SURVEY TREE
HEALTH
IN PARK

ADD TREES
TO BROWNFIELD

ADD STREET TREES

ADD TREES TO
PARKING LOT

PUT TREES ALONG
BIKE LANES

Jersey City Tree Canopy Assessment

A Report on Current Tree Canopy and Strategies for the Future

June 2015

Jersey City's tree canopy was mapped and analyzed as part of the Jersey City Environmental Commission's role of inventorying environmental resources and promoting long-range planning. The strategies presented herein are intended to protect and expand the city's investment in its trees in order to create a cleaner, greener, more livable and vibrant city for everyone.

June 2015

Acknowledgements

JERSEY CITY
ENVIRONMENTAL COMMISSION

Green Infrastructure Center

Contents

Executive Summary

This report presents the results of a shade tree study commissioned by the Jersey City Environmental Commission (JCEC). It includes a brief discussion of the city's current tree management challenges, tree benefits, and recommended strategies to realize the full potential of our urban shade trees.

The city's current tree canopy coverage is 17 percent, far less than comparable urban areas. This citywide percentage includes all lands, whether owned by private landowners, the city, or the state. Liberty State Park accounts for one percent of this. The tree canopy is a higher percentage of total land cover in some areas and lower in others. For example, it is noticeably lower on the western side of the city, where there are more industrial sites and ports, while it is higher in those areas with large parks. Tree canopy varies considerably by council ward.

TREE CANOPY COVERAGE BY WARD

Ward	Coverage
E	13.7%
A	14.8%
D	15.6%
B	16.6%
C	19.2%
F	20.8%

WARD
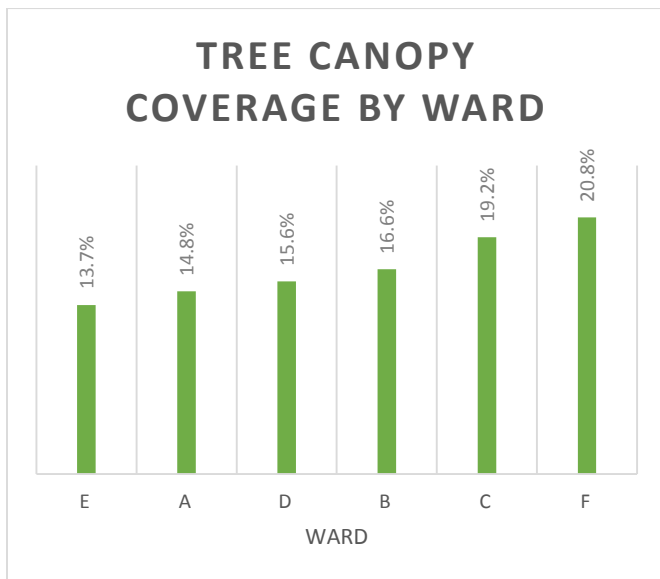
As an older and very dense northeastern city, Jersey City faces many challenges in caring for its urban trees. However, better care for the city's trees and an expanded tree canopy will help the city become cleaner, more vibrant, more attractive and more livable. The health, well-being and economic condition of city residents is tied to the green of their environment. The city's trees provide many benefits for shade, stormwater management, better air quality, reduced utility bills, enhanced safety, natural beauty, vibrant residential and business districts, and mental and physical health. But, as a living system, the city's tree canopy needs good care, management, and replacement over time.

Without concerted action the city, canopy will fall below 17 percent as the city is actually losing its tree canopy little by little every year – at least 124 trees annually. Loss is due to natural factors, such as old age or storm damage, but it is also caused by poor tree planting and care, such as planting trees in the wrong places, undersized tree planting wells, lack of management, and inadequate replacement planting.

Why does it matter if the city is losing its canopy? It matters because trees are providing the city with many benefits for clean air, stormwater management, cooling, natural beauty, and improved walkability and safety. For example, between 95 million and 155 million gallons of rainwater are currently intercepted annually by Jersey City's tree canopy and prevented from entering the stormwater system. This means less flooding and less sewer overflows. This equates to current annual savings to the Jersey City taxpayer of $760,000 to $1.2 million. Furthermore, this is a conservative estimate, since Jersey City's trees are most likely more mature than the ages used for modeling and the model does not account for water absorption by tree roots or evapotranspiration.

The city's trees also help to clean the air. They filter particulate matter, ozone, nitrogen and sulfur dioxide. This is very important for Jersey City's citizens, since cleaner air results in better public health. Using iTree Vue software, the city's trees were determined to remove 1.5 tons of carbon monoxide, 13.6 tons of nitrogen dioxide, 24.6 tons of ozone, 4.6 tons of sulfur dioxide, and 21.3 tons of particulate matter.

The city's trees also reduce costs to the city and add real economic value. Many statistics show that that trees both save money and generate new revenue. In residential areas, just three trees placed strategically around a house can reduce its utility bills by 50 percent. Trees can also increase property values by up to 37 percent, allowing people to realize greater benefits when they sell their home. In tree-lined retail districts, shoppers spend 9 to 12 percent more per item and shop longer. Rental rates for commercial spaces are also seven percent higher in high-quality, green landscapes. Well-treed areas are also safer, since crime decreases by up to 52 percent in neighborhoods with trees. A greener Jersey City will also help the city bring in the sort of jobs it needs: well-paid professional jobs. The creative class, which includes artists, media personnel, marketers, lawyers, and analysts make up 30 percent of the U.S. workforce and they place a premium on outdoor recreation and access to nature.

A number of management and funding problems make it difficult for the city to realize the benefits provided by its urban trees: tree wells are too small; agencies are more response-based than management-focused; tree management is underfunded and understaffed, and private sectors and the public are under-tapped as partners. As a result, trees cost the city more to maintain, investments are not fully realized, and needs, such as better stormwater management and reduced flooding, are not being met. But we can change this. The Jersey City Environmental Commission has taken a critical step in assessing the city's current canopy, as well as its impervious areas, and has followed up with analysis and key strategies for how to meet the challenges, address the needs, and realize the benefits from a well-managed shade tree canopy. The JCEC held multiple public meetings and a community open house to solicit community input. They

then established three primary goals and associated objectives to better manage, protect and expand the city's shade trees.

Goal 1: Expand Jersey City's Tree Canopy

Goal 2: Promote Long Term Viability for City Trees

Goal 3: Create a Long-Term Funding Mechanism for City Tree Planting and Care

The project consultants developed a map of possible planting areas to help the city target where trees are needed and could be added. However, adding more trees is not enough; better management is needed too. To protect its investment in new trees, the city should ensure that trees survive as long as possible. To maintain its canopy, it will need to adopt tree planting standards. It will need to fund a professional arborist and more field staff to help maintain and care for city trees. The trees are an investment and they must be tended for that investment to grow and thrive, paying the city dividends in stormwater management, better community health, improved property values, and vibrant business districts. The city needs a true partnership focus to achieve its goals and it needs to fully engage its citizens and the private sector, as many other successful urban forestry programs have done.

A Possible Planting Area (PPA) analysis was performed at a city-wide scale using the best data currently available. This image shows PPA area broken out by surface type - Impervious (e.g. parking lots, sidewalks) and Non-Impervious (e.g. grass, bare earth).

A Possible Planting Area (PPA) analysis was performed at a city-wide scale using the best data currently available. This image shows PPA area broken out by surface type - Impervious (e.g. parking lots, sidewalks) and Non-Impervious (e.g. grass, bare earth). Note that the PPA estimates where trees could be planted, not necessarily where they should be planted.

Addressing these goals and associated actions will meet Mayor Fulop's goal of making Jersey City the best mid-sized city in America by attracting new businesses, expanding development, and improving government services. A greener Jersey City will attract better paid jobs and thus a better tax base over the long term. Investment in the city's trees will show prospective businesses that the city is healthy and thriving. It will also motivate people to spend more time and money in retail areas and will promote home purchases and higher house and condominium values. It will also improve community health by cleaning the air, creating walkable streets, and increasing community safety. All the investments made in the city's trees, parks, and open spaces will be returned to the city's coffers many fold.

Introduction

In summer 2014, the Jersey City Environmental Commission (JCEC) funded a study of the city's tree canopy. This report provides both the results of that study, as well as a brief discussion of the city's current tree management challenges, then presents recommendations from the JCEC to address identified needs. We begin with a discussion of the study's findings and then summarize the many benefits provided by the city's trees. This is followed by a description of the challenges the city faces in managing its trees, and concludes with recommended strategies to support the city's tree canopy.

The JCEC enlisted consultants from the nonprofit Green Infrastructure Center (GIC) to create a Shade Tree Inventory, also called a tree canopy assessment. Tree canopy assessments can be used to target priorities for reforestation of those areas most in need. In New York, Los Angeles and elsewhere, Million Tree Initiatives have created ambitious goals for re-greening cities. These programs emphasize planting goals that most often target street tree sites or parks, but also include reforestation efforts on vacant land.

The JCEC and GIC analyzed the results and reviewed the city's tree management needs and opportunities to better protect and restore the city's canopy. Based on this analysis, the JCEC has identified short-term (2-5 year) actions, as well as aspirations for long-term improvements in urban tree management and canopy.

This report suggests that Jersey City begin to consider its trees, green spaces, community gardens, trails, and other environmental features, as part of its urban infrastructure. Just as the city plans for sidewalks, roads, and other public facilities – its gray infrastructure – so should it consider how to care for its "green infrastructure." Trees provide many key functions that make the city more livable and vibrant. For example, they clean the air, absorb stormwater, reduce summer temperatures, provide natural beauty, and facilitate economic benefits, by reducing utility bills and fostering better rental and retail environments. These and other benefits are detailed in the next section.

However, before discussing the benefits of an urban tree canopy, it is important to briefly acknowledge the city's current management structure for urban trees. While the city has a management plan called the Community Forestry Management Plan (adopted in May 2015), it does not currently implement all of the recommendations within it, due, in part, to budget and staffing constraints. The management plan does not set specific goals for expanding the canopy, but it does make recommendations to take better care of the city's existing canopy and to set goals for its expansion. The mission of the Community Forestry

Management Plan is "To ensure the health, safety, and sustainability of Jersey City's community forest and shade trees for the economic, environmental, and aesthetic benefits provided to City residents and visitors.[1]"

This report examines those issues and also makes recommendations for going beyond the status quo. It also includes newly created data that show the current extent and status of city trees and recommends a strategic approach for making improvements.

Since the production of both this study and the Urban Forest Management Plan were simultaneous, the authors collaborated to ensure accurate cross-referencing and that key recommendations were compatible. As a result, recommendations and objectives from this report have been included within the Community Urban Forestry Management Plan. A list of those recommendations and where they can be found in the plan are included in Appendix E. The Management Plan references this report, as well as the need to include canopy maintenance as one of the city's goals. For example, the plan calls for development and implementation of actions to increase or sustain canopy percentages. It also acknowledges some of the city's current management challenges for maintaining its urban tree canopy.

In order to become greener, Jersey City first needs to strengthen its current tree planting and management structure. A robust care and maintenance program is needed before the city can expand its canopy. This report discusses the current challenges facing the city in this regard and makes recommendations for improvement. In order to make these improvements, the city needs to dedicate greater resources (staff, time, and funding) to strengthen its commitment to conserve, restore, and expand its urban forest.

There are many reasons why the city's trees are a worthwhile investment that will pay it back many fold. If Jersey City were to implement all of the best management practices recommended in its Urban Forest Management Plan, as well as the ideas presented in this report, it would be well on its way to becoming greener, cleaner, and healthier, as well as more resilient and vibrant, both socially and economically.

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[1] Jersey City Community Forestry Management Plan 2015-2019

What Are Other Cities Doing?

Cities are beginning to recognize the many benefits provided by their urban canopy and are willing to pay to support their urban trees because they reap tremendous dividends as a result. Indeed, many cities have already established ambitious tree canopy goals (see Table 1).

Many areas are adopting Million Tree goals, such as Los Angeles in 2006 (http://www.milliontreesla.org/) and New York City in 2007 (http://www.milliontreesnyc.org/). These projects are public-private partnerships, allowing those cities to leverage more diverse funding sources and participation from the private and nonprofit sectors.

In 2007, New York City's canopy was estimated at only 24 percent of its urban landscape. However, as of May 2015, 970,022 trees have been planted, sending the city well on its way to reaching its Million Tree goal by its 2017 deadline. The city's helpful website, technical guidance, planting instructions, requirements for new tree planting and replacement, plus its active volunteer programs are reasons for the city's success. The city has also linked its tree program to its stormwater management goals and its urban heat reduction objectives. For example, the US Forest Service found that the average street tree in New York City intercepted 1,525 gallons of rainfall annually, while larger trees, such as the London plane, captured as much as 2,875 gallons a year (Peper et al 2007).

New York City spends approximately $21.8 million in a typical year planting new trees and maintaining existing trees. While this may seem high, the cost-benefits ratio shows it to be an extremely wise investment, since those street trees provide approximately $100.2 million (or $172 per tree; $15 per capita) in net annual benefits to the community. These numbers were derived from the city's tree canopy study, as well as from the extensive inventory work it conducted as part of its management plan.

Jersey City can now embrace a more strategic approach to caring for its trees with the new tree canopy assessment data. In future years, the city can expand its urban forest management to include more tree inventory data to address diversity, tree health, and on-the-ground conditions.

Tree inventory was not funded under this study. In the future, more inventory data would help the city better manage its trees and allow for more calculations of their benefits to the city. In 2005, the city estimated it had 75,000 public trees (street trees, parks etc.) under its management responsibility. Unfortunately, the data layer from 2005 does not contain information regarding species, health, size, maintenance needs or site conditions. There are also no planting sites stored in the current tree layer.[2] (For more details on what is recommended for the inventory, see page 29 of the Community Forestry Management Plan.)

However, as noted in the Introduction, the first step for the city is to improve its tree management and maintenance and to make strategic decisions as to where new trees are planted. The high resolution canopy data now available for Jersey City allows it to identify and manage its urban canopy in a much more strategic and effective manner, targeting new trees where they are most needed and thereby creating a greener city for the enjoyment of all.

