# Greening Somerville

## Tufts UEP Field Projects 2016

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# Greening Somerville

## To Improve Environmental Health and Community Well Being

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# Executive Summary

*Figure 1, Quincy Street Open Space*
*Photo Credit: Sharon Ron*

This report highlights the urgent need for increased green and permeable spaces in Somerville, MA. It offers a replicable methodology for identifying opportunities for our client, Groundwork Somerville, to partner with and educate both the public and private sectors on the issue. By implementing this methodology, we present an initial set of recommendations, supplemented with some reflection on the project and an appendix with additional information.

Somerville faces water management challenges that many communities struggle with. The city is engaged in long term efforts to replace aging pipes and infrastructure, but efforts to control stormwater runoff at the source are still valuable. To this end, prioritizing low impact development (LID) strategies can go a long way in reducing negative health externalities that are the result of excessive paving and a lack of green and permeable spaces in a city.

At the beginning of this project, our client requested that we focus our recommendations for green space interventions within Somerville's 'environmental justice' (EJ) neighborhoods. These are communities identified by the State of Massachusetts as having experienced and been exposed to environmental injustice. Our first steps were to establish a methodology by which we could identify areas within the EJ communities that are especially in need of additional green and permeable spaces, and to conduct a review of the relevant literature on mapping methods, stormwater management and LID. We then selected seven variables that were used to evaluate green space accessibility and stormwater vulnerability in Somerville. Our literature review on LID and the benefits of urban greening locally and nationally gave us a proper background in best practices and grounds our recommendations in empirical research.

After determining which census blocks were in greatest need of additional green and impervious spaces, we selected the "highest priority" areas within Somerville's EJ neighborhoods to ground truth. We then established a walking survey which allowed us to evaluate and compare parcels for potential impact and partnership opportunities, based on the goals and values of Groundwork Somerville. After compiling a comprehensive list of potential parcels, we then identified five exemplar sites that illustrate a range of redesign strategies and methods.

In order to help Groundwork initiate the next step of exploring the feasibility of each site for redesign, we include in the Appendix a section highlighting relevant zoning codes and legal mechanisms for partnership and acquisition. We end with some reflection on our process and lessons we learned in taking on this project. Our Appendix consists of stand-alone sections that encompass some of the relevant research we undertook that we believe could be useful as educational material and provide additional context for the reader.

*Figure 2, Gorilla Gardens of Somerville*
*Photo Credit: Lauren Lynch*

# Team Members

The authors of this report are Anthony Lechuga, Lauren Lynch, Sharon Ron, Brooke Schwartz, Cecilia Smith and Gabriel Sub. We are a team of students undertaking a field project at Tufts University's School of Urban and Environmental Policy and Planning. The client for this project is Groundwork Somerville, a local branch of a national non-profit, Groundwork USA. Groundwork Somerville enlisted the team's help to identify potentially promising areas for greening in the city. This report represents the culmination of the field project, providing educational resources and context for our recommendations.

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## Acknowledgments

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# Part I: Context

# 1.0: Introduction

*Figure 3, Community Garden, Somerville*
*Photo Credit: Lauren Lynch*

Across the country, recognition is growing of the important role that urban parks and green spaces play in promoting environmental health and community well-being. They serve as spaces that bring people together, build community and provide environmental and health benefits such as purifying the air we breathe and filtering pollutants from contaminated stormwater.

However, analyses of the spatial distribution of urban green space reveal alarming inequities. Historically, communities of color and low-income urban populations have been concentrated in areas with limited access to green space (Wolch, Byrne, & Newell, 2014; McPhearson, Kremer, & Hamstead, 2013; Pham Apparicio, Séguin, Landry, Gagnon, 2012). As a result, they are more vulnerable to heat-related illnesses and have increased exposure to dangerous environmental toxins (Wolch, Byrne, & Newell, 2014).

At the same time, recent demographic trends indicate that America's population as a whole is becoming increasingly urban; according to the 2010 US Census, more than 80.7 percent of the U.S. population now lives in urban areas. During the past decade the rate of population growth in America's cities (12.11%) outpaced that of our nation's overall growth rate ("Growth in Urban Population Outpaces Rest of Nation," 2012). These findings underscore the urgency with which the environmental injustices associated with inequitable access to urban parks and green spaces must be addressed.

Cities across the country are becoming increasingly dense, and aging infrastructure and shrinking municipal budgets are fueling more rigorous competition for funding. The development of strong partnerships between municipal government agencies, local non-profit organizations, and community groups will become increasingly important to ensure that all residents have equitable access to nature within their cities.

In 2012 Somerville released their first ever long term comprehensive plan: SomerVision 2010-2030. The document was informed by a three-year planning process which sought to engage representatives of all sectors of the Somerville community. Among the wide array of goals outlined in the plan, many highlight residents' desires to see increased investment in environmental restoration and the improvement of access to, and maintenance of, the City's public green and open spaces.

*Figure 4, Somerville Community Word Cloud*
*Source: SomerVision 2010-2013 Plan*

These goals included the following:

- To design and maintain a healthy and attractive public realm that fosters community connection.
- To create and program a network of vibrant public open spaces and shared use paths throughout the city.
- To maximize environmental sustainability in design and implementation of all infrastructure systems and public facilities.
- To improve stormwater and wastewater management systems to increasingly separate stormwater and sewage and support desired levels of future growth.
- To approach our waterfront as a regional ecological resource, balancing community access and ecological health.
- To increase the City's public open space by 125 acres by 2030 (SomerVision, 2012).

## 1.1 Project Overview

In support of Somerville's long-term community vision to increase both the quality and quantity of public open space, Groundwork Somerville engaged a team of Tufts University graduate students in the Urban and Environmental Policy and Planning (UEP) program in a semester-long Field Project, from January to May 2016.

The project goal is to assess and prioritize locations within the City where the development of new public green spaces will address various challenges. The team was to develop initial recommendations for green space redevelopment in areas of the City that are most vulnerable to environmental inequities; with a particular focus on using green infrastructure and low impact development strategies to improve local stormwater management.

In addition, these recommendations aim to address the social injustices that characterize current access to public green space. We focus our empirical analysis within Somerville's environmental justice communities: neighborhoods with the greatest health inequities based on race, income and language barriers.

Due to Groundwork's strong programmatic focus on community engagement, the project's methodology and recommendation process is presented as a tool that can be modified and discussed with the community. However, because of time and capacity constraints, there was no community engagement involved in developing the report beyond the project team's interaction with the client and meetings with other organizations working on urban greening in Somerville.

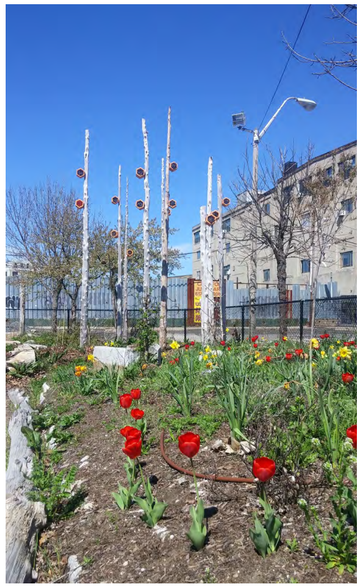

*Figure 5, South Street Farm*
*Photo Credit: Lauren Lynch*





## 1.2 Document Overview

This document is divided into 3 parts: Part I: Context, Part II: Methodology, and Part III: Recommendations. Part I summarizes recent efforts to increase Somerville's open and green space, outlines the City's stormwater management problems, provides a high level overview of applicable low impact development strategies and reviews relevant literature on environmental justice.

Part II provides an overview of our two-phase methodology for identifying and prioritizing sites. The Vulnerability Analysis section describes the methodology used to generate census block-level recommendations for the location of new public green spaces in Somerville. The Site Analysis and Prioritization section of the report describes how the findings generated through the vulnerability analysis were groundtruthed, and the approach that was taken to develop a parcel-level categorization and ranking system.

Part III concludes with green redevelopment recommendations for five exemplar parcels that meet our prioritization criteria and demonstrate the range of possibilities for increasing green spaces and improving stormwater management.

**Part I: Context**

**Part II: Methodology**

**Part II: Recommendations**

# 2.0: Environmental Justice

To inform our process, and to align ourselves with the work of both our client and the City of Somerville, our report mainly focuses on the notion of environmental justice as described and acted on by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA). The definition of 'environmental justice communities' that they outline informs our mapping methodology, as explained later on. To give the reader context, we provide a brief overview of how environmental (in)justice has played out in Somerville.

## 2.1 EEA Definition

The Massachusetts Executive Office of Energy and Environmental Affairs has advanced a definition of environmental justice (EJ) and developed a set of policies designed to promote equitable environmental conditions within the Commonwealth. A 2002 report provides this definition of environmental justice: "Environmental justice is based on the principle that all people have a right to be protected from environmental pollution and to live in and enjoy a clean and healthful environment. Environmental justice is the equal protection and meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies and the equitable distribution of environmental benefits" (EOEA, 2002).

In developing a policy strategy to pursue EJ, the EEA defines targeted EJ communities (communities identified as especially vulnerable to environmental injustice) as census block groups where: "The median annual household income is at or below 65 percent of the statewide median income for Massachusetts; or, 25 percent of the residents are minority; or, 25 percent of the residents are foreign born, or, 25 percent of the residents are lacking English language proficiency" (Ibid). The census blocks that match at least one of these criteria are mapped and hosted on the EEA website, using data from the 2010 census (MASSDEP, 2016).

There are a number of initiatives underway that are specifically tied into the State's efforts to promote environmental justice. Many of them are listed on the MASSDEP website (Ibid). By incorporating EEA data on EJ communities as a variable in our own mapping methodology, we hope that this report can build on, and connect to, ongoing efforts to promote green urban redevelopment.





## 2.2 Environmental Justice in Somerville

Incorporated in 1872, Somerville has had a long and complex history managing open space and a diverse and dense population. As the city grew, its population was increasingly made up of working-class and immigrant families; by 1920, immigrants made up the majority of Somerville's population (Ostrander, 2013, p. 21). High population density, a characteristic still prominent, spurred the construction of the many triple deckers that still line the city's streets. It was around this time that the balancing act of providing sufficient affordable housing and maintaining open green space took center stage in city debates (Ibid, p. 22).

This is not to say that the debate had not already raged for decades. An 1896 story headlined, "Beauty or Business: Shall we Have Parks or Factories" betrayed the fact that the choice had largely been made in favor of factories, as well as the housing required to shelter workers. This left precious little space for parks and other green areas, and created an issue that continues today (O'Connell, 2013, p. 117-118).

The onset of the Great Depression led to a loss of industry, further exacerbated by the first waves of automation. Even after the Depression ended, population continued to decline from its peak of nearly 104,000 in 1930. The nationwide trend of suburban growth left cities, including Somerville, with a dwindling tax base and limited sources of work for the residents who remained. Population has remained fairly steady in the high 70,000's since 1980 (Ostrander, 2013, p. 22-23).

The city's demographics have changed quite dramatically since the 1980s, with many recent immigrant families making the city their home. Almost thirty percent of the city's population are immigrants, and many of them arrived relatively recently. Three quarters of the immigrants in the country arrived after 1980, with a third of them coming after 1995. This diversity is reflected in Somerville's public schools, where nearly one half of students grow up speaking a non-English language (Ibid, p. 23).

The neighborhood of East Somerville has large concentrations of minority and low income families, compared to the rest of the city. This part of the city is cut-off from neighboring areas by McGrath and I-93 highways, which functionally segregates the community (Ibid, p. 24). One reason East Somerville is more attractive to immigrants is that housing costs are lower than in the rest of the city. Pressure to provide sufficient housing limits opportunities for green urban design, and is a major reason why this report looks for opportunities for Groundwork Somerville to partner with landowners to increase permeability and green space.

# 3.0: Somerville at a Glance

Somerville, MA is located in Middlesex County, two miles northwest of Boston ("About Somerville," 2016). With a population of 78,901, encompassing an area of just over 4 square miles, Somerville is recognized as the most densely populated community in New England 19,151 people/sq. mile) (Ibid). Additionally, with a large immigrant population and upwards of fifty languages spoken in its schools, Somerville is also an ethnically diverse city (Ibid).

In 2012 Somerville voters adopted the Community Preservation Act (CPA), thereby approving a 1.5% property tax surcharge to raise revenue for projects that create open space, affordable housing and historic preservation.

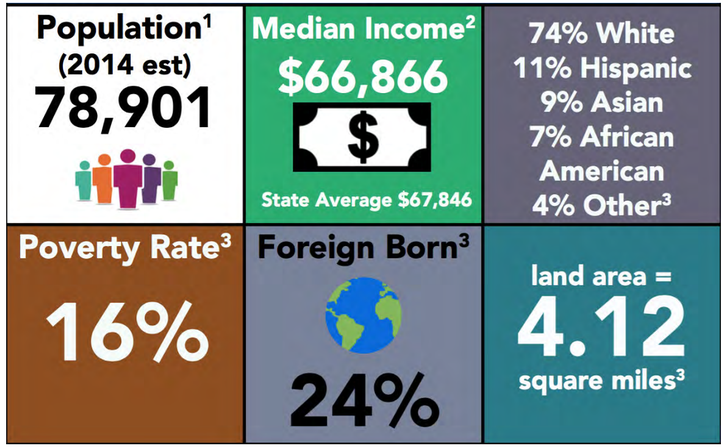


*Figure 6, Somerville at a Glance Infographic*
*Sources: 1. American Community Survey 2014 Population Estimate; 2. ACS 2010-2014 5 Year Estimate (2014 dollars); 3. US Census 2010*
*Created by: Lauren Lynch*





## 3.1 Somerville's Recent Park Development and Restoration Efforts

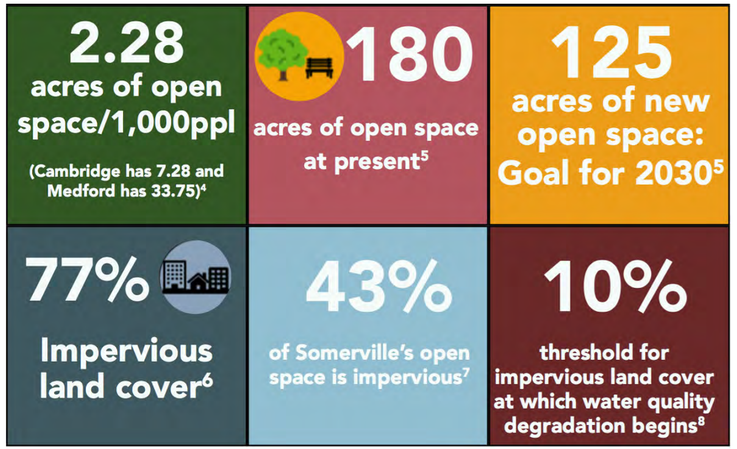


*Figure 7, Somerville at a Glance Infographic (Part 2)*
*Sources: 4. Somerville 2011 Land Use Technical Report,*
*5. Somervision Comprehensive Plan 2010-2030, 6.US EPA Impervious Cover and Watershed Map, 7. GIS Analysis by Sharon Ron and Lauren Lynch, 8. US EPA Website*
*Created by: Lauren Lynch*

Under the joint leadership of Mayor Joseph Curtatone and Director of Parks and Open Space Arn Franzen, the City has worked to rejuvenate public parks and open spaces, renovating 17 existing parks and adding four new parks since December 2012. In line with the goal to increase open space by 125 acres by 2030, as specified in the SomerVision plan, the development of these new green spaces has thus far contributed 2.05 acres of new open space to the City's portfolio. Many of the recent park renovations prioritize improved stormwater management and increased access to urban agriculture as key features of their designs (Parks and Open Space, 2016). The following profiles highlight some of the City's most recent efforts.

## Lincoln Park

In January 2016, the City of Somerville presented the final plans for the renovation of Lincoln Park, a 6.6-acre public park near Union Square. Although not in a flood zone, Lincoln Park has experienced periodic flooding during heavy rains, and is identified as a problem area in the City of Somerville's Hazard Mitigation Plan (MAPC, 2013). The final redevelopment plans represent a more than 3-year collaborative planning effort between community members, landscape architects from Weston Sampson/Spurr, and representatives of Somerville's Departments of Engineering, Water, Recreation, Public Works, and Inspectional Services. In addition to improvements to play area facilities and school yard upgrades, a key element of the renovation plans is the installation of a 1.26 million-gallon subsurface stormwater management system, as well as the installation of rain gardens that will act to capture and reuse stormwater (Parks and Open Space, 2016).

*Figure 8, Lincoln Park*
*Source: Somerville Parks Department website*





## Otis Street Playground

The Otis Street Playground renovation, at the corner of Otis Street and the McGrath Highway, is another example of Somerville's continued efforts to integrate improved stormwater management into city park design.

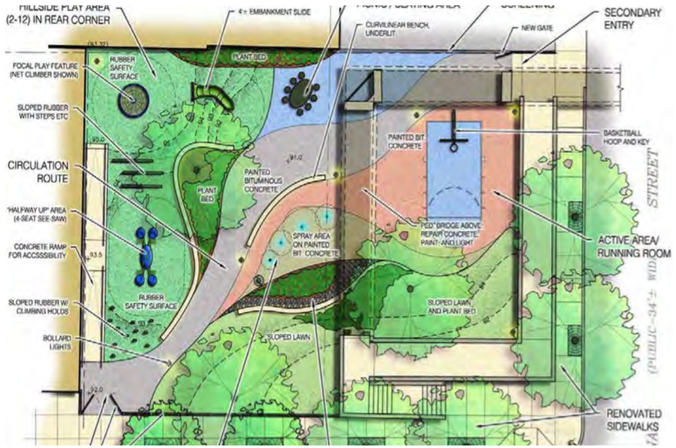


*Figure 9, Otis Street Playground*
*Source: Somerville Parks Department Website*

It is funded in part by a $400,000 Parkland Acquisitions and Renovations for Communities (PARC) Grant from the Massachusetts Executive Office of Energy and Environmental Affairs. Renovation plans for the 7,569 square foot playground will include permeable paving, in addition to new features that will significantly improve public safety and accessibility for disabled visitors. Additional funding for the playground restoration will be provided by the Federal Department of Housing and Urban Development Community Development Block Grant Program (Parks and Open Space, 2016).

## Symphony Park

Low impact, sustainable design methods were a top priority in the making of Symphony Park, the City's newest pocket park. After acquiring the 8,000 square foot property in 2010, the City engaged in a multi-year planning process with residents and landscape architects at the Somerville-based landscape design firm, GroundView.

Symphony Park was inaugurated in November, 2015. Funding for this renovation also came from a $400,000 Parkland Acquisitions and Renovations for Communities (PARC) Grant from the Massachusetts Executive Office of Energy and Environmental Affairs, and was supplemented by the US Department of Housing and Urban Development. (Parks and Open Space, 2016).

*Figure 10, Symphony Park Rendering*
*Source: Somerville Parks Department website*





## Quincy Street Open Space

*Figure 11, Quincy Street Open Space*
*Photo Credit: Lauren Lynch*

Quincy Street Open Space, which was renovated in 2012, serves as a 5,000 square foot sustainable woodland park, intended to expand the city's tree canopy. The park also features a drainage system which serves to capture and absorb stormwater on site (Parks and Open Space, 2016). Located between Somerville Avenue and Summer Street, this small open space provides a quiet place for Somerville residents to connect with nature.

