

# Resilient Green Infrastructure and Workforce Development

*Defining Pathways Toward a Boston-Area Program  
for Underserved Communities*

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The Nature  
Conservancy 

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# Contents

<b>Acknowledgments</b> .....	2
<b>Summary</b> .....	3
<b>Section 1: Introduction and research question</b> .....	5
<b>Section 2: Learnings from a literature scan</b> .....	6
<b>A</b> Setting the stage .....	6
<b>B</b> Community impacts of green infrastructure workforce development programs .....	11
<b>C</b> Success themes for green infrastructure workforce development programs .....	11
<b>D</b> Challenges of establishing green infrastructure workforce development programs .....	17
<b>E</b> Training and certification programs: benefits and gaps .....	18
<b>F</b> Role of unions .....	19
<b>Section 3: Benefits of green infrastructure workforce development</b> .....	23
<b>A</b> Overview .....	23
<b>B</b> Benefits for the Talbot-Norfolk Triangle/Codman Square/Dorchester area .....	23
<b>Section 4: Locations of current green infrastructure jobs</b> .....	26
<b>A</b> National context .....	26
<b>B</b> Greater Boston .....	27
<b>Section 5: Future prospects for green infrastructure jobs and careers</b> .....	29
<b>A</b> National context .....	29
<b>B</b> Greater Boston .....	29
<b>Section 6: Prospects for green infrastructure workforce development in Codman Square</b> .....	32
<b>Conclusions and future research</b> .....	39
<b>References</b> .....	40



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# Summary

In order to attain social and environmental justice and equity, underserved communities must be able to participate equally, both benefiting from and contributing to a thriving economy. Green infrastructure workforce development is one potential approach to improve social, economic, and environmental resilience through green jobs that have a low barrier to entry and can provide steady, long-term work. Our goal is to identify potential pathways for the Codman Square neighborhood in Boston to create a green infrastructure workforce development program that prioritizes environmental and social sustainability while offering equitable economic opportunities to people of color, particularly young people and men of color, who are chronically underserved populations.

The Codman Square Neighborhood Development Corporation (CSNDC) and The Nature Conservancy (TNC) partnered on this “green paper” to help guide the development of such a program. We started with a literature scan of green infrastructure that considered the benefits and challenges of green infrastructure workforce development programs for communities. We honed in on foundational aspects such as the classification of green infrastructure jobs, determining and forecasting the number of workers needed, and the importance of high-road employment practices such as offering a living wage and opportunities for career advancement. Key challenges to green infrastructure job development include a lack of knowledge and perception issues about green infrastructure, lack of funding and financing for such projects, and the displacement of vulnerable populations due to gentrification. We also considered how formal training and certification can help ensure quality work and enable career development, and how green infrastructure jobs might fit in the context of worker unions. Ultimately, we distilled and synthesized learnings from several existing green infrastructure workforce development programs into success themes for initiating and launching a local program, identifying trainings and benefits for participants, and determining what types of contract services to offer.

To develop a green infrastructure workforce development program that is customized for the Codman Square community, we gathered information in three areas. First, to help ensure that the program benefits the participants and community, we gathered baseline population and environmental statistics for the Codman Square area, from which to assess social, economic, and environmental impacts as the program develops. Second, to inform program development and selection of a business model, we sought to understand the existing and projected market for green infrastructure jobs in Greater Boston and beyond. Third, to understand the specific enabling conditions and barriers in the Codman Square area, we examined current activities and learnings from them. On the basis of the success themes, we generated a set of questions intended to guide development of a Codman Square program, by helping to create a strategy and identify stakeholders, solidifying policies and funding, and developing partnerships and resources. Based on this information, CSNDC is well-positioned for a successful green infrastructure workforce development program, particularly given its previous experience working with community members and the targeted participant groups, strong relationships with partner organizations, and training and organizational capabilities, as well as the multiple potential opportunities for green infrastructure work in the Greater Boston area.

Our aim is for this green paper to serve as a comprehensive living document that informs and guides decisions regarding a green infrastructure workforce development program and that will be updated as programs evolve and new data become available.



## Key takeaways from our work so far

1. Organizations follow a wide variety of approaches to develop successful green infrastructure workforce development programs that are based on the local context; that use a customized, iterative strategy; and that involve the community, local government, and appropriate partners.
2. It is important to develop a green infrastructure career matrix, offer options to address the seasonality of green infrastructure jobs, and include work-readiness and “soft skills” trainings. These approaches help program participants from underserved communities envision a better future for themselves.
3. Sharing the benefits of green infrastructure and options for installation and maintenance with municipalities may help broaden use of green and hybrid infrastructure.
4. CSNDC is well-positioned to pilot a workforce development program that includes certification by the National Green Infrastructure Certification Program (NGICP), related training, and job connections for an initial cohort of people of color, including young people and re-entry citizens.
5. Potential employers have indicated that they would be more likely to consider applicants who have been NGICP certified.
6. The Boston Water and Sewer Commission has expressed a need for NGICP-certified workers to maintain and inspect private and public green infrastructure projects around the City and ensure that they are functioning properly. In instances where the green infrastructure facilities are not functioning, qualified people will be needed to do that maintenance, creating an opportunity for CSNDC to develop a workforce to fill that need.
7. Reciprocal partnerships with skill-building and job placement organizations will yield opportunities for their program participants to receive NGICP certification, and for CSNDC NGICP certification participants to receive additional certifications (e.g., OSHA-10 safety training with YouthBuild). Potential partners could help offset NGICP course and certification costs.
8. CSNDC (and possibly other area community development corporations) can provide certification candidates with hands-on experiences planting rain gardens or other green infrastructure features at their real estate properties. Designing these features into future CSNDC projects will expand homegrown opportunities for education and skill building in the community.
9. CSNDC will participate in the Massachusetts Clean Energy Center’s internship program, which will connect potential green infrastructure employers and employees to determine whether each is a good match for the other, leading to more potential employment for NGICP certificate holders.



# Section 1: Introduction and research question

High unemployment for men of color, health-related issues in urban environments such as heat stress related to heat island effect and poor air quality, and a historic lack of investment in affordable housing, public transit, economic opportunities, and walkable streets in cities speak to the need for social, economic, and environmental justice. The development of a workforce to install and maintain green infrastructure in urban areas represents a potentially significant economic opportunity for under-resourced and marginalized communities and a chance to address issues of inequity. We envision environmental nonprofit organizations, local community development corporations, state and local governments, and people of color who own businesses or are contractors, among others, working together to generate transformative solutions that help to provide social and economic justice for these communities and increase urban climate resilience.

In accordance with this vision, a major objective of the partnership between CSNDC and TNC is to improve the social and environmental resilience of residents—particularly people of color and their communities—starting in Boston’s Codman Square area. This objective is two-fold: creating skills training and job opportunities that offer residents steady work, possible career paths, and ways to make a positive contribution to their neighborhood; and advancing green infrastructure development to reduce stormwater and other climate-related impacts, such as the urban heat island effect.