Example Tree Goals		
City	**Current Tree Canopy Cover**	**Desired Canopy Tree Cover**
Baltimore, MD	27.40%	40% by 2030
Boston, MA	28% (2007)	35% by 2030
New York City, NY	2006 - city 24%, Queens 45.2%, Brooklyn 26.6%, Staten Island 13.5%, Bronx 9.4%, Manhattan 5.3%	increase urban forest by 20% over next decade
Norfolk, VA	33%	40% by 2030
Philadelphia, PA	15.7% (2007)	30% all neighborhoods by 2025
Pittsburgh, PA	41.70%	60% by 2032 (40% for Allegheny Riverfront area)
Providence, RI	23% (2007) - 5% more than 1999; 23.9% (2013);	40% by 2030
Washington, DC	35% (2,031 acres of UTC)	40% by 2035

Table 1 *Example tree canopy goals from several cities. Source: Nowak and Greenfield 2012.*

Estimating Jersey City's Tree Canopy

The tree canopy is a bird's eye view of how much of Jersey City is covered by trees, by area. It was estimated using aerial imagery taken in 2013.[3] The images were then 'classified' to represent the types of land cover of interest. In this case, those categories are: tree canopy; non-tree vegetation (shrubs, grass, etc.); buildings (rooftops); and non-building impervious surfaces (roads, sidewalks, parking lots, etc.).

To perform the image classification, the GIC used a new software tool called Land Image Analyst (LIA). The tool was developed by the U.S. Geological Survey and the USDA Forest Service and is scheduled for public release in 2015. It uses a supervised classification approach. One advantage of this software is that, since it is free, it is easily accessible and the data can be updated by Jersey City staff without having to pay additional consulting fees.

One caveat concerning this data is that the images will not show either the most recently planted trees or those that were very small at the time (e.g. 1 inch caliper trees less than 6-8 feet tall), since the available imagery was a year old and small trees may have been classified as shrubs. However, this issue goes away as trees grow taller and the data are updated.

Another way to improve the data accuracy is to conduct additional field work. For example, students from NJ City University could geolocate new trees from recent planting projects, such as those recently added at Liberty State Park.
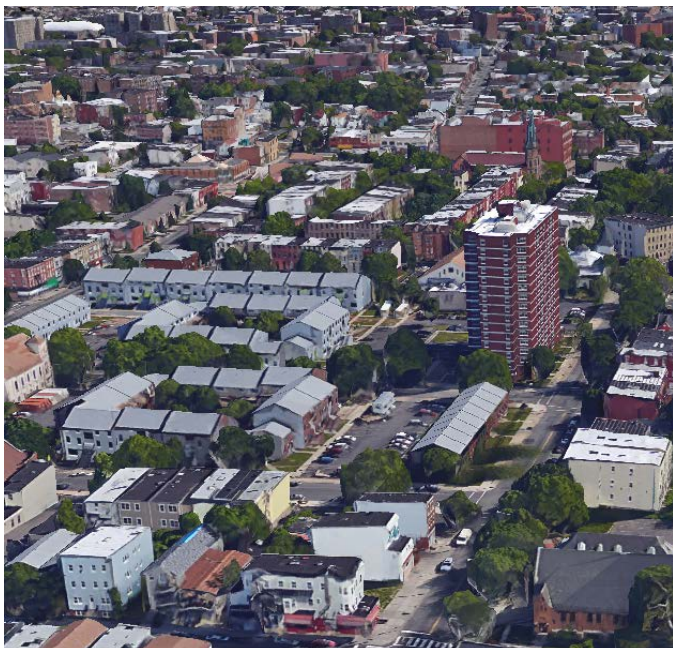

Image Source: Google Earth 2014

[3] Source of the imagery used is the 2013 National Agriculture Imagery Program (NAIP)

How Much Canopy Do We Have?

Using 2013 imagery, in 2014 consultants from the GIC estimated the tree canopy coverage at 17 percent of land within the city's boundaries, which equates to 1,587.3 acres.[4] (See Figure 1: Tree Canopy Citywide.) This citywide percentage includes all lands, whether owned by private landowners, the city, or the state. Liberty State Park accounts for one percent of this. Naturally, the tree canopy is a higher percentage of total land cover in some areas and lower in others. For example, it is noticeably lower on the western side of the city, where there are more industrial sites and ports, while it is higher in those areas with large parks. Thus, the tree canopy is not uniform across the city and varies considerably by council ward. (See Figure 2: Tree Canopy by Council Ward). As shown, the downtown financial district (Ward E) has the lowest canopy, at just 13.7 percent. However, trees are just as important to downtown business districts as they are to residential areas.

JERSEY CITY LAND COVER

- Non-Tree Vegetation — 14%
- Tree Canopy — 17%
- Bare Earth/Sand — 7%
- Impervious — 43%
- Building — 19%
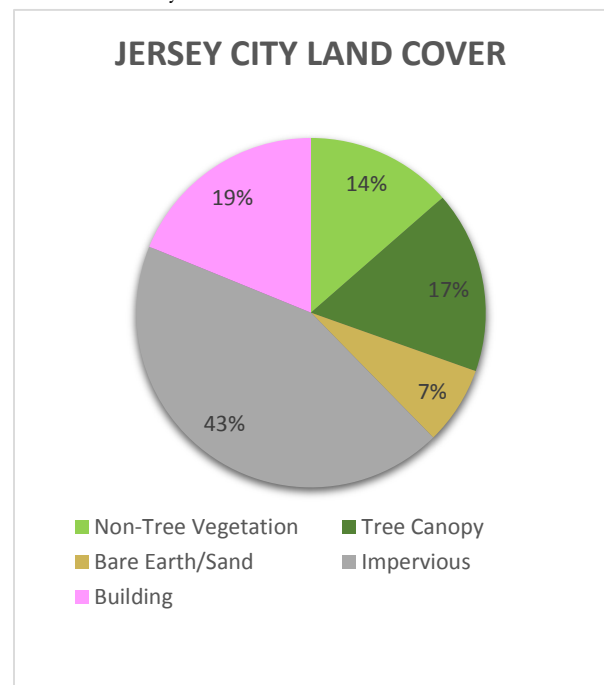
Figure 1 Land cover types in Jersey City, based on a land cover classification using imagery from August 2013.

The current tree percentage is not static and will decrease each year unless action is taken to stem the decline. Even maintaining the current 17 percent canopy coverage will require concerted action by the city.

Such action will require an increase in the number of trees planted, as well as a marked improvement in their survival rates. Even while accounting for new trees planted annually, the city suffers a net loss of at least 126 trees per year. (See Appendix F for net loss calculations.)

[4] See Appendix B: Technical Documentation

Jersey City Urban Tree Canopy

Legend

- Municipal Boundary
- Non-Tree Vegetation
- Tree Canopy
- Bare Earth/Sand
- Water
- Non-Building Impervious
- Building

Figure 2 Citywide Tree Canopy

Figure 3 *Tree canopy by council ward. If Liberty State Park is excluded, the percentage for ward F drops to 17.1 percent (other wards are not significantly affected).*

Since there are no data for private removals, such as from backyards or apartment courtyards, the actual number of trees lost or removed each year is likely to be much higher.[5]

The JCEC has already evaluated the potential for planting new trees in the city. Over the long term, in addition to stemming the 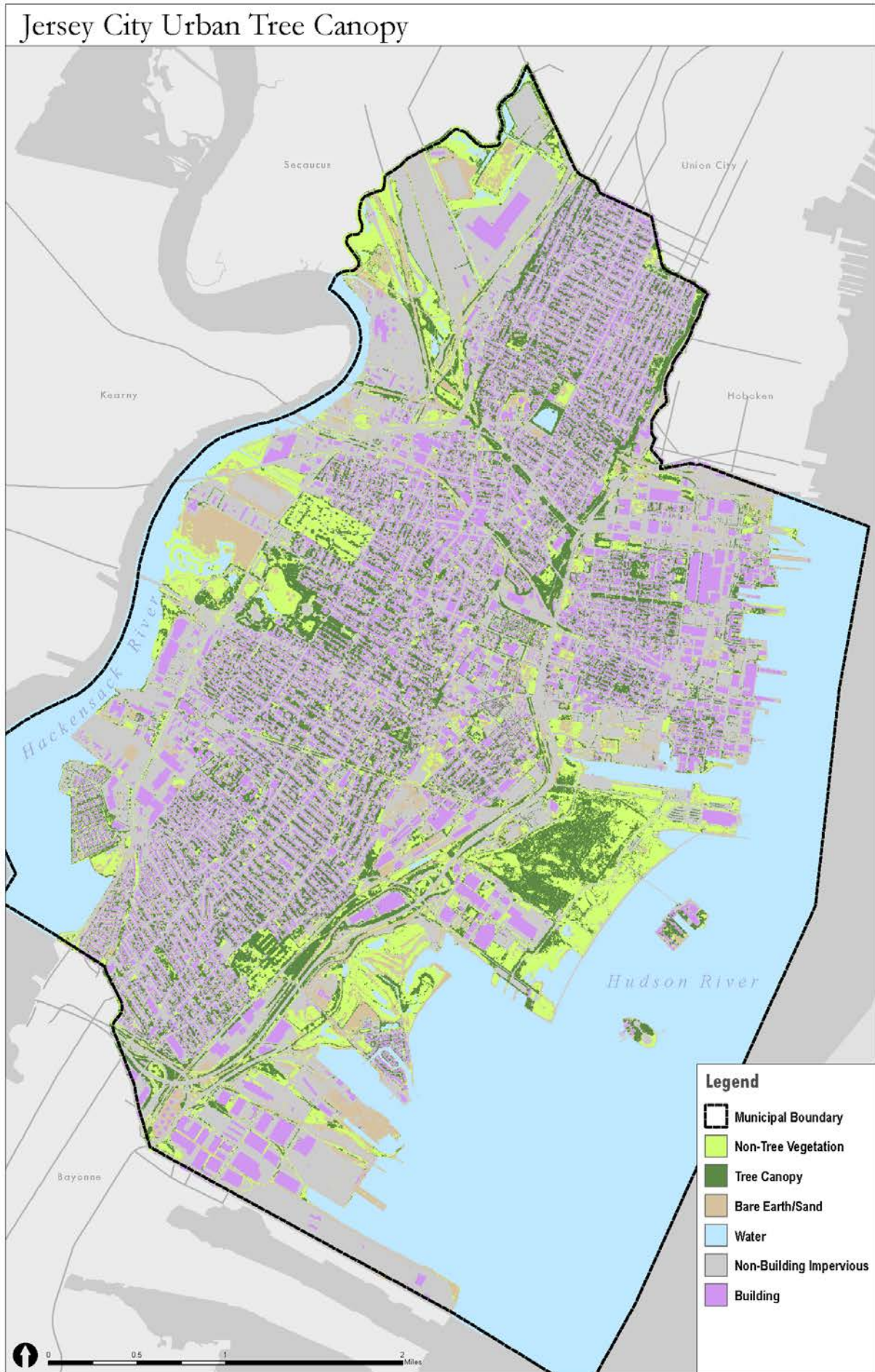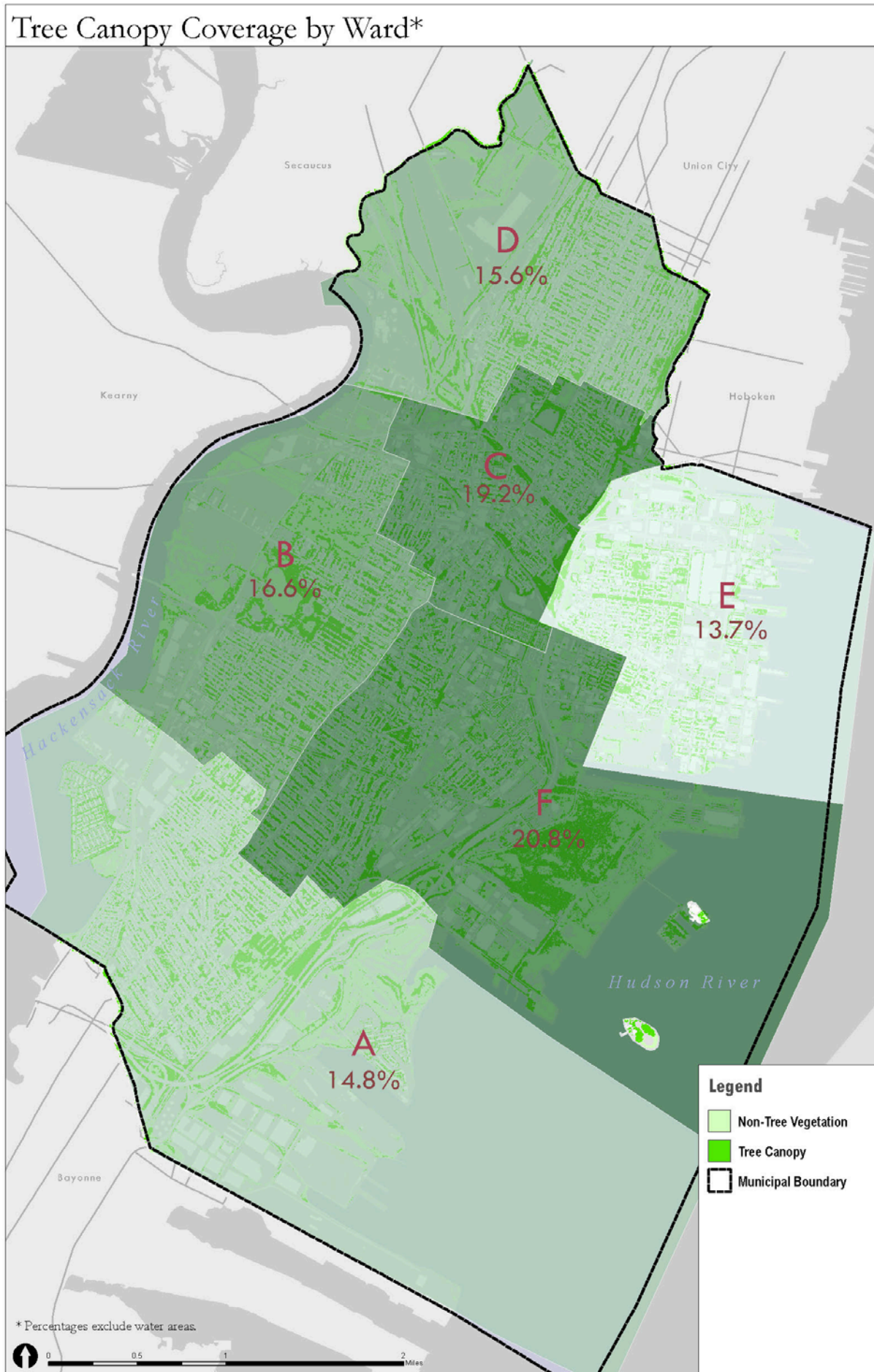decline, it would like to see the city adopt a goal that increases the current canopy to 20 percent. This would require a significant increase in current tree planting and management capacity. To reach that figure, Jersey City will require a net increase of about 16,750,000 square feet of tree canopy, which equates to approximately 30,000 trees.