# 3.2 Non-Profit/Community Efforts to Increase Somerville's Green Space

The City of Somerville has made great efforts to improve the quality and quantity of public green space in the community. In addition, there are a variety of non-profit organizations that play a key role in supporting and promoting investment in Somerville's Public Green spaces.

*Figure 12, South Street Farm*
*Photo Credit: Groundwork Somerville*

## Groundwork Somerville

Groundwork Somerville is a local community organization and one of 22 independent non-profits that make up the national Groundwork USA network. Their mission is to "bring about the sustained regeneration, improvement and management of the physical environment by developing community-based partnerships which empower people, businesses and organizations to promote environmental, economic and social well-being" (Groundwork USA, 2016). Within Somerville, Groundwork has focused much of their work on transforming brownfields into environmentally healthy and economically productive spaces. They also work to reclaim vacant lots for adaptive re-use projects. With more than 15 years of experience supporting the development of public green spaces and working to increase access to locally grown, healthy food for Somerville's most vulnerable residents, Groundwork Somerville plays a unique and vital role in addressing environmental injustices within the city.

The majority of projects completed by Groundwork Somerville have been urban agriculture sites, such as the South Street Farm, a 1/4 acre farm with a rain catchment shed that was built on vacant parking lots licensed from the city (Recover Green Roofs, 2013). They are part of an urban agriculture network that includes garden classrooms in every public elementary school. They are maintained both through the support of the community as well as by local Somerville schools (Somerville Farm to School, 2016).





## Somerville Neighborways

Somerville Neighborways is a relatively new and growing grass roots effort to better connect schools, parks and squares. This is accomplished by transforming low-traffic streets into pedestrian-safe community spaces, or "Neighborways," through community engagement and public art projects. Inspired by the national Neighborways movement that originated in Portland, OR, Somerville Neighborways takes a tactical approach to urban planning.

Paint and planters are common indicators of Neighborways throughout the city. In the long term, the group aims to replace planters with fully permeable bump-outs, which can play a significant role in increasing the amount of permeable green space throughout the city (Somerville Neighborways, 2016).

To date, Somerville Neigborways has completed two pilot projects with the approval of the Somerville Transit Commission; the first, a yellow street mural on Willoughby Street completed in August 2015, and the second a small set of pavement stencils on Madison Street, completed in September 2015. As of January 2016, the group has mapped out an additional two miles of planned Neighborways that are intended to form a continuous "NeighborWay Play Street" connecting Porter Square, Lexington Park, the Community Path, City Hall and Somerville High School. The strong community support that has been generated by these projects and Neighborways' proactive collaboration with city officials offer a promising example of new strategies for increasing public access to open spaces throughout the city (Somerville Neighborways, 2016).

*Figure 13, Temporary bump-out*
*Photo Credit: Somerville Neighborways*

These park renovations, urban farming projects and new "neighborway" connections provide a snapshot of recent efforts to increase both the quantity and quality of public green spaces. They also reflect the similarity between the City's vision for Somerville's future and the mission of this project. Despite these successes, the City has a long way to go before reaching its goal of 125 new acres of open space, and even further to go in increasing the amount of open green space that is essential to providing both social and environmental services for all of Somerville's residents.

# 4.0: Stormwater

Given the high level of impervious surface cover that characterizes most urban environments, during rainstorms large quantities of stormwater precipitation is unable to soak back into the ground. Instead, this water gets funneled into retention ditches and underground stormwater systems, carrying pollutants and garbage debris to local water treatment facilities, as well as into local waterways. During rain storms or the rapid melting of accumulated snow, urban drainage systems and natural waterways can become overwhelmed by large volumes of water, causing floods and water treatment plant failure. Moreover, poorly managed stormwater has an even greater potential to cause unnecessary local floods, as well as damage to local ecosystems due to the dispersal of contaminated water.

Conventional stormwater management systems (also called gray infrastructure) are engineered water abatement components. Examples include gutters, storm sewers, tunnels, culverts, detention basins, pipes and mechanical devices, that collectively capture and convey runoff (American Rivers, 2015). Most conventional stormwater management systems prioritize the swift removal of stormwater from urban areas over supporting the functions of the local ecosystem. Externalities associated with conventional stormwater management strategies include the dramatic alteration of natural hydrology and increased concentration of pollutants.

Stormwater runoff from impervious surfaces has been deemed a “key contributor” to the collapse of healthy freshwater ecosystems in urban environments (Roy et al. 2008). In addition, numerous studies have demonstrated the negative consequences of poor stormwater management on public health. Outbreaks of waterborne bacteria and viruses, as well as increased exposure to metals, and chemical pollutants are all connected to poor water management practices (Gaffield, Goo, Richards, & Jackson, 2003). Across the state of Massachusetts, polluted stormwater runoff is the leading cause of water quality and quantity problems (MAPC, 2015).

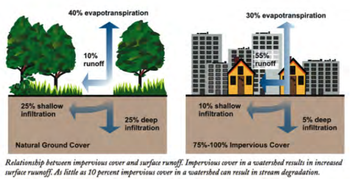


*Figure 14, Urban Runoff*
*Source: US EPA*





## 4.1 Stormwater Management in Somerville Today

Like many older cities and towns, the sewage and stormwater infrastructure in Somerville is in dire need of repairs and replacements (Caputo, 2011; Chambers, et al., 2012). Flooding, stormwater runoff, and a combined sewer and stormwater system are major issues that remain unresolved. A significant challenge to addressing Somerville’s flooding and runoff pollution problem is that Somerville has very little undeveloped land (only 2%), and few permeable green spaces to absorb rain and melting snow (Caputo, 2011; Chambers, et al., 2013; MAPC, 2013). This combination of over-paved space with poor stormwater infrastructure leads to a system that naturally tends towards environmental damage.

As outlined in the 2013 Somerville Hazard Mitigation Plan, flooding affects 6.3% of the city’s land area (about 168 acres) and is identified as the most serious hazard to Somerville (MAPC, 2013). Furthermore, flooding happens in areas that do not correlate with flood zones calculated by FEMA. This is an indication that flooding is occurring in places where it should not due to poor drainage and deficient stormwater infrastructure (MAPC, 2013).

In addition to flood risks, Somerville's highly developed land use pattern (77% impervious surfaces) impairs nearby water bodies and prevents groundwater recharge. The city lies within the Charles River and the Mystic River watersheds, both of which are negatively affected by urban runoff and by the still existing combined sewer overflows (CSO’s) (MRWA, 2016).

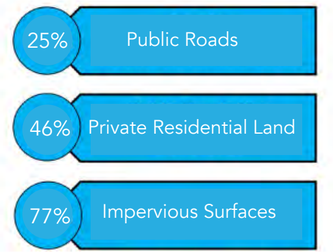


*Figure 15, Somerville Land Acreage*
*Source: Somerville: Land Use Technical Report*

## 4.2 Applying Best Practices to Somerville's Stormwater Management

*Figures 16 (top left) Cobble Hill, 17 (top right) Cobble Hill, 18 (bottom right) Prospect Hill, Green Space Best Practices*

While Somerville has made significant progress in addressing flooding and reducing water pollution from CSOs, there is still work to be done. Replacing the combined sewer system and expanding "hard" stormwater infrastructure is an expensive task that requires more spending than cities can afford. Creative, low-impact solutions are already a part of Somerville's plan to address water quality issues and offer an inexpensive stormwater and flood mitigation alternative. At the same time, greening efforts transform the landscape into places that people can enjoy.





# 5.0: Low Impact Development

Low impact development (LID) is an approach to land development (or re-development) that aims to maintain, restore or replicate naturally occurring hydrologic processes. Its primary purpose is to control stormwater at the source and maximize natural water storage, infiltration, recharge and discharge (US EPA LID 2000; Dietz 2007; Ahiablame, Engel, & Chaubey 2012). Rather than relying on large-scale, engineered gray infrastructure systems, LID applications retain rainwater and allow it to soak into the ground naturally.

The primary focus of this report is providing recommendations for increasing green open space and promoting environmental justice, improving resident quality-of-life, stormwater management, and environmental sustainability. This makes understanding the different techniques and benefits of low impact development approaches important for our report. LID has the potential to help alleviate negative impacts by naturally removing pollutants and bacteria which directly affect issues of environmental justice and quality-of-life.

The economic and aesthetic benefits of LID serve a two-fold purpose: reducing costs of infrastructure and greening the city. Beautiful streets raise property values and improve economic vitality in other ways. Cities that use LID approaches to stormwater management can help restore the natural hydrology of local watersheds and provide cleaner and safer water for their communities. LID techniques such as bioswales and rain gardens act as natural filters for stormwater polluted with bacteria, nutrients, metals and sediments from city streets, cleaning the water before it returns to the water table. Given that LID approaches to stormwater management mimic natural processes, it has the potential to minimize costly construction and maintenance costs of artificial water systems.

*Figure 19, Denver Housing Authority LID Source: US EPA Green Infrastructure*

# 5.1 Examples of Low Impact Development Techniques

The design elements of LID vary depending on the intended outcomes as well as the given landscape. All of the following are potential LID ideas that could be implemented in Somerville.

## Green Roofs

Green roofs are best located on flat-topped buildings and consist of vegetation and soil. They reduce excess surface runoff during severe rainstorms and can provide temporary water storage. Green roofs are especially useful in dense areas where buildings are larger and there are more impervious surfaces. They have been demonstrated to be a cost-effective method of managing stormwater (US EPA, 2016).

## Bioretention Areas

A bioswale is one type of retention area that consists of vegetation and/or permeable biomass shaped into a channel that retains stormwater in narrow areas. Planter boxes are similar but consist of constructed boxes with vertical walls, vegetation and open or closed bottoms that retain and filter water. Rain gardens are another similar bioretention method that consists of shallow vegetated basins that naturally collect, slow and filter water. All of these designs use a similar method to collect, slow and filter stormwater (US EPA, 2016).

*Figure 20 (far left), Green Roof*
*Figure 21 (middle), Rain Garden*
*Source: US EPA*





## Permeable Pavers

Permeable pavement is any surface that allows runoff to infiltrate local water tables. On the other hand, regular pavement creates a barrier that does not allow water to recharge local watersheds. Permeable surfaces include permeable concrete, asphalt or interlocking pavers. This type of solution is highly useful in dense areas such as Somerville with limited permeable surfaces and flooding problems (US EPA, 2016).

## Rain Barrels

Rain barrels are connected to homes typically through downspout connections and come in various sizes. They are designed to store large quantities of rainwater in barrels either for use by the household, or for managing the volume of water drainage into the stormwater system. While these are especially useful in arid environments, they can also be helpful in areas seeking to control rainwater runoff (US EPA, 2016).

*Figure 22 (left), Permeable Pavers*
*Figure 23 (right), Rain Barrel*
*Source: US EPA*

## 5.2 Feasibility of Low Impact Development

Given community concerns over the cost of LID, the EPA and other academic institutions have conducted significant studies into its economic feasibility. The EPA report titled *Reducing Stormwater Costs through Low Impact Development* (LID) Strategies and Practices, analyzed seventeen different examples of LID from across the country, comparing their construction costs to those of conventional methods. Their study found that LID can provide significant cost savings. The overall cost-savings from using LID averaged between 15 and 80 percent per project.

### Table 1, Stormwater Mitigation Costs Using LID

*(Project life-cycle costs)*

| Project | Conventional Development Cost | LID Cost | Cost Difference[a] | Percent Difference[b] |
|---|---|---|---|---|
| 2nd Avenue SEA Street | $868,803 | $651,548 | $217,255 | 25% |
| Auburn Hills | $2,360,385 | $1,598,989 | $761,396 | 32% |
| Bellingham City Hall | $27,600 | $5,600 | $22,000 | 80% |
| Bellingham Bloedel Donovan Park | $52,800 | $12,800 | $40,000 | 76% |
| Gap Creek | $4,620,600 | $3,942,100 | $678,500 | 15% |
| Garden Valley | $324,400 | $260,700 | $63,700 | 20% |
| Kensington Estates | $765,700 | $1,502,900 | -$737,200 | -96% |
| Laurel Springs | $1,654,021 | $1,149,552 | $504,469 | 30% |
| Mill Creek[c] | $12,510 | $9,099 | $3,411 | 27% |
| Prairie Glen | $1,004,848 | $599,536 | $405,312 | 40% |
| Somerset | $2,456,843 | $1,671,461 | $785,382 | 32% |
| Tellabs Corporate Campus | $3,162,160 | $2,700,650 | $461,510 | 15% |

*Source: US EPA, 2007*



# Part II: Methodology

# 6.0 Vulnerability Analysis

The primary goal of our project is to identify potential land for green space redevelopment by Groundwork Somerville. In an effort to determine which areas within the City of Somerville are most vulnerable to environmental justice inequities, and most in need of increased access to public green space, we used Geographic Information Systems (GIS) to conduct a vulnerability analysis by census block. The maps generated as a result of this process provide a quantitative basis for our preliminary block-level recommendations.

These maps were then used to guide the second stage of our analysis, in which we ground truthed our findings. This process was conducted through site visits in order to assess the feasibility of converting specific parcels within the identified blocks to public green spaces. Given the dual social and environmental aims of this project, all of our recommendations focus on increasing access to public green space within Somerville's Environmental Justice communities.

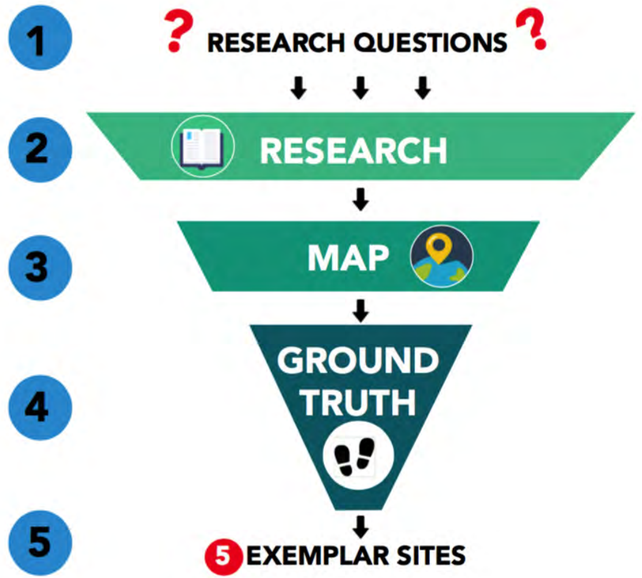


*Figure 24, Field Project Methodology Infographic*
*Created by: Lauren Lynch*





## 6.1 Vulnerability Mapping Literature

A review of the literature on mapping methodologies for assessing urban green space access revealed a wide range of approaches. Much of the literature prioritizes certain elements of this analysis, but does not include an assessment of *both* the social justice and environmental vulnerability indicators.

Studies focused more heavily on assessing opportunities to develop ecological corridors than the social justice implications of prioritizing locations for redevelopment as public green spaces (McPhearson, Kremer, & Hamstead, 2013; Thrall, Swanson, & Nozzi, 1988). Other reports conducted vulnerability and feasibility studies at a scale larger than that of the City of Somerville, but are nevertheless useful in confirming the types of variables and methods used for such assessment (Thrall et al., 1988; Lee and Hong, 2012; La Rosa, 2013).

### Locke et. al. GIS Mapping Methodology (2011)

The team conducted a review of the literature and an analysis of GIS mapping methodologies developed to answer questions similar to our own. We decided to model our analysis and methodology off of an approach developed by students and faculty at the University of Vermont, in support of New York City's MillionTreesNYC tree planting and urban greening initiative. The 2011 report documenting this approach was published in *Cities and the Environment*, an online journal of peer-reviewed research and reports on urban ecology. It has been cited by numerous researchers aiming to prioritize recommendations for tree planting and green space interventions from New York and Baltimore, to Atlanta and Austin. Locke et. al.'s GIS mapping methodology was selected as the model for our analysis due to its inclusion of socio-economic and environmental indicators that fit well with Groundwork Somerville's priorities. In addition, the Locke et. al. methodology uses a straightforward approach to creating unweighted composite scores, using z-scores for small scale geographic units, which meets the needs of our assessment.

Locke et. al.'s framework includes both neighborhood level need-based criteria and parcel level suitability-based criteria, which were combined and mapped using ArcGIS. The study provides valuable insight into how variables can be clustered, standardized for inclusion in the statistical model and ultimately mapped (Locke et al., 2011).

## Our Methodology

We adapted the Locke et. al. 2011 methodology for our analysis of Somerville and incorporated GIS datasets from MassGIS, the US Census Bureau, the Cities of Somerville and Cambridge, and NASA into our model. Ultimately, our selection of variables was based on their relevance to Groundwork Somerville's goal of maximizing both the social and environmental impacts from increasing public green space in strategic locations. The seven variables included in our analysis are listed to the right. Justifications for their inclusion in our model follow. For a detailed description of how we performed our GIS analysis for each variable, please see our models in Appendix 10.2.

## Standardization of Variables

We aggregated all of our data at the census block level in an effort to provide preliminary recommendations that could be useful in informing our field visits and site evaluations. Locke's methods helped us account for the fact that the variables used to measure need- and vulnerability-based criteria typically use a wide range of scales. For example, the units for number of 311 calls per block were dramatically different than the units for the percent of each block covered by impervious surfaces.

We followed Locke's methods to calculate z-scores for each census block, for each variable, in order to generate standard and comparable measures. The individual variable scores for each census block were added to create a unitless, composite score representative of that block's measure of need. See Appendix 10.2 for a more detailed discussion of the formula and process used.

1. Open Space Access
2. Population Density
3. Impervious Surface Density
4. FEMA 100 and 500 year flood zones
5. 311 water related calls
6. Road Density
7. Average Surface Temperature





## Open Space Access

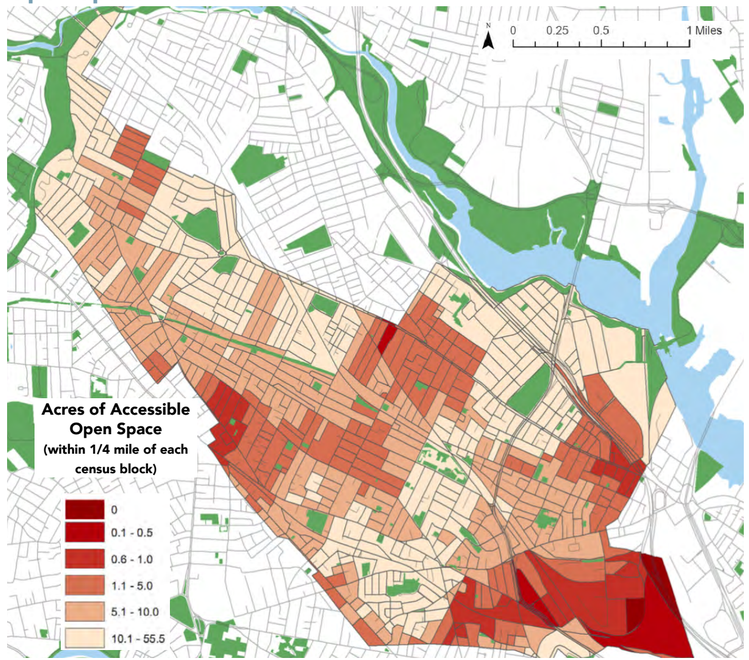


*Figure 25: Open Space Access Map, Created by: Sharon Ron and Lauren Lynch*
**To best address the needs of our client, this map uses manual breaks to illustrate the variation in open space accessibility at a grain size appropriate to Somerville.*

Cities set their own standards for how much park and open space is desirable. In the 2012 SomerVision Comprehensive Plan, Somerville established the goal of adding 125 acres of publicly-accessible, open space to their current 182 acres. Convenient access to open space is a critical resource for promoting resident and environmental health (CDC, 2016). Central to SomerVision's goal is ensuring that all Somerville communities have equal access to the health and ecological benefits of improved open space.