*“Our goal is...to create a green infrastructure workforce development program that prioritizes environmental and social sustainability while offering equitable economic opportunities to people of color, particularly young people and men of color...”*

This green paper is an initial step toward addressing the question: **How can green infrastructure workforce development support equitable economic opportunity and environmental sustainability in the Codman Square neighborhood, and in particular lead to the creation of sustainable jobs for people of color, with a focus on young people and men of color?** We aim to 1) share our findings within a national context and learn from existing green infrastructure workforce development programs, 2) identify potential pathways that can help create a green infrastructure workforce development program in Codman Square, and 3) help inform TNC’s and CSNDC’s decisions on next steps in the partnership.



## Section 2: Learnings from a literature scan

### A Setting the stage

**Definition of green infrastructure.** Green infrastructure can be defined broadly as “a collection of natural lands, working landscapes, and appropriate constructed interventions that conserves ecosystem functions and provides benefits to human populations” [1]. For the purpose of this green paper, we will focus mainly on urban green stormwater infrastructure, which, along with other nature-based solutions, “reduces and treats stormwater at its source while delivering environmental, social, and economic benefits” [2]. Green infrastructure approaches that reduce stormwater runoff include small- and large-scale elements such as rain gardens, pervious pavement, bioswales, planter boxes, rainwater harvesting, downspout disconnection, green streets and alleys, green parking, green roofs, urban tree canopy, and land conservation [2, 3].

**Green infrastructure job categories, education, and skillsets.** Our discussion will focus on green infrastructure work in the installation, maintenance, and inspection (IMI) phases, each of which requires distinct skillsets [1]. The IMI phases can also be referred to as operations and maintenance work, which has an overlapping set of standard occupational categories [4]. While current research reports on green infrastructure jobs use the broader definition of green infrastructure, two key learnings are likely to apply to the subset of occupations in green stormwater infrastructure.



**Examples of green infrastructure.** (Left) Pervious pavement installation completed by the Mississippi Watershed Management Organization in Minneapolis, MN. (Middle) Rain garden facility completed by HABESHA in Atlanta, GA. (Right) Unplanted bioswale designed to accept and filter water from the adjacent roadway, part of Boston’s Slow Streets Initiative in Codman Square. All photos courtesy of David Queeley.





First, researchers have identified 30 core IMI occupations across seven green infrastructure sectors: construction, landscaping, groundskeeping, urban forestry, tree care, ecological restoration, and water/wastewater (see Figure 2 in [1]). However, none of these occupations solely encompasses green infrastructure work, and for most of these occupations, only a small percentage of jobs are in green infrastructure. Therefore, it is difficult to classify green infrastructure jobs using standard occupational codes and to determine accurately the number of green infrastructure workers, the organizations that employ them, or the extent to which community volunteers who help with tree plantings and rain gardens might impact the demand for paid jobs in green infrastructure [1]. For discussions of existing jobs and predicted job growth in green infrastructure, see sections 4 and 5 in this green paper.

Second, of the 30 core occupations identified, 18 require a high school diploma, 10 have no formal educational requirement, and 2 require an associate degree [1]. The overarching core competencies needed across green infrastructure IMI occupations include equipment selection and maintenance, repair, operation and control, troubleshooting, quality control analysis, and installation [1]. Specialized skills may include water quality and water treatment skills and an understanding of plant selection and maintenance. Operations and maintenance work can involve “vacuuming pervious pavement, annual cleaning of cisterns, spot weeding, pruning, erosion repair, trash removal, and mulch raking of rain gardens; cleaning of inlets and periodic replacement of pervious pavement; re-mulching void areas; and treating or replacing diseased trees and shrubs of vegetated swales” [4]. In addition to these technical skills, employers seek general employability and soft skills that include communication, writing, and math skills [1].

***Green infrastructure: entry-level work and need for better-defined career pathways.*** A major consideration regarding jobs that have a low barrier to entry, such as some green infrastructure jobs, is the risk that employers will follow “low-road” practices, including offering poor wages and benefits and limited job security. For example, maintenance workers have a high rate of layoffs during slow periods [4]. The lack of pathways for ongoing success and the seasonality of green infrastructure work are additional considerations. Ensuring higher standards allows entry-level workers better access to a living wage and enables green infrastructure workforce development programs to be successful and sustainable. Examples of higher standards include offering a living wage or the prevailing wage, using a list of pre-approved contractors who have trained workers, hiring local residents, requiring minimum certification standards, and ensuring that job seekers have equal access to opportunities.

Green infrastructure installation and maintenance is generally considered to be excellent entry-level work that offers potential skill building and advancement. However, the career paths for green infrastructure remain poorly defined. Rather than climbing a career ladder within an individual green industry subsector, those who work in green infrastructure may have opportunities to build a career lattice that covers multiple subsectors. This means that workers may have more options to develop a broad skillset, enables the workforce to be more resilient and upwardly mobile [4], and addresses the issue of seasonality in green infrastructure work. For example, the Sustainable South Bronx and Verde Landscape workforce development programs (see Table 1a and text below) offer trainings for workers to develop skills that apply to urban agriculture and energy efficiency, in addition to green infrastructure.

The tree care industry is well-established and has its own set of credentials and degree programs. The Tree Care Industry Association and International Society for Arboriculture created a career pathway flowchart for arboriculture [5] that may be a useful reference for developing a career matrix for green infrastructure.



**TABLE 1A | U.S. green infrastructure workforce development programs, from literature scan**

LOCATION	PROGRAM	TYPE	YEAR STARTED	WEBSITE(S)
<b>FOR ADULTS</b>				
Atlanta, GA	Urban Green Jobs—HABESHA and TNC	Nonprofit	2015	<a href="https://habeshainc.org/habesha-works-2">https://habeshainc.org/habesha-works-2</a>
Baltimore, MD	Clean Water Certification/NGICP	Municipal utility	2016	<a href="https://ngicp.org/project/baltimore-city-dpw">https://ngicp.org/project/baltimore-city-dpw</a>
Buffalo, NY	PUSH Blue/NGICP	Nonprofit	2013	<a href="https://www.pushbuffalo.org/push-blue">https://www.pushbuffalo.org/push-blue</a>
Cleveland, OH	Cleveland Botanical Garden Tree Corps	Nonprofit	2018	<a href="https://cbgarden.org/tree-corps">https://cbgarden.org/tree-corps</a>
Columbus, OH	Blueprint Columbus	Municipal utility	2015	<a href="https://www.columbus.gov/utilities/projects/blueprint">https://www.columbus.gov/utilities/projects/blueprint</a>
Detroit, MI	Eastside Community Network: Green Team	Social enterprise	2017	<a href="http://www.ecn-detroit.org/the-green-team">http://www.ecn-detroit.org/the-green-team</a>
Kansas City, MO	Green Stewards/NGICP	City government	2017	<a href="https://www.kcmo.gov/programs-initiatives/smart-sewer/green-stewards-program">https://www.kcmo.gov/programs-initiatives/smart-sewer/green-stewards-program</a>
Milwaukee, WI	Milwaukee Metropolitan Sewerage District/NGICP	Municipal utility	2016	<a href="https://www.mmsd.com/careers/workforce-development">https://www.mmsd.com/careers/workforce-development</a>
New Haven, CT	Advancing Green Infrastructure/GreenSkills	Academic	2007	<a href="https://uri.yale.edu/programs/green-infrastructure">https://uri.yale.edu/programs/green-infrastructure</a>
New Orleans, LA	Launch NOLA Green/NGICP	Nonprofit	2018	<a href="https://www.launchnola.org">https://www.launchnola.org</a>