In the near term (2-5 years) the JCEC recommends a steady increase in the number of trees planted to at least maintain the current coverage. Once the city has achieved a stable canopy by expanding its maintenance and management capacity as recommended in the Community Forestry Management Plan and this report, then, it can consider more ambitious goals. For example, if the city planted 5,000 additional trees per year for six years, it would reach its goal of 30,000 trees planted by 2022. Alternatively, it could take a longer-term approach and plant 1,500 additional trees per year for the next 20 years, which would achieve the 20 percent goal in roughly 30 years.

Why Should Jersey City Invest in Its Trees?

Jersey City's tree canopy provides many benefits. Some of these can be quantified, while others can be inferred from research studies in similar U.S. cities. An urban tree canopy (UTC) does not constitute a forest per se, but taken city-wide, can serve a vital role in keeping built-up areas cool and can provide many other benefits.

Cities are beginning to recognize these benefits and are willing to support their urban trees because they reap tremendous dividends. For example, city trees are a strategic way to reduce excess stormwater runoff and flooding. During a one-inch rainfall, one acre of urban forest will release just 750 gallons of runoff, while a parking lot will release 27,000 gallons! That is 36 times more runoff.[6] Now, cities are starting to use their tree canopy as a key stormwater management strategy. This can be seen in Vancouver, Washington where the city allocated 100 percent of its stormwater utility fee funds to support the city's urban forestry program. As a result, they calculated that the services provided by the city's existing tree canopy saved residents $12.9 million per year in cost savings since they did not have to manage that stormwater with constructed systems.[7]

Benefits of City Trees

The benefits provided by trees for Jersey City include:

Stormwater Runoff Prevention

Urban forests intercept stormwater. In cities, stormwater runoff is a major a problem where large paved and roofed areas prevent infiltration of rainwater. As a coastal city, Jersey City does not have good drainage and storm drains routinely overflow. Sixty percent of Jersey City's land drains into a combined sewer system in which rainfall and sanitary sewerage are carried together. This can lead to challenges with sanitation when high rainfalls cause these sewers to exceed their capacities. There are 21 Combined Sewer Overflow (CSO) discharge locations in the city. While it is working to correct these problems, the city suffers 100 to 150 breaks in its sewer lines annually and also experiences problems with sewage backup during high tides.[8]

A key solution is to reduce the amount of stormwater entering the system in the first place. This would reduce overflows, improve sanitation issues and diminish street flooding. Studies have shown that an urban canopy can reduce a city's stormwater runoff by anywhere from two to seven percent.[9] Between 95 million and 155 million gallons of rainwater are currently intercepted annually by Jersey City's tree canopy and prevented from entering the stormwater system during initial rainfall runoff (first 1 - 2 inches). Increasing the tree canopy by just three percent to 20 percent total coverage would potentially reduce that runoff by a further 15-25 million gallons. And a 25 percent tree canopy across the city would potentially reduce runoff by between 150-230 million gallons, which would significantly reduce the burden on the city's overstrained stormwater and sanitary system.

Assuming a very conservative monetary benefit of $0.008 per gallon of captured stormwater, this equates to current annual savings to the Jersey City taxpayer ranging from $760,000 to $1.2 million. An increase in the tree canopy of just 3 percent could potentially save the city an additional $500,000 annually. And 2 percent coverage would achieve potential annual savings of $1.8 million. Furthermore, this is a conservative estimate, since Jersey City's trees are most likely more mature than the ages used for modeling and the model does not account for water absorption by tree roots or evapotranspiration.

One challenge when trying to include water absorbed through roots and evapotranspiration is that many of the tree wells around the city's current trees are extremely small. If the city made those wells larger, the trees' root systems would be able

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[5] The GIC contacted multiple private tree care companies. Most lacked adequate tree removal records, so estimating removals from private properties was not feasible.
[6] Penn State Extension

[7] Vancouver Urban Forestry Management Plan 2007
[8] Ripple Effects, Rutgers Report 2014
[9] (Fazio 2010)

to absorb more water and savings per tree would rise exponentially. (See Appendix H for tree planting guidance).

Reducing Climate Change

The economic value of sequestering carbon was estimated using i-Tree Vue software, which showed carbon storage at 59,311.1 tons ($71.21 per ton) for a total value of $4,223,779 in benefits annually. The equivalent value for CO2 is 217,434.4 tons ($19.43 per ton) at a value of $4,223,779 annually.

Improving Air Quality and Public Health

The city's trees help clean the air. They filter particulate matter, ozone, nitrogen, and sulfur dioxide. This is very important for Jersey City's citizens, since cleaner air results in better public health. These benefits can also be represented financially; the total air quality benefits that trees provide to Jersey City equate to about $550,000 per year! Broken down by pollutant, the i-Tree Vue software provided the following values of the city's trees for removing air pollution:

Carbon monoxide (CO): 1.5 tons per year for an annual value of $2,111, or $1,450.46 per ton annually.

Nitrogen dioxide (NO₂): 13.6 tons per year for an annual value of $138,687.2, or $10,212.24 per ton annually.

Ozone (O3): 24.6 tons per year for an annual value of $251,145.0, or $10,212.24 per ton annually.

Sulfur dioxide (SO2): 4.6 tons per year at an annual value of $11,512.8, or $2,500.12 ton annually.

Particulate matter (PM10): 21.3 tons per year at an annual value of $144,954.8, or $6,818.24 per ton annually.

Exposure to particulate matter can cause heart and lung disease and may worsen acute and chronic bronchitis and asthma. Both nitrogen and sulfur dioxide also cause respiratory problems. They can irritate the nose, throat, and airways, resulting in coughing, wheezing, shortness of breath, or a tight feeling in the chest. Those who are at the greatest

risk of these symptoms are people with asthma or similar respiratory problems, such as emphysema. Children are also more susceptible to ill-effects because their lungs are still developing and their respiration rates are faster.[10] However, areas with more street trees, even at the neighborhood scale, have lower prevalence of asthma among children.[11]

Street trees also encourage people to exercise; they are more likely to walk when they see a treed city street. Streets without trees are perceived to be longer, and destinations farther away, making people less likely to walk.[12] The more we walk, the fitter we are, so encouraging walking is an important outcome of greener city streets. Streets without adequate tree canopy equate to less walkable neighborhoods and less vibrant business districts.

Reducing Costs and Adding Value

The city's trees also reduce costs to the city and add real economic value. While a full economic analysis is beyond the scope of this report, there are many well researched statistics to support the argument that trees both save money and generate new revenue. (See Table 2 for a cost/benefit comparison for several tree planting scenarios). In residential areas, just three trees placed strategically around a house can reduce its utility bills by 50 percent.[13] During a hot summer in the city, this can equate to significant savings! Trees can also increase property values by up to 37 percent, allowing people to realize greater benefits when they sell their home.[14]

In retail districts where there are tree-lined streets, shoppers spend 9 to 12 percent more per item and shop longer.[15] Rental rates for commercial spaces are also seven percent higher in high-quality – green – landscapes.[16] This results in better revenue for the city, which can use those added revenues to better support its public trees.

People also value trees for their natural beauty. New home buyers ranked the presence of a tree as a top reason for their

Estimated Cost/Benefit Valuation for Tree Planting Scenarios							
New Trees	Total Benefits/yr	Total Costs/yr	Net Benefits/yr	Lifetime Benefits	Lifetime Costs	Total Value	New Canopy Coverage
30,000	$ 867,400	$ 458,800	$ 408,650	$ 48,189,200	$ 22,889,800	$ 25,299,300	~20% (+3%)
41,000	$ 1,182,900	$ 625,600	$ 557,300	$ 65,717,000	$ 31,215,000	$ 34,502,000	~22% (+5%)
62,500	$ 1,813,800	$ 959,300	$ 854,500	$ 100,771,900	$ 47,864,800	$ 52,907,100	~24% (+7%)
70,000	$ 2,050,400	$ 1,084,400	$ 966,000	$ 113,912,800	$ 54,107,000	$ 59,805,800	~26% (+9%)
84,000	$ 2,444,700	$ 1,293,000	$ 1,151,750	$ 135,820,900	$ 64,512,900	$ 71,308,000	~28% (+11%)
99,000	$ 2,878,500	$ 1,522,400	$ 1,356,100	$ 159,919,500	$ 75,959,200	$ 83,960,250	~30% (+13%)

Table 2 *Calculations showing the estimated costs and benefits of planting trees. The column at right indicates what the city wide tree canopy coverage would be if the corresponding number of new trees (from the "New Trees" column) were to be planted. The current tree canopy coverage is 17 percent. The "Total Value" column summarizes the total net benefits over the life of the trees. The costs and benefits are derived from the USDA Forest Service's research on the comparative benefits of small, medium, and large trees (Large Tree Argument: The case for large trees versus small stature trees 2004). The ratio of small/medium/large trees used in these calculations are derived based off of the actual areas available for planting in Jersey City.*

[10] Buka et al, 2006
[11] Lovasi et al, 2008
[12] Tilt et al 2010
[13] Parker 2003

[14] Foster et al, 2011
[15] Wolf 2006
[16] Laverne et al 2003

choice of which home to purchase. Well-treed areas are also safer since there is up to 52 percent less crime in those areas.[17] This means that streets with trees are more desirable and safer than streets without trees.

Despite a small recovery in the economy and the recent declines in the city's unemployment rate, many people remain concerned about the job market. A greener Jersey City will mean it is more competitive when it comes to enticing the sort of jobs it needs: well-paid professional jobs. The creative class, which includes artists, media personnel, marketers, lawyers, and analysts make up 30 percent of the U.S. workforce and they place a premium on outdoor recreation and access to nature.[18] Additionally, small companies, especially those that have a well-paid and skilled workforce, place a premium on the 'greenness' of the local

environment.[19] Also, with a more mobile labor force, many of whom can chose where they work, attracting skilled workers to choose Jersey City is key to continued economic recovery. The graphic on the following page provides a summary of these benefits.

As an older city, founded in 1660, Jersey City has seen a great deal of development. As a result, today 62 percent of its land cover is impervious. This percentage is higher than many other U.S. cities. For example, New York City comes in at 59.8 percent, while other East Coast cities, such as Boston (48 percent) and Baltimore (52 percent), are significantly lower.[20] As a result, it becomes more challenging to find ways to make the city greener. However, there are many opportunities to add more tree canopy. These include street medians and sidewalk planting strips, creating tree gardens

1. 16th Street Playground
2. Pavonia/Marion Playground
3. Harmon Street Pool
4. Exchange Place
5. 1st Street Playground
6. Terrace Avenue/Edward Crincoli
7. Meluso Park
8. Terry Dehere/Garfield Avenue Park
9. Martiniak-Enright Park
10. Boyd-McGuiness Park
11. Oak Street Park
12. Virginia Avenue Park
13. Lt. R.B. Grover Memorial Park
14. Tumulty Park
15. Cueno Place Park
16. Terrance Avenue Park
17. Skinner Memorial Park
18. Ralph Taylor Memorial Park
19. Arthur Ashe Basketball
20. Woodland Avenue Park
21. Sgt. Anthony Park
22. Cornelius Parker Park
23. Monticello Avenue Mini Park
24. Paulus Hook Park
25. LaPointe Park
26. Stevens Park
27. Wayne Street Playground
28. City Hall Park
29. Wilkinson Avenue Park
30. Ferris Triangle Park
31. Apple Tree House
32. Dr. Lena Edwards Park
33. Fitzgerald-Holata Park
34. Muhammad Ali Park
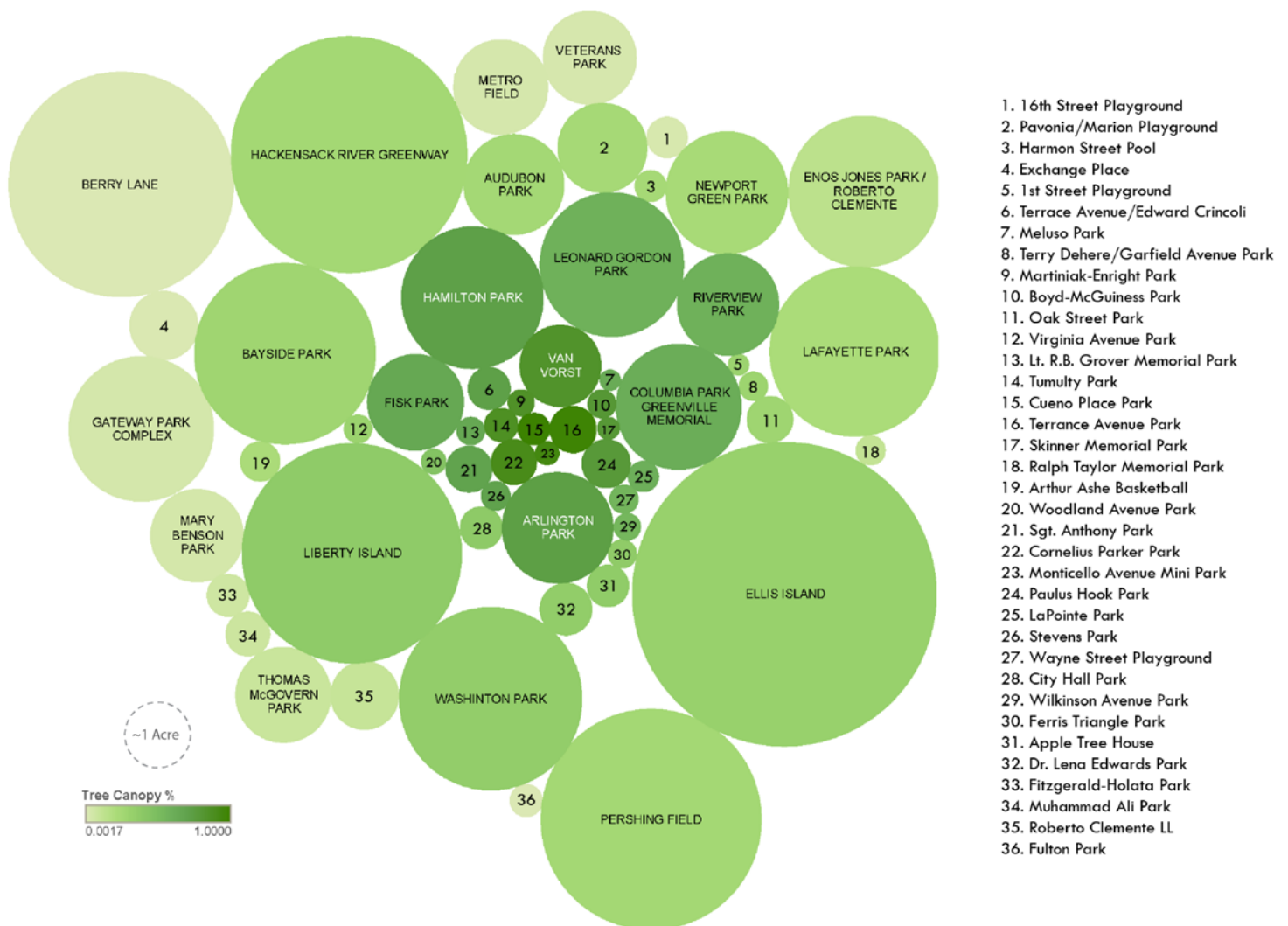35. Roberto Clemente LL
36. Fulton Park

Figure 4 Visualization of parks in Jersey City by their size (in acres) and their tree canopy coverage (percent of park covered by tree canopy). Liberty State Park and Lincoln Park are excluded from this diagram.