In addition, the literature suggests that existing resources should be accounted for in needs assessment as parks that are too closely spaced or too similar may suffer from under use (Thrall, Swanson, & Nozzi, 1988; Lee & Hong, 2013). By identifying those areas that are particularly "park-poor," our methodology seeks to target communities who stand to benefit most and to maximize open-space utility.

## Population Density

Given Groundwork's focus on community-based partnerships, we target recommendations for green space development in areas that are more densely populated. This is becuase close proximity to open space in these areas provides more convenient access to a larger number of park users (Thrall, Swanson, & Nozzi, 1988). A review of other cities' open space needs assessments supports the approach of prioritizing densely populated areas, based on service area analysis (Mukri, 2009).

It is worth noting that this, and all maps in this report, rely on 2010 census demographic information as census data is more reliable and precise than other sources (ACS 1, 3, 5 year estimates). That being said, residential development has recently occurred in the Assembly Row area, and the population density is therefore no longer zero.

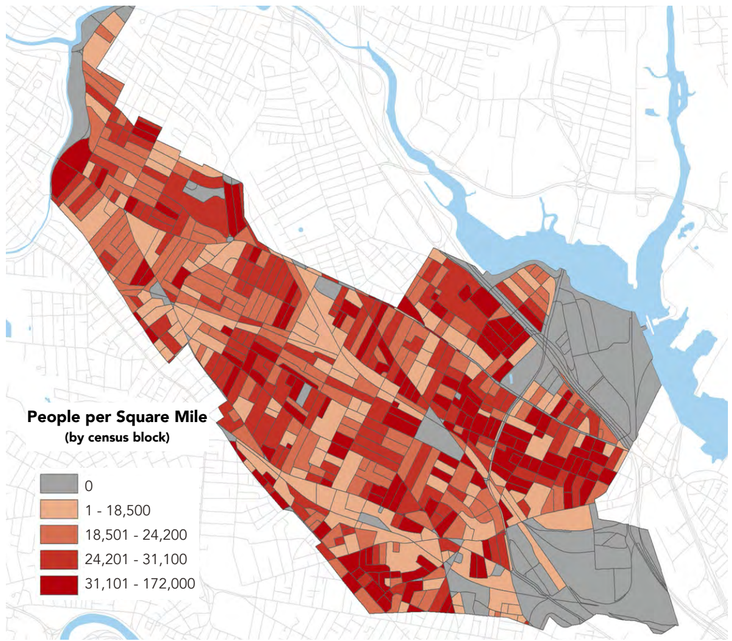


*Figure 26: Population Density Map, Created by: Sharon Ron and Lauren Lynch*





## 311 Calls Related to Water and Catchbasin Issues, and FEMA 100 and 500 Year Flood Zones

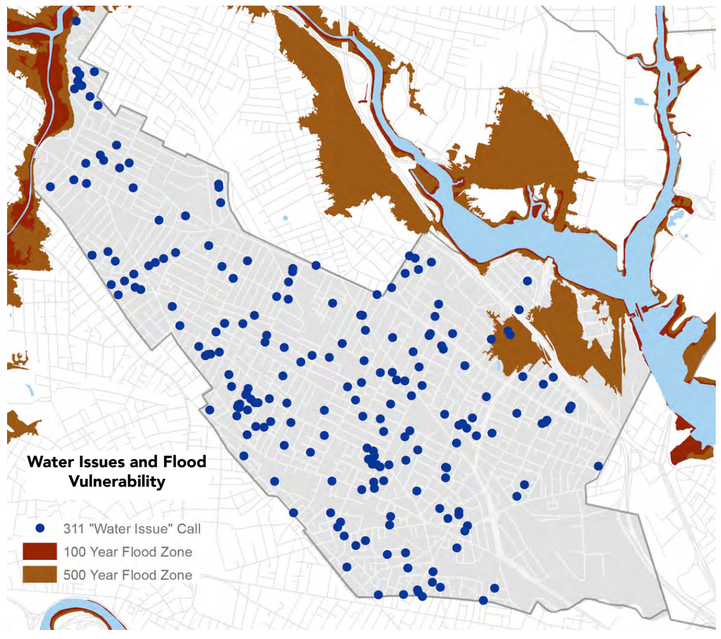


*Figure 27: Flood Vulnerability Map, Created by: Sharon Ron and Lauren Lynch*

Green spaces have been demonstrated to play an important role in improving flood control and reducing stormwater management costs ("Green Water Infrastructure," 2016). According to Somerville's 2013 draft Hazard Mitigation Plan, flooding presents the greatest natural hazard to the city.

Given that many of Somerville's flooding issues are a result of stormwater infrastructure failures exacerbated by increased development, it is important to include data that reflects recent flood reports by local citizens in addition to data presented by the FEMA National Flood Hazard layer (MAPC, Hazard Mitigation Plan 2013). Locke et al. used a sample of 311 constituent service calls as a proxy variable to measure local flooding, a method which was adapted for this analysis. Two representatives of the Somerville Department of Public Works provided our team with guidance as to which water-related reports were most likely to coincide with stormwater issues (Call with DPW 2/2015).

## Impervious Surface Density

Increases in the proportion of impervious to pervious surfaces, particularly in densely developed urban areas, have been correlated with degraded stream systems and increased pollutant loads in stormwater (Brabec, Schulte, & Richards, 2002). According to an Impervious Cover and Watershed Map published by the US EPA in 2010*, 77% of the City of Somerville is covered by impervious surfaces, which include building rooftops, streets, sidewalks, driveways, and parking lots, among others.

As a part of the SomerVision master plan, efforts to increase green open space and incorporate more natural elements, such as street trees, will play an important role in helping the city to manage some of its recurring stormwater issues (MAPC, 2013). Knowing which areas of Somerville have a greater percent of impervious surface area may help to identify prime locations for green infrastructure and LID stormwater management interventions.

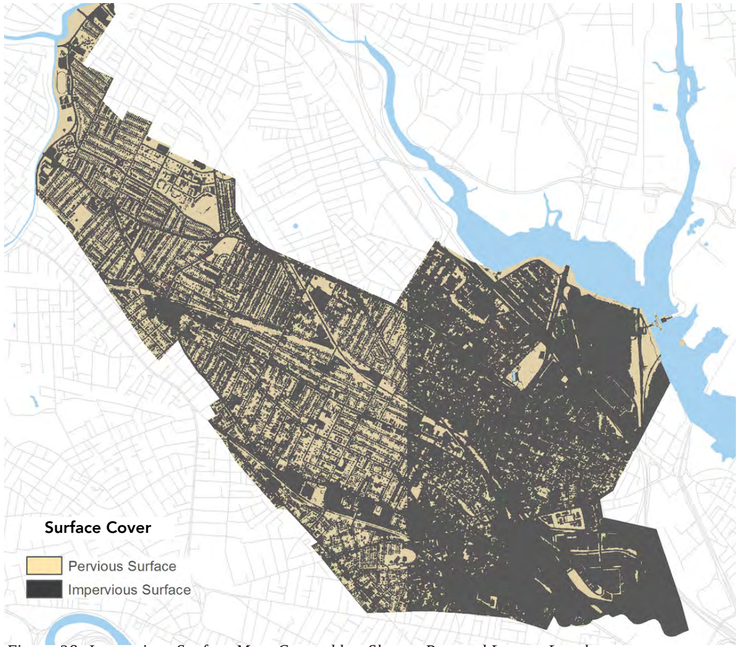


*Figure 28: Impervious Surface Map, Created by: Sharon Ron and Lauren Lynch*
**Note: There is an issue with the orthoimage used to create this map. The vertical line dividing East and West Somerville is not indicative of a real physical feature, and should be disregarded when interpreting this information.*





## Road Density

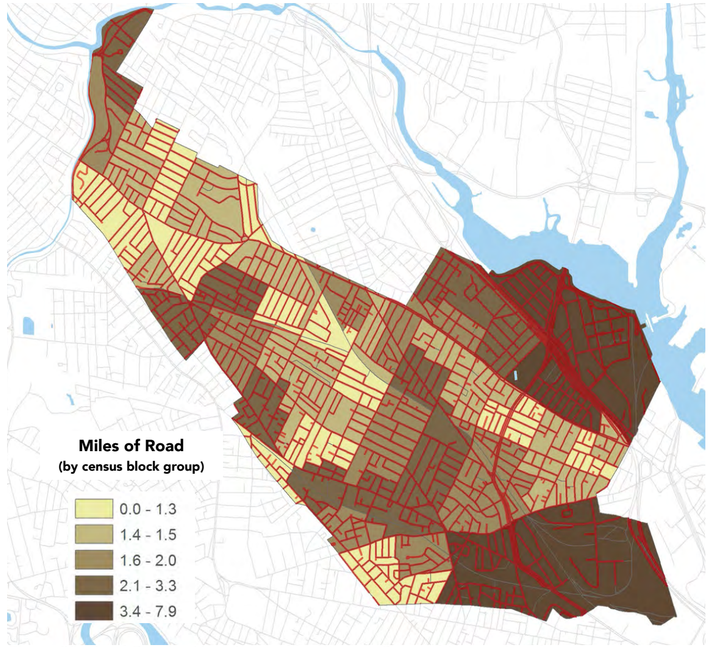


*Figure 29: Road Density Map, Created by: Sharon Ron and Lauren Lynch*

Urban air pollution, to which vehicle exhaust is a major contributor, is one of the top 15 global causes of health impairments (Marshall, Brauer, & Frank, 2009). In Somerville particularly, exposure to air pollutants emanating from highway traffic is currently being studied as a part of the Community Assessment of Freeway Exposure and Health Study (CAFEH, 2016).

Green infrastructure can help mitigate these negative health impacts by removing air pollutants and reducing ambient air temperature (Akbari, Pomerantz, & Taha, 2001). For our analysis, road density is used as a surrogate measure for areas of acute air pollution. While this measure does not account for the differences in road typology, the literature does not support treating separate road classifications differently (Locke et al., 2011). We measured this variable by block group rather than by census block due to the manner in which census blocks are defined, and to reflect the dispersed nature of air pollution.

## Average Surface Temperature

There is a rich body of research demonstrating that as urban areas have grown and become increasingly covered in dark, paved surfaces, temperatures in cities have risen (Akbari et. al, 2001; Arnfield, 2003). According to the US EPA, this phenomenon, known as the urban heat island effect (UHI), can result in increased nighttime temperatures of up to 22 degrees Fahrenheit in cities, as compared with nearby rural areas (Heat Island Effect, 2016). From a public health perspective, urban heat islands are responsible for reducing local air quality due to the combination of higher temperatures and increased pollution (Hoverter, 2012).

Augmenting tree canopy, especially around buildings, is an effective way to increase energy efficiency, particularly during hot summer months (Akbari et. al, 1992). By including in our model information about which parts of Somerville are at the greatest risk of UHI, we are better able to provide guidance about where to prioritize green infrastructure.

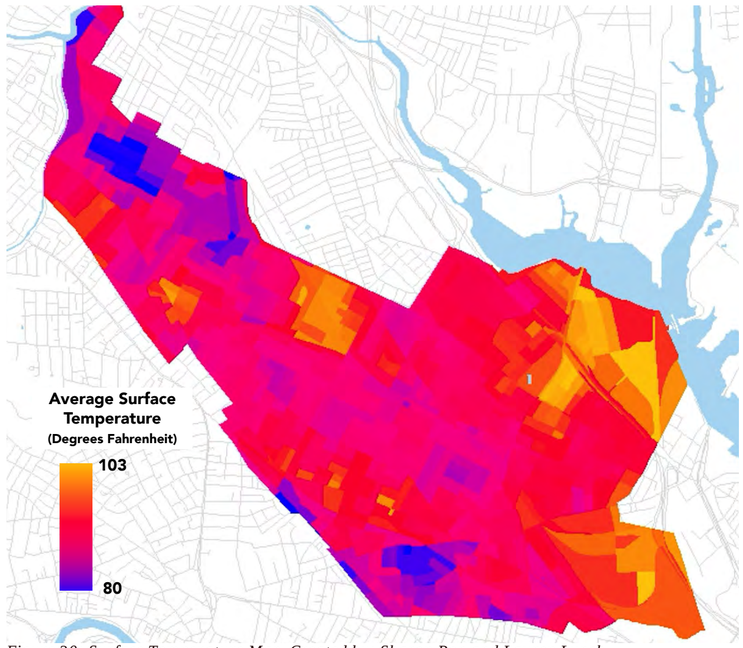


*Figure 30: Surface Temperature Map, Created by: Sharon Ron and Lauren Lynch*





## Environmental Justice

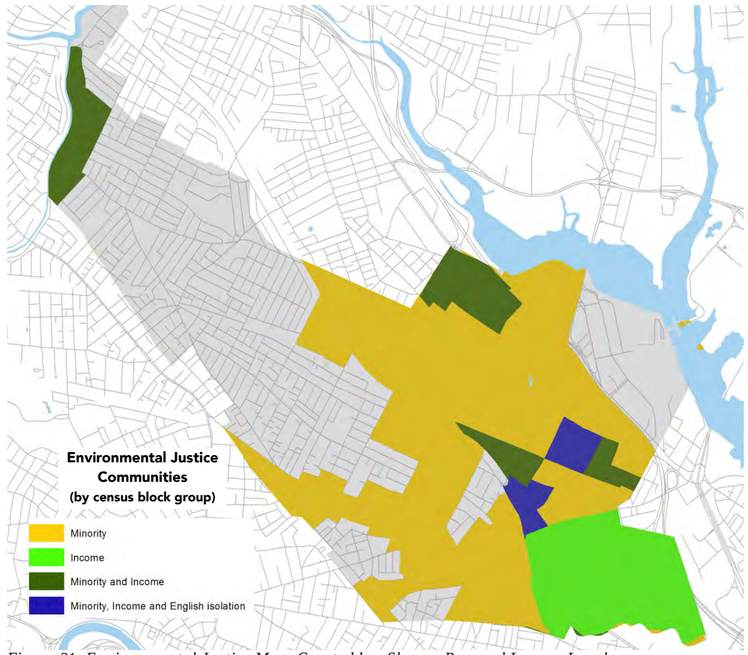


*Figure 31: Environmental Justice Map, Created by: Sharon Ron and Lauren Lynch*

Per the request of Groundwork Somerville, after compiling the block-scores for all of the social and environmental variables included in our GIS model, we focused our recommendations for green space redevelopment within the EEA defined Environmental Justice block groups. Our initial round of ground truthing focused on areas which met *at least two* EJ criteria, depicted in dark green and dark blue on the map to the left. During a second round of ground truthing we expanded our area of analysis to include *some* census blocks which met only *one* EJ criteria. On the following page the composite map depicts all ground truthed areas with a dark blue outline.

In light of the rapid rate of demographic change in Somerville, we remind the reader that this data comes from the 2010 Census.

# 6.2 Results

## Composite Map

After calculating final composite scores for each census block, we used quantiles to develop an unweighted index of priority blocks, on a scale from 1-5; 1 (red) representing the "highest priority" census blocks, whose score fell within the top 20%, and 5 (green) representing the "lowest priority" census blocks, whose score fell within the bottom 20%.

In order to generate recommendations for block prioritization that would be feasible to ground truth within our timeframe, we focused all of our recommendations on census blocks within the EJ neighborhoods, outlined in black. To further focus our recommendations, we ultimately ground truthed those block groups outlined in blue.

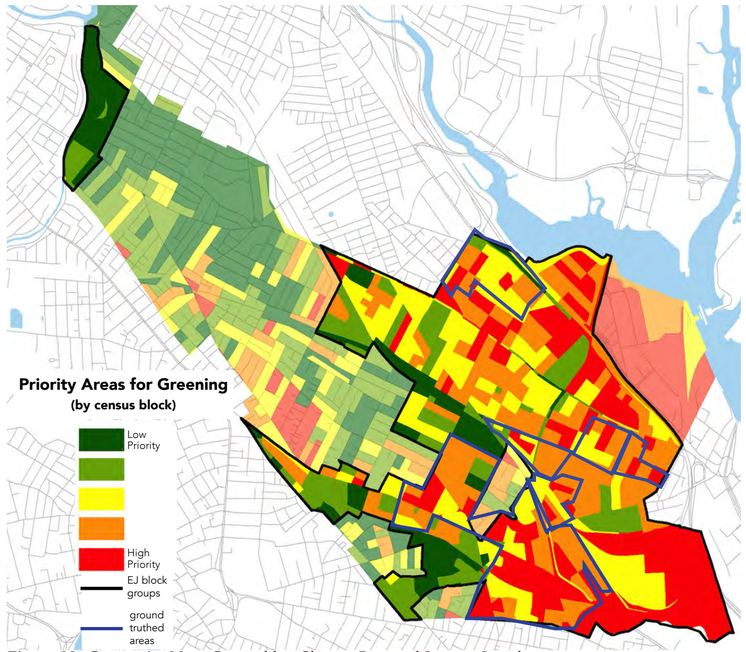


*Figure 32: Composite Map, Created by: Sharon Ron and Lauren Lynch*





## Social Vulnerability

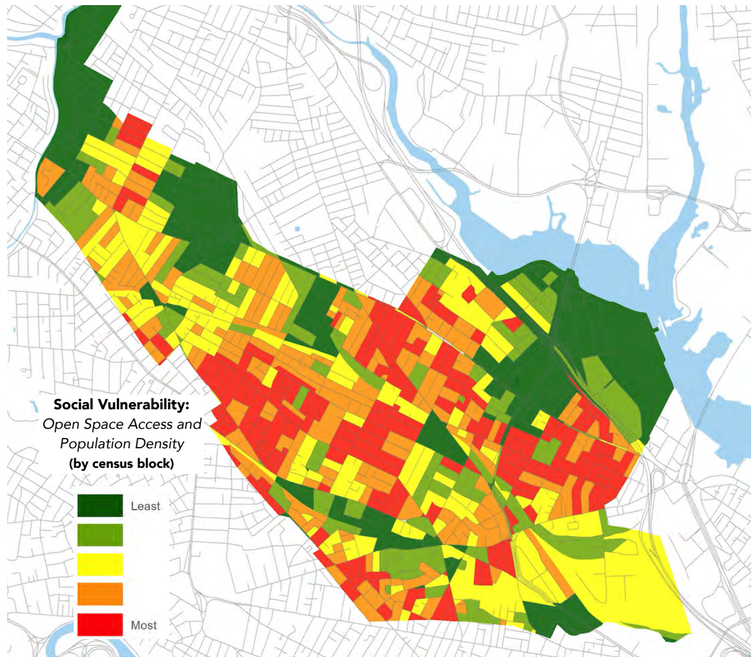


*Figure 33: Social Vulnerability Map, Created by: Sharon Ron and Lauren Lynch*

In addition to the unweighted index, we also generated three additional composite maps to demonstrate how focusing on subsets of our seven variables may result in the prioritization of different blocks. While these maps were not used for the ground truthing portion of our work, they may be useful in helping to identify areas in the city that would benefit from particular green space interventions, based on different priorities.