**TABLE 1A** *continued*

LOCATION	PROGRAM	TYPE	YEAR STARTED	WEBSITE(S)
New York, NY	Sustainable South Bronx (SSBx) BEST (Bronx Environmental Stewardship Training) Academy	Nonprofit	2001	<a href="http://www.ssbx.org">http://www.ssbx.org</a>
Oakland, CA	Dig Cooperatives, Inc.	Co-op	2005	<a href="https://www.dig.coop">https://www.dig.coop</a>
Pawtucket, RI	Groundwork Rhode Island	Nonprofit	1983	<a href="http://groundworkri.org">http://groundworkri.org</a> (joined Groundwork USA in 2000)
Philadelphia, PA	PowerCorpsPHL (youth and re-entry citizens)	City government	2011	<a href="http://powercorpsphl.org">http://powercorpsphl.org</a>
Pittsburgh, PA	Landforce	Social enterprise	2015	<a href="https://www.landforcepgh.org">https://www.landforcepgh.org</a>
Portland, OR	Verde Landscape	Social enterprise	2005/6	<a href="https://verdelandscape.org">https://verdelandscape.org</a>
Prince George's County, MD	The Clean Water Partnership	Community-based public-private partnership	2014	<a href="https://thecleanwaterpartnership.com">https://thecleanwaterpartnership.com</a>
Providence/Newport-Aquidneck, RI	Rhode Island Green Infrastructure Coalition	Coalition of nonprofits, businesses, government	2015	<a href="http://www.greeninfrastructureri.org">http://www.greeninfrastructureri.org</a>
Seattle, WA	Seattle Conservation Corps	City government	1986	<a href="http://www.seattle.gov/parks/about-us/special-initiatives-and-programs/seattle-conservation-corps">http://www.seattle.gov/parks/about-us/special-initiatives-and-programs/seattle-conservation-corps</a>



**TABLE 1A** *continued*

LOCATION	PROGRAM	TYPE	YEAR STARTED	WEBSITE(S)
Washington, DC	DC Water: Green Infrastructure Training Program/ NGICP	Municipal utility	2017	<a href="https://www.dewater.com/whats-going-on/news/dc-water-green-infrastructure-training-program-creating-new-job-opportunities">https://www.dewater.com/whats-going-on/news/dc-water-green-infrastructure-training-program-creating-new-job-opportunities</a> <a href="https://www.dewater.com/green-infrastructure">https://www.dewater.com/green-infrastructure</a>
<b>FOR YOUTH/YOUNG ADULTS</b>				
Cleveland, OH	Cleveland Botanical Garden Green Corps	Nonprofit	1996	<a href="https://cbgarden.org/community-forestry/green-corps">https://cbgarden.org/community-forestry/green-corps</a>
Howard County, MD	Restoring the Environment and Developing Youth (READY)	Nonprofit	2012	<a href="https://www.facebook.com/Restoring-the-Environment-and-Developing-Youth-READY-310643849029954">https://www.facebook.com/Restoring-the-Environment-and-Developing-Youth-READY-310643849029954</a>
Onondaga County, NY	Onondaga Earth Corps (OEC)	Social enterprise	2004	<a href="http://www.onondagaeearthcorps.org">www.onondagaeearthcorps.org</a>
Seattle, WA	Duwamish Infrastructure Restoration Training (DIRT) Corps	Nonprofit	2015	<a href="https://www.seattleparksfoundation.org/project/duwamish-infrastructure-restoration-training-dirt-corps">https://www.seattleparksfoundation.org/project/duwamish-infrastructure-restoration-training-dirt-corps</a>
				<a href="https://www.facebook.com/theDIRTcorps">https://www.facebook.com/theDIRTcorps</a>
Multiple locations	The Corps Network (young adults age 16–25 and veterans up to age 35)	Nonprofit; public-private partnerships	1985	<a href="https://corpsnetwork.org">https://corpsnetwork.org</a>

All websites accessed in August 2020.



## **B Community impacts of green infrastructure workforce development programs**

A green infrastructure workforce development program in Codman Square would increase economic opportunity by creating a pipeline of skilled and certified workers, particularly young people and men of color who are earning low-to-moderate incomes, to work on public and private capital projects that are built to new green standards. Such a program would provide equitable policy change, promote social enterprise development, and create a replicable model combining equity, economic development, and sustainability.

While studies have assessed the economic, health, and other benefits of green infrastructure [6, 7, 8], few studies have assessed the longer-term impacts of green infrastructure workforce development programs with respect to the local environment, the local economy, and workers' financial stability and outlook. One exception is a 2019 report on Philadelphia's Green City, Clean Waters program. The report estimates that since its inception in 2011, the program has produced an annual economic impact of \$89 million for the city, creating about 1,000 jobs and \$30 million in compensation per year, an almost 9% reduction in crime, and \$50 million in savings on health-related costs attributed to access to open space [9]. Another (unpublished) study by The Clean Water Partnership, a community-based public-private partnership working on stormwater management in Maryland since 2015, estimated that their program treated 4 billion gallons of water per year and reduced costs by 30% for Prince George's County, in addition to helping create a local workforce around green infrastructure [3].

Green infrastructure jobs can provide skills training and a living wage to workers, especially those with barriers to employment, such as previous incarceration and/or a history of substance use disorder or poverty [3]. However, green infrastructure projects also have the potential to displace workers and communities living in or near such projects, due to gentrification. This issue has impacted several green infrastructure workforce development programs [3]. While it is not always possible to prevent displacement, communities can work to prevent the potential for displacement. For example, they can connect green infrastructure projects to programs that counteract displacement, such as those that provide affordable housing (e.g., Portland, Oregon's Verde Living Cully project) and community land ownership projects (e.g., PUSH Buffalo's and Detroit's Eastside Community Network's strategy). They can also prioritize the hiring of local residents and the intended demographic on green infrastructure projects (e.g., via Community Workforce Agreements) [3]. In addition, communities in partnership with local government can give displaced residents a "right to return." One innovative program in Portland, Oregon provides housing assistance to first-time homeowners who were displaced or at risk of displacement [10].

## **C Success themes for green infrastructure workforce development programs**

On the basis of our literature scan, we identified success themes and sorted them into three categories: 1) starting up a green infrastructure workforce development program, 2) trainings and benefits for workers, and 3) the types of services and projects offered to prospective employers (Table 2). Many of these success themes are derived from reports describing multiple programs across the United States (see Table 1a for selected programs and Table 1b for city initiatives). In addition, we incorporated in Table 2 the best practices shared by leaders of the partnership between TNC Georgia and the HABESHA organization in Atlanta, which collaborate closely on the Urban Green Jobs green infrastructure workforce development program in Atlanta [11, 12, 13]. For best practices on stakeholder analysis, including equity tips, see the TNC Story from the Field interview with Myriam Dormer [14].