[17] Frances 2001

[18] Florida 2002

[19] Crompton Love and Moore 1997

[20] Nowak 2012

How do
TREES BENEFIT
Jersey City?

LESS CRIME!

Apartment buildings with high levels of green landscaping have up to **52%** fewer crimes[2]

LOWER UTILITY COSTS!

Just 3 strategically-placed trees can **decrease utility bills** by **50%**[1]

BETTER FITNESS!

People living near greenery are **40%** more active than people in less green areas[4]

BETTER BUSINESS!

When trees are present, shoppers will spend **9** to **12%** more for products![3]

FEWER AUTO ACCIDENTS!

Street trees can **decrease automobile accidents** by **46%**[5]

HIGHER PROPERTY VALUES!

Trees can increase residential **property values** by up to **37%**[6]

LESS ASTHMA!

Childhood asthma is up to **25% less** prevalent in well-treed areas of cities[8]

COOLER SUMMERS!

Evapotranspiration can help reduce peak summer temperatures by **2° - 9°F**[7]

LESS FLOODING!

One mature tree can store **50 to 100** gallons of water during a storm[9]

LESS POLLUTION!

Mature trees absorb **120 to 240 lbs** of **particulate pollution** each year[10]

Jersey City's existing tree canopy removes about 1.5 tons of carbon monoxide, 13.6 tons of nitrogen dioxide, 24.6 tons of ozone, 4.6 tons of sulfur dioxide, and 21.3 tons of particulate matter each year. This is equal to about $550,000 in value!

Jersey City's existing tree canopy intercepts between 95 million and 155 million gallons each year. This is water that is prevented from entering the City's stormwater infrastructure during the initial rainfall (first 1 - 2 inches) during a storm. This equates to between $760,000 to $1.2 million in benefits!

Green Infrastructure Center, Inc. 2015

Summary of several of the benefits that trees provide. See box in Appendix A for the reference sources used in this graphic.

and tree-lined sidewalks at public institutions (such as schools or other municipal lands), and planting trees in public parks. The city should encourage the private sector to plant more trees on its property on a voluntary basis, such as yard plantings or within office or apartment building courtyards and entryways.

Even though most residents have some access to open space, the size and quality of that space varies considerably. While about 79 percent of residents are within a quarter mile of a city park, the size of those parks varies from 870 acres (Liberty State Park) to 0.02 acres (Brett Triangle Park). The majority of city parks are small, with 60 percent under one acre. Parks also vary in how green they are. The diagram shows park size and relative tree canopy.

Unfortunately, while parks offer an easy opportunity to plant trees with room to grow, many city parks do not have the capacity to add many more trees. The city is actively working to add trees to parks where it can. In May 2015, the city planted 700 trees in the newly created Berry Lane Park, funded through federal and county grants and created on former brownfield lands. This has added much-needed green space to a low-income neighborhood while cleaning up past contamination and is an excellent example of adding green to a neighborhood where trees and parkland were sorely needed.

However, the trees within the city's older parks also need attention. The city has conducted some inventory work within parks, but not yet in all of them. Parks should be evaluated in terms of the age of their trees, as well as the diversity of tree species and their condition. For example, Lafayette Park has mature trees but there are only a few species and several trees show evidence of storm damage and may not last a long time. Furthermore, if the streets leading to those parks are also planted with trees, they will become more inviting to urban walkers and bicyclists.

Tree felled by hurricane Sandy in Jersey City Heights. Image source: http://frogsaregreen.org/

City Tree Management Challenges

Following the onslaught of "Superstorm Sandy" in 2012, many urban tree canopies were devastated. In New York City (NYC), at least 8,000 street trees were destroyed, along with thousands more in parks and on private lots (*New York Times*, 2012). No figures are available for total tree loss in Jersey City, however given its proximity to the NYC, it was likely a similar number. This means, not only a loss to the city's natural beauty, but also a tremendous loss in capacity to intercept rainfall and evapotranspire excess stormwater.

Stump remaining in tree well.

Although storms, even extreme ones, are part of a city tree's normal life, urban trees suffer more than others. One reason for tree loss in Jersey City is reduced life-span caused by increased stress. Urban trees, especially those in the street median or along sidewalks or parking islands, don't live as long as they would if they were planted in an open space or a forest because soil quality and quantity are less, water and air are restricted, sunlight is blocked by tall buildings and narrow streets, and roots are constrained by sidewalks, curbs, drains, pipes, etc. This means that urban trees often have less stability and are more susceptible to storm damage because their roots are less able to support the rest of the tree. Also, trees in urban areas do not tend to re-seed naturally, since they are usually planted in tree wells surrounded by cement. Even in open areas, such as parks or cemeteries, saplings are often mowed down.

Many of the areas set aside for trees in the city are currently missing trees. There are numerous empty tree wells or wells filled with dead tree stumps and current planting areas are often inadequate to support a long-lived tree. While most agree that removing stumps from existing tree wells is one practical way to make room for more trees, the city lacks capacity to fully tackle the problem. They have only one staff member assigned to stump removal and the equipment needed to grind and remove stumps is often broken.

Tree Management Challenges:

- Lack of adequate planting wells.
- Old stumps have not been removed, which prevents new plantings.
- Lack of staff to inspect and prune trees.
- Large trees are planted under wires.
- Lack of species diversity in some areas.

In addition, many streets have the same species of tree all along them, such as John F. Kennedy Boulevard, which has a predominance of sycamores. This offers less visual interest and makes the entire street more susceptible to wholesale insect infestations and fungal disease. If one tree suffers a disease, it is more likely to infect trees of the same species and a whole avenue of trees can be lost.

Furthermore, sycamores can grow up to 75 to 90 feet tall at maturity and can easily become entangled in overhead lines.

A street with many low-hanging wires – not uncommon in Jersey City – limits the number of types of trees that can be planted.

Jersey City has a preponderance of sycamores, since they were once favored for cities because of their large spreading canopy and fast growth in difficult conditions. However, today they present problems for urban areas because they are subject to several insect and fungal problems and are very good at getting their way in the battle of the sidewalk versus the tree root. While this is good for the tree, it creates trip hazards, limits travel for disabled persons and adds to maintenance costs. In addition, the tiny hairs on the sycamore's seed balls irritate the skin and can cause respiratory distress if inhaled by sensitive people. Sycamore trees should be pruned regularly to promote a center leader,

remove deadwood, and maintain a strong structure. For many parks and streets in Jersey City, the sycamore is the predominant tree. And most of them are likely not pruned regularly and are interfering with overhead wires.

Sidewalk damage from tree roots, causing the need for endless patching.

Jersey City lacks the resources to provide proactive tree care. However, now is the time to dedicate resources to sound urban forest management and allow the city to save money in the long run. For example, it can inspect trees that may have a problem before the next storm occurs, or proactively prune trees to maintain their long-term health. The city is not able to follow all the recommendations for staffing in its urban forest management plan for tree care due to a lack of adequate resources dedicated in the annual budget. For example, the city currently prunes an average of 500 trees a year. Based on a 2005 estimate of 75,000 trees under city management, it will take 150 years to prune each tree just once. The city has expressed a desire to instigate a 10-year pruning cycle which will require 7,500 trees to be pruned per year.[21]

A tree outgrowing its tree well.

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[21] Community Forestry Management Plan page 33

In short, current resources for city tree management and maintenance are inadequate. The city does not have a robust tree management program. Although the Department of Public Works, Division of Parks and Forestry, is responsible for maintaining city trees, planting new trees as part of the city's tree donation program, and removing dead or damaged trees that are causing public safety hazards, there are not adequate staff to meet the demand. Much of its maintenance work entails responding to problem trees. Much of the pruning done is complaint driven rather than proactive management. Some of this emergency response work demand could be curtailed over time by lessening maintenance through good choices on what to plant, where, and how. This would allow the city to shift more resources from emergency care to long term wellness care for its trees.

When the wrong tree is planted in the wrong place, there are consequences. Chief among them is excessive pruning by the utility companies. There is a lack of attention to selecting the right -sized tree for the space available, causing unnecessary conflicts with overhead utility wires and subsequent tree topping, which damages and often kills trees.

Tree that has been topped to avoid conflicts with overhead wires.

Right Tree, Right Place

Urban trees should be selected for the right conditions, such as for tolerance to drought or pollution. If they are planted in bioswales, rain-gardens or along open water, they should be able to thrive under periodic inundation. Also, tall growing trees should not be planted under power lines or in places where their roots will interfere with underground utilities (there are tools and materials to reduce this likelihood), or where they will push up sidewalks and cause danger to either pedestrians or traffic.

The simple rule is: right tree, right place. Large canopy trees will do best in open areas, whereas smaller spreading trees can often thrive in tight spaces.

Newly planted Ginkgo trees that will become entangled in overhead wires as they grow.

Unfortunately, many trees are planted every year in the wrong place. Besides inadequately sized and constructed tree wells, the number one issue for Jersey City is the continual planting of tall trees under power lines, which results in tree damage during power line maintenance. At the community open house held to share ideas from this project, many attendees commented on this issue. Power companies routinely top the trees (cut off their topmost branches) or cut a V-shaped wedge in the top of the tree to let the lines continue unhampered right through their middle. This is an unfortunate practice as it kills the tree over time. However, contractors, builders, individuals, and others routinely plant inappropriate trees under power lines. While it is possible that some trees predate the overhead lines, consultants from the GIC observed many newly planted trees under power lines that will grow tall enough to interfere with the lines.

To address this issue of poor planting choices, several years ago the city adopted an ordinance under *§345-64. – Public or private common open space design standards [Amended 12-18-2013 by Ord. No. 13-138],* which specifies which trees are appropriate to plant in the city, as well as guidance on size and maintenance characteristics. However, while this is very positive step for the city, it is clear that it is not always followed and many trees continue to be planted in the wrong place.

As noted, trees provide many benefits so every effort should be made to ensure their longevity and to replace those lost from any cause, whether old age, storm damage or improper care. The city should allocate additional funds to create a robust and successful planting program.

Where to Plant Trees

To get a start on analyzing where trees might be fitted within the urban landscape, the GIC created a model to evaluate space on the ground. A Geographic Information System (GIS) model was created using exclusion factors to estimate

how much of the treeless area would actually be open to future planting. A Possible Planting Area (PPA) analysis was created to show areas in which it may be possible to plant trees. To assess PPA, the GIC included three types of land cover:

- ✓ non-tree vegetation
- ✓ bare earth
- ✓ non-building impervious

These land cover types were included in the PPA, while all other types were removed from consideration. The process involved two distinct steps. First, a one-meter land cover dataset was queried to map the three land cover types. Next, a series of exclusionary factors were used to eliminate certain areas in order to develop a more realistic estimate of the plantable area. Obvious barriers, such as buildings, railroad tracks, athletic fields, golf course fairways, footpaths, and roads were excluded. Buffers were applied to some of these barriers to increase the accuracy of the estimate (for example, a four-foot buffer was placed around buildings, because trees should not be planted immediately adjacent to buildings).

This resultant map did not represent areas of potential tree canopy, but rather identified those areas in which trees could possibly be planted (as tree canopy can overhang a street or building).

A PPA map estimates areas that are feasible to plant trees – it is not a suitability map. For example, a wide sidewalk may be initially identified as a feasible place to plant a tree, but may not turn out to be suitable if there are low power lines or an abundance of underground utilities. Thus, any PPA needs to be field checked and compared against unseen barriers, such as underground utilities and city development plans. For example, it would not be prudent to plant trees along an

avenue that is due to be widened. A PPA analysis of this sort is useful for setting realistic long-term goals for a citywide tree canopy, as well as identifying potential opportunities for tree planting.

Unfortunately, as noted earlier, much of Jersey City's streets have problems with excessive overhead wires. Even when power or phone lines run along only one side, cross wires to each residence on the other side of the street still create barriers to planting large street trees. This problem can be solved over time by replacing overly tall trees with smaller trees, or by burying lines underground. Keep in mind, however, that while putting utilities underground solves overhead problems, care is still needed to avoid excessive harm to tree roots. Putting utilities underground is also very expensive.

See the illustrations in Appendix H for examples of how to provide the best planting conditions for urban trees. In addition, the utility company PSEG provides their own list of trees they deem acceptable to plant under power lines. See: www.pseg.com/home/education_safety/safety/vegetation_ mgmt/right_tree.jsp.

Since individual streets may also be targeted for tree planting, the study included an analysis of how well-treed each city street actually is. The color-coded map can be used to highlight areas where there are few or no trees. This may be because of overly narrow sidewalks, extensive overhead wires, or it could simply be because no-one has ever planted any trees there. Areas could also be targeted because they are part of a new master plan or an economic redevelopment plan.

Figure 5 *This series of images highlights the difference between Possible Planting Area and Potential Tree Canopy. Possible Planting Area (highlighted yellow in the center image) estimates area in which a tree could be planted. Potential Tree Canopy (highlighted orange in the image on the right) can overhang areas in which it is not possible to plant a tree (like a road).*

Figure 6 *The map at left shows Urban Tree Canopy data for a part of Jersey City, New Jersey. The map at right shows the predicted Possible Planting Area for the same geographic area. Note that two types of Possible Planting Area are distinguished: Impervious (e.g. parking lots, sidewalks) and Non-Impervious (e.g. grass, bare earth).*

Reasons to Target Streets for Tree Planting:

- Trees have been lost from storms and need replacing.
- Trees are aging and will need replacing
- An area is redeveloping (trees attract buyers, tenants, and shoppers).
- The street connects to other places people walk or bike to, such as a city park.
- It is a school walking route (trees add to safety and shade).
- It is a key entrance corridor to the city.

