fact that the Fairmont community has not been officially registered as a historic neighborhood, no development restrictions are applicable for the street redevelopment. However, the Old Rosenwald School is registered as historic for the National Register of Historic Places. Preservation of the historic school building is planned to help build the identity of the community. The proposed design should consider enhancing the school as a central social gathering place, providing strong connectivity between it and the surrounding residential area and promoting community activities and pride.

2. Circulation and street condition improvement

Redevelopment of major travel roadways should be initiated to provide a pedestrian-friendly network, create safe crossings, and complete the sidewalk system. The proposed design should aim to address the shortage of sidewalks around the planned community center and Fairmont Park. Landscape features should be added along streets that have few or no street-side plants; greenbelts and greenways are also efficient methods to increase the amount of greenery, as well as to accommodate pedestrian traffic. Separated walking paths provide easy accesses for pedestrians to facilities in the neighborhood. Developing such linear parks that connect the existing green space and provide efficient pedestrian activities corridors can significantly increase the green space ratio within the community.

3. Analysis of feasibility

The majority of the soil within Fairmont is HSG B soil and is preferred for applying stormwater facilities. Development should avoid the soil protection zone near the existing streams in the community.

The north-west portion in Fairmont encompasses in the lower area of the watershed and is partially within the 100-year floodplain. North 3rd Street has direct accesses to the creeks that run through the community. With the observed street runoff issues, the proposed Green Street design should aim to address the issue by retrofitting the street with appropriate stormwater facilities to protect the natural drainage way. In addition, the streets within the north-west portion of the community have moderate slopes that are suitable for applying most types of stormwater control facilities. However, considering the intent to enhance the social uses of the Old Rosenwald School property, the steep slopes along North 3rd Street adjacent to this property potentially pose challenges such as limiting the available space and the feasibility of applying stormwater treatment facilities. Any proposed design should consider incorporating the space within the school property to promote the connections and activities with the school as a gathering place.

CHAPTER 6

DESIGN APPLICATION

Previous chapters have introduced and interpreted the Fairmont neighborhood background and its current conditions. In addition, the comparison between the Fairmont neighborhood and the model mill community of Chicopee, GA, has shown the potential for the Fairmont neighborhood to improve its streets' physical condition and to enhance pedestrian circulation. This chapter presents the proposed Green Street design in Fairmont. The general project vision for the proposed design includes:

- Managing stormwater runoff at the existing and proposed impervious surfaces by providing green infrastructure;
- Providing stormwater facilities that are feasible, low-cost, suitable to the site condition, and aesthetically enhance the community;
- Improving pedestrian and bike safety, and enhancing the overall accessibility of the community;
- Connecting schools, parks, and critical residential area;
- Maintaining historical characteristics and enhancing community identity.

According to the design process outlined in Chapter 3, the proposed project will include the site selection, criteria for selecting stormwater management strategies, and interpretation of the details in proposed design features.

Site Selection and Segments

Based on the study of the existing conditions at Fairmont, the selected site for the proposed Green Street design includes Blanton Avenue from Pool Road to North 3rd Street and North 3rd Street to the intersection with Jefferson Street (Figure 6.1). The design application site was selected based on both environmental criteria and cultural/social criteria as follows.

Environmental criteria:

- The streets have a moderate slope (1% to 4%) for implementing stormwater control structures.
- The soil condition of the site is preferred as HSG B and above.
- The site is located in the lower portion of the watershed.

Cultural/Social criteria:

- Strong pedestrian connections need to be built to Fairmont Park and the school district, tying the surrounding residents closely to the Fairmont community's cultural center.
- The properties adjacent to the streets are acquirable for the project.
- The site size is limited to three blocks (around 3000 feet long) for design purpose.

Figure 6.1 shows a comprehensive environmental condition of the Fairmont community. Based on an overlaid analysis of existing conditions, the selected site area for the proposed Green Street project is located on the lower side of the Cabin Creek tributary watershed. It is partially within the 100-year floodplain, and contains the low point of North 3rd Street. The slope condition is desirable for proposing street improvement project and green infrastructure.

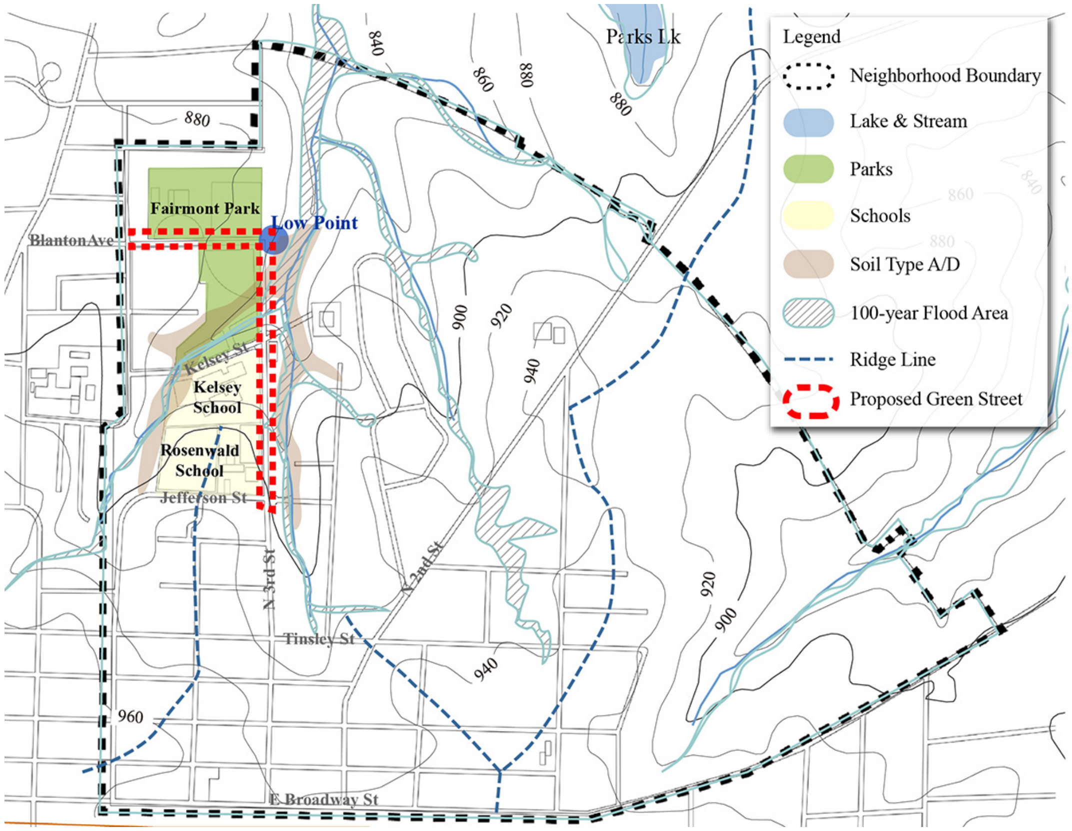


Figure 6.1 Site selection – and environmental condition analysis (By author)

Overlaid with the social context of Fairmont, the selected area in figure 6.2 shows a corridor that travels through Fairmont Park and connects the community center, Kelsey School, and the historic Rosenwald School. There are also opportunities to utilize the existing sidewalk along Blanton Avenue and, the walking path between the two schools to improve the pedestrian circulation of this area and to emphasize the connections to the existing residential areas in the south and west. The existing pedestrian bridge at the south end of the selected site can be utilized for a connection to the planned residential are on Fairmont's east side. In addition, the city's 2024 comprehensive plan outlines a proposed linear green space along the creek (shown as green dash line in figure 6.2), which offers another opportunity to enhance the connection from the selected Green Street site to the east side community.

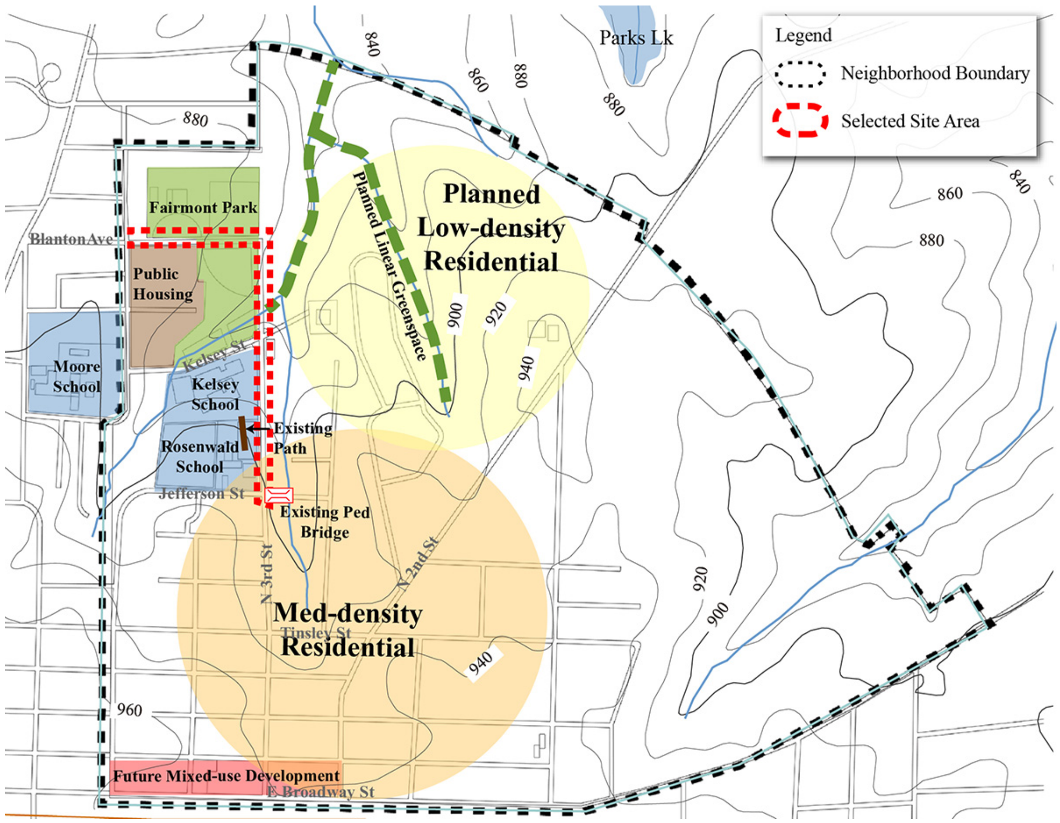


Figure 6.2 Site selection – and social context analysis (By author)

The site is divided into four segments for further assessment and design: Blanton Street Fairmont Park Segment; North 3rd Street Creek Segment; North 3rd Street Kelsey School Segment; and North 3rd Street Historic Rosenwald School Segment (figure 6.3).

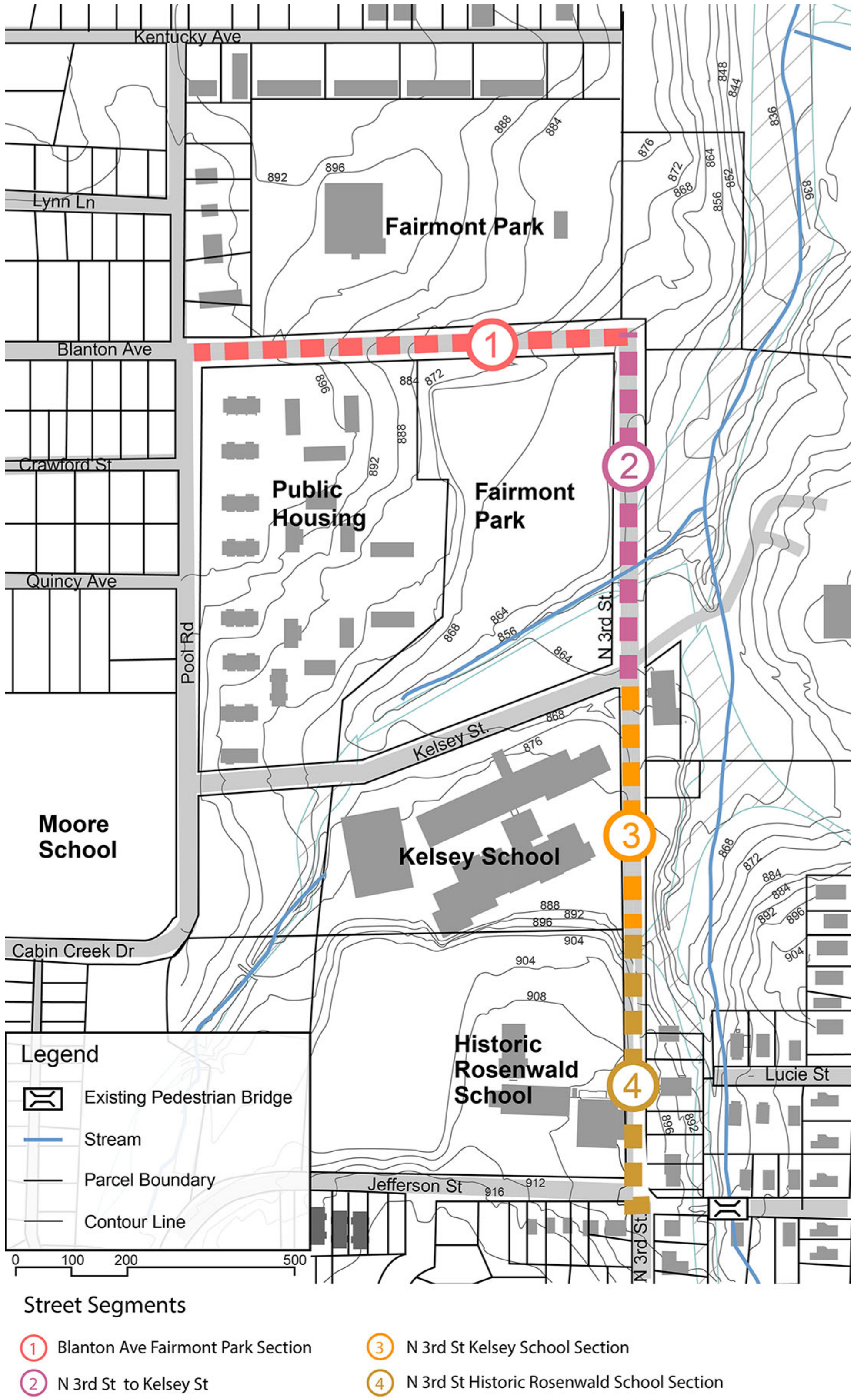


Figure 6.3 Site location and street segments (By author)

Stormwater Management Strategies Selection

Building on the analysis of different options for stormwater facilities outlined in chapter three, any selection of stormwater management strategies should fit the site layout, and natural conditions, as well as the community's context. Due to the fact that there are no development restrictions in Fairmont, modifying streets and parking lots is a viable solution for reducing the total amount of impervious surface at the site. However, from the perspective of historic preservation, any proposed modifications should consider maintaining the current neighborhood appearance and conveying a "small town" feeling. Therefore, it is appropriate to narrow the street width where needed to accommodate proposed stormwater facilities, while also slowing down motor traffic, enhancing the sense a small town neighborhood.

Another strategy to minimize the impervious surface of the site is to add street trees where there is a lack of canopy and limited or restricted to application of stormwater facilities. The proposed streetscape improvement takes into consideration the preservation of the existing large canopy trees while adding more street trees to provide additional shade along the street and the proposed pedestrian paths.

The proposed stormwater BMPs are suitable for application in low-density residential streets and on parking lots. Stormwater curb extensions and vegetated swales fit well in the chosen streets with no additional on-street parking needs. In addition, they have the flexibility to be applied to the existing site layout, such as parking lot entrances, and residential drives. From the perspective of maintaining the site's current rural feeling, these applications contribute less hardscape to the site and create a more natural looking to the streetscape, helping maintain the historic mill town appearance of Fairmont.

Proposed Design

The following pages present each segment's site inventory map, existing conditions analysis, design opportunities, and potential concerns. Based on the analysis, a Green Street design scenario is proposed for each street segment, presenting details and interpretation of the proposed streetscape elements and stormwater facilities.