The map to the left depicts "social vulnerability," which considers the relationship between two variables: open space access and population density. Census blocks in red indicate areas with high population densities and low access to open space. These areas may benefit from green space interventions which focus on increasing neighborhood park space and spaces for active recreation and community interaction.

## Public Health Vulnerability

The map to the right depicts "public health vulnerability," which considers the relationship between two variables: average surface temperature and road density, as a surrogate for air pollution. Census blocks in red indicate areas with comparatively high surface temperatures and high road density/ high air pollution.

These areas may benefit from green space interventions which focus on increasing tree canopy to reduce temperatures and contribute to air purification. It is important to keep in mind that active recreation green spaces are not recommended for these areas, as we do not aim to increase resident exposure to air pollution.

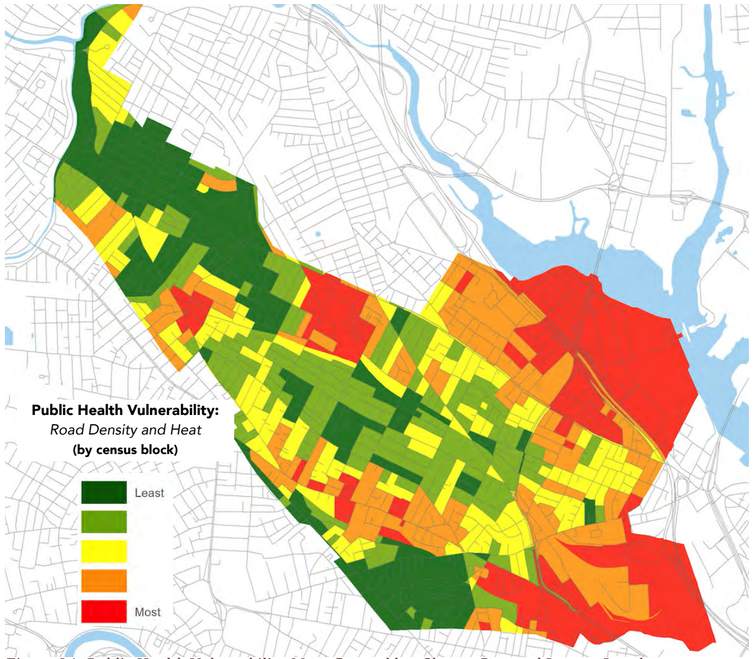


*Figure 34: Public Health Vulnerability Map, Created by: Sharon Ron and Lauren Lynch*





## Environmental Vulnerability

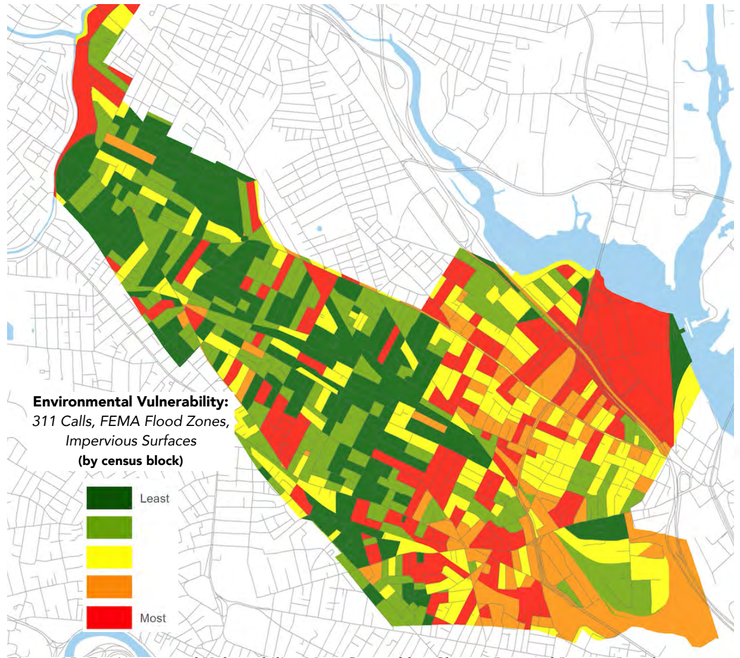


*Figure 35: Environmental Vulnerability Map, Created by: Sharon Ron and Lauren Lynch*

The map to the left depicts "environmental vulnerability," which considers the relationship between three variables: impervious surface density, FEMA flood zones and 311 water related issue calls. Census blocks in red indicate areas with a high percentage of their area covered in impervious surfaces, with a high percentage of their area within a FEMA 100 or 500 year flood zone, and with a high number of 311 water related calls.

These areas may benefit most from green space interventions which prioritize stormwater management, such as bioswales, rain gardens and permeable pavers.

## 6.3 Discussion of Findings

With the exception of the clusters of blocks in eastern Somerville, the location of priority areas varied across the public health, environmental, social, and full composite maps. The public health vulnerability map reveals pockets of high priority blocks around Davis Square, north of Highland Ave, and along Somerville Ave. The social vulnerability map also shows clusterings of high priority blocks, but centered in east-central Somerville. Rather than clusters, the environmental vulnerability map uncovers single high priority blocks surrounded by low priority areas scattered across the city. These disparate patterns likely reflect the different types of data sourced for each composite map.

The overall composite map is a reflection of where these maps overlap. The Brickbottom and Assembly Square areas, in the southeastern and north eastern parts of the city, emerge as priority areas in the public health and environmental vulnerability maps. However, due to their low population density at the time of this report, they are not high priority locations in the final composite map. The neighborhoods to the east and north of Assembly and directly to the east of Brickbottom are high priority areas on all composite maps including our overall composite map.

The all-variables composite map also identified a few high priority blocks around Davis Square and along Somerville Ave, but the Environmental Justice block groups, primarily located in East Somerville and which provided the final filter in our mapping methodology, did not include these areas. While the specific blocks varied, the areas where all maps overlapped became a jumping off point for our ground truthing process.

It is also worth noting that our GIS analysis of open space and land cover revealed that, at the time of this report, approximately 43% of all open spaces in Somerville are impervious. As the City embarks on the addition of new open spaces as a part of the Somervision Plan, it will be essential to ensure that these new open spaces prioritize permeability so that City residents are able to reap the full social, environmental and health benefits of such spaces.





# 7.0 Ground Truthing

Ground truthing is the process of verifying on site the accuracy of information gathered by remote sensing, aerial photography, satellite, cartography, and other research methods. In our project, we used ground truthing for the on-site analysis of the parcels identified through the GIS mapping process as most vulnerable to environmental injustices. By visiting the sites on the ground we gained a better sense of the physical characteristics unavailable through aerial imaging. Therefore, after applying the GIS spatial analysis, we were able to limit our search to clusters of parcels for ground truthing.

In order to be consistent in our site analyses, we approached each site with a set of identical criteria for determining the feasibility of utilizing a parcel for redevelopment. This on-site analysis of parcels was an essential step in the filtration process for selecting the parcels that would provide the greatest potential for development or partnership. To facilitate our analysis, we developed a walking survey for generating some objective and subjective information about each site. Recognizing the potentially large differences among sites, we created a list of notable features to be documented while walking:

Types of Parcels:

1. Vacant
2. For Sale
3. Not for sale, but with redevelopment potential
4. Public Housing
5. Private Business Partnerships
6. Schools

Conditions:

1. Type of structures (single family home, multi-family, apartments, mixed-use, commercial)
2. Size of the parcel (acres)
3. Assessed value
4. Excess paved surfaces
5. Owner
6. Problems to be addressed
7. Methods for addressing problems

Through our ground truthing analysis we were able to further refine our assessment of sites that would be feasible for greenspace redevelopment.

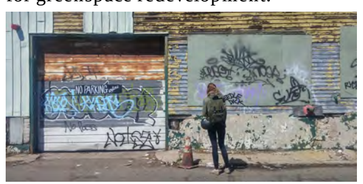


*Figure 36, Lauren Ground Truthing*
*Photo Credit: Sharon Ron*

# 7.1 Selecting Exemplar Sites

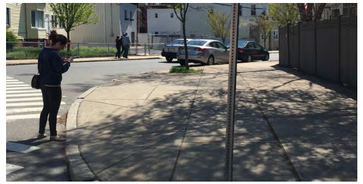

*Figure 37, Sharon Ground Truthing*
*Photo Credit: Lauren Lynch*

While a substantial proportion of our initial analysis was driven by quantitative data acquired through GIS, it is important to acknowledge that much of the methodology that guides our recommendations is values based. Our partner Groundwork Somerville values functional open space including parks and urban agriculture sites. Additionally, Groundwork Somerville operates under a limited budget that requires us to consider price and feasibility of partnering with landowners as a factor. Knowing that Groundwork Somerville mostly works through community partnerships allowed to us to consider exemplar sites based on their potential for redevelopment with private and city partners rather than by acquisition of land through purchase. In an attempt to isolate sites that accommodate the wide spectrum of work done by Groundwork Somerville, we selected sites that could accommodate the following types of solutions:

1. Passive stormwater retention areas
2. Active recreational green space
3. Garden spaces
4. Passive greening for increased public health

Through addressing each site located by ground truthing individually we were able to assess the feasibility of Groundwork Somerville creating a redevelopment plan with the greatest impact. Considering site ownership, current use and size helped us to determine what type of redevelopment would be possible within each particular parcel. We then selected to expand our recommendations for five exemplar sites which demonstrate different development options. Each site is paired with a relevant case study.

Our ground truthing raised some questions that fall beyond the scope of this project. Namely, we noticed that areas within the census block groups we walked showed signs of having recently been subjected to neighborhood turnover, as Somerville has seen an upsurge in housing costs. Though clearly there is still a huge need for additional green areas in these census blocks, it is also important to remember that these communities were labeled as EJ neighborhoods based on data from the 2010 census and that the rapid changes underway in the city may not be reflected in this data.





## Exemplar Site Location Map

*Figure 38, Broadway*
*Credit: Tony Lechuga*

*Figure 39, 1 Virginia*
*Credit: Tony Lechuga*

*Figure 40, Broadway Place*
*Credit: Tony Lechuga*



*Figure 41, 0 Perkins*
*Credit: Tony Lechuga*



*Figure 42, 70 Perkins*
*Credit: Tony Lechuga*

# Part III: Recommendations

# 8.0 Recommendations:

## Overview

Through our process of surveying the mapped areas and compiling a list of potential partnerships for our client, we decided to present five different parcels for case studies. When taken together they cover a broad range of options for implementing LID strategies outlined earlier. These exemplar sites provide both immediate targets for increasing access to green space and illustrate different types of green redesign. We chose to offer a selection of cases that provide a range of options because the timeframe of our project made investigating the feasibility of each potential partnership or transfer of land unrealistic.

For this reason, the feasibility of a potential redesign was considered as a part of our ground truthing process. Though we include some research on legal tools and mechanisms for proceeding with redesign projects, the ultimate goal of these case studies is to provide a menu of redesign options. They demonstrate possibilities that can potentially be implemented around Somerville.

These green redesign measures are suggested based on the physical characteristics of the sites, as well as the stated goals of Groundwork Somerville. We strongly recommend that a thorough process of community engagement be initiated to determine what types of green urban development is desired by residents at each site, and that our case studies be used only as prototypes for future design considerations.

Any efforts at green redesign in Somerville will require knowledge of the legal mechanisms that would allow Groundwork Somerville to engage in development projects. Additional knowledge regarding various policy tools that can incentivize green redevelopment provides opportunities for advocacy and public education. These could ultimately increase opportunities for Groundwork Somerville to create more green space in the city. To aid in this capacity we include information about legal tools and zoning regulations regarding parcel acquisition and repurposing in Appendices 10.3 and 10.4.

## 8.1 Exemplar Sites

The five exemplar sites reflect different 'archetypes' of LID implementation. Together they offer a fairly comprehensive look at what kinds of projects Groundwork could propose to various communities in Somerville.

The senior living community at 70 Perkins St. provides a good potential partner for Groundwork Somerville. The living center is surrounded by grass, but the space is underutilized. There are no paths, no tables or benches, and no opportunities to engage with the landscape. Adding any of the above, or designating a space for gardening, would create opportunities for intergenerational learning and encourage a more active lifestyle for the residents.

Broadway Place is a tiny street where, like most of Somerville, the houses are surrounded by paved surfaces. Its location right off of the busy Broadway corridor makes it an ideal candidate for transformation into a green alleyway. The redesign could incorporate either permeable pavers or a layer of flora (with tire-tracks) to create a model for permeable streets and, potentially, a green space for active use. This redesign would help deal with stormwater management and the heat island effect.

The 0 Perkins St parcel is a unique space. It is in the middle of the block and does not front on any street, but can be accessed from Pinckney St. This vacant space is already mostly permeable, but can be transformed into a more active space and connected with Perkins Park, which lacks a green space where people can play and relax.

Next to 1 Virginia St is a plot of land that is a right-of-way to McGrath Highway. This bare gravel area is not used as road and merely acts as a buffer for cars and unlucky pedestrians in the area. Its location right on the highway means it is not well suited for active use or even passive recreation. An area like this is an example of where Groundwork could partner to create a bioswale or rain garden to help with water management and liven up the corner.

The section of Broadway between Cross and Franklin streets has very wide sidewalks with only potted trees to offer any relief for water absorption, while providing minimal shading and tree cover for pedestrians. Though this area has just recently undergone a redevelopment, its width and importance as a central corridor means it remains a prime target for increased LID and permeability. This stretch of sidewalk is already reserved for the mobile planters, so we recommend that this space be repurposed either to provide more comprehensive greening for its environmental benefits, or that it be transformed into a permeable bike lane to increase transportation alternatives and encourage fossil fuel free methods of travel.

The entirety of the mapped area is over-paved and there are few opportunities for large-scale redesign projects. Some of the best opportunities we found to create active green space are underutilized areas that are somewhat 'green' already. The notion of better utilizing existing green space, together with the identified opportunities to create entirely new green areas, helps to frame both the exemplar sites and those included in the digital database of parcels.

# Community Gardens Partnership: 70 Perkins Street

## Site Overview

70 Perkins St. is the site of the Mount Pleasant Apartment Homes. This building has 65 units that house seniors 62+ as well as people with disabilities under 62. The property is surrounded on three sides by open grass areas and limited bushes. This comprises a large amount of unused open green space.

**Table 3: 70 Perkins Overview**

| | |
|---|---|
| Address | 70 Perkins Street |
| Neighborhood | East Somerville |
| Size | 1.43 acres |
| Ownership | Private - Perkins Street Associates |
| Use | In Use, Senior Living Center |
| Assessed Value (2016) | $7,090,000 |

*Source: Somerville Assessors Map*

*Figure 49 (top left), Figure 50 (top right), Figure 51 (bottom right) 70 Perkins St*
*Figure 52 (bottom left), 70 Perkins Street Parcel Map*
*Photo Credit: Tony Lechuga, Figure 52 Source: Somerville Assessors Maps*





# Case Study and Recommendations

## Case Study: Nationalities Service Center, Philadelphia, PA

At this site in Philadelphia, the community engaged seniors to create accessible community gardens. They used volunteer seniors to teach youth about types of plants and gardening practices. The idea was to use space, knowledge, and the existing community assets in a more beneficial and active way. This gave the entire community a sense of place and identity within the gardens.

## Recommendations

Given the level of potential open space at this site we recommend expanding the current partnership Groundwork Somerville enjoys with the East Somerville Community School to include Mount Pleasant Apartment Homes. Engaging both the school and the seniors in a joint project could have social benefits for both age groups. The gardens would need to be accessible for both youth and senior citizens and could be either purely aesthetic or for food. Even the small addition of benches to this space would make it accessible for the residents.

*Figure 53 (top): Nationalities Senior Center Garden, Figure 54 (middle): Community Volunteer Planting, Figure 55 (bottom): Raised Bed Gardens*
*Source: US EPA*

# Green Alley: Broadway Place

## Site Overview

Broadway Place is a small street that serves only six residential lots near Sullivan Square station and the I-93 expressway. This mostly paved, very narrow, dead-end street does not contain adequate sidewalks. The residential parcels consist of single-family houses, which greatly diminishes parking needs, making this small street a good example of a possible green alley project.

*Figure 56 (top left), Figure 57 (top right), Broadway Place*
*Photo Credit: Tony Lechuga*
*Figure 58 (bottom): Broadway Place Parcel Map*
*Source: Somerville Assessors Maps*

**Table 4: Broadway Place Overview**

| | |
|---|---|
| Address | Broadway Place |
| Neighborhood | East Somerville |
| Size | 0.88 acres |
| Ownership | City of Somerville |
| Use | Public street |
| Assessed Value (2016) | n/a |

*Source: Somerville Assessors Map*





# Case Study and Recommendations

## Case Study: San Francisco Living Alleys Market Octavia Toolkit

The San Francisco "living alleys" project is based upon voluntary participation, where residents assume responsibility for implementation and maintenance. Developed by the San Francisco Planning Department, Municipal Transportation Agency, Department of Public Works, and Professor Antje Steinmuller and the CCA architecture studio, the toolkit is designed to enable members of the community to understand the design elements and implementation processes (San Fransisco Planning Department). A "living alley" is a street designed to give preference to pedestrians and bicyclists within a right-of-way. It fosters human interaction, while at the same time maintaining its function as a street.

## Recommendations

Engage with property owners and enlist collaboration with the city to transform this street into a green alley that both addresses storm water issues and creates a place for neighborhood residents to be active and interact with one another. Street hydraulics, road composition, underground utilities, emergency vehicle access, and accessibility issues must be addresses before implementation measures are decided.

- Use the San Francisco Living Alleys Toolkit as a resource for planning and implementation
- Provide space for active uses
- Plant trees, provide seating areas and install permeable pavers
- Include residents in all stages of the process, from design to development.

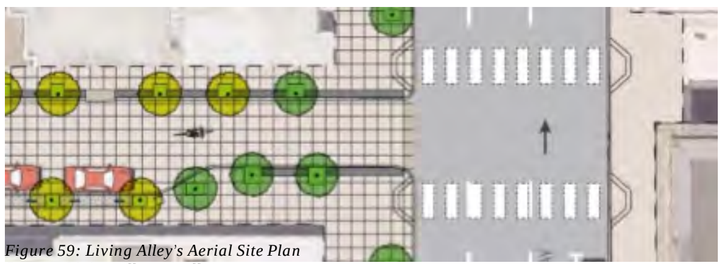

*Figure 59: Living Alley's Aerial Site Plan*
*Source: Living Alleys Toolkit*

# Active Use Park: 0 Perkins Street

## Site Overview

o Perkins Street is a vacant, open green space in the middle of a residential block. It backs up to residential houses and it appears they use this space as storage only, as it is filled with some discarded items. While the parcel has no street facing sides, it can be accessed through the Pinkney St. alleyway, which leads to one home entrance. This asphalt alleyway/parking area also connects the parcel to the Perkins Street Playground.