**TABLE 1B | Municipal-led green infrastructure initiatives, from literature scan**

LOCATION	INITIATIVE	SOURCE OR INITIATIVE WEBSITE, IF AVAILABLE
Ann Arbor, MI	Providing Financial Incentives for Residents to Expand Green Infrastructure	<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Austin, TX	Weaving Green Infrastructure into Every Part of the City—by Design	<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Buffalo, NY	RainCheck (Buffalo Sewer)	<a href="https://raincheckbuffalo.org/project/">https://raincheckbuffalo.org/project/</a>
Charlotte, NC	Linking Green Stormwater Infrastructure and Protection of the Urban Forest	<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Denver, CO	A Voluntary Approach to Expanding Green Stormwater Infrastructure	<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Detroit, MI	Greening of Detroit	<a href="https://www.greeningofdetroit.com/services-1">https://www.greeningofdetroit.com/services-1</a>
		<a href="https://detroitstormwater.org/">https://detroitstormwater.org/</a>
		<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Lincoln, NE	Growing a High-Tech Green City on the Nebraska Prairie	<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Lynnwood, WA	Edmonds Community College: Landscape and Restoration Horticulture associate degree	<a href="http://catalog.edcc.edu/preview_program.php?catoid=48&amp;poid=9449&amp;returnto=13766">http://catalog.edcc.edu/preview_program.php?catoid=48&amp;poid=9449&amp;returnto=13766</a>
Philadelphia, PA	Green City, Clean Waters	<a href="http://www.phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan">http://www.phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan</a>
Portland, OR	A National Leader in Green Stormwater Infrastructure	<a href="https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf">https://jfforg-prod-prime.s3.amazonaws.com/media/documents/NatureWORKS-Issue-Brief-032317_v3.pdf</a>
Seattle, WA	Seattle Rainwise Program	<a href="http://www.seattle.gov/utilities/environment-and-conservation/projects/green-stormwater-infrastructure/rain-wise">http://www.seattle.gov/utilities/environment-and-conservation/projects/green-stormwater-infrastructure/rain-wise</a>

All websites accessed in August 2020.



**TABLE 2 | Success themes from existing green infrastructure workforce development programs**

STARTING A GREEN INFRASTRUCTURE WORKFORCE DEVELOPMENT PROGRAM
Address a neighborhood need at the intersection of social and environmental issues
Understand state and city policy, initiatives, and funding commitments and allocations
Assess whether existing training programs can meet the demand for a green infrastructure workforce
Grow the program from a trusted local umbrella/parent organization with the necessary resources (e.g., space, insurance coverage, equipment)
Make a comprehensive assessment of the parent organization’s relevant strengths and gaps (e.g., land and building assets, existing programs, level of trust and engagement in the community)
Choose the appropriate business model, employment strategy, and support structures
Include a career pathway matrix for trainees to understand the skills and credentials they need, wage scales, and opportunities for advancement (potentially including how to start a small business)
Gather data on the economic, environmental, and social benefits of green infrastructure throughout the program, to sustain strong resident and political support
Partner with other organizations (e.g., foundations, community development organizations, local nonprofits, government) to maximize resources, trainee referrals, transitional services, and job placement <ul style="list-style-type: none"> <li>• Research and develop a clear concept and scope that is integrated with both partners’ missions and strategies</li> <li>• Seek the right partners, building relationships with them and their communities over time, and learn and co-create with them for traction and sustainability</li> <li>• Identify the right tools and resources</li> <li>• Ensure frequent, regular communication, good documentation, and robust processes</li> <li>• Create a holistic program based on participants’ lived experience</li> <li>• Commit to being hands-on and deeply involved in co-managing the program</li> <li>• Work to increase the partner organization’s ownership and leadership capacity as appropriate</li> </ul>
Assess the financial ecosystem for support for nonprofit startups and nontraditional ownership models
Identify funding sources for the nascent program (e.g., philanthropy/grants, more readily attainable contracts) and for growth (public and private business contracts)
Work with local government to determine/establish the potential job market for installation and maintenance of green infrastructure
Learn from staff at other programs and connect with mentors who offer opportunities for exposure and visibility (e.g., for job contracts) and open doors to funding sources



**TABLE 2** *continued*

TRAININGS AND BENEFITS
Understand whether certification is necessary for employment and future success
Offer an orientation session to introduce program and values and foster teamwork
Seek grants or donations from local companies to fund training
Provide paid, on-the-job trainings
Offer tailored support/wraparound services that recognize trainees/employees' value: <ul style="list-style-type: none"> <li>• Job search, employability, and retention skills</li> <li>• Connections for employment opportunities and further education</li> <li>• English for speakers of other languages</li> <li>• Childcare</li> <li>• Computer skills</li> <li>• Budget management and banking skills for financial empowerment</li> <li>• Help with renewing expired driver's licenses</li> <li>• Ways to establish personal and professional goals</li> <li>• Building confidence and leadership skills</li> </ul>
Supplement fundamental technical trainings in installation with other trainings: <ul style="list-style-type: none"> <li>• Job site and tool safety skills</li> <li>• OSHA certification</li> <li>• CPR certification</li> <li>• Land stewardship training</li> <li>• Modules on green infrastructure design principles, operations, maintenance, vegetation selection and management, and ecological restoration</li> </ul>
TYPES OF SERVICES AND PROJECTS
Take on a combination of installation and maintenance projects with varying scales from different employers, rather than relying on a single employer such as a large company
Offer job stability to overcome the seasonality of green infrastructure work (by diversifying to general services such as mowing, or offering off-season services such as weatherization and snow removal)
Seek opportunities for workers to apply their skills in contexts beyond green infrastructure projects (e.g., repurposing vacant/landfill sites, working in other green industry sectors)
Define a niche outside of union work to minimize competition and assure trainees of future long-term employment
Partner with employers, learn about their employment needs, and identify job opportunities





To guide the launch of a CSNDC program, we selected four success themes, from across all three categories, as starting points for further discussion:

### SUCCESS THEME 1

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**How organizations decided on their paths to green infrastructure workforce development programs and determined the appropriate business model and employment strategy (e.g., cohort training only or direct employment; professional growth or lower-skill work)**

Organizations took a wide variety of paths to develop their programs, depending on the local context, including government policies, capacity of the parent organization, and available partners, among other factors. In many cases, the cities invested in stormwater management are complying with federal Clean Water Act requirements.

The business models supporting green infrastructure workforce training programs with a focus on equity [3, 15] include:

- **Social enterprises:** mission-driven nonprofits with a fee-for-service component
- **Worker-owned cooperatives:** businesses owned and governed by the employees
- **Utilities:** organizations that provide communities with water, sewer, electric, or gas services
- **Public-private partnerships:** collaboration between a government agency and a private-sector company to finance and build public infrastructure projects, and
- **Consortia:** alliances of multiple organizations, sometimes across sectors, with common goals.