Segment 1: Blanton Avenue

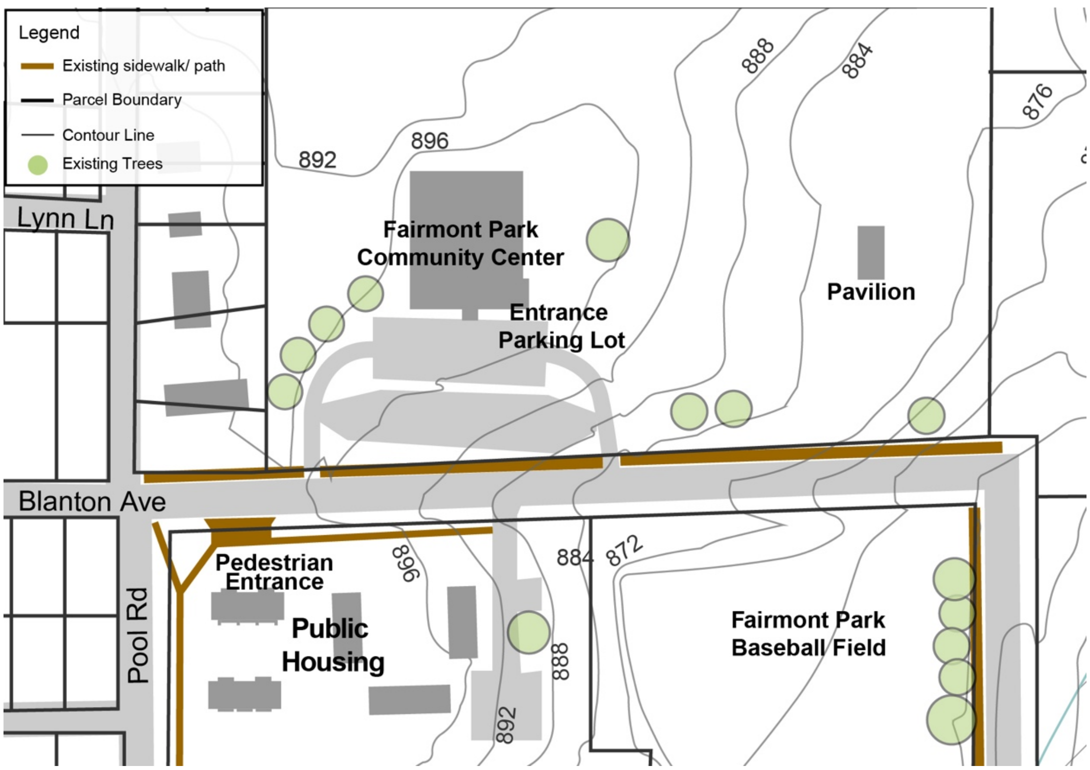


Figure 6.4 Segment1– Existing conditions (By author)

The first segment of Blanton Avenue is from Pool Road to North 3rd Street (figure 6.4). This segment provides access to Fairmont Park and Fairmont Public Housing, connecting the current residents on the west side of the neighborhood to the park. It also potentially connects the current residents on the west side of Fairmont with the future residential area on the east end of Blanton Avenue.

Figure 6.5 View of the Fairmont community center and the entrance parking lot

Figure 6.6 View west of Blanton Avenue showing the existing sidewalk (Photos by author)

Summary of opportunities:

- Propose multi-use paths on the street to make Fairmont Park a strong destination for green street travelers
- Propose sidewalks to connect the existing sidewalk within the public housing property to the existing sidewalk on the west side of North 3rd Streets
- The city of Griffin owns virtually all of the properties along both sides of the street, which are partially required for the project
- Propose safe crossing from public housing to the side path along Fairmont Park;
- Utilize the park entrance as an emphasized green space

The existing conditions of this street section include two 13 foot drive lanes, one 5 foot sidewalk on the north side of the street within the 50 foot right-of-way corridor (Figure 6.9a). There is a minimum of 14 feet of space from the existing road curb to the property line. The condition shows adequate space on the north side to expand the existing sidewalk to a 10foot multi-use path with a 12foot roadside swale on the north side. A 5foot sidewalk is proposed using the space left on the south side to close up the gap of the missing sidewalk from the public housing to North 3rd Street.

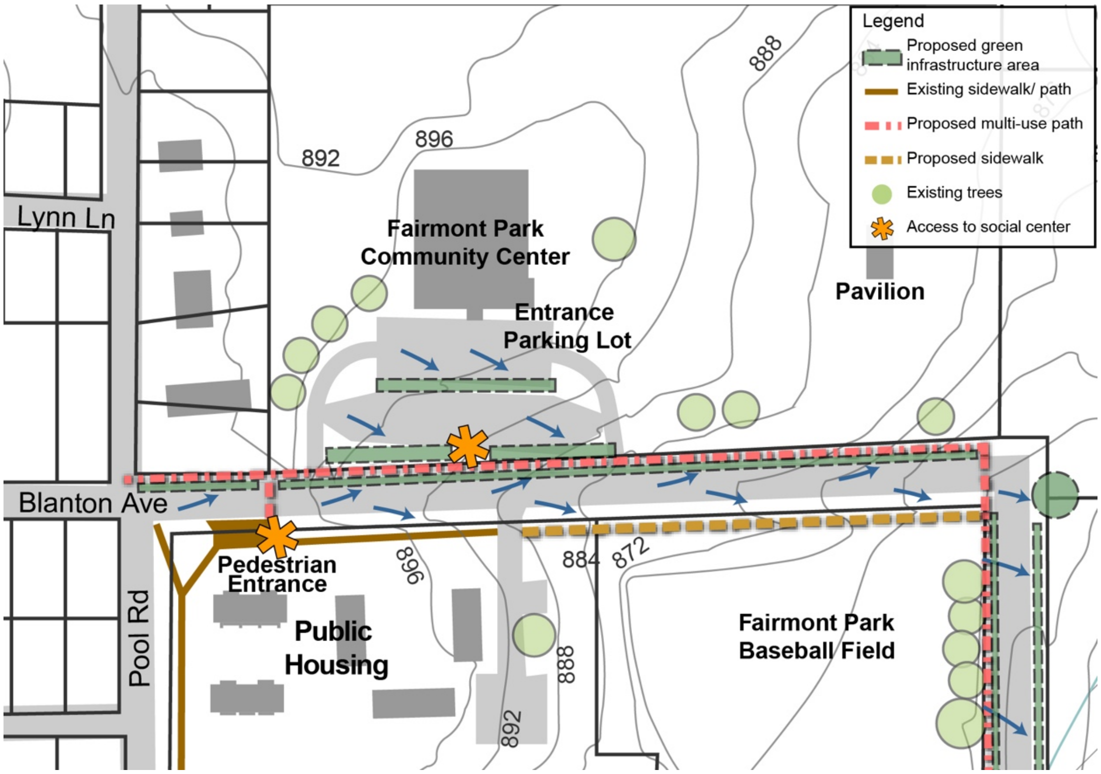
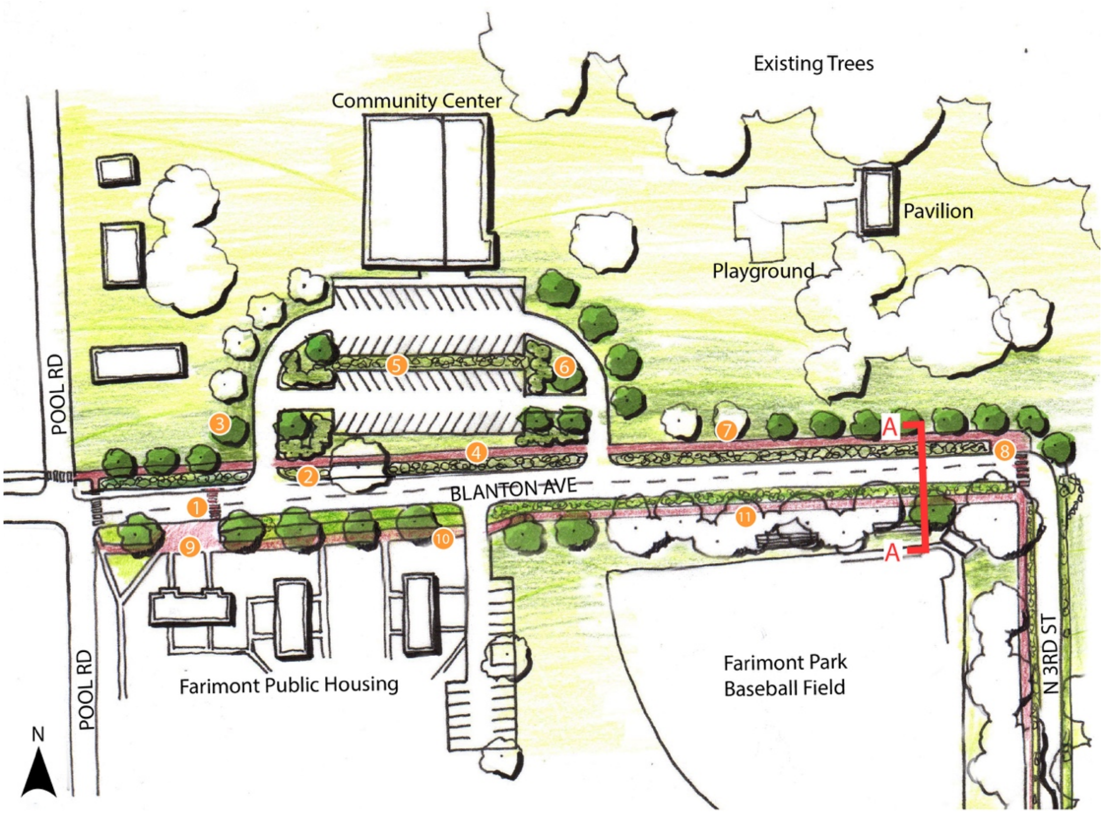


Figure 6.7 Segment1– Analysis map (By author)

Table 6.1 Segment1-Exising Conditions Summary

Street Length (ft)	**880**
Street Width (ft)	26
Right-of-way	50
Sidewalk condition	5' sidewalk on north side
Maximum cross section elevation difference (ft)	4
Adjacent Parking Lot (sq. ft)	21800

The proposed 10foot path provides a welcome pedestrian zone along Fairmont Park in order to serve more users and attract multiple activities, such as jogging, biking, and walking. In addition, a 5foot sidewalk is proposed to work within the current right-of-way width, as well as provide an alternative route on the other side of the street, connecting Fairmont Public Housing with the park. The proposed 12foot roadside retention swale is retrofitted from the existing grass strip, providing a better capacity to temporarily store and infiltrate stormwater runoff from the road surface. The swale separates the pedestrian zone from the street traffic, and facilitates stormwater management for the runoff from the street and the proposed paths and sidewalks. According to the road topography, the low point of this street segment is at the east end of Blanton Avenue, making it the potential location of a stormwater retention pond.



Legend

1. Provide cross walks
2. Proposed 12' wide road side swale
3. New street trees
4. Proposed 10' path
5. Proposed 12' wide parking lot swale
6. Improved landscape area
7. Preserved exisitng trees
8. Enlarged landing area with benchs
9. Farimont Public Housing entrance
10. Existing 5' wide sidewalk
11. Proposed 5' sidewalk

Figure 6.8 Proposed Green Street Design – Segment 1(Drawing by author)

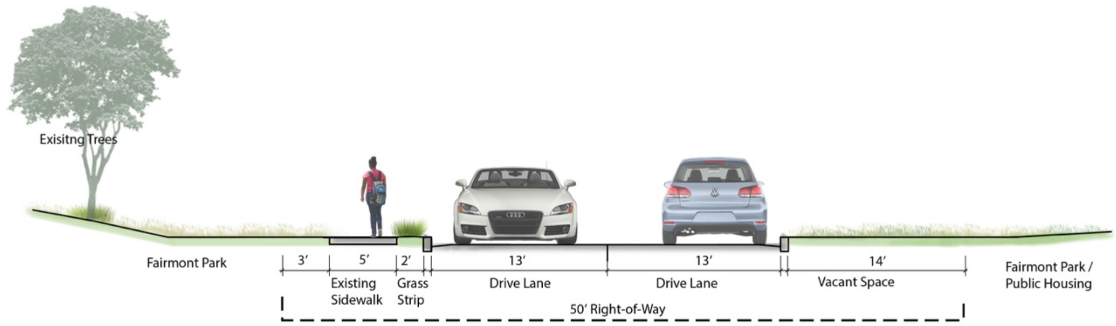


Figure 6.9a Section A-A – Existing street cross section

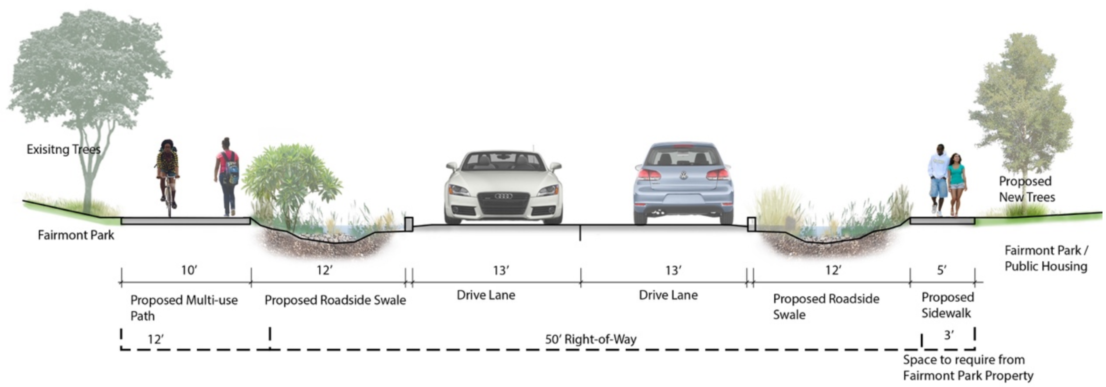


Figure 6.9b Section A-A – Proposed design

Summary of the proposed stormwater treatments:

- Provide approximately 600 linear feet (LF) of 12foot-wide bioswales within the entrance parking lot of the community center,
- 875 LF of 12 foot-wide road side swale along both sides of the street, and
- Approximately 19 new street trees along the proposed path/sidewalk.

Summary of the potential benefits:

- Provides safe and convenient crossing of Blanton Avenue for Fairmont Park users traveling to and from the public housing and adjacent neighborhoods,
- Connects the incomplete sidewalk on the south side of the street, and

- Establishes green space alongside Blanton Avenue as an expansion from Fairmont Park.