**Table 5: 0 Perkins Street Overview**

| | |
|---|---|
| Address | 0 Perkins St. |
| Neighborhood | East Somerville |
| Size | 0.17 acres |
| Ownership | Peter Tsourianis |
| Use | Vacant land |
| Assessed Value (2016) | $111,400 |

*Source: Somerville Assessors Map*

*Figures 60 (top), Figure 61 (bottom right), 0 Perkins Street*
*Figure 62 (bottom left), 0 Perkins Street Parcel Map*
*Photo Credit: Tony Lechuga, Figure 62 Source: Somerville Assessors Maps*





# Case Study and Recommendations

## Case Study: Alexander W. Kemp Playground at Cambridge Common, Cambridge, MA

The following case study is a completed redesign of Alexander W. Kemp Playground at the Cambridge Common in Cambridge, MA. The playground has a range of play features, many of which were built with naturally decay-resistant wood, living plant material, tree stumps and sand. Thus in addition to creating active play space, the park utilizes the natural environment. This site also includes many examples of permeable surfaces within playground spaces.

## Recommendations

For this site we recommend converting the lot into a park and playground that can be connected to Perkins Street Playground through the Pinkney St. alleyway. This could involve activating the current green space with playground equipment, benches and planter boxes. As the lot is in the middle of a residential block, we believe that it is necessary to consult with the neighbors to understand the needs of the community before any final decisions are made.

*Figure 63 (bottom left), 64 (top right), and 65 (bottom right), Kemp Playground*
*Source: City of Cambridge*

# Temporary Bioretention: Right-of-way beside 1 Virginia Street

## Site Overview

This small corner lot, located on the corner of Virginia Street and McGrath Highway, is part of the right-of-way for transitioning from the highway to the neighborhood residential streets. This makes it an unlikely spot for active use, but could easily serve as a place for greening and stormwater management. This site is similar to many that will be opening up with the future plans for grounding the McGrath Highway.

**Table 6: Right-of-Way**

| | |
|---|---|
| Address | n/a |
| Neighborhood | East Somerville |
| Size | 400 sq ft. |
| Ownership | Commonwealth of Massachusetts |
| Use | Vacant land |
| Assessed Value (2016) | n/a |

*Source: Somerville Assessors Map*

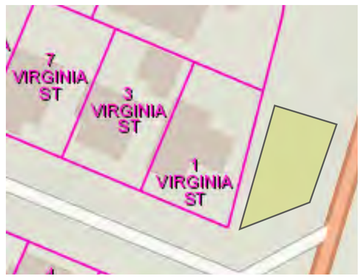

*Figure 66 (top left), Figure 67 (top right), 68 (bottom right), Right-of-Way*
*Figure 69 (bottom left): 1 Virginia Street Parcel Map*
*Photo Credit: Tony Lechuga, Figure 69 Source: Somerville Assessors Maps*





# Case Study and Recommendations

## Case Study: San Francisco's Pavement to Parks Research Lab

The Pavement to Parks Research Lab is the result of collaborative efforts between the City's planning, transportation and public works agencies. The program focuses on transforming underutilized paved areas into experimental parks that can be either reverted back to their previous uses, or reclaimed into permanent public spaces. Much like Somerville, San Francisco's streets and right-of-ways constitute about 25% of the City's total land area (City of San Francisco, n.d.). Therefore, Somerville shares similar needs that inform San Francisco's goal to re-imagine the potential of city streets.

## Recommendations

Through engaging with state authorities and working with the plans for the grounding of McGrath Highway, Groundwork Somerville could encourage using these areas for mobile planters. Community members could be enlisted to care for the plants and ensure the areas remain free of debris. The temporary nature of these planters allows for them to be moved at any point, or converted into permanent structures, adding to the benefits for stormwater management. This flexibility also allows the neighborhood to give feedback on projects before designing permanent installations.

*Figure 70 (top), Figure 71 (bottom): Mobile Planters*
*Source: San Francisco Planning Department*

# Sidewalk: Broadway between Cross Street & Franklin Street

## Site Overview

The segment of Broadway between Foss Park and I-93 has intermittent sections of sidewalk that are wider than necessary for pedestrian traffic. There has already been some effort to landscape with large planters, but it is not sufficient for stormwater management. This is mostly a business corridor that lacks significant greenscaping.

**Table 2: Broadway Overview**

| | |
|---|---|
| Address | Broadway |
| Neighborhood | East Somerville |
| Size | About 2000 ft. |
| Ownership | City of Somerville |
| Use | Public Walkway |
| Assessed Value (2016) | n/a |

*Source: Somerville Assessors Map*

*Figure 43 (top left), Broadway View 1*
*Figure 44 (top right), Broadway View 2*
*Photo Credit: Tony Lechuga*
*Figure 45 (bottom): Broadway Parcel Map*
*Source: Somerville Assessors Maps*





# Case Study and Recommendations

## Case Study: SW 12th Avenue between SW Montgomery and SW Mill Portland, OR

The following case study is a retrofit of an existing downtown sidewalk, SW 12th Avenue between SW Montgomery and SW Mill, in Portland, OR. The goal of this project was to provide attractive greenspace and stormwater management without decreasing street parking or pedestrian mobility. Four stormwater planters, each 18' by 4', were built, with a 3-foot-wide parking buffer to accommodate passengers exiting parked vehicles. These planters successfully retain runoff from nearly 7,500 square feet of impervious streets.

## Recommendations

For this site we recommend implementing a permanent bioretention area. This could include stormwater planters, as in the case study in Portland, OR or other low-maintenance, landscaped stormwater management strategies such as bioswales. This would maximize infiltration of rainwater, reduce flooding and increase green space.

*Figures 46 and 47 (top right and bottom left), Rain Garden*
*Figure 48 (bottom right), Stormwater drainage system*
*Source: ASLA*

# 9.0 Conclusions:

## 9.1 Lessons Learned

Given the practical constraints of conducting this research over the course of only four months, our methods, analyses and recommendations provide a preliminary and limited assessment of green space access and the potential for LID stormwater interventions in Somerville today. While our approach to the GIS mapping portion of this analysis provides a valuable framework for future study, Groundwork Somerville and other likeminded organizations may choose to incorporate additional variables in the model for analysis, depending on programmatic goals.

During the ground truthing portion of our assessment, our team observed first hand the demographic shifts that are occurring in the City of Somerville as a result of skyrocketing prices in the Somerville real estate market (Real Estate Boston, 2015; WickedLocal, 2014). A major area of concern that emerged during the course of our research relates to the fact that the development of even the most well-intended green spaces may ultimately feed into the cycle of gentrification by increasing local property values and thus facilitate the displacement of the very residents the green spaces were intended to serve (Wolch et. al., 2014). With this in mind, it will be particularly important to carefully consider how the addition of new public parks and green spaces throughout the city will affect local residents, and engage community members in thoughtful conversations to be sure that their needs are truly being met.

## 9.2 Community Outreach

The scope of our work included no direct analysis of community desires and needs. Therefore, to be consistent with the previous methods and values of Groundwork Somerville, we recommend that any project based on this report include thorough community outreach.

Given that this step has yet to be taken, we limited our recommendations to potential use and the associated environmental concerns these sites could help alleviate. In keeping with The American Institute of Certified Planners (AICP) Code of Ethics and Professional Conduct we recognize that the responsibility to the public includes achieving, "social justice by working to expand choice and opportunity for all persons, recognizing a special responsibility to plan for the needs of the disadvantaged and to promote racial and economic integration" (American Planning Association 2009). In this way Groundwork Somerville can ensure that they meet the needs of the community through participatory decision-making and outreach.





## 9.3 Further Partnerships

While Groundwork Somerville has established strong relationships with community schools, we see great potential for expanding existing partnerships and creating new ones. Senior living centers provide ideal locations for creating community partnerships for urban gardens. For example, Groundwork Somerville may consider expanding their work with schools to enable intergenerational projects.

Additionally, given the limited potential for new large-scale open spaces due to urban density, Groundwork Somerville could expand their partnerships to include private homes. Many homes in Somerville have limited permeable spaces and Groundwork Somerville could present itself as a source of knowledge and resources. Similarly Groundwork Somerville could create partnerships with private business owners. By presenting themselves as local resources they could help businesses create or expand their green spaces.

## 9.4 Concluding Remarks

In light of the recent release of the SomerVision Comprehensive Plan, there is growing interest in the development of new green spaces throughout Somerville. However, given the density of development that already exists, efforts to reclaim parcels for use as public greenspaces must be strategic.

Our research, analysis and on-the-ground investigation revealed that while there is not a significant amount of readily available vacant property for redevelopment as greenspace. Groundwork Somerville and like-minded organizations should continue to engage in strategic partnerships with institutions, businesses and local residents, to demonstrate best practices that can be replicated throughout the city.

Given Somerville's long term struggle to efficiently manage stormwater runoff, new green spaces should be designed to serve the dual function of providing places for public recreation as well as contributing to improved stormwater management through the incorporation of low impact development strategies. Similarly, Groundwork and the City should explore linking green space development with other city-wide community development efforts, in order to maximize the impact of such spaces.

# Bibliography


Ahiablame, Laurent M., Bernard A. Engel, and Indrajeet Chaubey. (2012). Effectiveness of low impact development practices: Literature review and suggestions for future research. Water Air and Soil Pollution 223 (7): 4253-73.

Alexander W. Kemp. Playground at Cambridge Commons. (n.d.) Retrieved from http://www.cambridgema.gov/CDD/Projects/Parks/commonkemp

American Institute of Certified Planners (AICP). (2009). AICP Code of Ethics and Professional Conduct.

Akbari, H., Pomerantz, M., & Taha, H. (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. Solar Energy, 70(3), 295–310.

American Rivers. “Green Infrastructure Training” Accessed October 15, 2015. http://www.americanrivers.org/green-infrastructure-training/stormwater-management/gray-infrastructure/

Arnfield, A. J. (2003). Two decades of urban climate research: A review of turbulence, exchanges of energy and water, and the urban heat is land. International Journal of Climatology, 23(1), 1–26.

Brabec, E., Schulte, S., & Richards, P. L. (2002). Impervious Surfaces and Water Quality: A Review of Current Literature and Its Implications for Watershed Planning. Journal of Planning Literature, 16(4), 499–514.

Chambers, et al. (2012) Recommendations for Updates to the Stormwater Management Policy in Somerville, MA. Worcester Polytechnic Institute. Interactive Qualifying Project Number: IQP-PPM-1203.

Caputo, L. (2011). Robust Stormwater Management Strategies under Climate Change: A Case Study in Somerville, Massachusetts. (Master’s thesis). Retrieved from ProQuest Disserrtations and Theses (1502660)

CDC - Designing and Building Healthy Places - Home. (n.d.). Retrieved April 27, 2016, from http://www.cdc.gov/healthyplaces/







Chuckie Harris Park, Parks and Open Space, City of Somerville, MA Retrieved February 24, 2016 from http://www.somervillema.gov/departments/ospcd/parks-and-open-space/harris.

Chau, H.F. (2009). Green Infrastructure for Los Angeles: Addressing Urban Runoff and Water Supply through Low Impact Development. Retrieved from www.waterboards.ca.gov/water.../la_green_infrastructure.pdf

City of Chicago, IL. (2010-2016). City of Chicago City Service. Retrieved from http://www.cityofchicago.org/city/en/depts/cdot/provdrs/street/svcs/green_alleys.html

City of Portland, OR. (2005). SW 12th Avenue Green Street Project. Portland, OR: Environmental Services.

City of Somerville Office of Strategic Planning and Community Development, MA. (2011). Trends in Somerville: Land Use Technical Report. City of Somerville, Office of Strategic Planning and Community Development.

City of Somerville, MA. About Somerville. Retrieved March 12, 2016 from http://www.somervillema.gov/about-somerville

City of Somerville, MA. (2015). City of Somerville Zoning Overhaul. Website accessed March 23, 2016, from http://www.somervillema.gov/zoning/

City of Somerville, MA. (2014-2016). Departments: Conservation Commission. Retrieved March 23, 2016, from Somerville, MA: http://www.somervillema.gov/departments/concom

City of Somerville, MA. Lincoln Park, Parks and Open Space. Retrieved February 24, 2016 from http://www.somervillema.gov/node/53644

City of Somerville, MA. Parks and Open Space. MA Retrieved February 24, 2016 from http://www.somervillema.gov/departments/ospcd/parks-and-open-space

City of Somerville, MA. (2015). Somerville Zoning Ordinance, January 22, 2015 BOA Submital. Retrieved March 27, 2016, from: http://www.somervillema.gov/zoning/resources/2015-01-22-ordinance-boa-submittal.pdf

City of Somerville, MA. SomerVision Comprehensive Plan 2010-2030. Adopted Aril 19, 2012.

Community Assessment of Freeway Exposure and Health (CAFEH). Improving the Health of Near Highway Communities. Retreived May 9, 2016, from: http://sites.tufts.edu/cafeh/project-description/improving-the-health-of-near-highway-communities/

Daniels, T., & Daniels, K. (2003). The Environmental Planning Handbook for Sustainable Communities and Regions. Chicago: American Planning Association.

Dehpande, V. & Roden, B. (2005, May). Stormwater Asset Management Using GIS. Presentation at Environmental Expo & Conference, Boston, MA. Retrieved from http://www.slideshare.net/vvdeshpande/stormwater-asset-management-using-gis-v5

Dietz, Michael E. 2007. Low impact development practices: A review of current research and recommendations for future directions. Water Air and Soil Pollution 186 (1-4): 351-63.

Enterprise Community Partners, Inc. (2016). Enterprise Green Communities. Retrieved from Enterprise : http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities

Franke, L. (2013). Practicing Architecture. Retrieved April 18, 2016, from The American Institute of Architects: http://www.aia.org/practicing/AIAB099982

Gaffield, S. J., Goo, R. L., Richards, L. A., & Jackson, R. J. (2003). Public Health Effects of Inadequately Managed Stormwater Runoff. American Journal of Public Health, 93(9), 1527–1533.

Gattuso, Dana Joel. 2008. Conservation Easements: The Good, the Bad, and the Ugly. National Policy Analysis #569. A publication of the National Center for Public Policy Research. http://www.nationalcenter.org/NPA569.html

Green Water Infrastructure, American Rivers. Retrieved March 2, 2016 from http://www.americanrivers.org/initiatives/pollution/green-infrastructure/

Groundwork USA Mission. (n.d.) http://groundworkusa.org/about-us/mission/





Growth in Urban Population Outpaces Rest of Nation, Census Bureau Reports (2012, March 26). Retrieved March 23, 2016, from https://www.census.gov/newsroom/releases/archives/2010_census/cb12-50.html

Heat Island Effect, US EPA. Retrieved March 30, 2016 from https://www.epa.gov/heat-islands

Hoverter, Sarah P. Adapting to Urban Heat: A Toolkit for Local Governments, Georgetown Climate Center. Washington, DC. 2012

HUD. (2016, April 18). Public Housing Environmental & Conservation Clearinghouse. Retrieved April 18, 2016, from U.S. Department of Housing and Urban Development: http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/programs/ph/phecc/ginitiative

Jay, Jessica. 2010. Conservation Easements and Tax Benefits. Conservation Law. http://www.conservationlaw.org/publications/01-ConservationEasementsandBenefits.pdf

La Rosa, D. (2014). Accessibility to greenspaces: GIS based indicators for sustainable planning in a dense urban context. Ecological Indicators, 42, 122–134.

Lee, G., & Hong, I. (2013). Measuring spatial accessibility in the context of spatial disparity between demand and supply of urban park service. Landscape and Urban Planning, 119, 85–90.

Locke, D. H., Grove, M., Lu, J. W. T., Troy, A., O'Neil-Dunne, J. P. M., & Beck, B. D. (2010). Cities and the Environment. Cities and the Environment, 3(1).

Los Angeles Recreation and Parks Department, & Mukri, John Kirk. (2009). 2009 Community Wide Needs Assessment (Citywide Final Report) (pp. 1–78). Los Angeles, CA: Department of Recreation and Parks. Retrieved from www.laparks.org/planning/pdf/finalreport.org

MassCEC, Stormwater: To Fee or Not to Fee. Retrieved on March 2, 2016 from http://www.masscec.com/blog/2015/06/08/stormwater-fee-or-not-fee.

Mandelker, D. R., & Payne, J. M. (2001). Planning and Control of Land Use Development: Cases and Materials (Vol. Fifth Edition). LexisNexis.

Marshall, J. D., Brauer, M., & Frank, L. D. (2009). Healthy Neighborhoods: Walkability and Air Pollution. Environmental Health Perspectives, 117(11), 1752–1759.

MassDEP Environmental Justice. (2016). Retrieved from http://www.mass.gov/eea/agencies/massdep/service/justice/ #3 Perspectives, 117(11), 1752–1759. http://doi.org/10.1289/ehp.0900595

MassGIS, Environmental Justice Criteria. Retrieved on February 2, 2016 from http://www.mass.gov/anf/research-and-tech /it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/cen2010ej.html.

McPhearson, T., Kremer, P., & Hamstead, Z. A. (2013). Mapping ecosystem services in New York City: Applying a social–ecological approach in urban vacant land. Ecosystem Services, 5, 11–26.

Metropolitan Area Planning Council (MAPC). (2013). City of Somerville Hazard Mitigation Plan Update.

Metropolitan Area Planning Council (MAPC). Stormwater Financing/Utility Starter Kit. Accessed on March 2, 2016 . http://www.mapc/org/Stormwater_Financing

Morris, Ashleigh. 2011. "Conservation Easements and Urban Parks: From Private to Public Use" *Journal of Natural Resources*, Vol. 51, No. 2. 357-384. http://lawschool.unm.edu/nrj/volumes/51/2/Morris.pdf

Mukri, John Kirk. City of Los Angeles, Department of Recreation and Parks, Citywide Needs Assessment. 2009.

Mystic River Watershed Association. (2016). Combined Sewer Overflows. Retrieved on April 12, 2016 from http://www.mwra.state.ma.us/03sewer/html/sewcso.htm

NAHB Research Center, Inc. (2003). The Practice of Low Impact Development. U.S. Department of Housing and Urban Development, Office of Policy Development and Research. Washington, D.C. : HUD. Retrieved April 18, 2016





O'Connell, J. C.. (2013). The Hub's Metropolis: Greater Boston's Development from Railroad Suburbs to Smart Growth. MIT Press. Retrieved from http://www.jstor.org/stable/j.ctt5vjr6h

Office of Policy Development and Research (PD&R) U.S. Department of Housing and Urban Development. (2016). Case Studies: Chicago, Illinois: Historic Green Rehabilitation at Harvest Commons. Retrieved April 18, 2016, from HUD USER: https://www.huduser.gov/portal/casestudies/study_01012014_1.html

Otis Street Playground, Parks and Open Space, City of Somerville, MA Retrieved February 24,2016 from http://www.somervillema.gov/departments/ospcd/parks-and-open-space/otis-street-playground

OSPCD . (no date). The RA/RB Report: An Analysis and Discussion of Current Residential Zoning Regulation. Somerville by Design.

Ostrander, S. A.. (2013). Citizenship and Governance in a Changing City: Somerville, MA. Temple University Press. Retrieved from http://www.jstor.org/stable/j.ctt14bt4fb

Park Standards & Performance | City of Vancouver Washington. (n.d.). Retrieved March 14, 2016, fromhttp://www.cityofvancouver.us/parksrec/page/park-standards-performance

Pham, T.T.H., Apparicio, P., Séguin, A.M., Landry, S., Gagnon, M., 2012. Spatial distribution of vegetation in Montreal: an uneven distribution or environmental inequity? Landscape and Urban Planning 107 (3), 214–224

Quincy Street Park, Parks and Open Space, City of Somerville, MA Retrieved February 24, 2016 from http://www.somervillema.gov/departments/ospcd/parks-and-open-space/quincy-street.