Making Smarter Investments in Tree Care and Management

To protect its investment in new trees, the city should ensure that trees survive as long as possible. To maintain its canopy, it will need to adopt tree planting standards. Urban trees, especially those planted in the street median or within sidewalks and parking islands, do not usually live as long as they would under 'natural' conditions, since there are diminished planting conditions.

There have been many studies of urban tree mortality rates (but no recent studies for Jersey City). An estimated annual mortality for new streets trees is 5.1 percent. If the wrong tree is planted, mortality rates may be even higher. Many trees in Jersey City are planted in situations that prohibit a long life span. Rather than continually replacing trees, or removing trees that have become hazardous, it would be better to invest in proper placement and planting.

A generally accepted rule of thumb is that a large-sized tree (16 inches diameter at breast height) needs at least 1,000 cubic feet (10x10x10) of uncompacted soil (McKeand and Vaughn 2013). However, urban soils are often highly compacted, which makes it far more difficult to achieve water
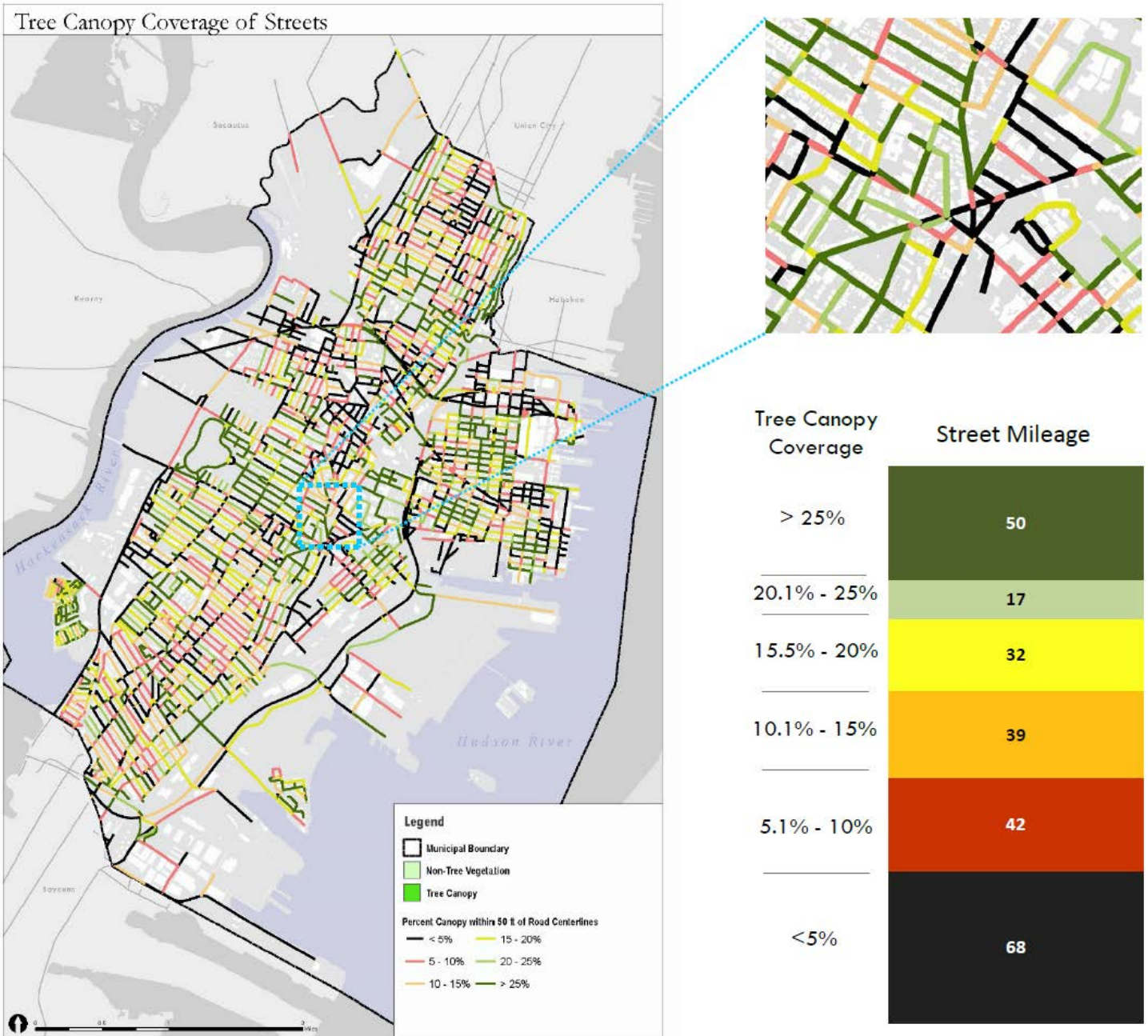
Figure 7 *An example of an analysis done using the tree canopy data that can help inform tree planting priorities. The map shows canopy coverage on a street by street basis (canopy coverage within 50 feet of street centerlines). A higher percentage means the street has more trees along it. The stacked bar chart shows the total mileage of streets in each of the six coverage categories.*

absorption and proper drainage. The soil may also be comprised of low-grade fill dirt and thus have poor levels of organic matter and nutrients. Urban trees may also need engineered structural soils that provide greater holding strength where root spread is limited.

The city needs to adopt clear standards for how new trees should be planted and how existing sites where trees are missing might be improved to ensure their survival. New York City has adopted very detailed standards for proper tree planting. (See Resources Section, Appendix A).

To best care for its trees, Jersey City needs to have a certified arborist on staff to advise the city on priorities for trees and to better oversee the implementation of professional

management standards. In addition, if the city increases the number of trees planted each year and increases the amount of oversight and monitoring, which this report recommends, it will need to employ more field workers, whether they are assistant arborists or well-trained DPW maintenance staff.

The city will also need to allocate more resources to the Division of Parks and Forestry, whose annual budget is approximately $3 million, of which only $400,000 is budgeted though Community Development Block Grants (CDBGs) for sidewalk repair and No-Net Loss funds. But this is not enough to fully cover trimming, pruning, removals and planting. Approximately half of the $400,000 budget was dedicated to planting new trees in 2014. However, as noted,

The Four Standards for *Tree City USA*

- A tree board or department.
- A tree care ordinance.
- A community forestry program with an annual budget of at least $2 per capita.
- An Arbor Day observance and proclamation.

reducing the annual decline in city trees requires greater expenditures of funds and staff time.

To qualify for many state and federal grants for tree planting and care, the city needs to become a Tree City USA. There are thousands of Tree Cities in the U.S., from small towns to large cities. The city almost meets these requirements (see box at right). It would need to activate its Shade Tree Commission, expand its current tree ordinance, increase expenditures for city trees by at least $80,000, and plant an official Arbor Day Tree. These goals are doable and will be met if the recommendations of this report are followed. The designation is approved by the National Arbor Day Foundation. It also requires an updated annual report each year to confirm the program is still in place and to document accomplishments.

Strategic Recommendations to Care for Jersey City's Trees and Green Spaces

The Jersey City Environmental Commission reviewed the shade tree inventory results and researched key findings to develop the following recommendations. A public open house held in May 2015 provided an opportunity for citizens to review ideas and offer their support and suggestions. (See Appendix C). These strategies are intended to protect and expand the city's investment in its trees in order to create a cleaner, greener, more livable and vibrant city for everyone. All of these objectives can be achieved within the next two to three years. If there is a long-term need, it is identified as the next focus to begin within five years after the first objectives have been achieved.

Jersey City Environmental Commission's Recommended Approach

By **engaging** with Jersey City's stakeholders across the board from neighborhoods to agencies to developers, Jersey City will increase **awareness** of the value that shade trees provide in urban environments for **economic development** and overall **resiliency**. The City will utilize a combination of **systems** to **gain** new trees with **increased plantings**, **retain** and **protect existing trees**, and **maintain** all trees through **training programs and partnerships**. Ultimately, we will increase communication and **collaboration** in order to promote **accountability**, create sustainable systems and show trees' **long-term value**.
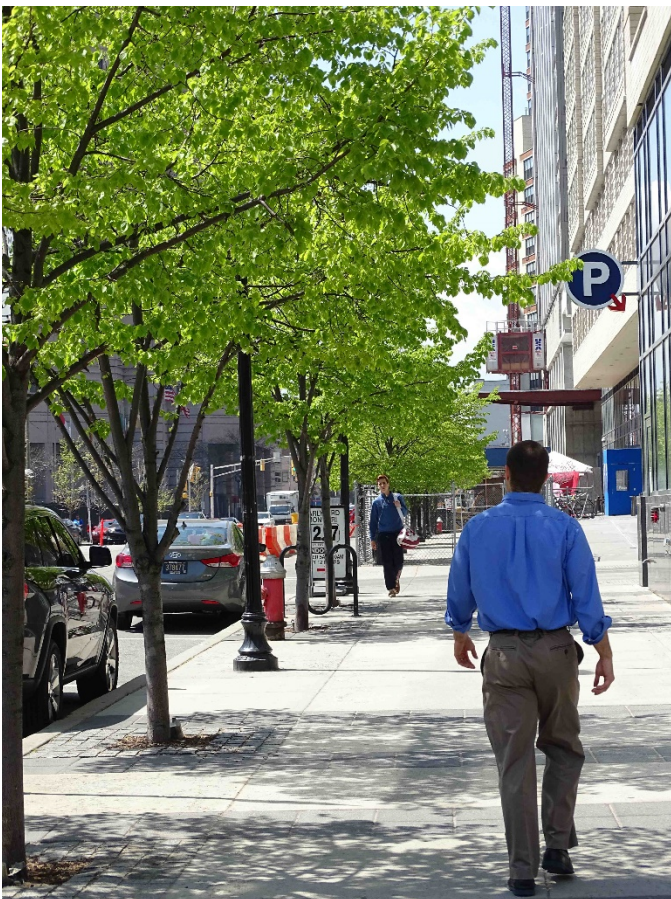
Public Participation in the Goal Setting Process

In order to create an inclusive and transparent goal setting process, the JCEC invited public comments at key points in the project. The GIC facilitated three JCEC meetings which members of the public attended. Information about the project was presented and discussed at each meeting, and public comments were recorded. The comments helped to, for example, identify potential partnerships and prioritize certain types of analyses.

Additionally, an open house was held by the Jersey City Environmental Commission (JCEC) and consultants from the nonprofit Green Infrastructure Center (GIC) on May 2, 2015. The meeting was held on a Saturday to make it more convenient for the public to attend. The primary objectives of the open house were to:

- Inform members of the public of the work being done to map and plan for Jersey City's trees.
- Gather comments, insights, and recommendations from members of the public.
- Facilitate communication between those interested in restoring the city's tree canopy.

As the event was structured as an open house, individuals were welcome to come and go as they pleased. Based on sign-in sheets, there were a minimum of thirty attendees (along with those who did not sign in), in addition to members of the JCEC and staff from the GIC. After a brief presentation summarizing the results of the tree canopy study, attendees were given the opportunity to comment on draft goals and objectives prepared by the JCEC and the GIC. The goal and objective statements were placed on large posters for attendees to view, with notepads to record comments. Attendees had the option to place orange dot stickers beside objectives that they felt should be a priority for the city, as well as a special blue dot sticker that they could place next to

their highest priority. While not a scientific poll, the results help to summarize the priorities of a variety of individuals and stakeholder groups. The public comments and voting helped to shape the goals and objectives in the following section, and in particular helped the JCEC identify priority items (identified in the "Within Five Years" section under each goal). Appendix C presents the detailed results of the open house, including vote counts and public comments.

Goal 1: Expand Jersey City's Tree Canopy

Obj. 1a: The city increases annual city tree giveaways from 120 to at least 700 and achieves a 90 percent survival rate by teaching planting techniques to recipients and inspecting plantings within three months and also one year. (The cost of this will be $385,000, $140,000 paid by residents. The current cost is $66,000, of which residents pay $24,000. Seven hundred is the city's current goal, although they have been averaging 120 new street trees planted annually.)

Obj. 1b: The city launches a citizen tree planting campaign which includes a web site with fact sheets on why to plant trees, what types of trees to plant, and where. It should include a digital app to show where new trees are planted or needed, and utilize door hangers, free or discount tree coupons, etc., to promote the campaign.

Long Term: Increase the tree canopy to 20 percent.

Goal 2: Promote Long Term Viability for City Trees

Obj. 2a: Revise the **city tree protection ordinance** in order to include tree management; also include standards for provision of tree wells and retrofitting of existing tree wells to ensure long-term tree survival. (Care of city trees is not
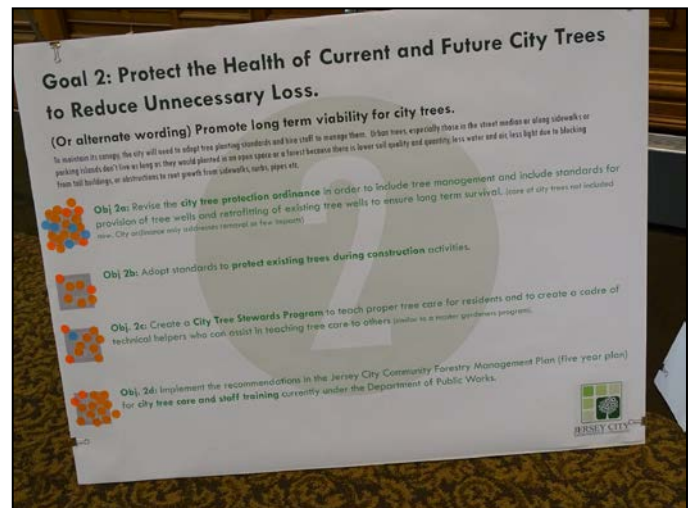
Several photos from the May 2 open house. The image at right shows one of the posters used to display the draft goals and objectives, and to allow the public to vote.

currently included in the city ordinance, which only addresses tree removal and a few impacts on trees.)

Obj. 2b: Implement the recommendations in the Jersey City Community Forestry Management Plan (five year plan) **for city tree care and staff training** currently under the Department of Public Works.

Within Five Years:

Obj. 2c: Adopt standards to **protect existing trees during construction** activities (see Appendix A: Exemplary Urban Tree Standards).

Obj. 2d: Create a **City Tree Stewards Program** to teach proper tree care for residents and to create a cadre of technical helpers who can assist in teaching tree care to others (similar to a master gardeners program).

Goal 3: Create a Long-Term Funding Mechanism for City Tree Planting and Tree Care

Obj. 3a: Partner with key community groups, such as the Jersey City Parks Coalition and neighborhood associations, to launch tree planting and tree care projects (partner with them to solicit and obtain grants).