Segment 2: North 3rd Street (creek segment)

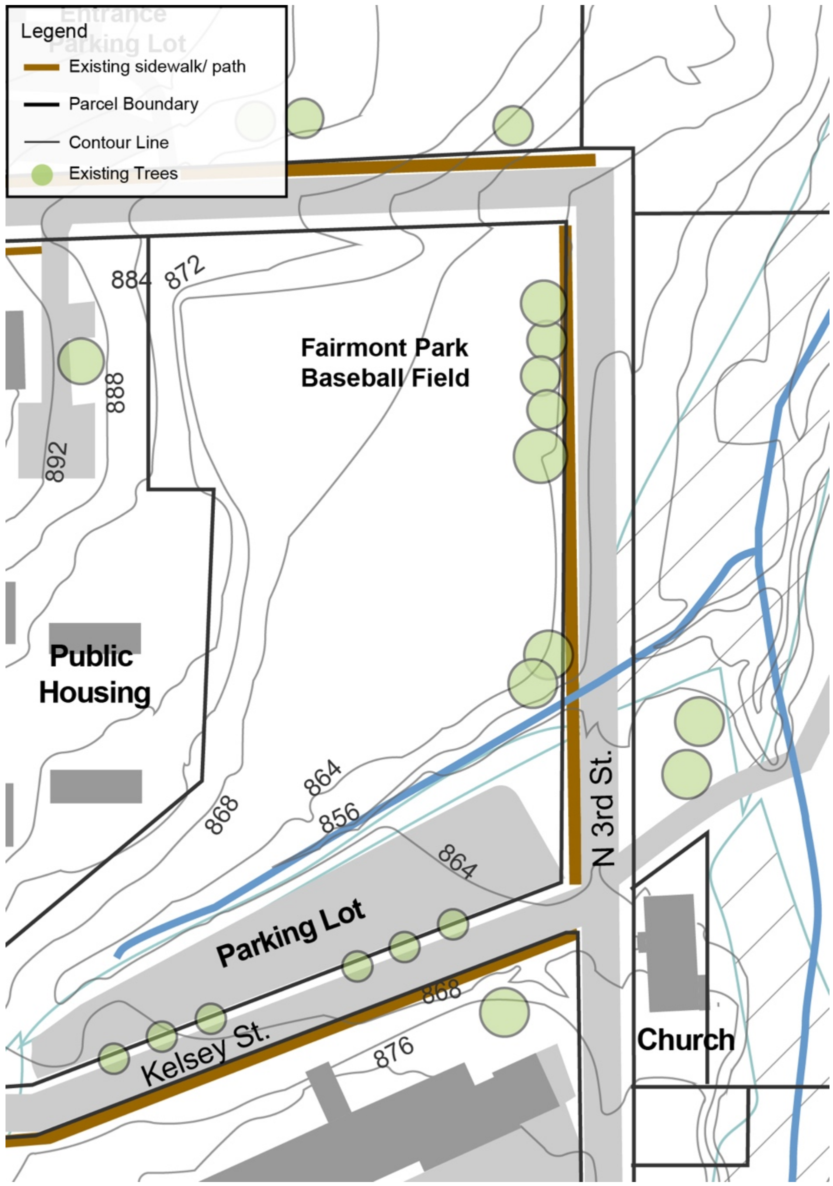


Figure 6.10 Street Segment 2 – Existing conditions (By author)

Figure 6.11 View south of the intersection of Kelsey Street and North 3rd Street showing the existing sidewalk and the parking lot across from Kelsey School (Photo by author)

The proposed design divides North 3rd Street into three parts based on the adjacent property boundary, as well as the different situations of street right-of-way and existing topography. Segment 2 starts from Blanton Avenue to Kelsey Street on North 3rd Street, connecting Fairmont Park with Kelsey School and the Old Rosenwald School (Figure 6.10). With the planned future residential area on the west side, the street shows the potential for improvement to provide a better connection between these two popular social centers.

Table 6.2 Segment2-Exising Conditions Summary

Street Length (ft)	575
Street Width (ft)	26
Right-of-way	50
Sidewalk conditions	5’ sidewalk on west side
Maximum cross section elevation difference (ft)	4
Adjacent Parking Lot (sq. ft)	45200

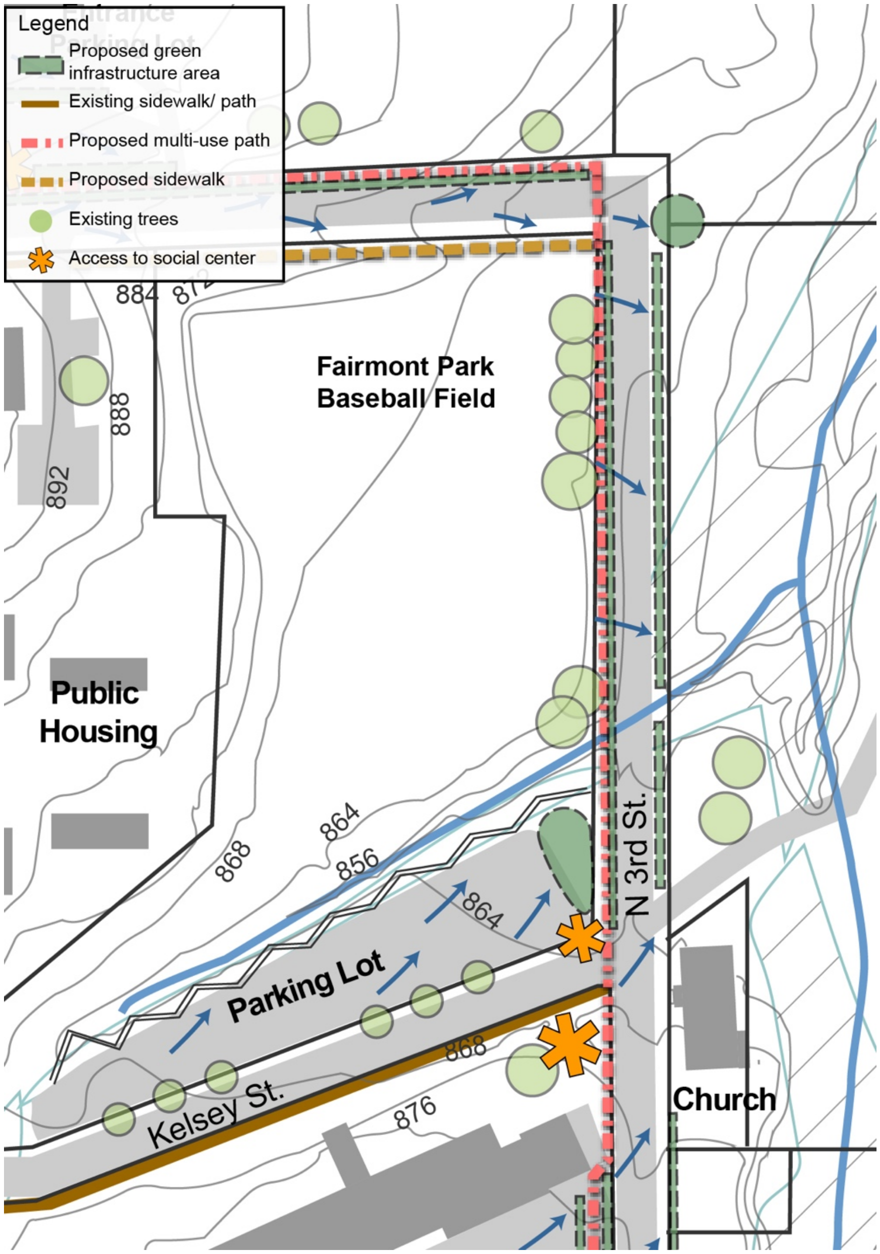
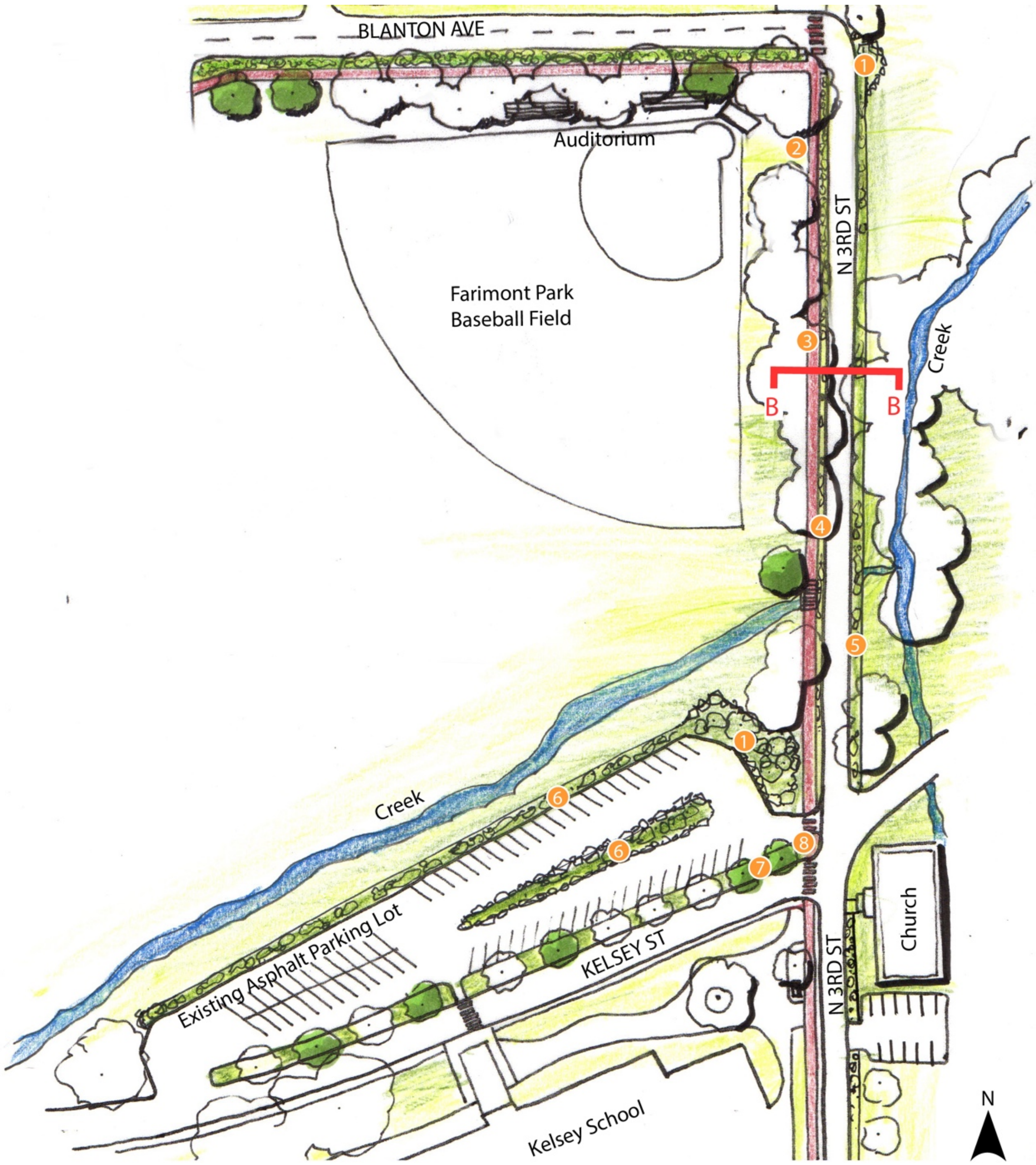


Figure 6.12 Street Segment 2 – Analysis map (By author)

Continuing from Blanton Avenue, segment 2 (figure 6.1) is located next to the Fairmont Park property with a 5foot sidewalk on the west side within the 50foot street right-of-way. However, as shown in Figure 6.10a, the available space on the west side is limited by existing trees and topography. Thus, the design proposes reducing the existing 13foot drive lane to 11 feet in favor of providing a 10foot path as well as accommodating the 5 foot stormwater curb extension as the on-site stormwater treatment within the right-of-way. Stormwater planters work well as curb extensions to fit the limited space and offer a great capacity for capturing runoff. However, they are most suitable for a high-density urban development, whereas stormwater curb extensions match the sense of low to mid-density neighborhood and provide economic benefits as well.

In order to preserve existing large canopy trees along the street adjacent to Fairmont Park, the proposed 10foot multi-use path narrows to 8 feet as shown in Figure 6.10b in dash lines. Moreover, in light of future residential development, streetscape improvements are proposed for the east side of the street. Providing a more open space for development, the proposed 12foot-wide swale is located at the ridge between the street and the creek, holding back the runoff from the street running directly to the river.

The existing parking lot (about an acre in size) located on Kelsey Street across from Kelsey School contributes the most impervious surface within this site segment. Driven by the principle of Green Street design to minimize impervious surface as much as possible, parking lot swales are proposed within and along the lower edge of the parking lot where runoff drains. The swale is enlarged at the low point to the east of the lot and is designed to avoid the State of Georgia 25foot development buffer from the existing creek.



Legend

1. Proposed Bio-retention pond at low point
2. Proposed 10′ path
3. Proposed path narrows to preserve existing trees
4. 5′ wide stormwater curb extenstion
5. 12′ wide roadside swale
6. 12′ wide parking lot swale
7. New street trees
8. Provide crosswalks and island

Figure 6.13 Proposed Green Street Design – Segment 2 (By author)

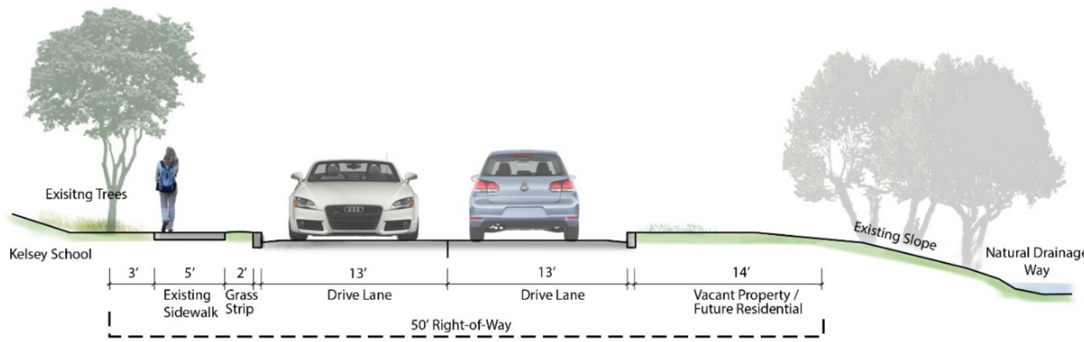


Figure 6.14a Section B-B – Existing Street Cross Section (By author)

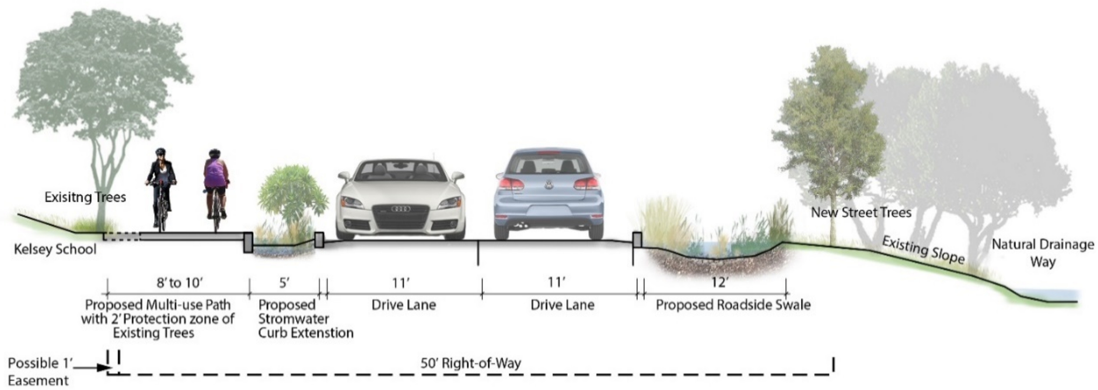


Figure 6.14b Section B-B – Proposed Street Cross Section (By author)

Summary of the proposed stormwater treatments:

- Provide approximately 600 LF of 12foot-wide road side bioretention swale along the west side of the street
- Propose approximately 790 LF of 12foot-wide swale in the existing parking lot on Kelsey School
- Provide approximately 584 LF of 5foot-wide curb extensions as buffer along the proposed path

- Propose twelve new street trees along the street and preserve existing large canopy trees
- Reduce the street width from 13 feet to 11 feet, resulting in a 15% reduction of the street impervious pavements

Summary of the potential benefits:

- Encourages pedestrian and bike circulation along North 3rd Street;
- Provides on-site stormwater management by establishing stormwater facilities, and minimizing stormwater runoff from the street going directly to the adjacent creek;
- Establishes greenspace alongside North 3rd Street as a linear park

Segment 3

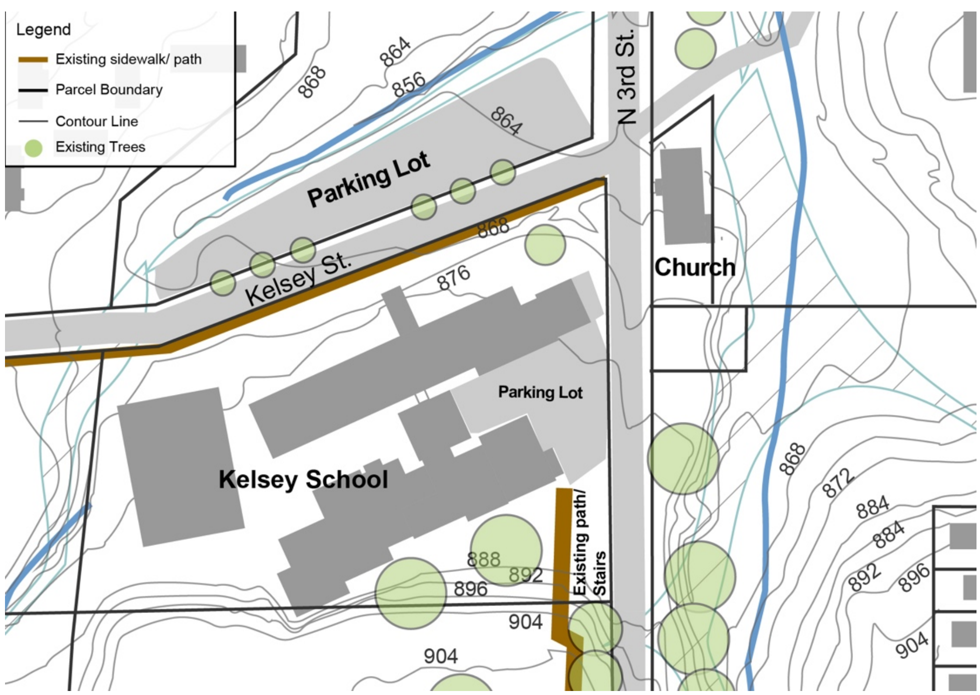


Figure 6.15 Street Segment 3 – Existing conditions (By author)

Segment 3 starts from the south end of segment 2 and ends at the Kelsey School property boundary. The intersection where this segment begins features a high amount of pedestrian activity resulting from the proximity of the parking lots at the school and nearby church. The proposed design aims to claim the available space located at the southwest corner of the intersection as a public open space.