Here we provide examples of the approaches taken and business models employed in four U.S. cities/regions:

***Detroit’s Eastside Community Network (ECN): Originating with a municipal stormwater program.***

The ECN’s original goal was to educate residents about installing green stormwater infrastructure and share information about the city’s stormwater fee rebate program. However, when the city changed this program, ECN pivoted to larger-scale green infrastructure installation and maintenance on business land. It established the Green Team in 2017 as a social enterprise focusing on equitable, reliable green infrastructure jobs for residents in eastside Detroit, an area heavily impacted by the 2008 recession. While ECN’s properties served as an “incubator” for the Green Team, these properties alone cannot sustain the program, and the Green Team is deciding whether to provide training only or provide longer-term jobs for trainees [3].

***Portland, Oregon’s Verde Landscape: Growing from small-scale installations in affordable housing complexes.***

Verde Landscape is a social enterprise that was established in 2005 with the goal of integrating environmental justice, job opportunities for low-income residents, and anti-displacement work. It is now partnering with a local community development corporation that owns large, affordable housing complexes and is employing some of Verde’s trainees [3]. Verde Landscape gradually built its expertise from small stormwater management projects to larger contracts for bioswales and tree plantings, then became a general contractor to install green infrastructure. These activities led to the launch in 2013 of Verde Builds, a social enterprise that refurbishes and retrofits low-income housing in collaboration with Verde Landscape. While Verde Landscape’s growth was based on its ability to secure public contracts as the city started to increase its commitment to green infrastructure, its revenue comes from a mix of philanthropy, public sources, and private business.



***DC Water: A national training and certification model.*** The DC Water utility, as part of its Clean Rivers Project, sponsors a program that invests in Washington, DC residents by offering training to build, maintain, and inspect green infrastructure [16, 17]. The program offers a national green infrastructure certification (see discussion of the National Green Infrastructure Certification Program, p. 18) to provide individuals, particularly those from low-income areas, with opportunities for job growth and portability. Certified residents can interview for jobs with DC Water’s contractors. Nearly three-quarters of participants obtain jobs, some of which are in green infrastructure, and most of them acquire full-time jobs that pay the prevailing wage. In addition to NGICP certification, the program provides hands-on training, stipends, job placement assistance, and mentoring.

***Rhode Island Green Infrastructure Coalition: A “one-stop shop” for green infrastructure and stormwater management.*** The Rhode Island Green Infrastructure Coalition [18, 19] encompasses about 40 stakeholder groups that collaborate across multiple sectors (environmental, industry, state and local agencies, and trade associations), with a focus on the Providence metro region and Aquidneck Island (Newport, Middletown, and Portsmouth). Workforce development is conducted mainly by two groups in the coalition, Groundwork Rhode Island and Woonasquatucket River Watershed Council, and the vast majority of their work is essential to the Green Infrastructure Coalition’s goals. TNC Rhode Island is not directly involved with these two groups, but does support their work through collaborative grant writing and advancing policy and communications strategies [20].

These examples, among others, show that 1) programs’ goals are often closely linked to local government initiatives and 2) having an established partner that offers employment in green infrastructure can help to sustain a nascent program and determine whether a program offers cohort training only or whether it is able to provide direct employment. We need more data to understand how program administrators in each case decided on the type of business model, how programs offer workforce development, and whether it is better to offer professional development (e.g., progression to supervisory roles) or focus on lower-skill work. Also, we need more information to understand the impact of these programs on participants and the extent to which the programs are truly able to advance equity.

## **SUCCESS THEME 2**

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### **Which local government agencies programs partnered with, and how programs established relationships with these agencies**

Green infrastructure workforce development programs partner with local government in a variety of ways. For example, these individual programs work directly with one or more public agencies, without formal coalitions:

- The Onondaga Earth Corps in New York partners with Onondaga County’s Save the Rain stormwater management program to secure contracts and funding [4], and with the City of Syracuse Department of Parks and Recreation and Department of Public Works on neighborhood and park beautification [21].
- Verde Landscape’s relationship with the City of Portland in Oregon started with a small \$5000 grant for a stormwater management project. As a result of that project’s success, Verde was able to obtain larger city contracts [3].
- Dig Co-op in California collaborated with the City of Oakland Redevelopment Agency on green job training [3].
- The New Haven, CT, GreenSkills program has multiple public-sector partners, including the New Haven Department of Engineering and the Greater New Haven Water Pollution Control Authority [22].
- As part of their training, members of the X-Cel Conservation Corps in Boston, MA, work on water conservation projects with local environmental organizations and city or state park agencies [23].



While partnerships with individual government agencies are often the norm, effective green infrastructure planning typically requires an integrative approach with coordination among departments and utilities [3]. State and federal agencies may support local green infrastructure efforts; for example, the U.S. Forest Service maintains an Urban and Community Forestry program [24].

We need more data on how organizations established relationships with local government staff and how the partnerships work. To achieve positive outcomes, it will be important to understand the process of engaging with agency staff and how to collaborate effectively across cultural and operational differences.

### SUCCESS THEME 3

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#### How organizations diversified to address the issue of seasonality/unpredictability and identified opportunities to broaden the context of green infrastructure work

Programs use two main approaches to deal with the seasonality of green infrastructure work and establish year-round job stability. The main approach involves tailoring the program to the climate and diversifying to related services that generate income during periods of low demand. Such services include mowing, snow removal, composting, growing plants and selling the surplus, utility maintenance and inspection work, equipment operation, home weatherization, and/or work to improve energy efficiency [3, 15]. The second approach, used by X-Cel Conservation Corps in Boston and Landforce in Pittsburgh, is to offer cohorts training and short-term employment, then placement in subsequent longer-term jobs at larger firms, through partnerships with these firms [3].

### SUCCESS THEME 4

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#### The types of organizations that are potential partners for “soft skills” trainings

Partner organizations for “soft skills” and work-readiness trainings that focus on under-resourced communities typically include nonprofits, workforce development organizations, government agencies, businesses, and colleges. For example, the Philadelphia PowerCorpsPHL program partners with a prisoner re-entry initiative that provides referrals for program participants and offers résumé development, interviewing skills, and other training and support [15]. The Blueprint Columbus program partners with neighborhood-based groups such as workforce development boards, community colleges, and re-entry and community development organizations to provide work-readiness skills and wraparound services [15], which help each participant overcome barriers to completing the program and obtaining and keeping a job. Section 6 lists some potential options for soft-skills trainings in Boston.

## **D Challenges of establishing green infrastructure workforce development programs**

***Lack of familiarity with green infrastructure.*** Fundamental challenges that some programs encounter are lack of knowledge about green infrastructure, a perception that green infrastructure has unknown performance and higher costs, resistance by regulators, and conflicts with smart growth principles and existing policies [25, 26]. Addressing these challenges is key to cultivating a workforce development program in municipalities that have yet to adopt green infrastructure as a significant strategy for stormwater management. The U.S. Environmental Protection Agency (EPA) webpage [25] discusses these challenges in more depth and offers strategies to address the barriers that confront municipalities and developers.