Obj. 3b: Create a **city arborist position** through the general fund to ensure that investments in current and future city trees are well protected. Assess the need for additional maintenance technicians for stump removal, pruning, planting, and watering. (The salary of an arborist is estimated @ $45,000 per year, plus benefits).

Within Five Years:

Obj. 3c: Apply to become a **Tree City USA** by adopting a tree protection ordinance and expending more per capita on tree care (see above Obj 2A and City Forestry Management Plan), in order to qualify for related state and federal grants for urban tree planting.

Obj. 4d: Obtain grants from foundations, the state, and federal agencies for tree planting and care grants. This requires staff time dedicated to grant writing.

Obj. 3e: Create a **Community Tree Care Fund by Ward** that residents may apply for to re-green each city ward.

Obj. 4f: Partner with local universities to train **students to help survey** tree species and planting conditions.
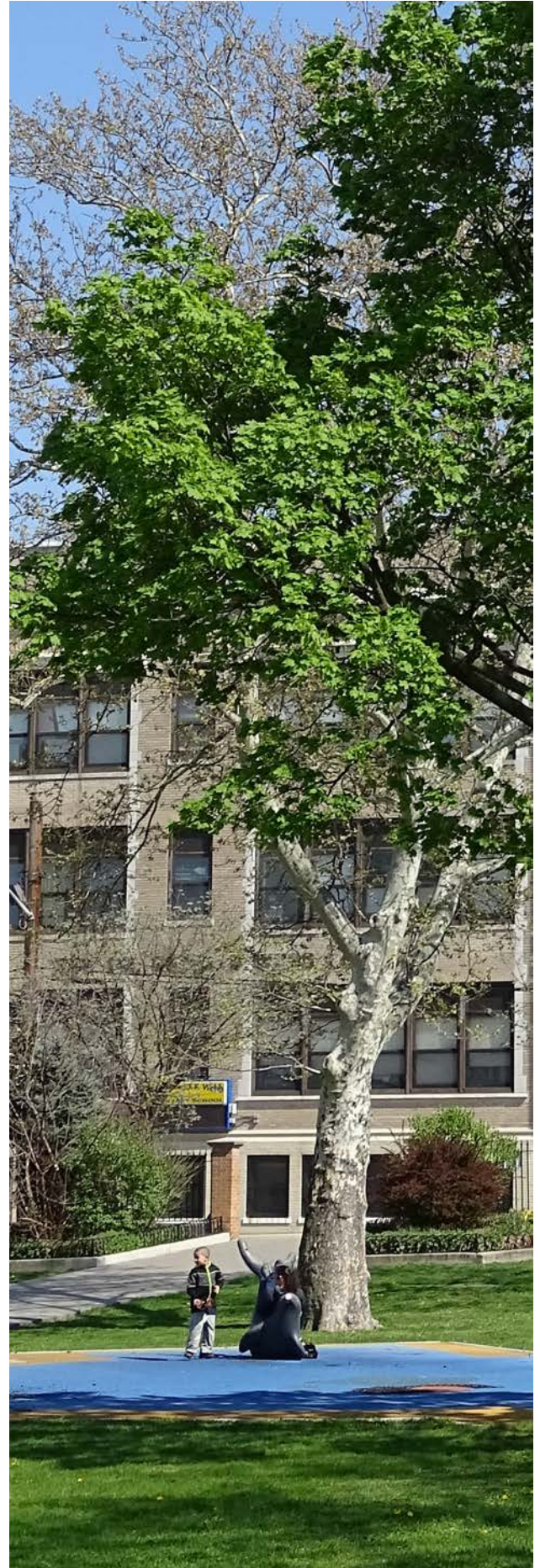
Conclusion

A successful city is also a green city. The health, well-being and economic condition of city residents is tied to the green of their environment. Even a highly developed area such as Jersey City can become more vibrant, more attractive and more resilient. Jersey City is in a stage of growth and many areas of the city, such as areas along Christopher Columbus Drive are redeveloping. As the city redevelops, at every stage it should ask, can we do this in a greener way?

The city's trees provide so many benefits to the city for shade, stormwater management, better air quality, reduced utility bills, enhanced safety, natural beauty, vibrant residential and business districts, and mental and physical health. But as a living system, the city's tree canopy needs good care, management, and replacement over time. The city is losing its tree canopy little by little every year.

But we can change this. The Jersey City Environmental Commission has taken a critical step by creating a project to assess the city's current canopy, as well as its impervious areas, and has followed up with analysis and key strategies for what should be done. All the created data are now housed with the City Planning Department. The city has the information and the assessment to take strategic action. Already, suggestions for improvement in city tree management are under consideration by the Division of Parks and Forestry. Citizens are excited to find ways to get more trees donated and planted!

To realize the recommended strategic approach, the city will need to allocate funds to support new staffing. A city the size of Jersey City should have a professional arborist to guide decisions about city tree management and adequate staff to care for the city's natural resources. The city needs more resources to care for the trees it has now and to begin to expand their numbers over time. A city arborist position and additional associated maintenance technicians should become part of the city's budget for the Division of Parks and Forestry beginning in 2016.

It is important to note that, while there are grants to support tree planting, it is not possible to meet all of the city's needs through grants alone. The city will need to make the first investment. This will meet city goals; Mayor Fulop has set a goal for making Jersey City the best mid-sized city in America by attracting new businesses, expanding development and improving government services.

Investing city funds in its tree canopy will help the city achieve its goal of becoming the best mid-sized city. Small companies, especially those that have a well-paid and skilled workforce, place a strong importance on the 'green' of the local environment.[22] A greener Jersey City will attract better

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22 Crompton Love and Moore 1997

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paid jobs and thus a better tax base over the long term. Investment in the city's trees will show prospective businesses that the city is healthy and thriving. It will also motivate people to spend more time and money in retail areas and will promote home purchases and higher house and condominium values. All of the investments made in the city's green infrastructure will be returned to the city's coffers. However, nothing is ever realized or grown without investment in time and resources.

Next steps to achieve the goals of this report involve discussions with the mayor and city councilors, division heads, neighborhoods and businesses. Allocations for the budget beginning in 2015 for the following year and beyond should be sought to fund new positions and to implement the backlog of city tree maintenance and management needs.

A shade tree commission is enabled under Chapter 10 of the city code and may be one way to organize these initiatives. In the meantime, the Jersey City Environmental Commission invites feedback, dialogue, and action to bring these goals to fruition. A list of current commissioners is found on the inside cover of this report. Contact the chairman or your local ward representative to share ideas and interest. A green city is a healthy city! Let's get it done.

APPENDIX A: BIBLIOGRAPHY

This list includes articles cited in the report text as well as links and references for useful related sources. All websites were confirmed as active links as of May 2015.

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Jersey City
Berry Lane Park Plan, Jersey City Redevelopment Agency. http://www.thejcra.org/?p=blp

Jersey City Environmental Commission http://www.cityofjerseycity.com/boards.aspx?id=8684

State of New Jersey:
New Jersey Shade Tree Federation http://www.njstf.org/resources_public.php

Department of Environmental Protection, Division of Parks and Forestry, Community Forestry: http://www.nj.gov/dep/parksandforests/forest/community/Benefits_economic.html

Regional and National:
Resources and Articles for Urban Forests: http://www.naturewithin.info/civic.html

Useful Web Links for Other Cities' Urban Tree Programs and Plans:

New York City's Million Trees Program, NY: http://www.milliontreesnyc.org/html/home/home.shtml

New York City's Million Trees Benefits: http://www.milliontreesnyc.org/html/about/forest.shtml

New York City's street Tree Spacing Diagram: http://www.nycgovparks.org/pagefiles/73/street-tree-spacing.pdf

Los Angeles, CA Tree People (nonprofit tree partnership group) https://www.treepeople.org/

Tree Baltimore, MD: http://www.treebaltimore.org/

Grow Boston Greene, MA: http://www.cityofboston.gov/parks/streettrees/growboston.asp

Norfolk, Virginia, VA: http://www.norfolk.gov/DocumentCenter/View/2489

Save the Rain guide to tree planting: http://savetherain.us/tree-planting/

Tree Philly, PA: http://www.phila.gov/ParksandRecreation/PDF/PPR_Parkland_Forest_Mgmt_Framework.pdf

Tree Pittsburg, PA: http://treepittsburgh.org/

Providence, RI: http://www.providenceri.com/sites/default/files/file/Parks_and_Recreation/Providence_Urban_Forest_as_of_2008.pdf

Washington, D.C.: http://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/dc_assessment_urban_forest_resources_strategy_2010-06.pdf

Exemplary Urban Tree Standards:

City of Charlottesville Urban Forest Management Plan:

> An Urban Forest Management Plan is intended to provide a framework for ensuring that the trees and forests are appropriately cared for. This guide from Charlottesville is an excellent example of the guidance that should be provided for staff, landowners, utility companies, developers, and residents to follow when making decisions about trees, and the land they live on and are responsible for. Download at: http://www.charlottesville.org/Modules/ShowDocument.aspx?documentid=13979

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www.epa.gov/heatisland/mitigation/trees.htm

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APPENDIX B: TECHNICAL DOCUMENTATION

This section provides technical documentation for the methodology and results of the land cover classification used to produce the Urban Tree Canopy (UTC) information for the Jersey City Environmental Commission, hereafter referred to as "JCEC." Land cover classifications are an affordable method for using aerial or satellite images to obtain information about large geographic areas. Algorithms are trained to recognize various types of land cover and the pixels in the raw image are converted to one of several types of pre-selected land cover types. In this way, the raw data (i.e. the images) are turned into information about land cover types of interest, e.g. what is pavement, what is vegetation. This land cover information can be used to gain knowledge about certain issues, for example: what is the tree canopy percentage in a specific neighborhood? Thus, the chain of gaining knowledge is as follows:

Data => Information => Knowledge

With knowledge in hand, derived quantitatively from the best available data, planning and decision making capacities are enhanced. Land cover information is not the end goal, but rather a product needed to support larger goals. The goal of this project was to provide the JCEC with a baseline shade tree inventory and to support them in creating strategic objectives.

Data Acquisition

Aerial Imagery

Two sources of imagery were considered for the classification. The first was the New Jersey High Resolution Orthophotography (4 band, 1 foot resolution). The second was NAIP[23] 2013 leaf-on imagery (3 band, 1 meter resolution). After testing each data source, the NAIP imagery was selected for the full classification for several reasons. First, the original 2012 imagery was flown in March and April, meaning that spring foliage was not completely matured. This caused many areas of tree canopy to be missed in the trial classifications. Secondly, the NAIP imagery from August 2013 is more current.

The full set of NAIP data was acquired through the Earth Resources Observation and Science (EROS) Center of the U.S. Geological Survey. Five tiles were required to cover all land area in Jersey City:

- *m_4007416_se_18_1_20130802_20130826.jp2*
- *m_4007416_sw_18_1_20130802_20130826.jp2*
- *m_4007424_ne_18_1_20130802_20130826.jp2*

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[23] The **National Agriculture Imagery Program** (**NAIP**) acquires aerial imagery during the agricultural growing seasons in the continental United States. It is administered by the USDA's Farm

- *m_4007424_nw_18_1_20130802_20130826.jp2*
- *m_4007424_sw_18_1_20130802_20130826.jp2*

Figure 8 *The five NAIP tiles in relation to the Jersey City municipal boundary.*

Pre-processing

The NAIP image tiles were first re-projected into the coordinate system used by Jersey City to maintain consistency with their information:

Projected Coordinate System:

NAD_1983_StatePlane_New_Jersey_FIPS_2900_Feet

Projection:	*Transverse_Mercator*
False_Easting:	*492125.00000000*
False_Northing:	*0.00000000*

Service Agency (FSA) through the Aerial Photography Field Office (APFO) in Salt Lake City

Central_Meridian: -74.50000000
Scale_Factor: 0.99990000
Latitude_Of_Origin:38.83333333
Linear Unit: Foot_US

Geographic Coordinate System:
 GCS_North_American_1983
Datum: D_North_American_1983
Prime Meridian: Greenwich
Angular Unit: Degree

The imagery was then clipped to the area of interest (Jersey City). A 100 foot buffer was used to avoid producing errors along the city boundary. Thus the total area of interest was all land within the Jersey City municipal boundary (inclusive of state and county land within[24]) plus the 100 feet of land or water surrounding it.

Supervised Classification

The imagery was classified using a supervised classification approach. The Land Image Analyst (LIA) software package was used to perform the primary classification. The tool was developed by the U.S. Geological Survey and the USDA Forest Service and is scheduled for public release in 2015. One advantage of this tool is that it will be widely accessible and can be updated by Jersey City staff over time.

The Decision Tree Classifier, which is part of LIA, was the classification algorithm chosen for this work as it is ideal tool for classifying data into categories (in this case land cover). This classifier uses the See5 decision tree software to build a model for the training data which can then be applied to unclassified areas. To "train" the algorithm to recognize certain types of land cover in the imagery, it is necessary to create training data by digitizing polygons that represent the land cover types of interest. The 1,578 total training samples were used during the entire process to test and improve the accuracy.

Post-processing

The raw classifications from LIA were then transferred into ArcGIS (v 10.2) to perform post-processing operations. Planimetric data were also used at this point to improve the classification. Roads, sidewalks, and trails were "burned in" to the raw classification (converted vector data to raster data, which then replaced the values in the raw classification). The "tree canopy" class was not affected by the burn-in process, however, because tree canopy can overhang streets. These data layers were also used to make logic-based assumptions to improve the accuracy of the classification. For example, if a

pixel was classified as "grass," but that pixel overlaps with the roads layer, then it was converted to tree canopy.

The final step was a manual check of the classification. Several ArcGIS tools were built to automate this process. For example, the ability to draw a circle on the map and have all pixels classified as "tree canopy" to "non-tree vegetation," which is a process usually requiring several steps, is now only a single step.

Results

The final classification produced highly accurate results for identifying tree canopy in Jersey City. An accuracy assessment was performed that found a producer's accuracy of 92.8 percent (the likelihood that an area of tree canopy was correctly classified as such) and a user's accuracy of 96.3 percent (the likelihood that an area classified as 'tree canopy' in the final classification is actually a tree) for the tree canopy land cover class. This level of accuracy meets or exceeds the precision for comparable cities. The classification resulted in an overall accuracy of 88 percent. The confusion matrix below shows these accuracy metrics based on randomly sampled points throughout the city.