Figure 6.16 Existing slope on the west side of North 3rd Street adjacent to the Rosenwald School

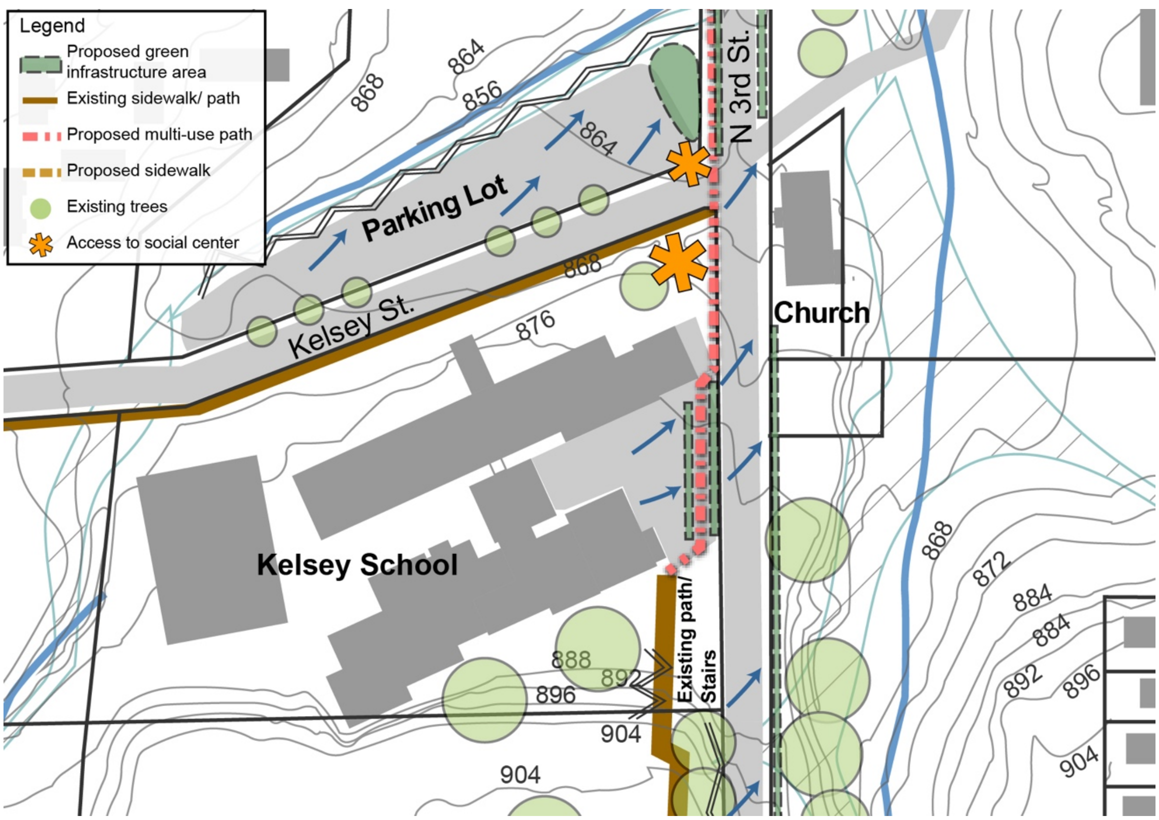


Figure 6.17 Street Segment 3 – Analysis map (By author)

Summary of opportunities:

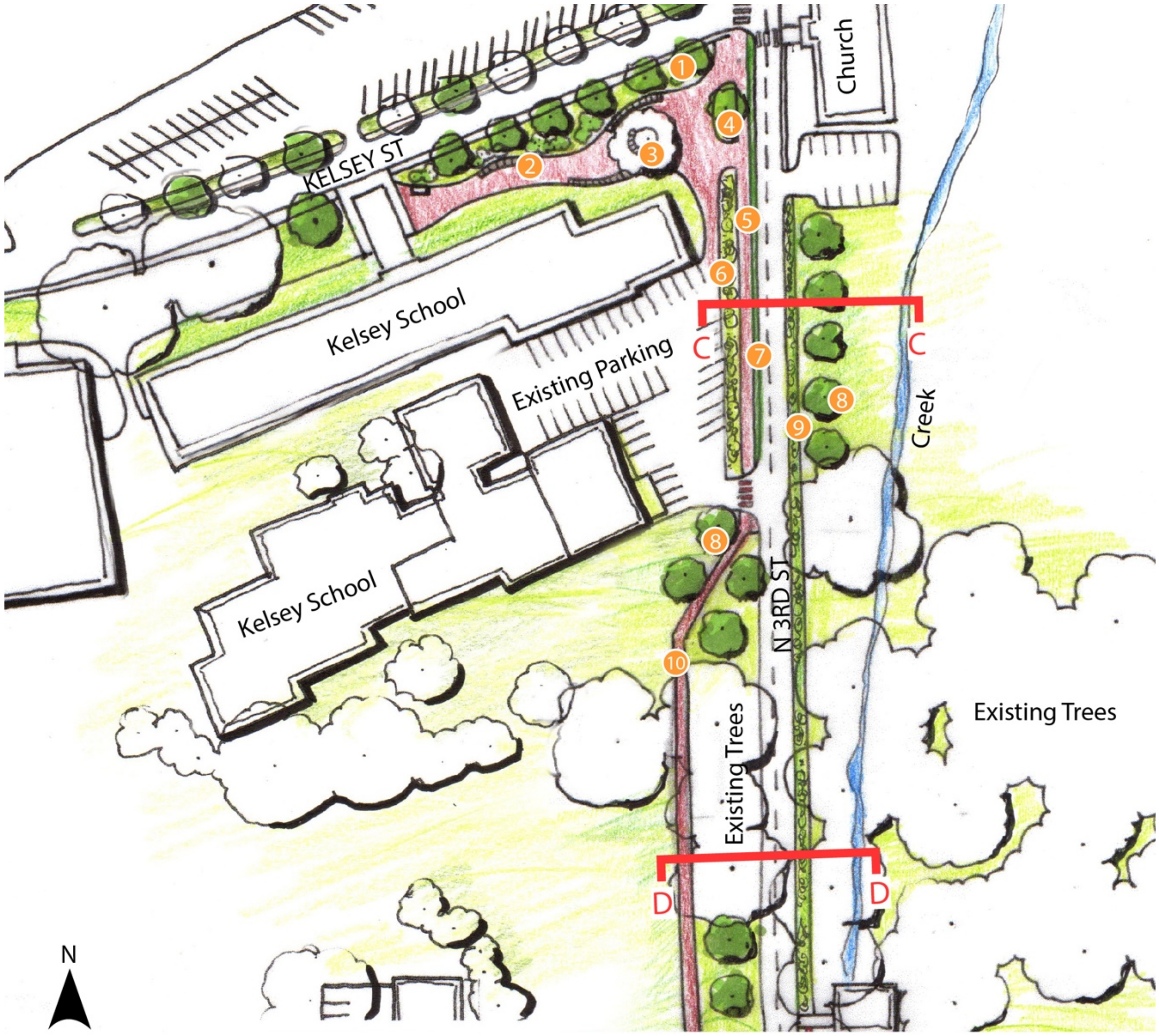
- Proposed public open space utilizing the corner space of the Kelsey School property to provide safe intersection crossing, as well as a pedestrian-friendly zone
- Stormwater facilities could be incorporated within the design for the open space in order to reduce the amount of runoff that needs to be captured from the proposed design
- Utilizing the current trail connecting Kelsey School and Rosenwald School as part of the proposed Green Street design
- Retrofitting the current parking lot at Kelsey School to provide on-site stormwater management
- Enhancing the entry from the residential area on the eastside of the region, incorporating the existing pedestrian bridge which is frequently used by the surrounding residents to get to the school and the park across the street

Table 6.3 Segment3-Existing Conditions Summary

Street Length (ft)	**670**
Street Width (ft)	24
Right-of-way	42
Sidewalk conditions	No sidewalk
Maximum cross section elevation difference (ft)	4
Adjacent Parking Lot (sq. ft)	0

To create a consistent connection for the proposed Green Street design, the 10-foot multi-use path is proposed for the west side of the street, adjacent to the parking lot at Kelsey School. As the entrance of the parking lot disconnects the linear space along the road, the design proposes a 5-foot stormwater curb extension because of its flexibility to be applied with a shortened length in this disconnected situation. The vacant space (currently overgrown) between the parking lot and the street is utilized for the proposed path as well as a parking lot swale. The extra space between the path and the parking lot offers streetscape improvement.

Moving south from Kelsey School to the old Rosenwald School, existing conditions show an 8foot path connecting the Kelsey School parking lot to the community garden area on the Rosenwald property. The current slope on the east side of this street portion is about 15%, which poses challenges to the application of any types of BMPs. Building on the improvement of the existing path, the proposed 10foot multi-use path can enhance the connection between these two schools. Street trees are added along the path to provide a comfortable environment for the users.



Legend

1. Proposed large stormwater curb extension
2. Seating area
3. Seating area around the existing tree
4. Stormwater planter with sculptures
5. Proposed 10′ path
6. Proposed 12′ wide parking lot swale
7. Proposed 5′ stormwater curb extension
8. New street trees
9. Proposed 12′ road side swale
10. Improved existing walking path

Figure 6.18 Proposed Green Street Design – Segment 3 (By author)

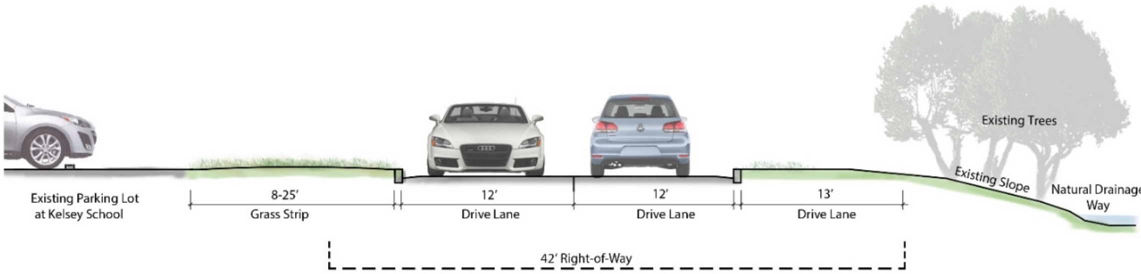


Figure 6.19a Section C-C – Existing Street Cross Section (By author)

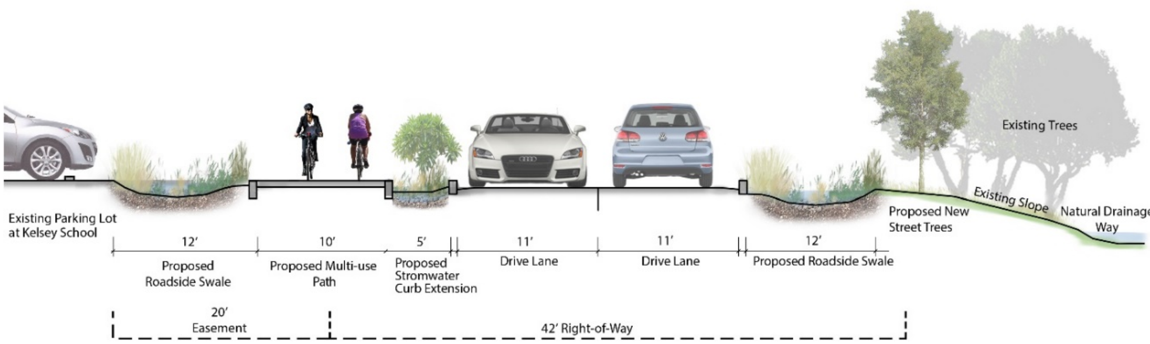


Figure 6.19b Section C-C – Proposed Street Cross Section (By author)

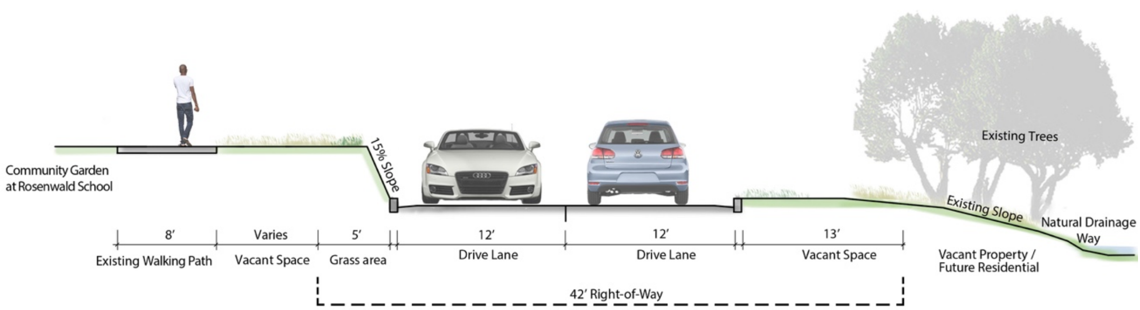


Figure 6.20a Section D-D – Existing Street Cross Section 2 (By author)

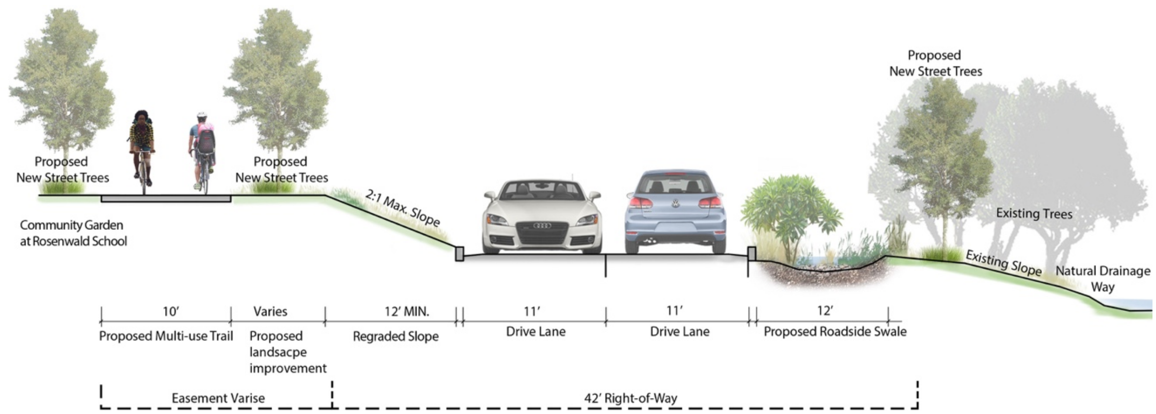


Figure 6.20b Section D-D– Proposed Street Cross Section 2 (By author)

Summary of the proposed stormwater treatments:

- Propose approximately 188 LF of 12foot-wide parking lot swale
- Propose approximately 270 LF of 5foot-wide stormwater curb extension along the proposed path next to the parking lot
- Provide approximately 615 LF of 12foot road side swale along the west side of the street
- Regrade the existing slope to a maximum of 2:1
- Propose 20 new street trees along the street and preserve existing large canopy trees
- Reduce the street wide from 12 feet to 11 feet, which results in a 9% reduction of impervious street pavements

Summary of the potential benefits:

- Encourages pedestrian and bike circulation along North 3rd Street

- Establishes greenspace at the intersection of Kelsey Street and North 3rd Street, offering an opportunity for an entertainment plaza for students, parents, and other residents;
- Enhances the connections between Kelsey School and the old Rosenwald School by retrofitting the existing walking path to a multi-use path;
- Establishes greenspace alongside North 3rd Street as a linear park to extend park qualities to adjacent properties.