**Financing of green infrastructure projects.** Municipalities face complex challenges with stormwater management, including covering the costs associated with complying with federal wastewater and stormwater regulations and the need to budget for green infrastructure across departments that are often siloed. Some of the existing funding options used by local governments to pay for green infrastructure projects, including green bonds, green banks, the Clean Water State Revolving Fund, community development block grants, and taxes and fees, are described in a report from Democracy Collaborative [3]. Establishing new or underused funding options, such as partnerships between private or community foundations and utilities, and considering utilities (e.g., the Boston Water and Sewer Commission) and city agencies (e.g., the Boston Parks and Transportation departments) to be “anchor institutions” that have a major interest in sustaining a thriving community [15], may help to overcome this challenge.

**Securing green infrastructure contracts.** One of the major challenges for green infrastructure workforce development programs is securing contracts. It can take significant expertise to navigate the process for government contracts by completing the application, making a bid, and getting reimbursed [3]. In addition, the length of time between the request for proposals and implementation may cause a financial burden for organizations that do not have upfront capital. Moreover, nonprofits may not be eligible for credits or preferences that municipalities offer to small businesses. Finally, lower-priced competitors (including some that engage in low-road practices) may enter bids for contracts [4]. For example, Verde Landscape has been outbid by a lower-priced competitor for services that Verde was contracted to do for the previous five years.

**Access to support structures.** Another overarching challenge for workforce development programs is the need for support structures, such as operational resources, funding, and training, among others. Programs that develop in alignment with a parent organization often have multiple advantages, including being part of a reputable organization and having access to established relationships and resources. In addition, green infrastructure systems tend to need more frequent ongoing maintenance (for example, more maintenance is needed at the outset before vegetation becomes established) than traditional gray infrastructure [27]. However, while funding for green infrastructure installations may be readily available, funds for maintenance are often not specified or allocated upfront. Approaches to ensuring maintenance support include specifying maintenance in the contract provisions [28], obtaining funding through a stormwater management fee [29], or engaging and educating residents in long-term maintenance [22]. A related challenge is limited and incomplete knowledge of installation and maintenance requirements. When green infrastructure installations are installed improperly or not maintained, they may be perceived as failures [4]. Green infrastructure training and certification, and sustainable funding for maintenance, can alleviate this challenge.

## **E Training and certification programs: benefits and gaps**

While green infrastructure operations and maintenance jobs tend to require low to medium skill levels, training is necessary for good-quality installation and maintenance [4]. In the United States, green infrastructure certification programs have been offered at the local, state, or national levels [30], with a wide range of program designs, from a focus on a single technology or employer to a broader overview of multiple green infrastructure systems and sustainable practices. However, many programs, with the exception of pervious paver and green roof installer programs, do not require trainees to pass a standardized professional certification exam [1]. In 2016, DC Water and the Water Environment Federation launched the National Green Infrastructure Certification Program (NGICP) to train a skilled workforce to conduct installation, maintenance, and inspection. The program supports community-based job creation and establishes national standards for professionals that enable job portability.



The NGICP training program consists of 12 modules that cover basic stormwater management and green infrastructure, specific installation types, and managing green infrastructure for long-term performance [31]. While NGICP training and certification occurs entirely in the classroom, it is important for programs to incorporate hands-on training. Table 3 shows key components, in addition to technical skills, for a green infrastructure workforce development course, based in part on learnings from the District of Columbia Water and Sewer Authority’s NGICP training [32]. These components include tips for the training team, resources and logistics, candidate applications and interviews, orientation session, technical modules, exam preparation, and celebrating the graduates’ success. For an example of a training program, see Figure 1, which presents the University of the District of Columbia’s model for aspiring green infrastructure professionals. In future, offering multiple levels of certification from basic to experienced—“stackable credentials”—would allow people to gain access at different points within a career matrix and provide clarity to their career development [1].

To date, NGICP has certified nearly 600 individuals [33] and can help to assure competency and professionalism in the green workforce. A recent review of green infrastructure workforce development programs showed that of 13 cities or counties, nine offered trainings but not through NGICP, two offered only NGICP training, and two offered NGICP in addition to other trainings [15]. Of the top five regions recommended as benchmarks for the review, just one offered NGICP training as an option. After completing the DC Water program (see above), 73% of the 2017 NGICP cohort found employment; of these graduates, 41% were employed by green infrastructure contractors. The Atlanta HABESHA and Rhode Island programs with which TNC partners do not use NGICP training.

To better understand the importance of certification in a green infrastructure workforce development program, we need to examine:

- the situations in which NGICP certification is necessary
- whether NGICP certification leads to preference for hiring or better wages
- the portability of NGICP certification
- the role, if any, that high schools, vocational schools, and/or community colleges can play in educating a green infrastructure workforce [34, 35].

## **F Role of unions**

Union jobs tend to have better compensation, benefits, and protections than the corresponding private sector jobs, which may employ day laborers [4]. In states where worker unions play a significant role in the water and construction sectors, it is important to determine how green infrastructure skills and jobs fit in the context of existing union work, in order to avoid competing with union jobs. We could create a niche for green infrastructure work that is distinct from union jobs, develop mutually beneficial relationships with existing unions, and/or establish a new union that deals only with green infrastructure jobs [3]. It is worth noting that workers with green infrastructure training often are employed in union jobs in other lines of work. Landforce Executive Director Ilyssa Manspeizer notes: “Most people do not go into green infrastructure. The more successful individuals go into union jobs...” [3].

An employment model for a green infrastructure workforce development program might consider that a strength of unions lies in their apprentice programs, which help to ensure a highly skilled and increasingly diverse workforce. For example, between 1994 and 2014 in New York City, Black apprentice participation