Confusion Matrix

Classification Data	Reference Data							
	TC	NTV	B	I	S	W	Row Total	*Unknown*
TC	103	4					107	*4*
NTV	8	60					68	*1*
B			24	3	1		28	*3*
I		1	19	81	2		103	*3*
S			2	13	72		87	*0*
W						49	49	*0*
Column Total	111	65	45	97	75	49	442	

Producer's Accuracy		User's Accuracy	
TC	92.8%	TC	96.3%
NTV	92.3%	NTV	88.2%
B	53.3%	B	85.7%
I	83.5%	I	78.6%
S	96.0%	S	82.8%
W	100.0%	W	100.0%

TC, Tree Canopy; NTV, Non-Tree Vegetation; B, Bare Earth/Sand; I, Non-Building Impervious; S, Building (Structure); W, Water

Figure 9 *Error matrix showing the results of randomly sampling points within each land cover class, and comparing that point's actual land cover with the land cover typed assigned during the classification process.*

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[24] Most comparable urban tree canopy assessments include all lands within the municipal boundary regardless of ownership, to ensure a correct assessment of coverage.

APPENDIX C: PUBLIC OPEN HOUSE SUMMARY

The goal and objective statements that were available for comment at the event are listed below. Note that these do not exactly match those that are presented in this report, as the objective statements were modified based on public comments and further discussions. Citizen rankings were used to select the priority objectives.

GOAL 1	Expand Jersey City's Tree Canopy to 20%
1a	City plants 1,500 trees per year for the next 20 years which achieves the goal in roughly 30+ years
1a.1	City plants 5,000 trees per year for 6 years to attain 30,000 trees planted by 2022
1b	Increase annual City tree giveaways from 120 to 500 and achieve a 90% survival rate by teaching planting techniques to recipients and inspecting plantings within 3 months and also 1 year
1c	City launches citizen tree planting campaign which includes: web site with why to plant, what to plant and where, door hangers, free or discount tree coupons, - consider an app to show where new trees are, etc.

Goal 1
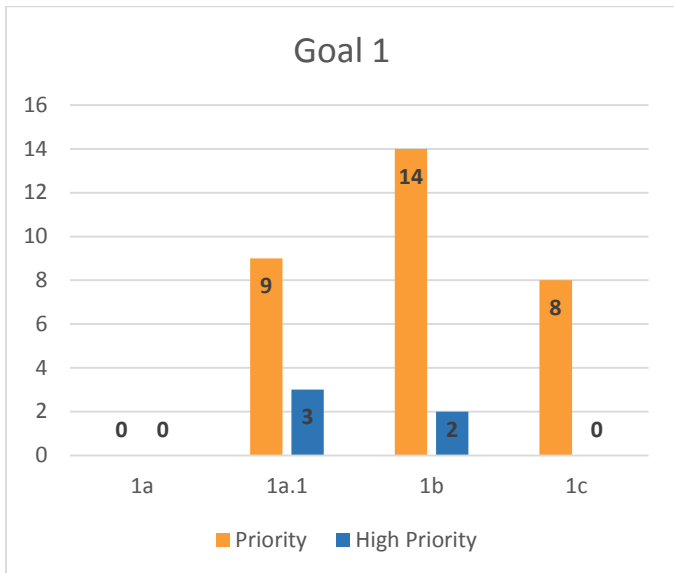
| GOAL 2	Protect the Health of Current and Future City Trees to Reduce Unnecessary Loss.
2a	Revise the city tree protection ordinance in order to include tree management and include standards for provision of tree wells and retrofitting of existing tree wells to ensure long term survival.
2b	Adopt standards to protect existing trees during construction activities.

2c	Create a City Tree Stewards Program to teach proper tree care for residents and to create a cadre of technical helpers who can assist in teaching tree care to others
2d	Implement the recommendations in the Jersey City Community Forestry Management Plan (five year plan) for city tree care and staff training currently under the Department of Public Works.

Goal 2
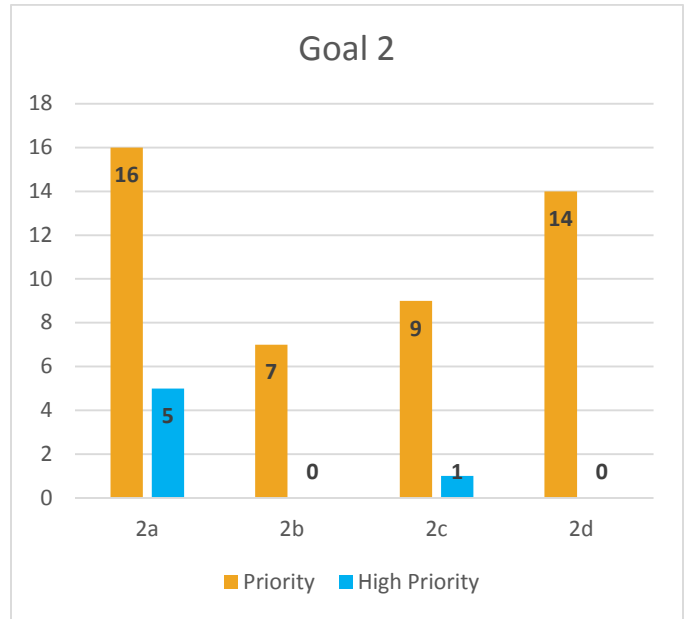
GOAL 3	Create Long Term Funding Mechanism for City Tree Planting and Tree Care
3a	Apply to become a Tree City USA by adopting a tree protection or (see above Obj 2A and City Forestry Management Plan) to qualify for related state and federal grants for urban tree planting.
3b	Partner with key community groups such as JC Parks Coalition, Neighborhood Associations, …. to launch tree planting and tree care projects
3c	Create a community tree care fund by ward that residents may apply for to re-green each city ward.
3d	Create a city arborist and assistant city arborist position through the general fund to ensure that investments in current and future city trees are well protected.
3e	Obtain grants from foundations, the state and federal agencies for tree planting and care grants.
3f	Partner with local universities to train students to help survey tree species, conditions.

Public comments:

- Include Sierra club!
- Provide a list of trees that can be planted in pots (with high CO2 sequestration).
- Internalize externalities (capture health, flooding, climate benefits by some mechanism that monetizes human and ecosystem services).
- Development includes a "tree" or green plan much like the waterfront walkway required access to the river. They need to include a plan and funding.
- Crowdsource funding – ioby (like the successful bike rack campaign)
- Advertise results in JC Independent Journal Reporter
- *Save Our Sycamores*
  - Pros: Powerhouses of carbon sequestration
  - Cons: they drop limbs
- Amend 2A ordinance to include 2B provision
- Take an ecosystem approach to trees and urban forests – include green infrastructure in this plan, as well as an urban heat island analysis.
- Require developers to provide a certain percentage of green space/tree/permeable surface for each project
  - (especially if project gets abatement AND build in strong enforcement!)
- High carbon sequestration trees
- Encourage people to voice their concerns @ JC_GOV@twitter or on the official JC GOV facebook page
- Pass ordinance requiring builder to replace trees they destroy
- Create tree nursery to provide discounted tree for homeowners.
- CHANGE.ORG petition – back it with a focused one week push to city council members to hear our ideas

- Open tree pit + Existing dead tree study and prioritize planting in these spots (right spot w/right tree)
- More info on trees suitability and guidelines on the City tree planting application
- Suggesting that the area near Lincoln Park and Hackensack river includes wetlands
- Pass ordinance re: planting only native species on public lands and as street trees, as well as incentivizing planting by residents, and ban certain invasives from being sold in JC.
- Promote this project by advertising in the Jersey Journal, JC Independent online and the reporter

Goal 3

	3a	3b	3c	3d	3e	3f
Priority	7	12	3	11	9	6
High Priority	0	6	0	5	0	2
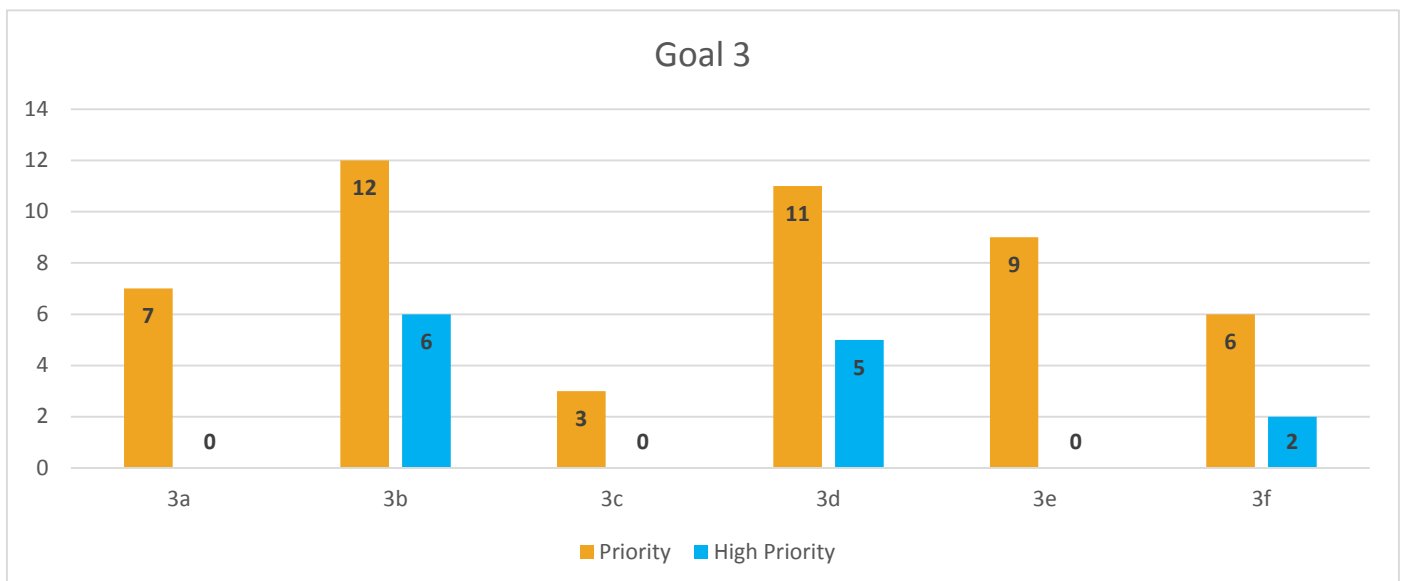
APPENDIX D: FUNDING RESOURCES FOR JERSEY CITY'S URBAN FOREST

The **National Fish and Wildlife Foundation** administers various federal grant sources. These often require a match which can be met through cash or in-kind matches. They are many different types of funds that could be used to address making the city greener from stewardship grants to coastal resiliency planning:
http://www.nfwf.org/whatwedo/themes/Pages/community-stewardship.aspx#.VWiexk9VhBc

Federal Grants for All Agencies. Lists all federal grants available from multiple federal agencies. Can search by topic (environment) and likely agency for urban trees (US Department of Agriculture).
www.Grants.gov

National Urban and Community Forestry Advisory Council: Issues RPFs for grants to address urban forestry. May require a mutli-jurisdicitonal approach.
http://www.fs.fed.us/ucf/nucfac.shtml

Northeast Region USDA Forest Service Region Grants. Issues competitive grant requests annually for all localities within the NE Region:
http://www.na.fs.fed.us/rfp/index.shtm

State of New Jersey, Department of Environmental Protection, Division of Parks and Forestry New Jersey Community Stewardship Incentive Program. Grants up to $3000 for community tree planting.
Email carrie.sargeant@dep.nj.gov

New Jersey Tree Foundation: Tree planting and stewardship group. Does not give grants but may donate trees or services. New Jersey Tree Foundation, 576 Leesville Road, Jackson, NJ 08527. www.njtreefoundation.org
http://www.state.nj.us/dep/parksandforests/forest/community/grants-csip.html

PSEG Corporate Grantmaking "We invest in public parks that improve the quality of life for local residents and in the environmental organizations that protect and preserve natural resources, address climate adaptation, and build sustainable communities. "

https://www.pseg.com/info/community/new_site/giving.jsp

Geraldine R. Dodge Foundation. "Focus on urban greening, particularly through community-led design and decision making " September deadline for grants.

http://www.grdodge.org/what-we-fund/environment/

Environmental Endowment for New Jersey: Grants ranging from $5,000 to $15,000
http://www.eenj.org/home/grant-guidelines

Alliance for Community Trees offers grants to its member organization to support local tree planting projects. These grants are the result of partnerships with corporate sponsors, as well as their employee volunteers. Requires membership fee paid first to join. http://actrees.org/what-we-do/grants-and-awards/planting-trees/

Individual and Corporate Support: In addition to applying for grants, some of which will require a nonprofit partner to make the application, the city should consider requesting donations for street trees. See the example programs in the bibliography for ideas. Jersey City should design a standard thank you sign to place at every location where a tree has been donated and an interactive map so people can look for sponsorships.

Many corporations like to sponsor volunteer days and will often provide the materials needed. Examples are United Parcel Service, Federal Express, Wells Fargo Bank and many more. Using volunteer labor (with supervision) and donated materials make many projects affordable. Just ensure that there will be long term care provided for any installations.

Many localities also partner with local nurseries and provide coupons for trees so residents can pick up and plant their own trees. This requires registering the trees' locations so that follow-up can occur to ensure that the tree was planted and is being cared for. Trees may be free or may have a discount.

Here is an example of a coupon program:
http://www.treevitalize.net/coupon/nursery.aspx Maryland offers discounts at more than 80 nurseries:
http://trees.maryland.gov/

An example of a comprehensive tree recognition program is in Tulsa OK.
https://www.upwithtrees.org/files/6514/0863/9270/Tree_Site_Complete_Packet.pdf

The City of New Orleans, LA also suggests people sponsor a tree or even leave trees to the city parks in their wills.
http://neworleanscitypark.com/donate

APPENDIX E: CROSSWALK WITH COMMUNITY FORESTRY MANAGEMENT PLAN (ADOPTED MAY 2015)

These goals are within the new edition of the city's official Management Plan and reflect the direct collaboration between the consultants preparing the management plan and the consultants creating the canopy assessment and recommendations for the JCEC. The Plan states that:

> *"During 2014, the JC Planning Department and the Environmental Commission have been working to determine the % of canopy cover and make recommendations for the next steps to increase not only the % of tree cover, but to also improve the City's green infrastructure. There are high expectations for the continued development of the amalgamation between the planning efforts of the Environmental Commission and the Division of Parks and Forestry responsible for on-the-ground work during the next 5-year period. "*

Category 3 – Desired Future Condition (page 6)

Goal #3a:

To set goals and action plans to sustain and/or increase tree canopy.

Objectives of Goal #3a:

(1). Set goals for % of tree cover by wards, zoning and/or other categories of land-use.

(2). Develop and implement action plans to increase or sustain % of canopy cover.

(3). Complete a tree canopy assessment, based on aerial imagery, every five to ten years and compare with previous tree canopy assessments to monitor change.