Segment 4

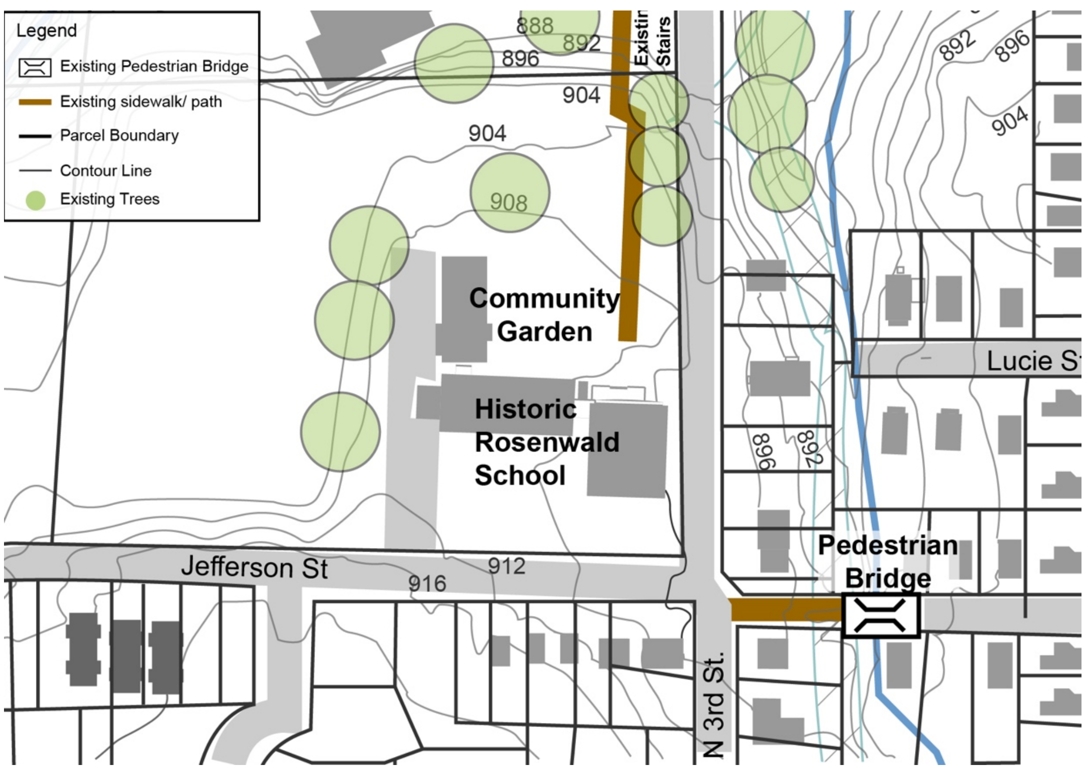


Figure 6.21 Segment 4 – Existing conditions (By author)

Figure 6.22 Existing pedestrian bridge connecting to eastside Fairmont neighborhoods (photo by author)

Table 6.4 Segment4-Exising Conditions Summary

Street Length (ft)	335
Street Width (ft)	24
Right-of-way	40
Sidewalk condition	No sidewalk
Max elevation difference (ft)	1
Adjacent Parking Lot (sq. ft)	0

Identified as a historical site, the Rosenwald School stands out as a community destination in the proposed design. Green Street project principles have the potential to be incorporated into the community redevelopment proposal (Planning and Development Services Department 2007), reclaiming this historic site as an open greenspace. Tying in the existing pedestrian bridge at Jefferson Street to North 3rd Street will create a connection from the east side of Fairmont to the school district and the park.

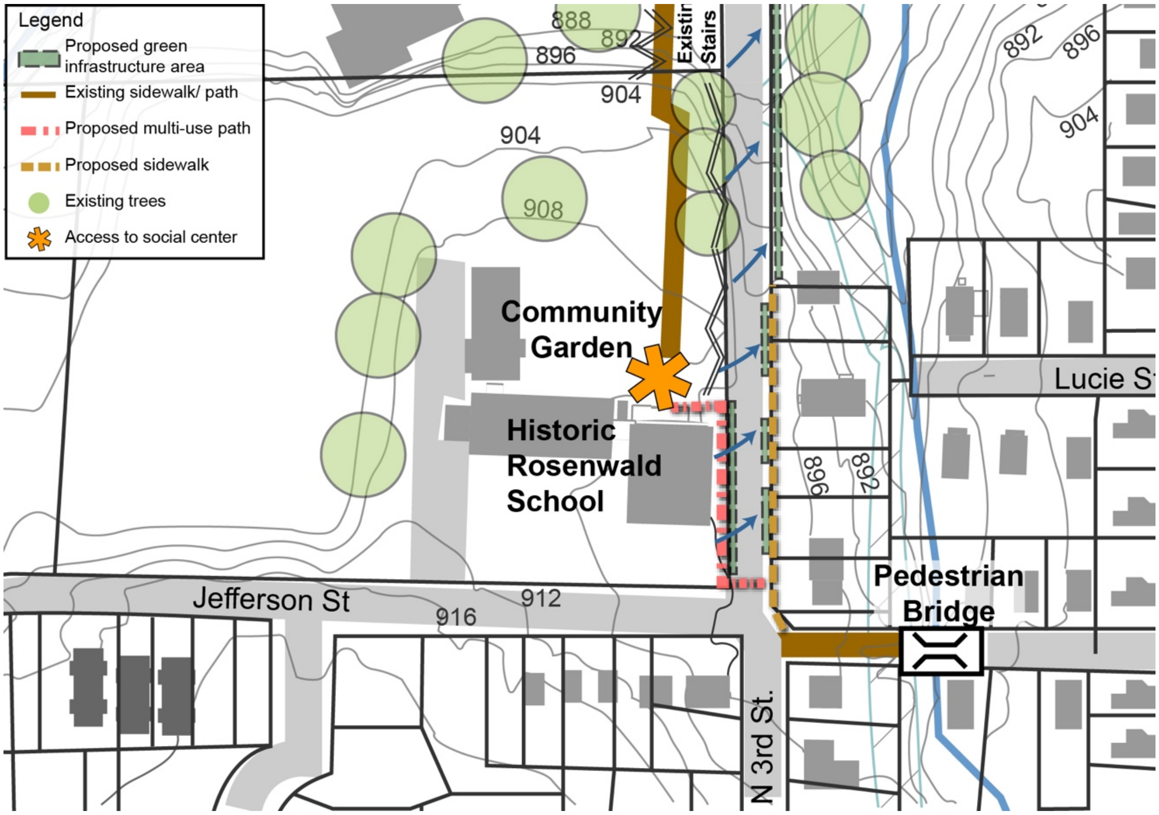
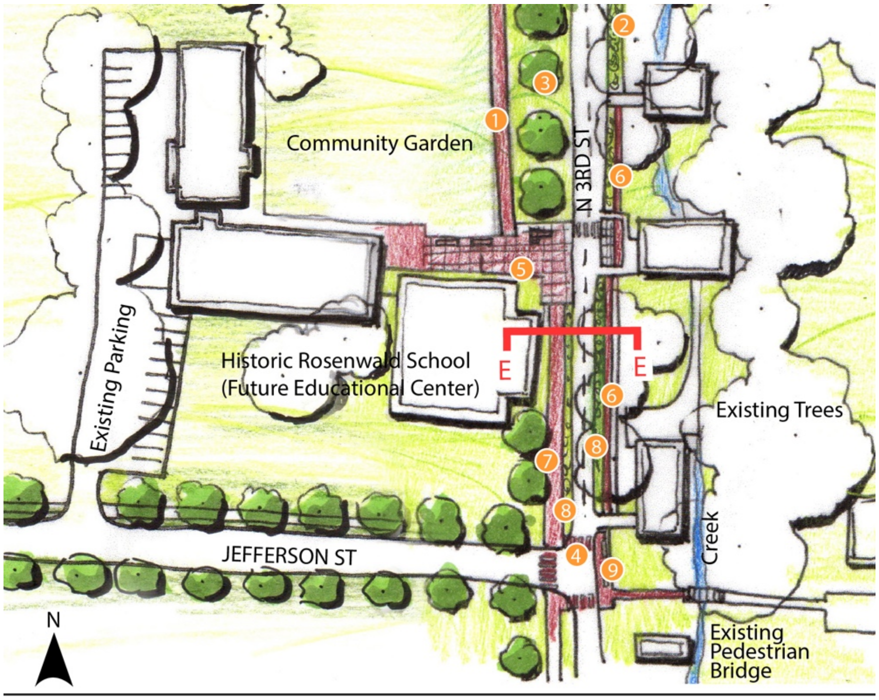


Figure 6.23 Segment 4 – Analysis map (By author)

Summary of opportunities:

- Provide greenspace along in the front of the Rosenwald School, revitalizing the historic school as a cultural destination for the community
- Coordinate with the Griffin Community Center Program and the community garden plan, as well as other public facilities already underway in the Rosenwald School redevelopment plan
- Enhance the entry from the residential area on the eastside of the region, incorporating the existing pedestrian bridge which is frequently-used by the surrounding residents to get to the school and the recreational park across the street



Legend
1. Proposed 10′ path improved from existing path
2. Proposed 12′ wide roadside swale (Segment 3)
3. New street trees
4. Provide crosswalk from residential area to the school
5. Proposed public plaza with seating area
6. Proposed 5′ sidewalk
7. Proposed 12′ path
8. Proposed 5′ stormwater curb extension
9. Landing area with seatings, connecting to the existing pedestrian bridge

Figure 6.24 Proposed Green Street Design – Segment 4 (By author)

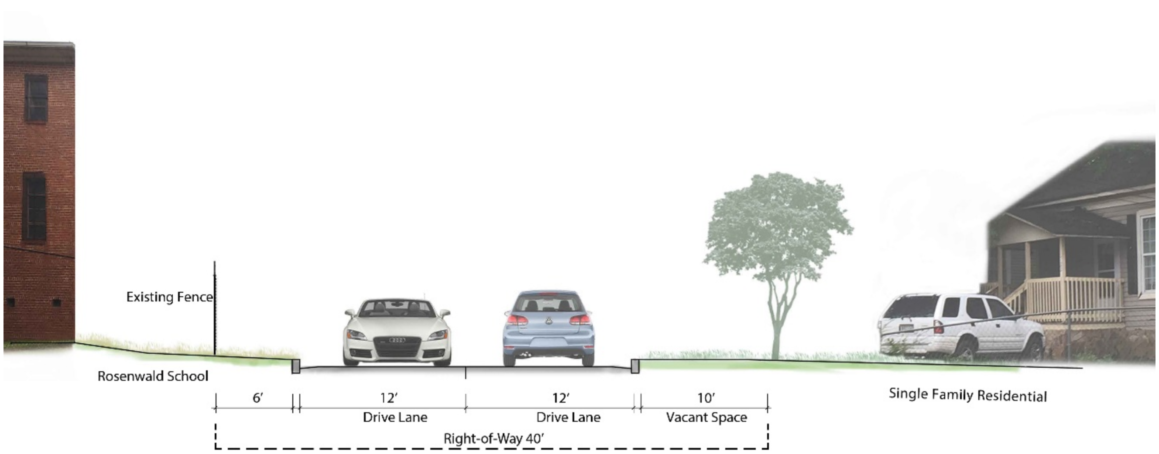


Figure 6.25a Section E-E – Existing Street Cross Section (By author)

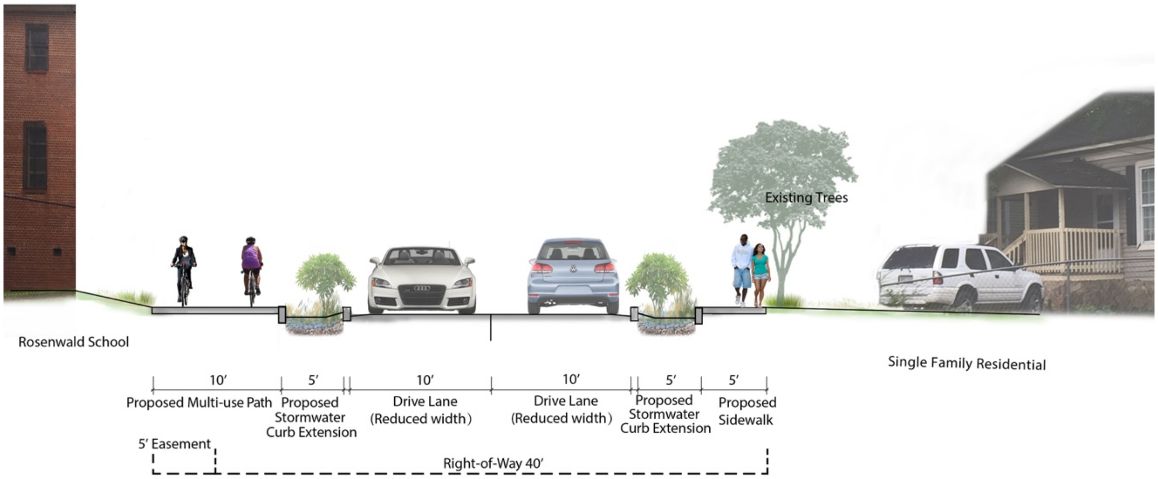


Figure 6.25b Section E-E – Proposed Street Cross Section (By author)

Some of these opportunities require space from the Rosenwald School property, which is owned by the city. However, with an existing historic gym located adjacent to the road, the available space from the road edge to the 2-foot clear zone from the building is limited to approximately twelve feet. In addition, current single family residence properties are located ten feet from the other side of the road and continue approximately 300 LF from the intersection towards the north. As a consequence, to accommodate the 40-foot right-of-way width and the limitations of the existing buildings on both sides of the street, the proposed design requires a road width reduction and keeps the two-way drive lanes. The proposed design also includes a ten-foot-wide multi-use path along the historic gym, entering the proposed public plaza at the school entrance. The proposed five-foot-wide sidewalk provides connections from the residential area to the future education center, as well as connections to the existing pedestrian bridge at the south corner of the intersection. Stormwater curb extensions along the proposed path and sidewalk allow the flexibility of being applied within a short distance, as well as in a limited road width.