Real Estate Boston, Can Cambridge and Somerville slow gentrification amid sky-high home prices? (24 August 2015) Retrieved on April 16, 2016 from http://realestate.boston.com/buying/2015/08/24/can-cambridge-and-somerville-slow-gentrification-amid-sky-high-home-prices/

Reducing Urban Heat Islands: Compendium of Strategies (October 2008) Retrieved April 2, 2016 from https://www.epa.gov/heat-islands/heat-is land-compendium

Roy, Allison H., Seth J. Wenger, Tim D. Fletcher, Christopher J. Walsh, Anthony R. Ladson, William D. Shuster, Hale W. Thurston, and Rebekah R. Brown. 2008. Impediments and solutions to sustainable, watershed-scale urban stormwater management: Lessons from Australia and the united states. Environmental Management 42 (2): 344-59

San Fransisco Planning Department. (n.d.). Living Alleys Market Octavia Toolkit. San Fransisco. Retrieved from http://sf-planning.org/living-alleys-toolkit

San Fransisco Planning Department. (n.d.). Living Alleys Market Octavia Toolkit. San Fransisco. Retrieved from http://sf-planning.org/living-alleys-toolkit

Somerville Farm to School Project: School Gardens. (n.d.). Retrieved from http://somervillefarmtoschool.blogspot.com/p/school-gardens.html

Somerville Neighborways. Retrieved February 18, 2016 from http://www.somervillestreets.com/

State of Massachusetts. Executive Office of Environmental Affairs. (2002). Environmental Justice Policy of the Executive Office of Environmental Affairs. Boston, MA. Retrieved from http://www.mass.gov/eea/docs/eea/ej/ej-policy-english.pdf

South Street Farm, Somerville, MA (2013) Recover Green Roofs. Retrieved from http://recovergreenroofs.com/south-street-farm/

Symphony Park, Parks and Open Space, City of Somerville, MA Retrieved February 24, 2016 from http://www.somervillema.gov/departments/ospcd/parks-and-open-space/symphony-park

Thrall, G. I., Swanson, B., & Nozzi, D. (1988). Green-space Acquisition Ranking Program (GARP): A computer-assisted decision strategy. Computers, Environment and Urban Systems, 12(3), 161–184.

The United States Environmental Protection Agency. “Elder Accessible Gardening”. Accessed April 7, 2016. https://www.epa.gov/sites/production/files/2015-10/documents/elder_accessible_gardening.pdf



The United States Environmental Protection Agency. “Low Impact Development (LID)” Accessed September 30, 2015. http://water.epa.gov/polwaste/green/

The United States Environmental Protection Agency. (2007). “Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices.” Accessed March 12, 2016. http://www.h-gac.com/community/low-impact-development/documents/Reducing-Stormwater-Costs-through-LID.pdf

The United States Environmental Protection Agency. “Somerville, Ma. Impervious Cover and Watershed Map”. Accessed January 16, 2015. https://www3.epa.gov/region1/npdes/stormwater/ma/ic/MA_Imperv2010_Somerville.pdf

The United States Environmental Protection Agency. “What is Green Infrastructure?” Accessed April 7, 2016. https://www.epa.gov/green-infrastructure/what-green-infrastructure

Dehpande, V. & Roden, B. (2005, May). Stormwater Asset Management Using GIS. Presentation at Environmental Expo & Conference, Boston, MA. Retrieved from http://www.slideshare.net/vvdeshpande/stormwater-asset-management-using-gis-v5

Ward, W. T. (2001). Land Conservation Options: A Guide to Massachusetts Landowners Fifth Revised Edition . The Massachusetts Land Trust Coalition . Essex County Greenbelt Association, Inc. and The Trustees of Reservations.

Washington State Department of Community, Trade and Economic Development, Interagency Committee for Outdoor Recreation, & Wilkerson, Juli. (2005). Planning, for Parks, Recreation, and Open Space in Your Community (pp. 1–153). Retrieved from www.commerce.wa.gov/Documents/GMS-Planning-for-Parks-Recreation-Open-Space.pdf

WickedLocal, Column: Preventing gentrification in Somerville’s Union Square (18 July, 2014) Retrieved on April 16, 2016 from http://somerville.wickedlocal.com/article/20140718/News/140717179

Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities “just green enough.” Landscape and Urban Planning, 125, 234–244.

# 10.0 Appendix:

## 10.1 Additional Information About Stormwater in Somerville

Somerville continues to face major stormwater problems that are historical in origin, but persist due to recent and current land use practices, such as excess paving and road surface areas. To start, portions of the city were built on marshlands and tidal estuaries that were filled in, including a river that was covered, causing drainage problems that persist until this day. The aging sewer and stormwater infrastructure in Somerville has been in need of costly repairs and replacements that can only be placed incrementally, as funding becomes available (Caputo, 2011; Chambers, et al., 2012). Thus, flooding, stormwater runoff, and a combined sewer and stormwater infrastructure cause economic, environmental and health problems that Somerville must continuously address.

Despite such challenges, Somerville lacks a comprehensive stormwater management plan. The most recent report we found that comprehensively addresses flooding and stormwater in the city is the 2013 Somerville Hazard Mitigation Plan, prepared by the Metropolitan Area Planning Council (MAPC) for the city, the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR), as part of FEMA's pre-disaster mitigation program. The report states that flooding affects over 6% of the city's land area (about 168 acres) and is the most serious hazard to Somerville (MAPC, 2013).

The report also identifies that flooding occurs in areas that do not correlate to flood zones calculated by FEMA, which is an indication that flooding is occurring in places due to poor surface drainage and a deficit in its stormwater infrastructure (MAPC, 2013). A significant challenge to addressing Somerville's flooding and runoff pollution problem is that Somerville has very little undeveloped land (only 2%), and green spaces, which absorb rain and melting snow (Caputo, 2011; Chambers, et al., 2013; MAPC, 2013).

In addition to flood risks, Somerville's highly developed land use pattern (73% impervious surface) impair nearby waterbodies and prevent groundwater recharge. The city lies within the Charles River and the Mystic River watersheds, both of which are negatively affected by urban runoff and by the still existing CSOs. Adding green spaces, including a three planting program, and reducing impervious surfaces are part of Somerville's active plan in addressing these water quality issues, and are consistent with the proposed hazard mitigation measures in the Somerville Hazard Mitigation Plan (MAPC, 2013).





Yearly reports on water quality status, permits and infrastructure projects can be found on the Massachusetts Water Authority and the Massachusetts Department of Environmental Protection websites. These reports, required under the Clean Water Act, provide some information on the city's efforts to mitigate stormwater and water quality challenges, but do not emphasize green infrastructure measures. Nevertheless, LID techniques, natural resources protection, and public participation and education are in line with Groundwork's Somerville's mission.

In addition to government sources, several past student projects provide additional information on Somerville's stormwater problems. A 2012 report by Worchester Polytech Institute students, acknowledged that the city lacked a well-defined stormwater management policy. Utilizing cost-benefit analysis, the study compared Somerville's BMP regulations with the outcomes of two large development projects, one of which had good results due to LIDs (Chambers, et al., 2012). A 2011 Tufts engineering student thesis, titled Robust Stormwater Management Strategies Under Climate Change, documents an extensive resiliency study utilizing climate change modeling and cost-benefit risk analysis. The results identified sewer separation as the best strategy for managing stormwater property damages (Caputo, 2011). Although the sole use of LID techniques did not present good flood control results, the author acknowledged that water quality was not factored into the cost-benefit models. The use of green infrastructure to mitigate stormwater has additional benefits, such as increasing carbon sequestration, providing additional recreation space, reducing CSOs, increasing land values, urban heat island mitigation, enhanced livability and reducing hard infrastructure costs (Caputo, 117).

Finally, a 2005 presentation by another Tufts student, Britta Roden, MS Economics, which might be the precursor to Somerville's Asset Management GIS database, demonstrated the significant economic value provided by trees in terms of runoff mitigation. Roden analyzed the role of Somerville's trees cover in damage prevention, calculating that the existing 18% tree cover (2005) was responsible for removing over four million cubic feet of storm water (Roden, 2005). These results are consistent with the goal of using green infrastructure to combat stormwater hazards.

## What is a Combined Sewer System?

A combined sewer system (CSS) is a method of piping and plumbing infrastructure utilized in many communities that relies on one set of sewers to dispose of both human waste and street runoff water. As demonstrated by Figure 72, this system works well in dry weather, but is prone to overflow in times of heavy rain. This overflow is referred to as a combined sewer overflow (CSO), transferring human waste into the surrounding watersheds. Far from being fertilizing material, the effects of this pollution can be seen in negative impacts across a spectrum of issues. As is common in many older cities, portions of the City of Somerville are served by combined sewer and sanitary systems, and seven CSO outfalls have been identified along the Alewife Brook

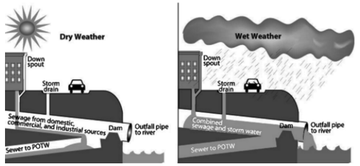


*Figure 72, CSO*
*Source: US EPA*

## Exploring a Stormwater Utility for Somerville

Massachusetts municipalities are authorized under Massachusetts General Laws to establish stormwater utilities. These are management authorities that can charge fees to property owners in the same way that utilities are allowed to charge fees for electricity, drinking water and sewering services (MGL Chapter 40 Section 1A, Chapter 40A Section 5, Chapter 44 Section 53F1/2, and Chapter 83 Section 16) (MAPC, 2016). In light of our analysis of Somerville's stormwater infrastructure, we strongly recommend that the city consider implementing a stormwater utility as a way to cover costs for stormwater management. At the same time, the City should develop policies that incentivize private property owners to implement LID stormwater management strategies.

Considering that most municipalities use general funds from property taxes to finance stormwater management, it can be difficult to obtain consistent funding given the competition from other municipal programs. Many cities throughout Massachusetts, including Newton, Chicopee and Reading, have had great success in establishing a stormwater utility program, which not only provides a consistent funding base for stormwater management efforts but is also an equitable means of holding individual property owners accountable for the stormwater generated by their property (MassCEC, 2015).

In combination with effective public education about low impact development management strategies, rebate programs that function within the framework of a stormwater utility can motivate property owners to seek out solutions to stormwater management at the site level. MAPC has developed a Stormwater Utility/Funding Starter Kit which may be a useful tool for the City of Somerville to review when considering whether a stormwater utility fee structure is a feasible option (MAPC, 2015).





# 10.2 Mapping

## Standardization of Variables

In order to determine the overall composite score for each block, the mean and standard deviation for each variable were calculated, and were then used to calculate z-scores using the following formula:

$$\frac{n - \bar{x}_n}{SD_n}$$

Where n is the observed value of the variable, n, at the census block level, xn is the mean of the variable n, and SDn is the standard deviation of the variable n. Once all of the variables were converted into standard units, the z-scores for each of the seven variables for each census block were added together to generate a unitless composite score. The proximity to open space z-score, was multiplied by negative 1, to reflect that a high magnitude (high amount of open space per block) corresponded with a low priority for green space interventions. The rest of the variables were all ranked such that higher z-scores were indicative of higher priorities for green space interventions.

## Methodological and Data Limitations

Locke et. al.'s 2011 methodology included variables which we had to exclude from our analysis due to lack of publicly available information or irrelevance to our project goals. Omitted variables include metrics of obesity and crime. The only public health data available were collected at the county level, too large of a scale to be of use in our analysis. With regard to crime data, our review of the literature did not find sufficient evidence to support the use of this variable as an indicator of locations that would benefit from urban greening.

Other potential sources of error result from the quality of data available. In particular, the 311 call dataset was not robust and did not disaggregate calls about flooding from all water-issue related calls. The impervious surface image was not uniform due to the collection instrument and may be subject to a level of precision error. Following the MillionTreesNYC methodology, we used road density as a stand-in for air pollution and related health impacts. This measures does not account for the differences in road typology. Multi-lane,

heavily-trafficked highways are likely to have a greater impact on air pollution than residential blocks, yet the literature did not support treating the separate road classifications differently. Nonetheless, it is important to acknowledge the roughness of this measure.

A certain amount of positional accuracy error is always associated with environmental features which lack defined border such as the FEMA flood maps and surface temperature. The demographic data for our project came from the U.S. Census Bureau's 2010 Census and from the American Community Survey (ACS) 2006-2010 5 year estimate tables. The Census Bureau provides a 10% margin of error associated with the ACS. The 2010 Census is not subject to sampling error by definition.

With regard to our approach to data analysis, while the use of z-scores was supported by the Locke et. al. methodology, it is important to note that z-scores are typically calculated to make comparisons within datasets that have continuous variables and are normally distributed. Though the majority of our datasets were normally distributed, some were not. While this may provide some statistical challenges and is a limiting factor in the predictive capacity of our model, the use of z-scores is a common tool for creating unweighted variables (Marshall et al. 2009).

Finally, our decision to aggregate all of our datasets at the block level was made after a thorough assessment of the risks and benefits of other approaches. We chose not to aggregate the data at a pixel level using raster methods, as we believed that this would indicate an unrealistic level of precision, given the imprecise nature of some of the environmental datasets. Our decision to use blocks also aimed to provide a set of recommendations for priority areas that was at a scale that would be feasible for ground truthing.

On the following pages we have included models which depict the GIS techniques we used for analyzing our datasets and developing our maps, as these methods may be useful for future, similar research.





## Table 7: Mapping Variabes

| Groundwork Somerville/Tufts UEP Climate Change and Green Space Access Vulnerability Analysis | | | |
|---|---|---|---|
| **Variable** | **Measure** | **Datasets Used for Analysis** | **Literature Cited** |
| Open Space Access | Square miles of open space within a .25-mile buffer of a block's centroid (by block) | MassGIS Data - Protected and Recreational Open Space. Updated: March 2015<br><br>City of Somerville Data – Open and Green Space<br>Updated: March 2016 | Thrall, Swanson, & Nozzi, 1988, Planning for Parks, \| Recreation and Open Space in Your Community, 2005, "CDC - Healthy Places", Lee & Hong, 2013 |
| Population Density | People per sq. mile (by block) | Census 2010, MassGIS | Thrall, Swanson, & Nozzi, 1988, Groundwork Somerville, City of LA Parks Planning Guide |
| Road Density | Miles of Road (by block group)<br><br>*Proxy measure of pollution* | MassGIS Data - Massachusetts Department of Transportation (MassDOT) Roads. Updated: June 2014. | Marshall et al, 2009, Akbari et al. 2001 |
| Impervious Surface Density | % of block covered in impervious surfaces<br><br>*Measure of vulnerability to flooding and urban heat island* | MassGIS Data - Impervious Surfaces Updated: 2005 | Lock et al 2011, Brabec, Schulte, & Richards, 2002, Xu, 2010, EPA 2010, Jr & Gibbons, 1996, MAPC, Hazard Mitigation Plan 2013 |
| 311 Calls Related to Water Issues and Catchbasin Issues | # of calls (by block)<br><br>*Measure of vulnerability to flooding* | City of Somerville Open Data Portal, 311 Constituent Service Daily Calls - period between July 1st, 2015 and January 12th, 2016. | Lock et al 2011, MAPC, Hazard Mitigation Plan 2013 |
| FEMA 100 and 500 year flood zones | % of block within flood zones<br><br>*Measure of vulnerability to flooding* | MassGIS Data - FEMA National Flood Hazard Layer Updated: July 2014 | APA Green Infrastructure, American Rivers, MAPC, Hazard Mitigation Plan Update 2013 |
| Average Surface Temperature | Average Surface Temperature (by block)<br><br>*Measure of Urban Heat Island Effect* | The Land Processes Distributed Active Archive Center (NASA, USGS Partnership )- On Demand Surface Kinetic Temperature | USGS, NASA |

*Source: Created by Sharon Ron and Lauren Lynch*

## Average Surface Temperature: Analysis by Census Block

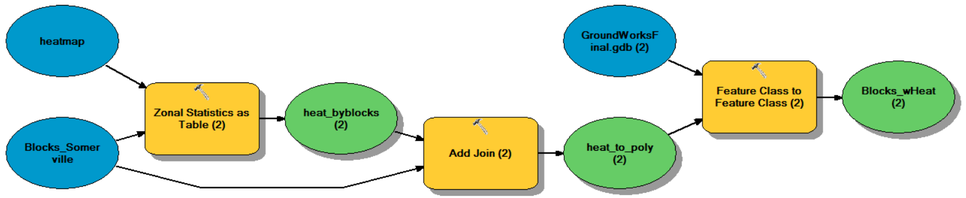


*Figure 73, Surface Temperature Model*

*Created by: Sharon Ron*





## Impervious Surface Density: Analysis by Census Block

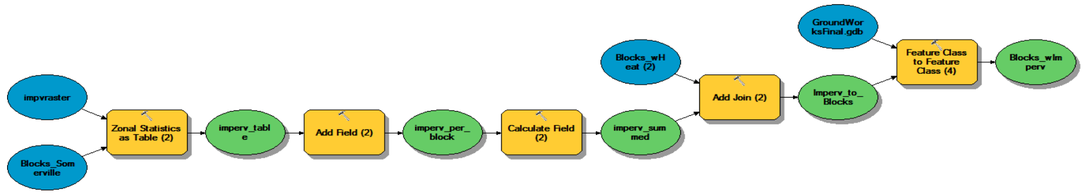


*Figure 74, Impervious Surface Density Model*

*Created by: Sharon Ron*

## 311 Water Related Calls: Analysis by Census Block

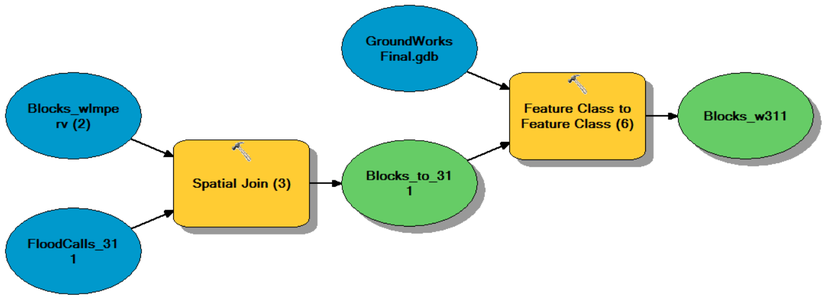


*Figure 75, 311 Call Model*

*Created by: Sharon Ron*





## Population Density: Analysis by Census Block

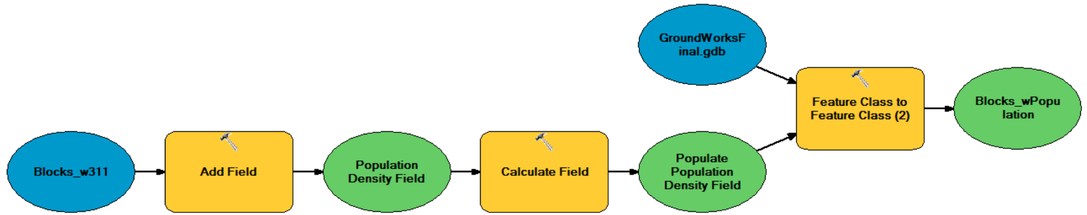


*Figure 76, Population Density Model*

*Created by: Sharon Ron*

## Open Space Access: Analysis by Census Block

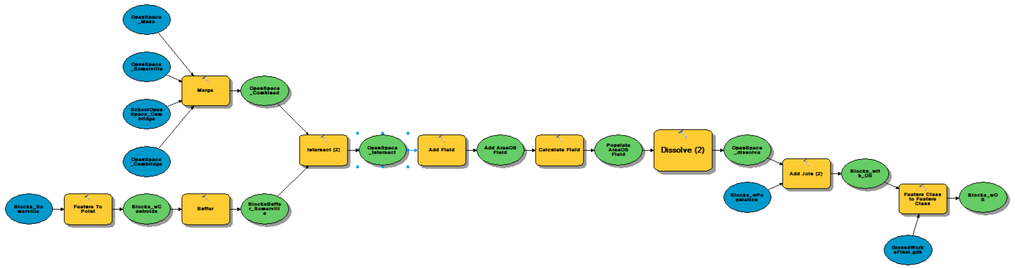


*Figure 77, Open Space Model*

*Created by: Sharon Ron*





## FEMA 100 and 500 Year Flood Zones: Analysis by Census Block

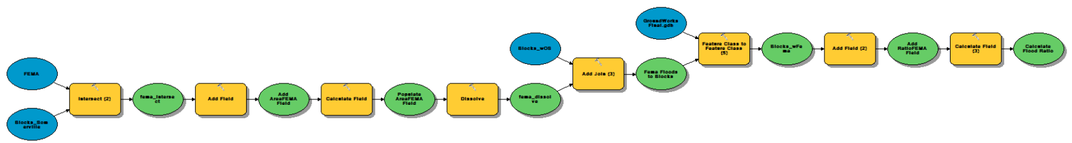


*Figure 78, FEMA Flood Zone Model*

*Created by: Sharon Ron*

## Road Density: Analysis by Census Block Group

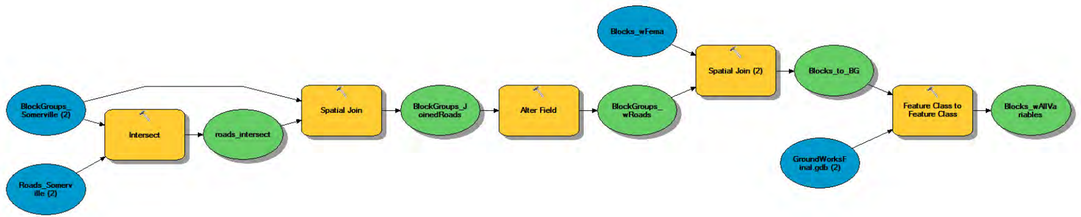


*Figure 79, Road Density Model*
*Created by: Sharon Ron*





# 10.3 Relevant Case Studies

## Chicago's Green Alleys Program

Chicago's Green Alley Program, which started as a pilot program in 2006, transformed over 100 alleyways into green LID spaces in four years (City of Chicago, 2010-2016). The main goal of the program is the address the periodic flooding issues and the City's stormwater challenges.