Goal #3c:

To continue and increase tree planting in City parks and along City streets.

Objectives of Goal #3c:

(1). Develop planting plans using data from the on-going assessments of 66 parks and data from the tree canopy assessment.

(2). Establish a goal to plant enough trees to meet the canopy goals suggested in the

Tree Canopy Assessment Report.

(3). Ensure that staff and contractors for the DPW follow recommendations in Design

Standards. [Amended 12-18-2013 by Ord. No. 13-138] .... to ensure the right trees are planted in the most suitable locations.

(4). Adopt planting standards for urban trees planted in city rights of way, city planting strips and in city parks

Goal #3d:

To encourage residents and businesses/corporations to care for and protect trees and to support tree planting on private property.

Objectives of Goal #3d:

(1). Publish tree canopy goals with explanations of the benefits of increased tree canopy.

(2). Distribute tree care information to homeowners as trees are planted.

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City of Jersey City Community Forestry Management Plan

(3). Distribute a preferred species list.

(4). Provide information on planting methods, elevation, care and sources of planting stock for 'backyard' tree planting.

(5). Adopt provisions to protect trees during construction.

APPENDIX F: TREE PLANTING SCENARIO CALCULATIONS

1. Calculations used to determine annual tree losses in Jersey City.

To increase its overall tree canopy to 20 percent, Jersey City will require a net increase of about 16,750,000 square feet of tree canopy.

- 16,750,000 square feet of tree canopy roughly equates to **21,750** mature trees.
    - This number is based on a ratio of 37/42/21 percent for small/medium/large trees.
    - Small/medium/large trees were defined as trees having canopy spread of 25ft/35ft/50ft respectively.
    - The canopy spreads are averages of trees found in Jersey City's tree planting ordinance.
    - The planting ratio (37/42/21 percent) was estimated using GIS by looking at the Possible Planting Area (excluding Liberty State Park). From that total area, it was estimated whether a large, medium, or small tree could be planted there (with large trees given preference over smaller trees). Thus, the PPA was divided into three classes, based on the size of tree that could be planted. Thus the ratio of 37/42/21 percent was arrived at for these three classes.
- It can be assumed that 34 percent of trees planted in an urban environment will die within 40 years.[25] This means that an additional **7,395** trees will need to be planted to reach the required goal for a 20 percent canopy.
- The DPW estimates that it removes about **187** trees per year, and plants about **122**.
- Anecdotal evidence suggests that the survival rate for trees is about 50 percent. This equates to a loss of 126 trees per year.[26]

To estimate the number of trees that need to be planted by 2020, in order to increase the city's canopy to 20 percent (when the trees mature):

$$\textbf{Tb} + \textbf{Tr} - (\textbf{DPWp} - \textbf{DPWr}) * \textbf{Y}$$

Tb => The base amount of trees that need to be planted to reach 20 percent canopy.
Tr   => Trees that need to be planted to replace trees that do not survive.

DPWp => The number of tree planted by DPW per year.
DPWr => the number of trees removed by DPW per year.
Y   => the number of years.

Filling in the numbers:
$$\textbf{21,750} + \textbf{7,395} - [(\textbf{122}*0.5^{27}) - \textbf{187})*5] = \underline{\textbf{29,775}}$$

Thus, **29,775** new trees are needed to reach a 20 percent tree canopy. Note also that there would have to be no net loss in trees per year after 2020. Currently there is a net loss of at least 126 trees, not counting those removed by private individuals.

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[25] From the *Northeast Community Tree Guide: Benefits, Cost, and Strategic Planning* by E. Gregory McPherson, James R. Simpson, Paula J. Peper, Shelley L. Gardner, Kelaine E. Vargas, and Qingfu Xiao

[26] Note that this number will be higher is private tree removals are accounted for. The GIC contacted multiple tree care firms that operate in Jersey City
[27] The number if trees planted by DPW is multiplied by 0.5 to account for estimated mortality)

APPENDIX G: USING THE CANOPY DATA

Investing in a tree canopy study is a great start to planning for a community's urban forest assets. However, data alone means little if it is not used effectively. The tree canopy data for Jersey City can be used for both short and long range planning, as well as help to answer questions as they arise (How much canopy coverage is there on this group of parcels? How much room to plant new trees is there in a park?).

Structure of the data: The tree canopy data are much more than the static maps presented in this document. The tree canopy data are in a raster layer that can be manipulated in GIS to address a variety of questions and investigate new issues, examples of which are shown throughout this report.

Short range planning: New development/development review How much do we stand to lose/can we take advantage of this just as a planning technician can pull up a utilities and transportation layers (gray infrastructure), it is beneficial to represent the overlay tree canopy data to view implications and opportunities for a site's green infrastructure.

Long range planning: Where to target tree planting, based on values, equity in different wards, neighborhoods. Which areas will mitigate storm surge/stormwater? Potential values to consider (and map) when engaging in a tree planting effort:

- Air quality improvement
- Reducing stormwater runoff
- Promoting public health
- Aesthetic improvement
- Urban revitalization
- Social equity
- Reducing crime
- Access to green
- Improving habitat quality and biodiversity

Other issues/thematic mapping: The data can be used to explore a variety of other issues. This is most often done through thematic mapping. For example, the map at left shows public schools overlaid on the tree canopy map. One quarter mile buffers are placed around schools to represent the areas that can reach a school by walking in 5 to 10 minutes. This map can help provide insight into the question of which paths might be improved through tree planting and other interventions to create safe routes to schools.

5 Minute Walk Zones to Public Schools
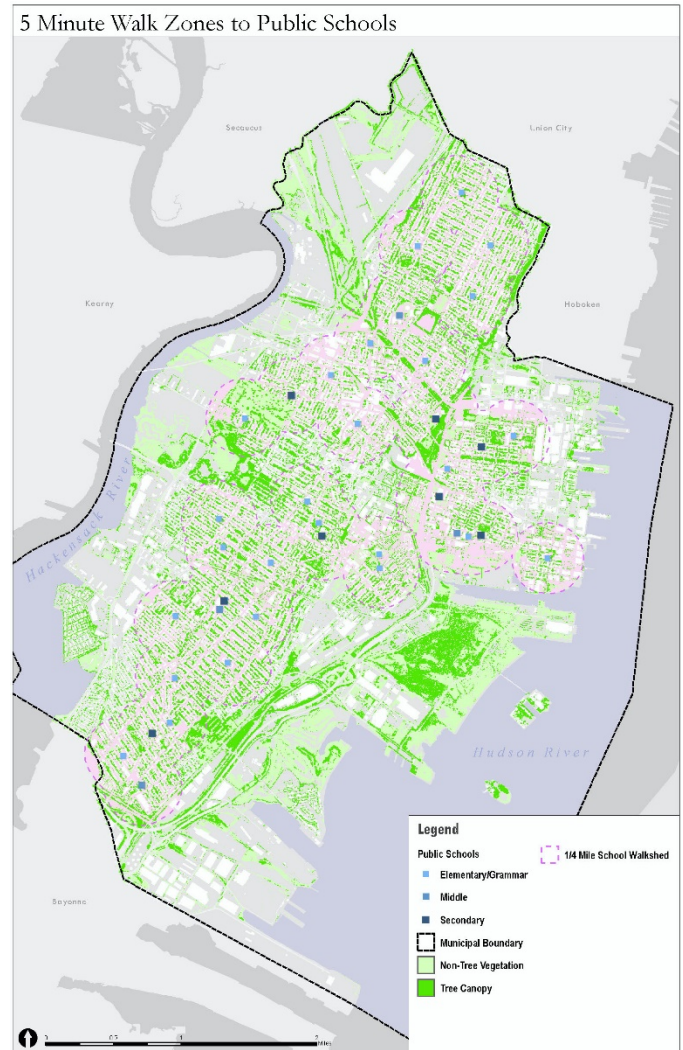
APPENDIX H: TREE PLANTING GUIDANCE

Image source: http://savetherain.us/tree-planting/

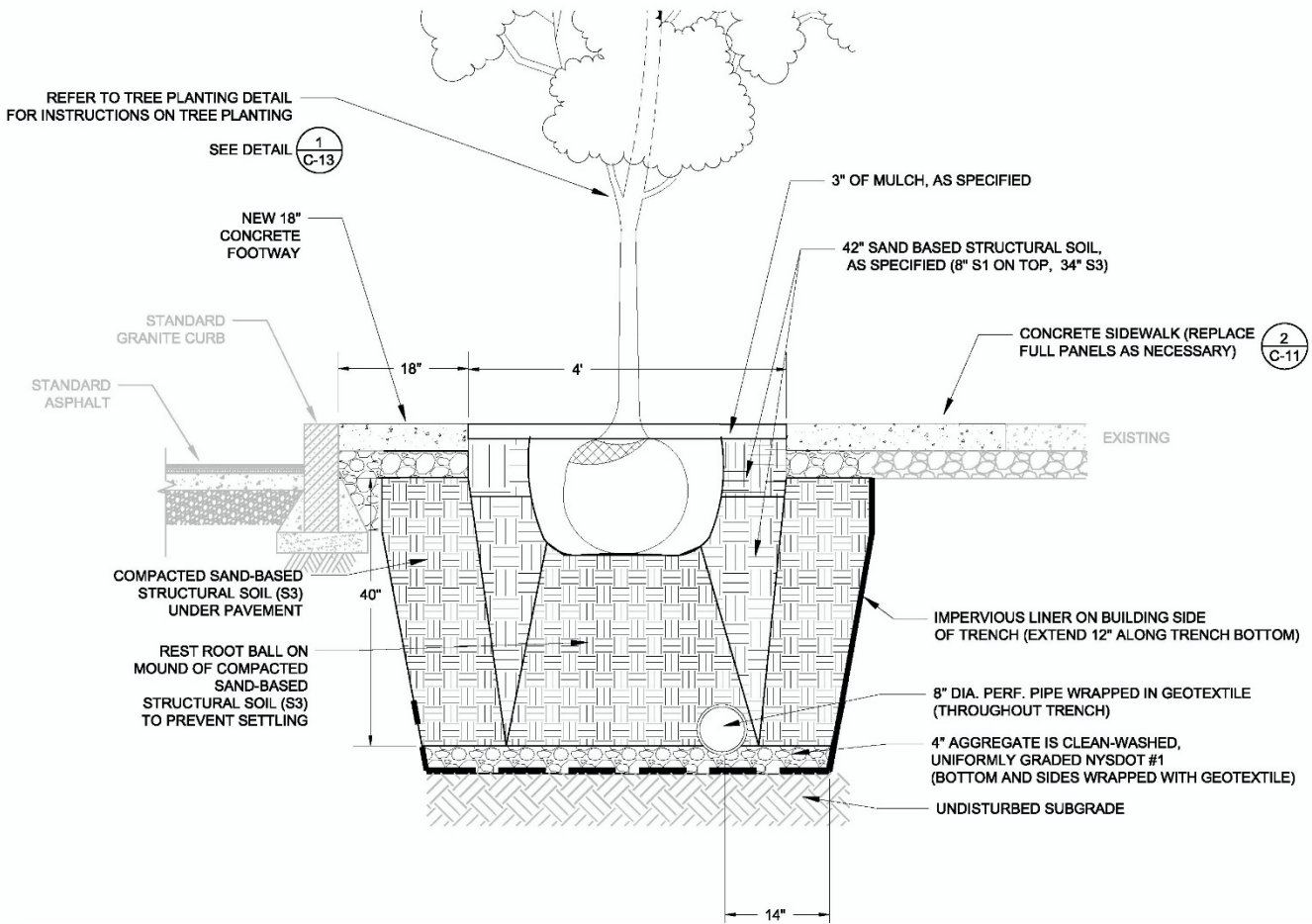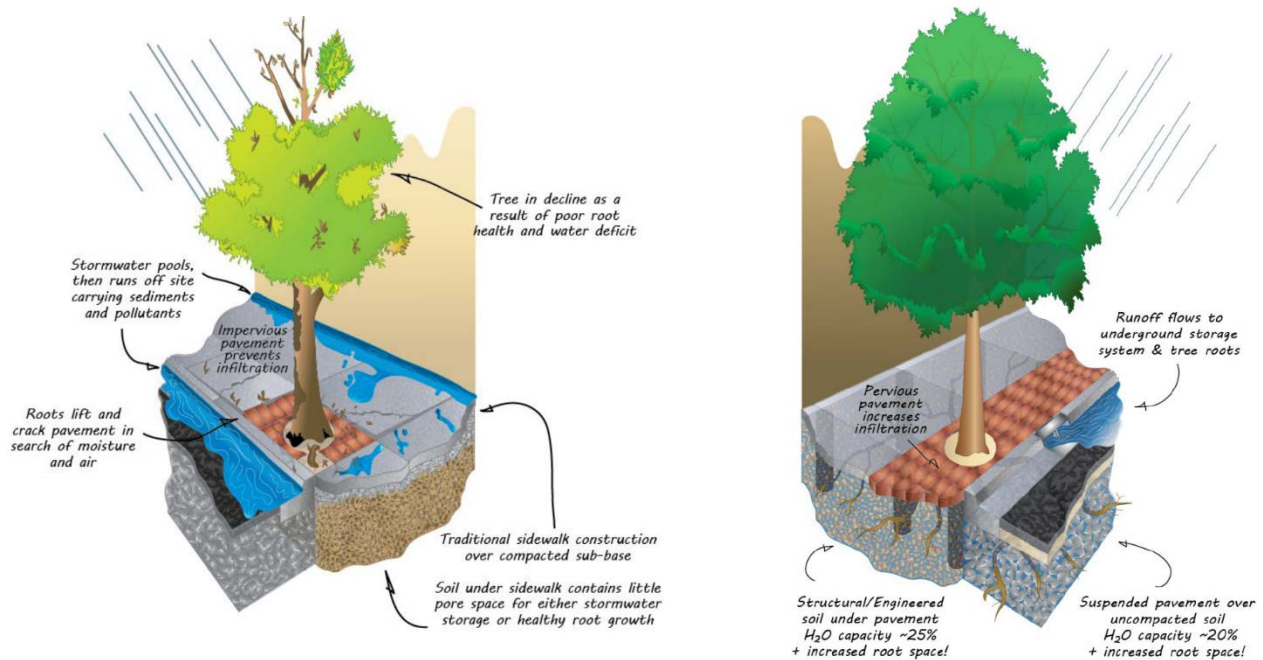*Illustrations of good (right) and bad (left) examples of street tree plantings. More information can be found in the Environmental Protection Agency's "Stormwater to Street Trees" manual: http://water.epa.gov/polwaste/green/upload/stormwater2streettrees.pdf*