Figure 6.26a Existing conditions on North 3rd Street adjacent to the old Rosenwald School property

(source: google map)

Figure 6.26b Proposed Green Street on North 3rd Street (by author)

Summary of proposed stormwater treatments:

- Propose approximately 190 LF of 5foot stormwater curb extensions on the west side of the street and approximately 240 LF along the east side of the street
- Reduce the street width from 12 feet to 11 feet, which results in a 9% reduction of impervious street pavements
- Propose 4 new street trees along the street and preserve existing large canopy trees

Summary of potential benefits:

- Encourages pedestrian and bike circulation along North 3rd Street
- Creates a safe environment for walking and biking to the school district
- Maintains the historical buildings' façade as historically distinct, offering future commercial and public greenspace opportunities
- Provides connections for east side residents to the redeveloped public facilities by including the pedestrian bridges

Summary of the Design Application

1. Proposed Green Street design locates and connects an underserved neighborhood with its current and future public greenspaces.

Fairmont Park, as well as the school complex including the Kelsey School and historic Rosenwald School, was identified as a public center for the Fairmont neighborhood as a whole. Developed from a mill neighborhood, the Fairmont community seeks a transition to providing a livable environment for its residents, while preserving and utilizing the historic buildings as a cultural resource. The Green Street plan was proposed to help build strong connections from the adjacent residential areas to this public activity center, and provide a safe, friendly travel environment to encourage multiple pedestrian and bicyclist activities. The proposed multi-use path was associated with differently sized seating areas and plazas to support the users' exercise, rest, and entertainment.

2. Common considerations for applying stormwater BMPs in the design

In order to maximize the use of native soil infiltration rate, stormwater BMPs should be applied within the areas that have a HSG B of A soil, which is indicated in the site's soil survey map.

The proposed design should minimize the disturbance of natural habitat space and existing native vegetation. Strategies such as tree protection structures and narrowing proposed sidewalk and multi-use paths to retain existing large canopy trees should be applied within the design.

3. Specific criteria for stormwater BMPs in design

Introduced in Chapter 3, the different stormwater facilities have their benefits and drawbacks. Thus, the proposed design should select the BMP or, in most cases, a combination of multiple types of BMPs to fit the site conditions and context.

Specifically speaking, roadside swales are suitable when there is adequate space alongside the street, where stormwater collection and infiltration is needed to prevent runoff from the road surface directly entering the nearby natural drainage way. In the proposed design, this type of BMP is widely applied adjacent to North 3rd Street and Blanton Avenue within the sufficient available space.

Vegetated swales in the parking lot are another primary BMP proposed in the design. They are suitable for this particular site to transform a portion of the larger sized parking lots into vegetated areas, disconnecting a sizeable amount of impervious surface for stormwater treatment purposes.

Stormwater curb extensions are generally inexpensive to build and increase the streetscape by adding vegetation areas. Compared to stormwater planters, they contribute less hardscape to the site, which is more contextually appropriate in the low-density town community setting of the Fairmont neighborhood. In addition, it offers flexibility in shapes and sizes. Taking the proposed design on North 3rd Street as an example, the width of the right-of-way as well as the street differs throughout the road; when space is narrowed, stormwater curb extensions convert a portion of the impervious surface of the street into stormwater facilities, and provide a further benefit of calming street traffic.

CHAPTER 7

EVALUATION

This chapter describes the stormwater management measurement methodology of using the National Stormwater Management Calculator, provided by the Green Values Stormwater Toolbox. The results will focus on runoff volume reduction, and provide recommendations for each design segment as detailed in chapter 6. The chapter concludes with a comparison of the calculation results between the proposed design and the existing site conditions, discussing how the proposed design improves the stormwater management capacity.

National Stormwater Management Calculator Methodology

The National Green Values Calculator (GVC) is a web-based application developed by the Center for Neighborhood Technology (CNT). It compares performance, costs, and environmental and economic benefits of low-impact developments (LIDs) to conventional management practices. The National GVC provides a quantified analysis of LID environmental benefits, which include reduced stormwater runoff volume and maintenance savings, carbon sequestration, reduced energy use, and groundwater recharge (Center for Neighborhood Technology 2016). The main goal for the calculator is to recommend a range of green infrastructure best management practices (BMPs) that help the user to determine the most economically efficient combination that meets their stormwater runoff reduction goal for the chosen site (Center for Neighborhood Technology 2009).

Users need to input information such as the site location, the lot size, and soil type (Figure 7.1). Based on the given location, the site precipitation data is generated from the nearest National Oceanic Atmospheric Administration (NOAA) weather station and automatically provided by the application.

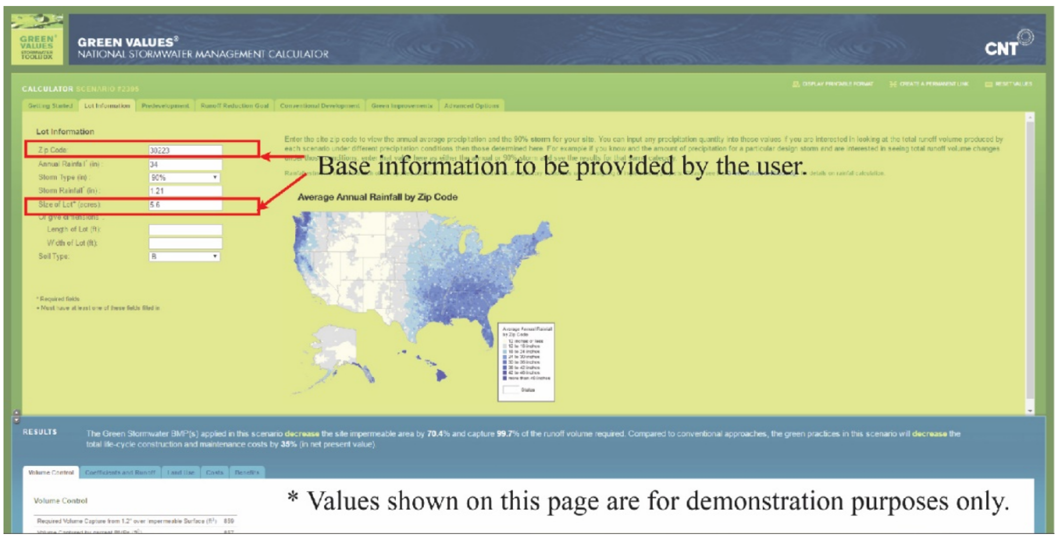


Figure 7.1 User to provide site information to begin (Source: Green Values; figure made by author)

The runoff reduction goal selected for the design application in the thesis was based on Georgia's stormwater management standard (Figure 7.2). The Georgia Stormwater Management Manual Volume 2 states Georgia's minimum stormwater management system's performance standards – are that both structural stormwater controls and BMPs capture and treat the runoff volume resulting from the first 1.2 inches of rainfall on a site (AMEC 2001).

Moreover, all of the existing vegetated areas will contribute the same capacity of capturing stormwater, while changes to impervious areas impact the difference between the results of the existing conditions and the proposed design. Consequently, the stormwater reduction goal was set to calculate the volume of runoff captured over the impermeable surface.

Figure 7.2 Selecting runoff volume reduction goal for the site
(Source: Green Values; figure made by author)

Users need to then provide conventional development conditions data and to define the green infrastructure in the green scenario (figure 7.3, 7.4). The conventional development data calculate the total amount of impervious areas on site, including roof size, parking lot area, street, sidewalk, and driveway. Green improvement allows users to

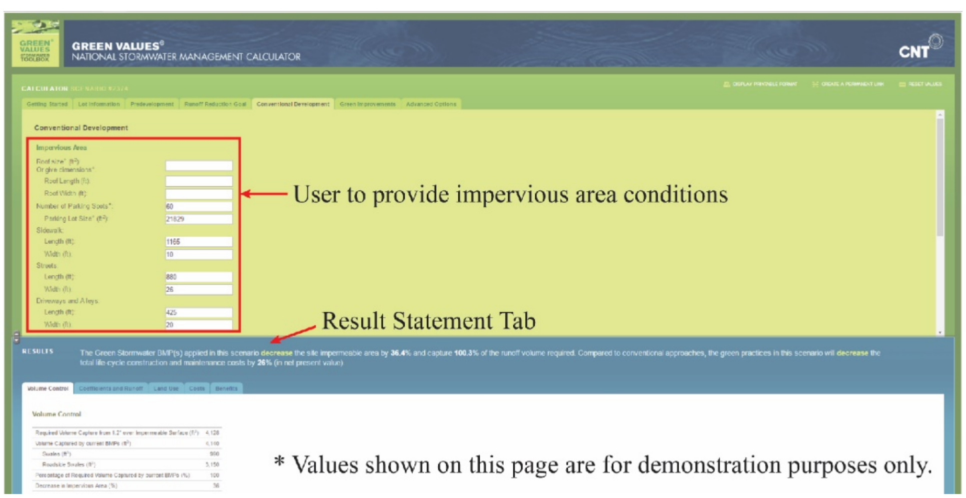


Figure 7.3 User to input conventional development data (Source: Green Values; figure made by

select from the given BMP options to determine the best combination to meet runoff reduction goals.

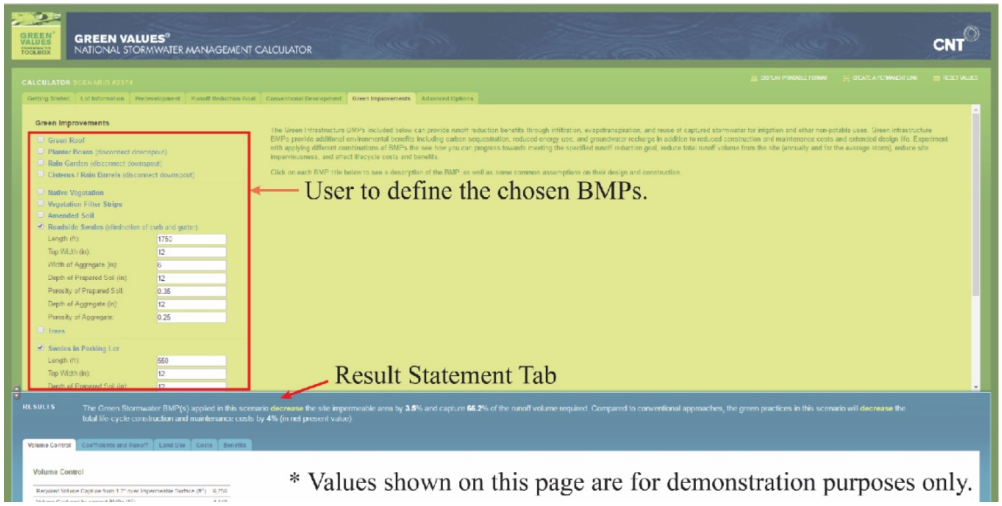


Figure 7.4 User to define Green improvement (BMPs) for the site

(Source: Green values; figure made by author)

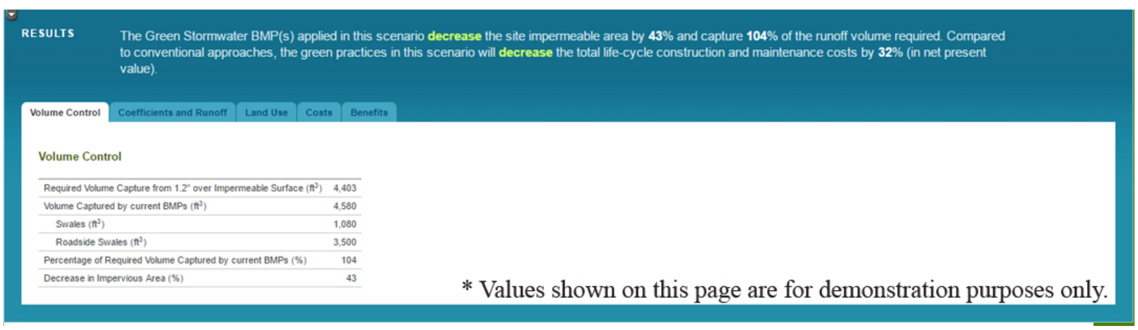


Figure 7.5 Results tab showing the runoff volume capture capability

(Source: Green values; figure made by author)

The result statement tab at the bottom of the page (shown in figure 7.3 and 7.4) is constantly updated based on the defined site conditions and BMPs. Users are able to see the affect of different choices continuously when inputting different BMP selections. The results are presented separately in different tabs, including the specified amount of runoff reductions, changes in the total runoff volume for the conventional and green scenarios, and detail on life cycle cost and analysis (figure 7.5). Based on the information provided by the user, the National GVC gives out two major hydrologic results: the runoff volume capture capability of the BMPs defined for the green scenarios; and the total runoff volume produced by pre-development, conventional development, and green development scenarios.

The runoff volume capture capacity is determined by the area of the BMP and the depth and void ratio of the sub-layers of the BMP (Center for Neighborhood Technology 2016). The calculator sums the volume capacity of each BMP to present whether or not the selected green scenario achieves the site runoff volume reduction goal. It also provides the percentage of required volume captured by the selected green scenario. The percentage of decrease in impervious area is determined by the total area of the selected BMP, as well as the effect of tree canopies.

Site Baseline Condition

The basic lot information repeated in each segment is:

- Zip code: 30223
- Annual rainfall: 34 inches
- Stormwater type: 90%
- Storm rainfall: 1.21 inches
- Soil type: B

Lot size was provided by the total area of the street segment's adjacent parcel, though, the overall size of the lot does not impact the final calculation results. However, the total amount of impervious surface, which was specified in each segment, does. The impervious areas counted in the calculation are the size of the parking lots adjacent to the street segments, and the width and length of the existing sidewalks, streets, and driveways.

Existing trees prevent stormwater from becoming runoff by intercepting rainfall through their canopies. According to the explanation of the results earlier in this chapter, the percentage of decrease in impervious area calculates the impact of the tree canopies on site. Therefore, in the site existing condition calculation, the decrease in impervious area are contributed from the existing trees. The quantity of the existing trees was estimated by counting the number of trees that have a canopy over 1000 ft^2.

The following pages present the existing conditions data for each design segment as defined in Chapter 6.