Document link:
http://www.cityofchicago.org/content/dam/city/depts/cdot/ Green_Alley_Handbook_2010.pdf

## Enterprise Partners: Green Communities

Listed under HUD PIH programs, Green Communities is a national program sponsored by Enterprise Partners that provides grants, financing, tax-credit equity and technical assistance to build and rehabilitate low-income housing units. Enterprise's Green Communities website contains various online resources, including case studies, retrofit toolkits, design guidelines and policy and advocacy tools to help plan for the development of green affordable housing.

Site link:
http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities

## Fairmont Greenway

This is a Boston-based project that may serve as a useful reference on models of parcel identification and acquisition, different forms of ownership, and public-private partnerships.

Site link:
http://fairmountcollaborative.org/our-work/create-a-fairmount-greenway

## Green Infrastructure for Los Angeles: Addressing Urban Runoff and Water Supply through LID

Comprehensive report on low-impact development benefits and techniques, containing suggestions for BMPs and street design. Funding, cost reductions and issues concerning equity are also addressed.

Document link:
http://www.waterboards.ca.gov/water_issues/programs/climate/docs/resources/la_green_infrastructure.pdf

## Green Values Stormwater Toolbox

Overview of how the Great Lakes landscape works and description of methods that minimize stormwater runoff without expensive infrastructure projects.

Site link:
http://greenvalues.cnt.org/

### Harvest Commons: Historic Green Rehabilitation

After purchasing a debilitated historic building, Chicago's Department of Housing and Economic Development engaged anti-poverty organization Heartland Alliance and the First Baptist Congregational Church, in the rehabilitation and conversion of the building into 89 green housing units for the city's most vulnerable residents. Besides providing housing for the homeless and formerly incarcerated women, the building maintains supportive services, such as a full-time nutritionist and gardener, a community garden, chicken coop, experimental kitchen and café for its residents (Franke, 2013). Succulent plants on the building's roof help to reduce stormwater runoff (Office of Policy Development and Research, HUD, 2016). Designed by Landon Bone Baker Architects, the project has won several awards.

### Market Octavia Living Alleys

A "living alley" is a street designed to give preference to people on a right-of-way. It fosters human interaction, while at the same time maintaining its function as a street. Vehicles, bicyclists and pedestrians share some spaces, while other areas are reserved for pedestrians only (San Francisco Planning Department). Street hydraulics, road composition, underground utilities, emergency vehicle access, accessibility, parking and traffic are all issues that must be addressed before implementation measures are decided.

Site link:
http://sf-planning.org/living-alleys-toolkit

### Missouri Botanical Garden: Rainscaping Guide

Technical guidance and reference material for rainscaping, including plant species and soils information.

Site link:
http://www.missouribotanicalgarden.org/sustainability/sustainability/sustainable-living/at-home/rainscaping-guide.aspx

### Opportunity Mapping: San Francisco Parklets and Plazas

Report by Gene Stromam, GIS Researcher SF Parks Alliance and SF Planning Department, 2014.

Report and presentation link:
http://pavementtoparks.org/research-project/opportunity-mapping-san-francisco-parklets-plazas/





### San Francisco's Pavement to Parks Research Lab

Pavement to Parks Research Lab offers technical resources, including assistance and support to researchers and to other cities, governments and municipalities in the U.S. and across the world. The program has been in operation since 2009 and boasts an immense collection of materials that focuses on transforming underutilized paved areas into experimental parks that can either be reverted to its previous use, or reclaimed into permanent public spaces.

Site Link:
http://pavementtoparks.org/

Step-by-step Parklet implementation manual document and examples link:
http://pavementtoparks.org/parklets/#parklet-manual

### Transforming Philadelphia's Schoolyards

This is a comprehensive design guide for transforming schoolyards into active green spaces. It provides case studies, design elements, and steps towards creating greener schoolyards and playspaces.

Document link:
http://www.cdesignc.org/uploads/files/547129531651180934-collaborative-transforming-philadelphias-schoolyards-guide.pdf

## 10.4 Legal Resources

*Disclaimer. This section was prepared by members of our team and the editor only for the purpose of generating ideas, and is not intended to serve as legal advice. A land use attorney should be consulted to gain further knowledge before undertaking any of the suggestions mentioned.*

To create permanent or temporary open space, cities and non-profit organizations can rely on several legal tools:

- the acquisition or lease of private lands,
- the conversion of publicly-owned lands, and
- the acquisition, acceptance of donation, or leasing of conservation easements.

Each of these has benefits and drawbacks. The purpose of this section is to provide an overview of possible legal mechanisms that may be used. We believe collaboration between private land owners and Groundwork Somerville and the city will generate the best results.

## Private Parcels Conversion to Open Space

1. Purchasing land

The most assured method of creating new open green space in Somerville is for the city or a non-profit organization such as land trust to purchase land in fee simple. This will entail appraising the land and negotiating its sale with private property owners. In addition to the City being able to accept private land donations, the most viable option is to use public funds for the outright purchase of land at full market value.

2. Purchasing conservation easements or restrictions

An alternative to acquiring land for open space preservation purposes, is acquiring an 'interest' on the land's development rights, where landowners retain their land in fee, but are subject to the restrictions. Conservation easements, also called conservation restrictions, are recorded deed restrictions on privately-owned land that can establish a permanent protection against development. Conservation easements are often used to preserve natural areas, but can also be used to preserve historic, scenic, and urban open space lands (Morris, 2011).

Somerville may wish to purchase conservation easements, compensating willing landowners for the reduction in their property's market value. This additional income to the landowner may help prevent property tax foreclosures and development pressure.

Bargain sales (part cash, part donation) are another option, where property owners may reduce the value of the land they are conveying as a conservation easement by the amount they owe in property taxes.

Advantages of purchasing conservation easements include lower costs to the buyer than purchasing the entire property, and that the restriction is based on voluntary private agreements, requiring willing sellers (offer) and buyers (acceptance). Permanent conservation easements run with the land in perpetuity, with one exception: they are not protected from eminent domain. All conservation restrictions in Massachusetts must be approved by the municipality involved, and by the designated Commonwealth agency, the Somerville Conservation Commission (SCC). The long-term management of perpetual conservation lands must be assumed by a responsible and qualified entity. The Massachusetts Land Trust Coalition (MLTC) has extensive information on land conservation options, including contacts and resources on its website: http://www.massland.org. Note: Since land under conservation easements does not have to be open to the public, such open to the public use should be made explicit. Enlisting the professional guidance of an experienced land trust organization to help Groundwork Somerville work with private landowners will ensure that all parties are better informed to negotiate the terms most favorable to them and the City. Groundwork can request that the City of Somerville provide for the appraisal and surveyor work, and plan accordingly with the city attorney and tax assessor.

3. Receiving donations of conservation restrictions (or easements)

Land owners can convey property interest to either a governmental entity, such as a water district, or town, or to a qualified private non-profit organization with 501(c) 3 status, such as Groundwork Somerville or a land trust. There are many private benefits that encourage land owners to donate their land development rights, due to substantial tax incentives. Even though it is a partial interest in land, a perpetual conservation restriction is considered a charitable gift, and therefore qualifies for tax deductions, given all requirements are in compliance (Ward, 2001). The income tax deduction is based on the fair-market value of the development rights, that is, the value of the land without the restriction. Donations of perpetual open space conservation restrictions also provide reductions in state and federal estate taxes. If the restriction significantly lowers the property value, land owners may be charged lower property taxes under Massachusetts state laws. However, benchmarks for reductions varies among municipalities, and such reduction may already be reflected in the property assessment (Ward, 2001, p. 25). A downside to the City is that by lowering the property value, the City also lowers its property tax revenues.

4. Leasing conservation easements (or term easements)

Landowners can alternatively create a temporary restriction, by leasing their land to the city or conservation organization for little or no charges. While non-permanent conservation restrictions are not eligible for tax deductions, an advantage of lease options is that landowners retain title rights to their property while receiving a modest income. Landowners that are not prepared or able to donate land may also find the lease option attractive. The drawback is that any conveyance of a temporary restriction on land development is not permanent and requires timely renewal.

Whether the City pursues land purchases, or the acquisition, acceptance or leasing of conservation easements, two bodies will be important actors involved in the stewardship of additional green open spaces.

### Somerville Parks and Open Space Department

Somerville's Parks & Open Space Department, which is in charge of actively planning for the creation, management and renovation of parks and open spaces, is part of the Mayor's Office of Strategic Planning & Community Development (OSPCD). The Parks and Open Space Department is undergoing the creation of a new 5-year Open Space and Recreation Plan to update the 2008-2013 one that should be consulted by our client when finalized. The department also maintains a list of current parks and an open space inventory that was used for our mapping analysis.

### Somerville Conservation Commission

The Somerville Conservation Commission (SCC) plays an important role in the preservation and protection of the city's natural resources, overseeing community gardens and planning for open space, as summarized below:

- Enforces and oversees wetlands and river protection acts under Massachusetts General Law, Chapter 131, Section 40.
- Has authority through the Conservation Commission Act, under Massachusetts General Law, Chapter 40, Section 8c, to approve environmental reviews and open space planning.
- Works with the Office of Strategic Planning and Community Development (OSPCD) in developing the city's Open Space and Recreation Plan.
- Planned and oversees eight community gardens, including administering a Conservation Fund to raise revenues for such purposes, and hiring a city-wide garden coordinator. (City of Somerville, 2014-2016)

The SCC consists of seven appointed volunteer members, and non-appointed members without voting powers. The Commission should be consulted with any proposed public open space acquisition plans.

## 10.5 Somerville Zoning that Supports Green Space

Several provisions of Somerville's proposed form-based code (Somerville Zoning Ordinance (SZO), January 22, 2015 BOA Submittal) offer opportunities for the conversion of land parcels into green spaces, either as usable open space or for green infrastructure. As the new Zoning Ordinance gets implemented over time, Groundwork Somerville, other non-profit organizations, Somerville's Parks and Recreation Department, Office of Strategic Planning and Community Development, Department of Public Works and Conservation Commission will have new reasons and occasions to collaborate with landowners and assess whether parts of their property could be converted to green spaces.

These opportunities include:

- minimum permeable surfaces of lots extended to a wider range of building types;
- required landscaping for door yards and forecourts, required outdoor amenity space, and permitted outdoor café seating;
- prohibition of outdoor storage of equipment in residential and mixed-use districts;
- community farms, gardens, the keeping of hen coops and bee hives, and other urban agricultural uses permitted in a wide range of districts;
- specific standards for landscaping across the city, and required landscape buffers between residential and other districts;
- new reduced parking requirements for all building types, maximum widths of driveways, maximum sizes of parking spaces;
- permeable surface minimums and landscaping standards for all public realm spaces, including different types of civic and recreational spaces.

To assess future rather than current zoning provisions for the purposes of this project, we consulted the proposed Somerville Zoning Ordinance submitted to the Board of Appeals in 2015. As of March, 2016, the City's webpage is still soliciting residents' participation in "reinventing zoning in Somerville" (City of Somerville, 2015).

Much of Somerville's residential construction (current zones RA and RB) took place at the turn of the 20th century, before automobiles were common and when public transportation was readily available. The advent of the automobile is responsible for the lack of yards throughout the city, as homeowners had to make space for driveways. Presently, minimum parking requirements absorb valuable ground space with pavement instead of gardens. Current zoning requires 1.5 to 2 parking spaces per unit in RA and RB zones, regardless of parking demand. High parking requirements in a city of rising land values and very limited open space are among the many reasons that incited the city to rewrite its zoning ordinance into a form-based code (see reduced parking requirements below.)

A summary of the new proposed zoning provisions pertaining to open space follows.

## Expanded permeable surface requirement

A minimum of 35% of all residential lots in 3-story districts must be of permeable surface and a minimum of 25% must be landscaped. This includes the new residential building types of cottage, house, paired house, duplex, row house, triple-decker, paired triple-decker, four-plex, six-plex, apartment house, and shop house. A minimum of 10% permeable surface is required for apartment buildings in 3- to 7-story mixed-use districts, and a minimum of 25% must be landscaped. A minimum 10% permeable surface is required for neighborhood stores, mixed-use buildings, commercial buildings, production buildings and fabrication lofts. (Article 3, under each building type). The current pervious surface requirement is 35% for Residential zones RA and RB, 30% for Residential Commercial (RC) and no requirement for all other zones.

## Required landscaping of door yards and forecourts

A dooryard is a frontage type featuring fenced or elevated gardens or patios that buffer dwellings from an adjacent sidewalk. They are permitted for all residential type buildings. Door yards must include a landscaped area, 12 inches above the sidewalk, with a minimum depth of 8' from the sidewalk to the building (Article 3.B.6).

A forecourt is a frontage type featuring a landscaped semi-public area, open to the sky, formed by a recess in a central portion of a building's facade. They are permitted for apartment buildings, mixed-use buildings and commercial buildings. Forecourts must be a minimum size of 12' x 12' and have a minimum of 30% (43 square feet) landscaped (Article 3.B.7).

## Required outdoor amenity space

One outdoor amenity space must be provided for each dwelling unit in residential and mixed-use buildings. Outdoor amenity spaces include yards, decks, porches, balconies, and roof terraces, and must include 24 square feet of unobstructed seating area (Article 3.F.).

## Allowed outdoor café seating

An outdoor café seating area is allowed as an auxiliary use of any eating or drinking establishment. This permitted use is an opportunity for the creation of pocket parks, parklets, and public-private collaboration. (Article 6.I.6.)

## Prohibited outdoor storage

The outdoor storage of equipment, inventory, materials, merchandise, supplies, or other items is prohibited, except in the Fabrication and Commercial Industry districts. This may facilitate the conversion of parcels currently used for such purposes into green open space (Article 5.A.4).





## Urban agriculture uses allowed

Community gardens and community farms as principal uses are permitted by right in all but Civic zones. Commercial farms as principal uses are allowed by right in all but Neighborhood Residential, Urban Residential, Fabrication, Commercial Industrial and Civic Districts (Table 5.1). Aviculture (the raising and care of birds, specifically of hens), apiculture (the maintenance of honey bee colonies, commonly in hives), commercial farming and residential gardening as accessory uses are permitted by right with limitations in all zones, but the Fabrication, Commercial Industry and Civic zones (Table 5.2).

The ownership, care, and control of residential gardens, hens, bees, and commercial farms are the responsibility of a resident of a dwelling unit on the lot (Article 5.C.4. a.b.c.d.)

## Landscaping and tree preservation standards

The purposes of this section include: to protect and expand the city's tree coverage; to reduce the heat island effect of excessively paved sites, to promote temperature regulation, to provide seasonal shade to reduce energy used in buildings; and to improve site permeability and reduce stormwater runoff, erosion of the landscape, and sedimentation of municipal infrastructure and regional waterways (Article 6.D.1)

The Landscaping and Tree Preservation requirements apply to new construction, the expansion of existing floor space, the expansion of parking, and site improvements (Table 6.1).

- Landscape Design

Landscaping should consist primarily of native species requiring minimal irrigation, fertilization, and maintenance. Plantings must be cold hardy, drought tolerant, and able to survive on natural rainfall once established with no loss of health. Planting areas must have uncompacted coarse loam that is a minimum of 12 inches deep. Soils must be appreciably free of gravel, stones, rubble, or trash. All compacted soil, contaminated soil, or road base fill must be removed (Article 6.D.2).

A minimum of two (2) kinds of landscape cover is required, including but not limited to trees, shrubs, permeable and pervious pavers, and turf grass. A minimum of one (1) large tree is required for each one thousand (1,000) square feet of landscaped lot area for lots in the Neighborhood Residence (NR) and Urban Residence (UR) districts. Proposed trees must be a min-

imum height of ten (10) feet or three (3) inches in caliper. Bare and exposed ground on a site and/or in required landscaped areas must be stabilized and maintained with turf grass, ground cover, or mulch to prevent soil erosion and allow water infiltration, with the exception of the following: land area dedicated to urban agricultural activities, as permitted; trails; naturally occurring stream beds, rock outcroppings, and similar features typically lacking in vegetation; and clay or sand surfaces associated with recreation fields and facilities.

- See also the provisions of Landscape Installation and Landscape Maintenance in this section.

- Tree Preservation

The preservation of existing, on-site trees and other vegetation is the preferred means for landscaping. Mature, healthy trees and vegetation may be used to fulfill landscape requirements of this Section according to the following: existing trees may be counted as required trees provided that the tree is at least four (4) inches in diameter at breast height, and is determined to be in good health and not damaged, diseased, or a threat to public health or safety. Invasive plant species to the State of Massachusetts must be removed from the site.