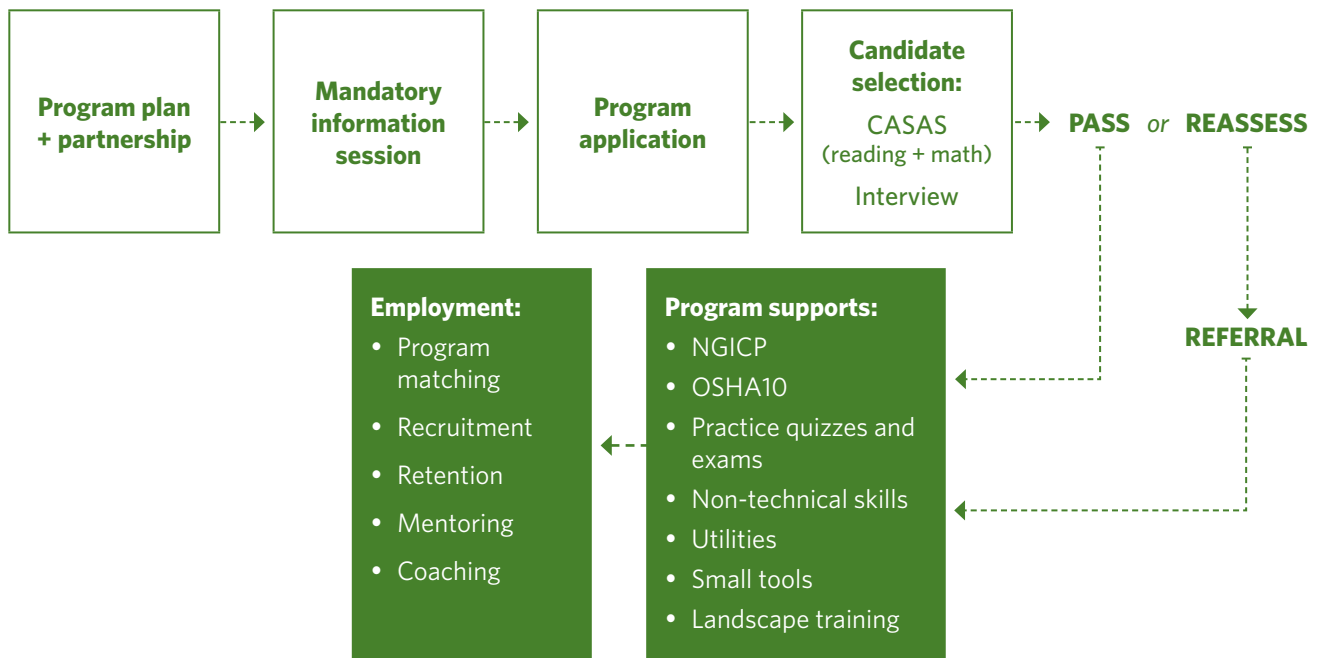


nearly doubled from 18% to 35%, which was attributed in part to changing demographics and civil rights lawsuits. From 2006 to 2015, 21% of New York City’s unionized construction jobs were held by Black workers, compared with 16% of non-unionized construction jobs, and Black union construction workers earned 36% more than Black non-union construction workers [36].

It may be worthwhile to explore whether a new or union-affiliated green infrastructure apprentice program is feasible in Boston (for a directory of Massachusetts apprenticeships, see [37]), or whether trainees can be accepted into an existing union apprenticeship program. In addition, since NGICP offers solely classroom-based training and certification, trainees should seek hands-on experience from a union or non-union apprenticeship program. A potential model is the Rhode Island Nursery and Landscape Association’s apprenticeship program for agriculture and plant-based industry; this non-union program is a partnership with the state of Rhode Island and includes companies that build green stormwater infrastructure [38].

### FIGURE 1 | DC Water’s Green Infrastructure Program Model for Aspiring Professionals

Model courtesy of Dwane Jones, University of the District of Columbia, 2018





**TABLE 3 | Key components of a green infrastructure training course**

<b>TRAINING TEAM</b>
Select the right training team to align with program objectives and deliver content in a way that engages participants
Identify opportunities to increase retention and candidate success
<b>RESOURCES AND LOGISTICS</b>
Utilize training notebooks
Provide on-site meals, stipends, and transportation assistance during trainings; provide reasonable accommodation for documented extenuating circumstances
Plan ahead for make-up sessions
<b>CANDIDATE APPLICATIONS FOR THE PROGRAM</b>
Tailor the application to ensure selection of the appropriate candidates for the program
Have each trainee include in their application a short essay describing their interests and motivations
<b>CANDIDATE INTERVIEWS</b>
Conduct preliminary screening to identify candidates who meet the minimum criteria for the program
Conduct in-depth interviews with qualified candidates to ensure that their goals align with the program's objectives
<b>ORIENTATION</b>
Make orientation mandatory for day 1
Introduce staff and participants
Discuss and manage expectations, and reiterate key themes throughout the course
Start to build peer rapport



**TABLE 3** *continued*

TECHNICAL MODULES
Select training locations that have nearby green infrastructure practices
Alternate lectures with hands-on activities and breaks, with an average of 5-7 exercises per day, and an all-day field training on the last day
Maximize interactive and hands-on activities
Ensure that participants can explain why green infrastructure is valuable and how it works
Include supplementary modules as appropriate (e.g., specialized knowledge of local plants, seasonal considerations, installation and maintenance details)
PREPARATION FOR CERTIFICATION EXAM
Hold regular review classes throughout the course and 2-3 review classes at the end
Provide regular practice quizzes (e.g., at the end of each section) and mock exams
Teach test-taking strategies and best practices
Integrate exam content and test-taking tips throughout the course
CELEBRATING SUCCESS
Honor program graduates in a meaningful way and include senior directors and Board members in the celebration
Highlight graduates and program in newsletters (e.g., to ratepayers) and other media

Source: "DC Clean Rivers Project, NGICP: Many Paths to Success," briefing for *Water Environment Federation's Technical Exhibition and Conference (WEFTEC) 2018*, by David L. Gadis, CEO and General Manager, District of Columbia Water and Sewer Authority, October 2, 2018.





# Section 3: Benefits of green infrastructure workforce development

## A Overview

From the business perspective of a “triple bottom line” framework, there are three categories of benefits from a green infrastructure workforce development program: social, environmental, and financial (also referred to as “people, planet, and profit”). The social and environmental benefits have traditionally been more challenging to measure than the financial benefits.

An anticipated increase in the need for green infrastructure workers [1] represents a potential opportunity for low-income populations and those with barriers to employment to gain access to entry-level jobs, a living wage, and career advancement. In the case of green infrastructure jobs, much of the work can be learned on the job, and potential barriers to employment such as past incarceration may be more readily bypassed [3]. Green infrastructure also has the potential to improve the local environment (e.g., by providing cleaner water and cleaner air), and enhance an area’s climate resilience (e.g., by providing flood protection). Depending on siting, some projects can improve conditions for the communities [39] that are the most vulnerable to climate change.

Some short-term data are available on the benefits of green infrastructure workforce development programs for workers. These data include the number of participants per program (8 to >100 annually), the graduation rate (50% to 83%), and the job placement rate (65% to >90%) [4, 15]. The DC Water program (a potential model for a Codman Square program) has goals to achieve an 80% graduation rate and 50% job placement rate [31]. Additional short- and long-term data could help in designing new programs. Long-term tracking could follow further employment, career advancement, compensation, workplace benefits, and housing for program alumni, as well as community benefits received from specific projects, such as urban heat island mitigation, health-related cost savings, and crime reduction. These variables are tracked by the City of Philadelphia for its Green City, Clean Waters program [9].