The existing conditions show that:

In segment 1,

- Required Volume Capture from 1.5" over Impermeable Surface: 5,331ft^3
- Total volume of stormwater captured by current BMPs: 0 ft^3
- Percentage of required volume captured by current BMPs: 0%
- Decrease in impervious area: 22%

In segment 2,

- Required Volume Capture from 1.5" over Impermeable Surface: 4,967 ft^3
- Total volume of stormwater captured by current BMPs: 0 ft^3
- Percentage of required volume captured by current BMPs: 0%
- Decrease in impervious area: 22.2%

In segment 3,

- Required Volume Capture from 1.5" over Impermeable Surface: 3,556 ft^3

- Total volume of stormwater captured by current BMPs: 0 ft^3
- Percentage of required volume captured by current BMPs: 0%
- Decrease in impervious area: 18%

In segment 4,

- Required Volume Capture from 1.5" over Impermeable Surface: 304ft^3
- Total volume of stormwater captured by current BMPs: 0 ft^3
- Percentage of required volume captured by current BMPs: 0%
- Decrease in impervious area: 62%

Table 7.1 Segment 1 - Existing Conditions

Segment 1	**Existing Conditions**
Lot Information	
Zip Code	30223
Annual Rainfall (in)	34
Storm Type (in)	90%
Storm Rainfall (in)	1.21
Size of Lot (acres)	10.65
Soil Type	B
Runoff Volume Reduction Goal	
Custom	
Precipitation Depth Capture (in):	1.2
Volume Captured Over:	Impermeable Surface
Required Volume to Capture On Site (ft^3):	5,331
Conventional Development	
Impervious Area	
Parking Lot Size (ft^2):	31400
Sidewalk	
Length (ft)	1100
Width (ft)	5
Street	
Length (ft)	880
Width (ft)	26
Driveway and Alleys:	
Length (ft)	425
Width (ft)	20
Green Improvement	
Trees	
Quantity	15
Average Canopy	1000
Results	
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	5,331
Volume Captured by current BMPs (ft^3)	0
Percentage of Required Volume Captured by current BMPs (%)	0
Decrease in Impervious Area (%)	22

Table 7.2 Segment 2 - Existing Conditions

Segment 2	Existing Conditions
Lot Information	
Zip Code	30223
Annual Rainfall (in)	34
Storm Type (in)	90%
Storm Rainfall (in)	1.21
Size of Lot (acres)	6.2
Soil Type	B
Runoff Volume Reduction Goal	
Custom	
Precipitation Depth Capture (in):	1.2
Volume Captured Over:	Impermeable Surface
Required Volume to Capture On Site (ft^3):	4,907
Conventional Development	
Impervious Area	
Parking Lot Size (ft^2):	45200
Sidewalk	
Length (ft)	584
Width (ft)	5
Street	
Length (ft)	575
Width (ft)	26
Green Improvement	
Trees	
Quantity	14
Average Canopy	1000
Results	
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	4,907
Volume Captured by current BMPs (ft^3)	0
Percentage of Required Volume Captured by current BMPs (%)	0
Decrease in Impervious Area (%)	22.2

Table 7.3 Segment 3 - Existing Conditions

Segment 3	**Existing Conditions**
Lot Information	
Zip Code	30223
Annual Rainfall (in)	34
Storm Type (in)	90%
Storm Rainfall (in)	1.21
Size of Lot (acres)	8.9
Soil Type	B
Runoff Volume Reduction Goal	
Custom	
Precipitation Depth Capture (in):	1.2
Volume Captured Over:	Impermeable Surface
Required Volume to Capture On Site (ft^3):	3,556
Conventional Development	
Impervious Area	
Parking Lot Size (ft^2):	27430
Sidewalk	
Length (ft)	
Width (ft)	
Street	
Length (ft)	672
Width (ft)	24
Green Improvement	
Trees	
Quantity	8
Average Canopy	1000
Results	
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	3,556
Volume Captured by current BMPs (ft^3)	0
Percentage of Required Volume Captured by current BMPs (%)	0
Decrease in Impervious Area (%)	18

Table 7.4 Segment 4 - Existing Conditions

Segment 4	**Existing Conditions**
Lot Information	
Zip Code	30223
Annual Rainfall (in)	34
Storm Type (in)	90%
Storm Rainfall (in)	1.21
Size of Lot (acres)	4.6
Soil Type	B
Runoff Volume Reduction Goal	
Custom	
Precipitation Depth Capture (in):	1.2
Volume Captured Over:	Impermeable Surface
Required Volume to Capture On Site (ft^3):	304
Conventional Development	
Impervious Area	
Parking Lot Size (ft^2):	
Sidewalk	
Length (ft)	
Width (ft)	
Street	
Length (ft)	335
Width (ft)	24
Green Improvement	
Trees	
Quantity	5
Average Canopy	1000
Results	
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	304
Volume Captured by current BMPs (ft^3)	0
Percentage of Required Volume Captured by current BMPs (%)	0
Decrease in Impervious Area (%)	62

Proposed Design Scenario Results

The following pages present a comparison between the results of the existing conditions and the proposed scenario for each design segment as defined in Chapter 6. Specific notes are provided below for clarifying the calculation process:

- In segment 3 and segment 4, the area of the proposed public plaza was categorized as parking lot area to be counted in the calculation.
- Both of the existing five foot-wide sidewalk and the proposed five foot-wide multi-use path were calculated under the tab "sidewalk" with a defined width of ten feet. In order to indicate the exact amount of impervious surface, the length of any existing five foot sidewalk was divided in half to be added to the total length, while the actual lengths of the 10foot multi-use path were used for the calculation. For example, the length of the existing 5foot sidewalk on the south side of Blanton Avenue is 280 LF. The number to be added in the calculator should be 140 LF.
- All proposed BMPs were calculated using the default values provided by the calculator to obtain their average performance, such as depth of the aggregate layer and depth of amended soil substrate. See appendix 2 to 5 for detailed values;
- Quantities of the proposed trees were calculated based on an assumption about the maturity of proposed tree's canopy being about 1000 ft^2.

Stormwater Management Calculator results of the design proposal show that:

In segment 1,

- Required Volume Capture from 1.5" over Impermeable Surface: 4,403ft^3

- Total volume of stormwater captured by current BMPs: 4,580ft^3
- Percentage of required volume captured by current BMPs: 104%
- Decrease in impervious area: 43%

In segment 2,

- Required Volume Capture from 1.5" over Impermeable Surface: 3,636ft^3
- Total volume of stormwater captured by current BMPs: 3,603ft^3
- Percentage of required volume captured by current BMPs: 99%
- Decrease in impervious area: 45%

In segment 3,

- Required Volume Capture from 1.5" over Impermeable Surface: 1,996ft^3
- Total volume of stormwater captured by current BMPs: 2,063ft^3
- Percentage of required volume captured by current BMPs: 103%
- Decrease in impervious area: 60%

In segment 4,

- Required Volume Capture from 1.5" over Impermeable Surface: 6,77ft3
- Total volume of stormwater captured by current BMPs: 7,53ft3
- Percentage of required volume captured by current BMPs: 111%
- Decrease in impervious area: 59%

The results for proposed design scenario presented an average of 104% of required volume captured by BMPs and an average of 52% decrease of impervious area.

Table 7.5 Segment 1 - Proposed Scenario

Segment 1	Existing Conditions	Proposed Scenario
Lot Information		
Zip Code	30223	
Annual Rainfall (in)	34	
Storm Type (in)	90%	
Storm Rainfall (in)	1.21	
Size of Lot (acres)	10.65	
Soil Type	B	
Runoff Volume Reduction Goal		
Custom		
Precipitation Depth Capture (in):	1.2	1.2
Volume Captured Over:	Impermeable Surface	Impermeable Surface
Required Volume to Capture On Site:	5,331	4,403
Conventional Development		
Impervious Area		
Parking Lot Size (ft2):	31400	31400
Sidewalk		
Length (ft)	1100	1440
Width (ft)	5	10
Street		
Length (ft)	880	880
Width (ft)	26	26
Driveway and Alleys:		
Length (ft)	425	425
Width (ft)	20	20
Green Improvement		
Roadside Swales		
Length (ft):		1750
Top Width (in):		12
Trees		
Quantity	15	34
Average Canopy	1000	1000
Swales in Parking Lot		
Length (ft)		600
Width (ft)		12

Table 7.5 to be continued in next page

Table 7.5 continued

Results		
Required Volume to Capture from 1.2” over Impermeable Surface (ft^3)	5,331	4,403
Volume Captured by current BMPs (ft^3)	0	4,580
Road side swales (ft^3)		3,500
Swales (ft^3)		1,080
Percentage of Required Volume Captured by current BMPs (%)	0	104
Decrease in Impervious Area (%)	22	43

Table 7.6 Segment 2 - Proposed Scenario

Segment 2	Existing Conditions	Proposed Scenario
Lot Information		
Zip Code	30223	
Annual Rainfall (in)	34	
Storm Type (in)	90%	
Storm Rainfall (in)	1.21	
Size of Lot (acres)	6.2	
Soil Type	B	
Runoff Volume Reduction Goal		
Custom		
Precipitation Depth Capture (in):	1.2	1.2
Volume Captured Over:	Impermeable Surface	Impermeable Surface
Required Volume to Capture On Site:	4,907	3,636
Conventional Development		
Impervious Area		
Parking Lot Size (ft2):	45200	45200
Sidewalk		
Length (ft)	584	584
Width (ft)	5	10
Street		
Length (ft)	575	575
Width (ft)	26	26
Green Improvement		
Curb Extensions		
Length (ft)		584
Width (ft)		5
Roadside Swales		
Length (ft):		600
Top Width (in):		12
Trees		
Quantity	14	26
Average Canopy	1000	1000

Table 7.6 to be continued in next page

Table 7.6 continued

Swales in Parking Lot		
Length (ft)		790
Width (ft)		12
Reduced Street Width		
Amount (%)		15%
Results		
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	4,907	3,636
Volume Captured by current BMPs (ft^3)	0	3,603
Curb Extension		1,022
Road side swales (ft^3)		1,501
Swales (ft^3)		1,080
Percentage of Required Volume Captured by current BMPs (%)	0	99
Decrease in Impervious Area (%)	22.2	45

Table 7.7 Segment 3 - Proposed Scenario

Segment 3	Existing Conditions	Proposed Scenario
Lot Information		
Zip Code	30223	
Annual Rainfall (in)	34	
Storm Type (in)	90%	
Storm Rainfall (in)	1.21	
Size of Lot (acres)	8.9	
Soil Type	B	
Runoff Volume Reduction Goal		
Custom		
Precipitation Depth Capture (in):	1.2	1.2
Volume Captured Over:	Impermeable Surface	Impermeable Surface
Required Volume to Capture On Site:	3,556	1,996
Conventional Development		
Impervious Area		
Parking Lot Size (ft2):	27430	27430
Sidewalk		
Length (ft)		590
Width (ft)		10
Street		
Length (ft)	672	672
Width (ft)	24	24
Green Improvement		
Curb Extensions		
Length (ft)		270
Width (ft)		5
Roadside Swales		
Length (ft):		615
Top Width (in):		12
Trees		
Quantity	8	28
Average Canopy	1000	1000

Table 7.7 to be continued in next page

Table 7.7 continued

Swales in Parking Lot		
Length (ft)		180
Width (ft)		12
Reduced Street Width		
Amount (%)		9%
Results		
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	3,556	1,996
Volume Captured by current BMPs (ft^3)	0	2,063
Curb Extension		473
Road side swales (ft^3)		360
Swales (ft^3)		1,230
Percentage of Required Volume Captured by current BMPs (%)	0	103
Decrease in Impervious Area (%)	18	60

Table 7.8 Segment 4 - Proposed Scenario

Segment 4	**Existing Conditions**	**Proposed Scenario**
Lot Information		
Zip Code	30223	
Annual Rainfall (in)	34	
Storm Type (in)	90%	
Storm Rainfall (in)	1.21	
Size of Lot (acres)	4.6	
Soil Type	B	
Runoff Volume Reduction Goal		
Custom		
Precipitation Depth Capture (in):	1.2	1.2
Volume Captured Over:	Impermeable Surface	Impermeable Surface
Required Volume to Capture On Site:	304	677
Conventional Development		
Impervious Area		
Parking Lot Size (ft2):		4000
Sidewalk		
Length (ft)		445
Width (ft)		10
Street		
Length (ft)	335	335
Width (ft)	24	24
Green Improvement		
Curb Extensions		
Length (ft)		430
Width (ft)		5
Trees		
Quantity	5	9
Average Canopy	1000	1000
Reduced Street Width		
Amount (%)		9%

Table 7.8 to be continued in next page

Table 7.8 continued

Results		
Required Volume to Capture from 1.2" over Impermeable Surface (ft^3)	304	677
Volume Captured by current BMPs (ft^3)	0	753
Curb Extension		753
Percentage of Required Volume Captured by current BMPs (%)	0	111
Decrease in Impervious Area (%)	62	59

Discussion of the Results

A comparison of the stormwater management calculations for the existing site conditions and the proposed design demonstrates that the proposed BMPs offer an overall increase in volume of the stormwater captured on-site (Table 7.5-Table 7.6).

Existing trees contribute an average of a 22% reduction in the total amount of the impervious area. However, there are no other observed stormwater BMPs in the current site conditions, resulting in no further captured stormwater. Shown both as quantities and in percentage, the proposed Green Stormwater BMPs offer a great decrease in the volume of the stormwater leaving the site by capturing 99% to 111% of the required volume. The design scenario also decreases the site impermeable area by 43% to 60% through a combination of pavement removal and tree canopies additions.

The following implications are discussed for a further understanding of the benefits that can be achieved by applying stormwater BMPs on site.

Looking at specific BMP contributions to achieve the required volume reduction goal and comparing their applied situations can help determine strategies for selecting the best BMPs for different site conditions. The result tables for segments 1, 2, and 3 show that when applied as a significant amount of continuous linear greenspace next to the existing street, the roadside swales provide a considerable contribution to the overall runoff volume reduction goal. For example, the 1,750 LF long 12foot-wide roadside swale capture 3,500ft^3 of runoff out of the total 4,580 ft^3 required for capture from the site (approximately 76%).

In segments 2 and 3, when the available space is limited by the site topography, or the current right-of-way in segments 3 and 4, only a limited amount of green infrastructure could be provided. However, the reduction of the existing street width and proposed new street trees result in a decrease of the volume required to be captured on-site. For example, in segment 3, the required volume capture from the existing impervious surface was 3,556 ft^3. The proposed design decreased the impervious area by 60%, which results in the required volume capture from the proposed scenario is becoming 1,996 ft^3. The volume captured by the proposed BMPs in this segment is 2,063 ft^3, providing a 103% required volume capture on site. These results show that street width reduction and new street trees are efficient strategies to be applied on-site where space for stormwater facilities is limited and a decrease of the impervious area is necessary.

CHAPTER 8

CONCLUSION

As stated in the first chapter, the purpose of this thesis is to use the Fairmont community as a pilot site for proposing incorporations of Green Street design. This thesis conducted a literature review and case studies of successful projects to determine the guiding design principles of Green Street design. Additionally, based on a background context study of historical mill-town community development and a comprehensive analysis of the Fairmont neighborhood, this thesis researched strategies for applying a Green Street design in a Southern town context, while most of the present projects have been constructed on the Western Coast and in metropolitan contexts.

The planning development of historic mill town neighborhoods focused significantly on providing a self-sufficient community for the residents, with a well-connected pedestrian network to principal commercial and educational areas, and social centers. Although there is no operating mill located in the neighborhood, the Fairmont community shares many historical similarities with other historical mill neighborhoods. The redevelopment of Fairmont aims to revitalize the two schools and Fairmont Park to create a more socially-centralized community with a walkable environment. Beginning with the revival of the historic Rosenwald School by constructing a community garden and launching several educational programs, the Fairmont community has initiated a redevelopment plan that embraces contemporary design practice focusing on building a comprehensive sustainable living environment. Viewed from the sustainable development perspective of the “triple bottom line,” the primary goal for incorporating Green Street design into the site is to achieve direct environmental benefits. Moreover, the proposed design in this thesis also seeks to achieve a harmonious social and ecological sustainability by providing a walkable circulation system and efficient connections to public services, while protecting existing natural resources and retrofitting the conventional streetscape with green infrastructures in a way that increases the environmental quality throughout the neighborhood.

The proposed design reclaims public green space along and within the historic Rosenwald School property as a social center for the community to promote a sense of identity for the neighborhood. Once again, building strong connectivity to existing and future green space is critical to enhancing overall social activities. The design also proposes incorporating linear parks, walking trails, sidewalks, and multi-use paths to promote more physical activities among the residents and to add aesthetic value to the community.

Challenged by a lack of established guiding principles for stormwater facility implementation within the mid-Southern Georgia region or towns with similar contexts, the design application at Fairmont takes into consideration the historic mill town characteristics of the site and provides a Green Street design to demonstrate the incorporation of contextual stormwater BMPs.

The reduction of street width decreases the total amount of impervious surface and provides traffic calming benefits. Stormwater curb extensions, vegetated swales, and rain gardens are appropriate for Fairmont due to their flexibility in adapting to various site layout conditions and for providing a sense of small town community. These strategies are appropriate for the case of Fairmont, which has historical roots but is not a registered historic neighborhood. However, any proposed modifications of street layouts and parking lots should consider keeping the current rural appearance and conveying a feeling of a low-density environment.

Discussion of National Green Value Calculator

The proposed design was evaluated using the National Green Value Calculator and compared with the results of the existing conditions to determine how much it would benefit the site ecologically by selecting the most suitable BMPs. The results indicate an overall increase in the volume of the stormwater captured on-site and a decrease of the total amount of impervious surface.