The preservation of existing trees located within a front, side, or rear setback area of a lot is required as a condition of any demolition permit or special permit to alter a nonconforming structure, provided that the tree is at least four (4) inches in diameter at breast height, and is determined to be in good health and not damaged (Article 6.D.5)

- Landscape buffers

Lots within any zoning district other than the neighborhood Residential (NR) district that abut the side or rear lot line of a lot in the NR district must be screened by a landscape buffer for 100% of the length of the shared lot line to increase privacy and minimize the trespass of undue sound and light between adjacent properties. A landscape buffer must be a minimum of four (4) feet in depth from the shared lot line, planted with a minimum of three (3) large trees with full canopy density for every one hundred (100) feet of lot line, and include a wall or fully closed fence. Preexisting, substantially equivalent vegetation that is preserved within the landscape buffer may substitute for any required landscape buffer plantings provided that the preexisting vegetation is healthy and growing (Article 6.D. 6).

## Parking, service and mobility

The new rules in this section emphasize the City's effort to reduce motor vehicle parking space requirements. Table 7.2 should be consulted before proposing the conversion of parking spaces into open space. The provisions below are of interest because they may result in reclaiming space now used for excess parking and wide driveways and repurposing them into green open space and/or green infrastructure. (Article 7)

## Reduced parking requirements

Parking requirements for all residential areas are one space per housing unit (Article 7, Table 7.2). For affordable housing units, senior housing, and housing for the disabled, the parking requirements are .75, .5 and .33 spaces per unit, respectively (Table 7.3). Parking requirements for all other uses have been maintained or substantially reduced from their current levels.

## Parking setbacks

All off-street parking, including surface and structured parking, but excluding underground parking, must be located at or behind the required parking setback as indicated for each building type (Article 7.B.7.c.i). For residential building types, the primary front parking setback is 20' and the secondary front parking setback is 10'. The minimum front setback for residential buildings is 10' and the maximum is 20', therefore parking is not permitted in front of a residential building (Article 2, under each building type; Article 3.B.2.d.i.; Article 7.B.7.c.i and ii). Parking is never permitted within a frontage (Article 7.B.7.c.ii).

## Driveways and vehicular entrances

Neighborhood Compatibility
Driveways and vehicular entrances

providing access to off-street parking with seven (7) or more parking spaces are prohibited within fifty (50) feet of any property within the Neighborhood Residence district, measured from the edge of the driveway or vehicular entrance along the front lot line(s) block face to the nearest property line (Article 7.B.11.a).

Design and Construction

Driveways may be located within required front, side, and rear setback areas, but are prohibited between the facade of a building and any front lot line. Driveways and vehicular entrances to off-street parking with six (6) or less parking spaces must be between eight (8) feet and twelve (12) feet in width. Driveways and vehicular entrances to off-street parking with seven (7) or more parking spaces must be between eighteen (18) and twenty-four (24) feet in width at the frontage (Article 7.B.11.b).

## Public realm standards

Among its many purposes, this section aims to ensure a variety of functional, well-designed civic and recreation spaces that complement the character of adjacent properties, contribute to a comprehensive open space network, and add vibrancy to the city. (Article 8)

## General provisions for all civic and recreation spaces.

### Landscape

All landscaping within civic and recreation spaces must comply with the provisions of Article 6.D.2. Landscape Design, §6.D.3. Landscape Installation, and §6.D.4. Landscape Maintenance (Article 8.C.2.d.i)

### Trees

Large trees are required as indicated for each type of civic and recreation space. At least one thousand (1,000) cubic feet of soil volume must be provided for each tree within a twenty-seven (27) foot radius of the tree trunk (Article 8.C.2.d.ii. a), b)).

A minimum sixteen (16) square foot open soil area must be provided around each tree, centered at the tree trunk. A tree grate or mulch at a minimum of three (3) inches in depth must be applied to or over the open soil area, as appropriate (Article 8.C.2.ii c), d)).

### Irrigation & Drainage

All irrigation systems must be designed to use a minimal amount of water. Drainage systems must be designed to return drain water to the soil. All water holding and infiltration facilities must be designed to meet the specific needs of each type of civic and recreation space (Article 8.C.2.h).

The table on the next page summarizes the design standards for civic and recreation spaces of two acres or less. (This excludes Regional Parks, Recreation Fields, Community Parks and Public Commons).





## Table 8: Somerville Zoning Ordinances

Somerville Zoning Ordinance. Proposed Design standards for Civic and Recreation Spaces of two acres or less (excludes Regional Parks, Community Parks, Recreation Fields and Public Commons)

| Type | Size | Definition | Examples | Trees (min) | Permeable surface (min) | Landscaped area (min) |
|---|---|---|---|---|---|---|
| Neighborhood Park | 8,000 SF to 2 acres | A civic space type designed for active and passive recreation with features and facilities that support the immediate neighborhood. | Perry Park, Albion Street Park, and Walnut Street Park. | 1/350 SF | 85% | 50% |
| Public Square | 8,000 SF to 2 acres | A civic space type designed for passive recreation and civic purposes. A free standing site with thoroughfares on all sides and landscaping consisting of formally disposed lawns, paths, and trees. | --- | 1/2,000 SF | 85% | 60% |
| Plaza | 8,000 SF to 1.5 acres | A civic space type designed for passive recreation, civic purposes, and commercial activities, with landscape consisting primarily of hardscape. Plazas are generally located in activity centers or at the nexus of major circulation routes. | Statue Park Plaza and Union Square Plaza. | 16 trees + 4 caliper inches/ 1,000 SF | 70% | 30% |
| Pocket Park | 800 SF to 10,000 SF | A civic space type designed for passive recreation consisting of vegetation and a place to sit outdoors. | Quincy Street Park, Symphony Park, and Stone Place Park. | 1/200 SF | 85% | 30% |
| Playground | 2,500 SF to 25,000 SF | A civic space type primarily designed as a play area for children. Playgrounds may be freestanding or incorporated as a subordinate feature of a regional park, community park, neighborhood park, or public common. | Walnut Street Playground, Grimmons Park, and Chuckie Harris Park. | 1/500 SF | 85% | 30% |
| Dog Park | 10,000 SF | A civic space type designed for the active recreation of dogs and their owners. Dog parks may be freestanding or incorporated as a subordinate feature of a regional park, community park, or neighborhood park. | Zero New Washington Community Park, Nunziato Field Off Leash Recreational Area (ORLA). | 1/30 feet of front lot line | 100% | 90% |
| Community Garden | 5,000 to 15,000 SF | A civic space type designed as individual garden plots available to residents for urban agriculture purposes, including storage facilities for necessary equipment. Community gardens may be freestanding or incorporated as a subordinate feature of a community park, neighborhood park, or pocket park. | Albion Community Garden and the South Street Farm. | 1/5,000 SF | 90% | 90% |

*Created by: Christine Cousineau*

## 10.6 Sources of Public and Private Funding

To acquire parcels of land or purchase conservation easements, either for the creation of green open space or the introduction of green infrastructure, Groundwork Somerville and the city of Somerville can avail themselves of several sources of public funding – at the municipal, state/federal, and state levels – as well as grants from private foundations. The sources summarized below were selected for their applicability to Somerville.

### Municipal funding

- Community Preservation Act (CPA) Fund
-

In 2012, Somerville residents adopted the Community Preservation Act, thereby establishing a revenue stream for the creation and preservation of open space and recreation areas, as well as for affordable housing and historic preservation. . The CPA is funded from three sources: a 1.5 % surcharge on residents' property taxes, a voluntary contribution from the city to an equivalent amount, and a state contribution from the Community Preservation Trust Fund. For fiscal year 2016, approximately $1 million was available for open space and recreation projects in Somerville, which can include land acquisition.

### Federal/state funding

Two federal programs administered by state agencies are particularly applicable to the project of greening Somerville.

- Clean Water State Revolving Fund (CWSRF)

Massachusetts' Department of Environmental Protection (DEP) administers the federal Clean Water State Revolving

### Table 9: Allowable Uses of CPA Funding

| Allowable Uses of CPA Funding | | | | |
|---|---|---|---|---|
| | Affordable Housing | Historic Preservation | Open Space | Outdoor Recreation |
| Acquire | Yes | Yes | Yes | Yes |
| Create | Yes | No | Yes | Yes |
| Preserve | Yes | Yes | Yes | Yes |
| Support | Yes | No | No | No |
| Rehabilitate and/or Restore | Yes, if acquired or created with CPA funds | Yes | Yes, if acquired or created with CPA funds | Yes |
| *Chart adapted from "Recent Developments in Municipal Law," Massachusetts Department of Revenue, October 2012* | | | | |

*Source: Somerville Community Preservation Act. http://www.somervillema.gov/cpa*





Fund (CWSRF) also called the State Revolving Loans (SRL) for Clean Water. The Fund provides low-interest long-term loans (20 years at 2%) to help municipalities plan and build projects that protect water quality, including CSO mitigation, Infiltration/inflow correction, green infrastructure and stormwater remediation. This Fund can also be used for land acquisition. In 2016, approximately $414 million were available for projects across the state. Project costs ranged from $1 million to $32 million. A minimum of 10% of the fund must be used for green infrastructure. (http://www.mass.gov/eea/docs/dep/water/approvals/year-thru-alpha/06-thru-d/16cwiupf.pdf)

**Eligible applicants:** municipalities, water resources authorities, regional wastewater utilities, state agencies.

- Massachusetts Land and Water Conservation Fund (LWCF)

The federal Land & Water Conservation Fund is administered by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA), through its Division of Conservation Services. The LWCF fund provides up to 50% of the total project cost for acquiring, developing and renovating park, recreation or conservation areas. Since 1965, nearly 4,000 acres of land have been acquired and hundreds of parks renovated in Massachusetts with the state portion of the federal program, which is administered by the Division of Conservation Services. LWCF grants reimburse a community 50% of the total project cost, up to a grant maximum of $250,000. (http://www.mass.gov/eea/grants-and-tech-assistance/grants-and-loans/dcs/grant-programs/massachusetts-land-and-water-conservation-fund.html)

**Eligible applicants:** municipalities, special districts and state agencies.

### State funding

State programs and funds available to municipalities for the creation of green space and green infrastructure include the Community Compact, the PARC Program, the Conservation Partnership Grant, and Our Common Backyards.

- Community Compact

Governor Baker created the Community Compact program as one of his first legislative initiatives after taking office in 2015. The program, administered by a Community Compact Cabinet chaired by Lieutenant Governor Polito, provides technical assistance and financial support to cities and towns to improve municipal government. Each city or town may choose up to three best practices to achieve from a list of 33 grouped under the categories of education, energy & environment, financial manage-

ment, housing & economic development, information technology, regionalization/ shared services, and transportation & citizens' safety. Support includes technical assistance services and funding from $4,000 to $400,000 per best practice.

1. Sustainable Development and Land Protection

**Best Practice:** There is a Master, Open Space and Recreation, or other Plan to guide future land conservation and development; Smart growth consistent zoning has been adopted (e.g. techniques in the MA Smart Growth/ Smart Energy Toolkit); Investments in infrastructure and land conservation are consistent with the MA Sustainable Development Principles.

2. Comprehensive Water Resource Management

**Best Practice**: There is a plan to supply and conserve water, manage stormwater, and treat and reuse wastewater; The MA Water Conservation Standards are being implemented; Municipal regulations promote green infrastructure and the use of low impact development techniques; An Enterprise Fund or other mechanism is in place to fund maintenance and replacement of water infrastructure.

3. Promote Local Agriculture

**Best Practice:** A right to farm by-law or ordinance has been adopted; The community supports access to fresh produce through the creation of farmers markets and/or establishment of urban agriculture (e.g. commercial ventures or community gardens); Farmland is conserved through acquisition and/or regulation; Sustainable forestry is encouraged.

As of May 2016, 217 cities and towns had signed a Community Compact, with 15 additional applications under review. http://www.mass.gov/governor/administration/groups/communitycompactcabinet/bestpractices/ Eligible recipients: all cities and towns in Massachusetts

The EEA's Division of Conservation Services offers several competitive grant programs to municipalities for the acquisition of green open space, the protection of water resources and the improvement of stormwater management, recreation land; and the development and renovation of parks. The LWCF fund described above, and the four programs listed below are explained in more detail at the Department of Conservation Services' website: http://www.mass.gov/eea/grants-and-tech-assistance/grants-and-loans/dcs/grant-programs/





- Massachusetts Parkland Acquisitions and Renovations for Communities (PARC) Program

The PARC Program was established in 1977 to assist cities and towns in acquiring and developing land for park and outdoor recreation purposes. Up to $400,000 in reimbursement of total project cost is available for the acquisition of recreation land, the development of new parks, or the renovation of existing parks. Any city, and any town with a population of 35,000 or more (there is a separate fund for Small Towns), that has an approved Open Space and Recreation Plan, and has conducted a public meeting about the proposed open space is eligible. The applicant must show the use of non-state funds for the municipality's portion of the program, and must have had a City Council or Town Meeting vote that appropriated 100% of the total project cost (CPA funds can be used).

**Eligible applicants:** municipalities. (http://www.mass.gov/eea/grants-and-tech-assistance/grants-and-loans/dcs/grant-programs/massachusetts-parkland-acquisitions-and.html)

- Conservation Partnership Grant

The Conservation Partnership Program assists private non-profit organizations in acquiring interests in lands suitable for conservation or recreation purposes. Potential projects fall into one of two categories:

1.Land or a conservation restriction (CR) purchased by an eligible applicant (50% of cost up to $85,000);
2.Due diligence for land or a conservation restriction gift donated to an eligible applicant (up to $10,000).

Selected applicants must convey a perpetual conservation restriction (MGL Chapter 184, sections 31 and 32), to the city or town in which the selected project is located, to be managed by either its conservation or recreation commission, a land trust, a state agency, or a combination. All projects must provide public access. (http://www.mass.gov/eea/grants-and-tech-assistance/grants-and-loans/dcs/grant-programs/conservation-partnership-grant.html)

**Eligible applicants**: non-profit organization with 501(c)3 status.

- Our Common Backyards Program

The Our Common Backyards Grant Program aims to build a new playground or spray park in each of the Commonwealth's 54 cities. The program helps cities create or renovate parks in the neighborhoods that need them most, preferably Environmental Justice neighborhoods. Each city is eligible to receive up to $200,000 in reimbursement for

the total project cost, which must be appropriated in full by a City/Town Council or Board of Aldermen vote. The grant round is now closed. (http://www.mass.gov/eea/grants-and-tech-assistance/grants-and-loans/dcs/grant-programs/ocbp.html)

**Eligible applicants:** any of the state's 54 cities.

## Private Foundations

The private foundations listed on pp. 109-11 were selected for their applicability to the Greening Somerville project. Within the general area of environment and conservation, they give grants to non-profit organizations for urban green spaces. The full list is found at the Fundsnet Services website: http://www.fundsnetservices.com/searchresult/13/Environment-&-Conservation-Grants/1.html.

The Associated Grant Makers (AGM) of Massachusetts is the best source for researching the full range of available private funding tailored to an organization's focus and needs. (http://www.agmconnect.org/)





## Table 10: Potential Sources of Funding

| Name of Foundation | Name of Grant | Funnding Areas | Amounts | Eligble Applicants |
|---|---|---|---|---|
| Arnst Family Foundation | Grants | Environment<br>Economic Development – projects invloved with the environment | $5,000 to $20,000 | Non-profit organizations with 501(c)3 status. |
| http://arntzfamilyfoundation.org/ | | | | |
| Captain Planet Foundations | Small Grants | Mission: give the next generation of environmental stewards an active understanding and love for the natural world in which they live.<br>Activities must be project-based; performed by youth; have real environmental outcomes; be based in the US. | $500 to $2,500 | Schools and 501(c)3 non-profits with less han $3 million annnual budget. |
| http://captainplanetfoundation.org/apply-for-grants/ | | | | |
| Cedar Tree Foundation | Sustainable Agriculture | Supports efforts to build the next generation of sustainable farmers, connect low-income urban populations with local, healthy food and agriculture, and promote market based solutions to expand the field. | $5,000 to $120,000 | Non-profit organizations with 501(c)3 status. |
| http://cedartreefound.org/2014-sustainable-agriculture-grants | | | | |
| Edison International | Community Grant | Funding areas: education, environment, civic engagement, public safety & preparedness. | Up to $5,000 | Non-profit organizations with 501(c)3 status. |
| http://www.edison.com/home/community/our-funding-priorities.html | | | | |

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| | | | | |
|---|---|---|---|---|
| Fields Pond Foundation Grants | Grants | Assisting community-based nature and land conservation organizations. | $1,000 to $25,000 | Non-profit organizations with 501(c)3 status. |
| http://fieldspond.org/guidelines.htm | | | | |
| Harry Chapin Foundaton | Grants | Community Education Programs<br>Arts-In-Education Programs<br>Agricultural and Environmental Programs | Up to $10,000 | Non-profit organizations with 501(c)3 status. |
| http://www.harrychapinfoundation.org/focus_focusandguidelines.php | | | | |
| Henry P. Kendall Foundation | Grants | Goal: create a resilient and healthy food system in New England by increasing the production and consumption of local, sustainably produced food. | Up to $350,000 | Non-profits, public schools, colleges. |
| http://www.kendall.org/grantseekers | | | | |
| Mazda Foundation | Grants | Education and literacy. Environmental conservation.<br>Cross-cultural understanding. Social welfare.<br>Scientific research | According to need | Non-profit organizations with 501(c)3 status. |
| http://www.mazdafoundation.org/Grant_Guidelines.html | | | | |
| Merck Family Fund | Grants | Preserving the environment and supporting low-income, urban communities. Conserving Ecologically Valuable Land.<br>Making Paper Production Sustainable.<br>Reducing CO2 Emissions Through Energy Efficiency and Carbon Pricing. Urban Farming and Youth Leadership.<br>Nw England State, New York City and Philadelphia. | Not specified | Non-profit organizations with 501(c)3 status. |
| http://merckff.org/ | | | | |
| New England | Seed | Wide range of activities under a broad defitinion of 'environment'. Project types | $250 - | Community-based groups in New |





| | | | | |
|---|---|---|---|---|
| Grassroots Environment Fund | Grants<br>Grow Grants<br>Harvest Grants | under Land & Water funding area: green infrastructure, green space, groundwater. Under Food funding area: community farms, gardens, composting, suported agriculture | $1,000<br>$1,000<br>$3,500<br>varies | England; volunteer-driven or no more than 2 FTE staff; annual operating budget under $100,000. |
| https://grassrootsfund.org/dollars | | | | |
| PSEG Foundation | Community Grants<br><br>Foundation Grants | Sustainable Neighborhoods funding area: public parks that improve the quality of life for local residents; environmental organizations that protect and preserve natural resources, address climate adaptation, and build sustainable communities. | Up to $5,000<br><br>Up to $20,000 | Non-profit organizations with 501(c)3 status. |
| https://www.pseg.com/info/community/new_site/index.jsp | | | | |
| Tiffany Foundation | Grants | In Uban Parks funding area: supports organizations that work to meet the needs of local communities through design improvements of urban parks and gardens. Supports creation of new urban green spaces, and rehabilitation, protection of exisitng ones. (gave to the Friends of the High Line in NYC and funded the Carousel on the Rose Kennedy Greenway in Boston.) | $50,00 to $5 mllion | Non-profit organizations with 501(c)3 status. |
| http://www.tiffanyandcofoundation.org/guidelines/parks.aspx | | | | |

*Source: Fundsnet Services: http://www.fundsnetservices.com/searchresult/13/Environment-&-Conservation-Grants/1.html*