The National Stormwater Management Calculator provides landscape architects, planners, and non-technical users a straightforward method and the performance results that can be achieved by applying green infrastructure. During the research process, the author has encountered the following concerns about using this calculator as an evaluation tool on Green Street project:

- The calculator provides a list of regulations aimed at achieving various levels of runoff volume reduction goal for users to choose from, while also allows users to customize the goal based on their region's standards (Center for Neighborhood Technology 2009). This capability sets a fundamental base for specifying the performance results in relation to the studied site.
- The calculator allows single data input for each category of site conditions, which limited the flexibility to input various standard sizes of the same

category. Thus, some mathematic methodologies should be applied to calculate and sum the exact amount of the categories, if various parameters such as the street widths exist for the same category.

- The evaluation can be run against multiple green scenarios with different combinations of BMPs for the same site. Then, decision makers can determine the best combination of BMPs by comparing the performance outcome and the lifecycle cost for each scenario.

Future Study

The existing site condition in the proposed design for this thesis has a generally moderate slope that is suitable for the majority of BMPs. Site conditions in areas of Fairmont that have steeper slopes may limit the selection of BMPs. Further research and exploration of design applications for various geographic conditions are needed.

Additionally, the proposed design site was selected in an area containing opportunities to acquire spaces from adjacent properties, providing the feasibility to accommodate the proposed features as a linear corridor. The remainder of the Fairmont neighborhood aside from the selected street segment consists primarily private-owned residential areas, which may limit this flexibility and require different types of streetscape improvements. Moreover, applying improvement in a residential area that has historical mill houses needs to embody an image of the appropriate historical characteristics. Further research should evaluate visual quality, material, plant selection, and any other limitation established to protect the integrity of the historic district in order to determine the appropriateness of applying stormwater facilities to residential conditions.

Previous studies have shown that parks, pedestrian-orientated circulation, and linear greenspace have the potential to increase the value of properties located within their immediate surrounding area. Research has shown that properties within 100 feet radius to a trail can enhance their value by 22% (Crompton 2004; Karadeniz 2008). Therefore, designing a Green Street with facilities that promote alternative transportation has an enormous potential to provide economic benefits for the community. Due to the limitations of the study, this thesis focused only on assessing the environmental and social benefits of incorporating the Green Street design in a southern mill town community. To achieve the “triple bottom lines” for building a sustainable neighborhood, future studies are needed to focus on evaluations of the potential economic benefits of Green Street design and to explore the how economic considerations might influence the selection of facilities to be incorporated into the design.

The development of the historic school serves as a significant starting point for Fairmont revitalization. The community garden and the proposed educational center provide a popular potential gathering place and have great potential to be utilized and incorporated into future projects, such as a connectivity improvement plan. Therefore, this thesis identifies this area as a reasonable place for inclusion. Further studies on introducing Green Street design to site with a context similar to Fairmont are indispensable for a Southern mill town community embracing Green Street design and pursuing the growth of a sustainable, culturally identifiable, and livable neighborhood.

BIBLIOGRAPHY

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. 1977. *A Pattern Language: Towns, Buildings, Construction*. New York: Oxford University Press, 1977.

AMEC Earth and Environmental Center for Watershed Protection, Debo and Asociates, Jordan Jones and Goulding, and Atlanta Regional Commission. Georgia Stormwater Management Manual Vol.2. 2001. Accessed August 26, 2015. http://documents.atlantaregional.com/gastormwater/GSMMVol2.pdf

American Society of Landscape Architects. "Stormwater Case Studies." 2014. Accessed November 10, 2014. http://www.asla.org/stormwatercasestudies.aspx

Austin, Gray. 2014. *Green Infrastructure for Landscape Planning: Integrating Human and Natural Systems*. Routledge, Jan 21, 2014

Bodin, Maria, and Terry Hartig. 2003. "Does the outdoor environment matter for psychological restoration gained through running?" Psychology of Sport and Exercise no. 4 (2):141-153.

Byrne, Thomas G. 2010. *The Chicago Green Alley Handbook: An Action Guide to Create a Greener, Environmentally Sustainable Chicago.* Commissioner Department of Transportation (CDOT). Accessed November, 2015. http://www.cityofchicago.org/content/dam/city/depts/cdot/Green_Alley_Handbook_2010.pdf

Buranen, Margaret. 2008. "Chicago's Green Alleys." Stormwater 9, no. 7: 50-55. Environment Complete, EBSCOhost.

Calkins, Meg. and H. Venhaus. 2011. Ecosystem Services and the NEXT Generation of Sustainable Site Design. Sustainable Sites Initiative.

Calkins, Meg. 2012. The Sustainable Sites Handbook: A Complete Guide to the Principles, Strategies, and Practices for Sustainable Landscapes. Hoboken, NJ: John Wiley & Sons

Calthorpe, Peter. 1993. *The Next American Metropolis: Ecology, Community, and the American Dream*. New York: Princeton Architectural Press, 1993.

CCDP. 2013. "Project brief Handout." Historical Preservation 4680 Community Charrette, Center for Community Design & Preservation, Athens, GA: October 25, 2013.

CCDP. 2014. "A Neighborhood Community Center Built on the Past: Fairmont Rosenwald School Complex as the Centerpiece for Area Revitalization in Griffin, Georgia." Center for Community Design & Preservation, UGA College of Environment and Design. October 25-28, 2014, Griffin GA

Center for Neighborhood Technology. 2009. "National Green Values Calculator Methodology". Accessed September, 2016. http://greenvalues.cnt.org/national/downloads/methodology.pdf

Choguill, Charles L. 2008. "Developing sustainable neighbourhoods." Habitat International (Impact Factor: 1.58). 03/2008; 32(1):41-48.

City of Seattle. Seattle Right-of-Way Improvements Manual Version 3.0, 2012. Accessed September, 2016. http://www.seattle.gov/transportation/rowmanual/

Crawford, Margaret. 1995. *Building the Workingman's Paradise: the Design of American Company Towns.* London: Verso.

Crompton, John L., 2004. "The Proximate Principle: The Impact of Parks, Open Space and Water Features on Residential Property Values and the Property Tax Base." Ashburn, Virginia. National Recreation and Parks Association

Davis, Allen P., William F. Hunt, Robert G. Traver, and Michael Clar. 2009. "Bioretention Technology: Overview of Current Practice and Future Needs." Journal of Environmental Engineering 135, no. 3: 109-117.

de Vries, S., S. M. van Dillen, P. P. Groenewegen, and P. Spreeuwenberg. 2013. "Streetscape greenery and health: Stress, social cohesion and physical activity as mediators." Soc Sci Med no. 94:26-33.

Doff, Wenda. 2010*. Puzzling Neighbourhood Effects: Spatial Selection, Ethnic Concentration and Neighbourhood Impacts*. IOS Press, 2010

EPA. 2009. *Green Streets: a conceptual guide to effective Green Streets design solutions*. Accessed November 28, 2013 http://water.epa.gov/aboutow/eparecovery/upload/2009_09_10_eparecovery_EPA_ARRA_Green_Streets_FINAL.pdf

EPA. 2008. *Managing Wet Weather with Green Infrastructure Municipal Handbook: Green Streets.* Accessed April 4, 2015 http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/guidance/handbooks/Documents/Green%20Streets%20Municipal%20Handbook.pdf

Faha, Mike, and Shawn Kummer. 2009. *GREEN Streets for GREEN Cities. American Nurseryman*. 209 (8) 8: 38-43.

Gehl, Jan. 1987. *Life Between Buildings: Using Public Space*. New York: Van Nostrand Reinhold.

Georgia Community Greenspace Program. 2003. *Greenspace Planning Tools.* Accessed Sep. 20, 2015 www1.gadnr.org/

Gidlöf-Gunnarsson, Anita, and Öhrström, Evy. 2007. “Noise and well-being in urban residential environments: The potential role of perceived availability to nearby green areas.” Landscape and Urban Planning. Volume 83, Issues 2–3, 19 November 2007: 115-126

Girling, Cynthia L. et al. 2000. *Green Neighborhoods: Planning and Design Guidelines for Air, Water and Urban Forest Quality*. University of Oregon: Center for Housing Innovation.

Girling, Cynthia L. et al. 2005. *Skinny Streets and Green Neighborhoods: Design for Environment and Community*. Washington, DC: Island Press.

Grahn, Patrik, and Ulrika K. Stigsdotter. 2010. "The relation between perceived sensory dimensions of urban green space and stress restoration." Landscape and Urban Planning no. 94 (3-4):264-275.

Hanchett, Thomas W.. *Charlotte Planners: Earle Sumner Draper* Accessed Aug.29, 2015 http://www.cmhpf.org/essays/Planning-Draper.html.

Hanchett, Thomas W. *Chharlotte’s Neighborhood Planning Tradition.* Accessed July 28, 2015 http://www.cmhpf.org/kids/neighborhoods/NeighPlan.html

Herzele, Ann, and Sjerp Vries. 2011. "Linking green space to health: a comparative study of two urban neighbourhoods in Ghent, Belgium." Population and Environment no. 34 (2):171-193.

Hur, Misun, Nasar, L. Jack, and Chun, Bumseok. 2010. “Neighborhood satisfaction, physical and perceived naturalness and openness.” Journal of Environmental Psychology Volume 30, Issue 1, March 2010

John, Garner. 1992. *The Company Town: Architecture and Society in the Early Industrial Age*. School of Architecture University of Illinois at Urbana-Champaign John Garner Professor

Oxford University Press.

Jordan, Jones, and Goulding. 2004. *City of Griffin 2024 Comprehensive Plan.* Accessed October 2, 2016. www.dca.ga.gov/largefiles/OPQG/2004/GriffinCi.Old.pdf

Karadeniz, Duygu, 2008. “The Impact of the Little Miami Scenic Trail on Single Family Residential Property Values.” University of Cincinnati, 2008

Kerr, H. John, and et al. 2006. “Psychological responses to exercising in laboratory and natural environments.” Psychology of Sport and Exercise. Volume 7, Issue 4, July 2006: 345-359

Kloster, Tom, Ted Leybold, and Clark Wilson. 2002 “Green Streets: Innovative Solutions for Stormwater and Stream Crossings.” In Global Solutions for Urban Drainage, edited by Eric W. Strecker and Wayne C. Huber, 1-18. American Society of Civil Engineers

Luederitz, Christopher, Daniel J. Lang and Henrik Von Wehrden. 2013. “A Systematic Review of Guiding Principles for Sustainable Urban Neighborhood Development.” Landscape and Urban Planning. 118: 40–52.

Ltieri, Miguel A. 1998. “Ecological Impacts of Industrial Agriculture and the Possibilities for Truly Sustainable Farming.” Monthly Review: An Independent Socialist Magazine. 50(3): 60.

Matsuno, Hiroko, Selina Chiu. 2001. *Stormwater Management Challenge SEA Street Seattle Public Utilities Seattle, U.S.A.* Accessed August 12, 2015. http://nacto.org/docs/usdg/stormwater_management_challenge_matsuno.pdf

McCreary, and Donna Michy. 2012. *Sustainable food, Sustainable Cities: Optimizing Ecosystem Services in Urban Agricultural Landscapes*. University of Georgia Catalog, EBSCO host. Accessed December 4, 2013. https://getd.libs.uga.edu/pdfs/mccreary_michy_d_201205_mla.pdf

Mitchell, R. 2013. "Is physical activity in natural environments better for mental health than physical activity in other environments?" Soc Sci Med no. 91:130-4.

Metro, Portland. Street Design Work Team. 2002. Oregon. Department of Transportation. *Creating Livable Streets: Street Design Guidelines for 2040*. Metro Regional Services.

National Association of City Transportation, Officials. *Urban Street Design Guide.* Children's Literature Comprehensive Database, EBSCOhost. Accessed June 5, 2016. http://nacto.org/publication/urban-street-design-guide.

Nevue Ngan Associates. 2011. "San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook." Portland, OR. Accessed June 7, 2016. https://www.asla.org/2011awards/500.html

NYC Environmental Protection. 2014. "NYC Green Infrastructure Program." Accessed November 10, 2014." http://www.nyc.gov/html/dep/html/stormwater/using_green_infra_to_manage_stormwater.html

Oregon Neighborhood Street Project. 2000. "Neighborhood Street Design Guidelines." Accessed August, 2016. https://www.oregon.gov/LCD/docs/publications/neighstreet.pdf

Perry, Clarence. 1998. The Neighbourhood Unit (1929). Reprinted Routledge/Thoemmes, London, 1998, p.25-44

Planning and Development Services Department. 2007. "Fairmont Community Urban Redevelopment Plan." Accessed August 31, 2015. http://www.cityofgriffin.com

Planning and Development Services Department. 2010. “Southwest Griffin Urban Redevelopment Plan.” Accessed August 31, 2015. http://www.cityofgriffin.com

Prince George’s County, Maryland, Department of Environmental Resources Programs and Planning Division (PGDER). 2000. *Low-Impact Development Design Strategies: An Integrated Design Approach*. EPA 841-B-00-003. Accessed September, 2016. http://www.princegeorgescountymd.gov/DocumentCenter/Home/View/86

Rosenbloom, Sandra. et al. 2013. “Urban Water: Strategies That Work.” Urban Institute. Accessed April 5, 2015. http://www.urban.org/UploadedPDF/413068-Urban-Water-Strategies-That-Work.pdf

Schipperijn, Jasper, Ola Ekholm, Ulrika K. Stigsdotter, Mette Toftager, Peter Bentsen, Finn Kamper-Jørgensen, and Thomas B. Randrup. 2010. "Factors influencing the use of green space: Results from a Danish national representative survey." Landscape and Urban Planning no. 95 (3):130-137.

Spalding County Parks & Recreation. *Fairmont Park*. Accessed September 2, 2015 http://www.spaldingparksandrec.com/parks_fairmont.php

Stein, Clarence S. 1951. *Toward New Towns for America.* The University of Michigan. University Press: 1951

Sustainable Sites Initiative. 2009. “The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009.” Accessed November 27, 2013. http://www.sustainablesites.org/report.

Sustainable Sites Initiative. 2009. “The Case for Sustainable Landscapes.” Accessed September 2, 2015. http://www.sustainablesites.org/report.

Three Rivers Regional Commission. 2013. "2014-2034 Comprehensive Plan." Accessed August 31, 2015. http://www.cityofgriffin.com

WaterSense. 2009. *WaterSense Water Budget Approach*, 2009, U.S. Environmental Protection Agency.

APPENDIX I

FAIRMONT COMMUNITY HOUSING CONDITIONS

The Fairmont Community Urban Redevelopment Plan records the existing housing conditions and recommends housing revitalizing strategies according to different defective conditions. The residential structures are classified into three categories based on this criteria structural defects: “Adequate”, “Deteriorating”, and “Dilapidated”. Only 30% of the structures are deemed to be “Adequate” for housing, which is described as having either no defects or slight defects and should require regular maintenance; 27% of the structures are “Deteriorating” and 43% are “Dilapidated”. While the deteriorating houses are still occupied and in use, 17% out of the 43% in “Dilapidated” houses are vacant.

The houses classified as “Deteriorating” have intermediate to serious defects that require repair and routine maintenance to provide a safe living environment. Defects in this category include apparent missing materials in parts of housing structures. The houses in the “Dilapidated” condition have more serious defects such as unstable original construction, or extensive damage from fire, flood, or storm. Those defects cause safety hazards and an environment with a high potential to be used for illegal activities, such as drug use and drug dealing, prostitution, and vagrancy (Planning and Development Services Department, 2007). Typical examples of the three housing structure conditions are shown in Figure 9.1.

Examples of Adequate Housing

Examples of Deteriorating Housing

Examples of Dilapidated Housing

Figure 9.1 Typical housing structure examples (Photos by the Author, 2013 and 2015)

It is suggested that the Fairmont community needs to physically improve structures in the “Deteriorating” and “Dilapidated” categories. From its beginnings, the neighborhood was characterized by the mill houses surrounding the old Rosenwald

School. Future study should look deeper into the historic resource registration status of the existing houses within the neighborhood and generate an inventory map with marks on the registered historic mill houses. Design guidelines for new construction and revitalization should give priority to the protection of the mill houses to preserve the historic characters of the community.