*“This workforce development program supports CSNDC’s mission to build a cohesive and resilient community in Codman Square and South Dorchester, develop affordable housing and commercial spaces that are safe and sustainable, and promote economic stability for low and moderate income residents of all ages.”*

—GAIL LATIMORE, EXECUTIVE DIRECTOR, CSNDC

## B Benefits for the Talbot-Norfolk Triangle/Codman Square/Dorchester area

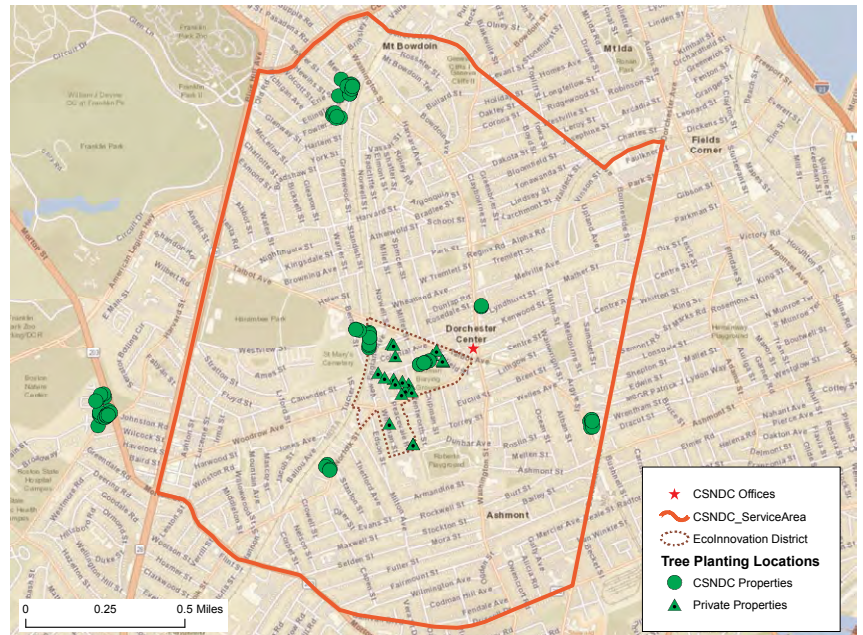
To determine the potential benefits of a local green infrastructure workforce development program for Codman Square, we need to understand the area’s current demographics. An overview for postal code 02124 [40], which includes Codman Square, is shown in Table 4. Notably, in this area in 2017, the estimated overall unemployment rate for people aged 25–64 years was 7.7%, which is significantly lower than the overall unemployment rates of 8.4% for males, 10.8% for those of Black or African-American identity, 16.0% for those of Hispanic or Latino (of any race) identity, 11.3% for those belonging to two or more races, and 18.5% for those specifying a different race. The estimated unemployment rate in 2017 for people aged 20–24 years



was 8.8%. Among people aged 25–64 years, the unemployment rate was 8.7% for those without a high school diploma and 13.8% for high school graduates.

To determine the potential benefits of a green infrastructure workforce development program for individuals and the community, as well as potential paths to growing such a program, it would be helpful to obtain the following additional information for the Codman Square neighborhood:

- The current income range for men of color (e.g., aged 20–24 years and not in college, and aged 25–64 years), to determine whether green infrastructure work could potentially increase their income and if so, by how much.
- The stated needs and aspirations of intended participants, including young people, underemployed and unemployed, and low-income men of color, and how these aspirations align with particular skills, the amount of physical labor, types of jobs and careers, and income levels for the green infrastructure workforce.
- An estimate of the number of potential green infrastructure workers, including those who were formerly incarcerated, their unemployment rate, and their current income range, including the information for 20 clients who signed up in the CSNDC Salesforce system and expressed interest in green infrastructure work.
- The number of businesses that are owned by people of color or women and poised to engage in green infrastructure work. Note that the amount of City of Boston contract funds awarded to businesses owned by people of color and/or women is currently <1% [41].
- Further research to understand the underlying reasons for poverty in the Codman Square neighborhood, such as the extent to which poverty reflects age or college experience. The population living in the 02124 zip code area has a below-poverty rate of 23.2%, and the smaller U.S. census tract 1005 area, which includes the Talbot-Norfolk Triangle Eco-Innovation District [42] within Codman Square, has a below-poverty rate of 30.9%.
- The potential for green infrastructure-related projects in Codman Square and Greater Boston (see Section 5) and the extent of competition for green infrastructure contracts.
- The desire of potential participants to work locally and the extent to which training and certification are portable among municipalities and regions (e.g., that use different types of plants). NGICP certification is intended to be portable nationally.
- The seasonality of green infrastructure and whether year-round opportunities exist.



Map showing the Codman Square Neighborhood Development Corporation Service Area, the Talbot-Norfolk Triangle Eco-Innovation District, and tree planting locations on CSNDC and private properties. Image courtesy of Jessica Dietrich/The Nature Conservancy.



**TABLE 4 |** An overview for postal code 02124, which includes Codman Square

DEMOGRAPHIC DATA FOR 02124 POSTAL CODE		UNEMPLOYMENT RATE	
Total population	55,074	Ages 20-24 years	8.8%
Median age	33.9 years	Ages 25-64 years	
Female	29,232 (53.1%)	• Overall	7.7%
Male	25,842 (46.9%)	• Less than high school graduate	8.7%
Citizens 18 and over, female	19,349 (35.1%)	• High school graduate (includes equivalency)	13.8%
Citizens 18 and over, male	16,595 (30.1%)	• Some college or associate's degree	7.1%
Graduates, high school or beyond	81.8%	• Bachelor's degree or higher	1.8%
Median household income	\$50,227	Female	7.4%
Individuals below poverty level	23.2%	Male	8.4%
Veterans	1,338 (2.4%)	Black or African American alone	10.8%
<b>RACE AND ETHNICITY</b>		White alone	5.2%
Black or African American alone	35,157 (63.8%)	White alone, not Hispanic or Latino	2.8%
White alone	12,634 (22.9%)	Hispanic or Latino (of any race)	16.0%
White alone, not Hispanic or Latino	9,013 (16.4%)	Asian alone	4.9%
Hispanic or Latino (of any race)	8,810 (16.0%)	Two or more races	11.3%
Asian alone	3,303 (6.0%)	Some other race alone	18.5%
Two or more races	1,806 (3.3%)		
Some other race alone	1,721 (3.1%)		
American Indian & Alaska Native alone	453 (0.8%)		

From 2013–2017 American Community Survey 5-Year Estimates, [https://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml](https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml), viewed on August 8, 2019; percentages shown are % of total population, except unemployment rates.

Unemployment rates are from U.S. Census Bureau, 2013–2017 American Community Survey 5-Year Estimates, <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml> Guided Search results for 2017 using search terms: People, Employment (Labor Force) Status, zip code 02124, skip race/ethnic groups, viewed on September 19, 2019.



## Section 4: Locations of current green infrastructure jobs

### **A National context**

As the green infrastructure workforce is at an early stage of development, it is difficult to identify jobs that exclusively handle green infrastructure IMI work [1]. As discussed in Section 1, green infrastructure work typically is part of broader, traditional occupations such as construction, landscaping, and water-quality protection. As of 2017, the overall U.S. green infrastructure workforce, defined broadly to encompass those working in direct, hands-on, entry-level and middle-skill IMI jobs and first-line supervisors, is estimated at <250,000, or about 6% of those involved in the 30 core IMI occupations. The occupations with the highest percentage of workers involved in green infrastructure IMI are tree trimmers and pruners (up to 75%), followed by landscaping and groundskeeping workers (up to 25% each), with each of the remaining occupations at 5%–15% [1].

The proportion of total infrastructure that is green infrastructure is not known [26]. However, it is estimated that in the United States, almost half of all green infrastructure installations designed to address stormwater capture, water quality, and water scarcity are at educational institutions or parks and open spaces. The four most common installation types are bioswales (20%), rain gardens (17%), bioretention facilities (16%), and permeable pavement systems (15%) [26]. This estimate highlights the opportunities to connect with anchor institutions, local governments, and neighborhoods that traditionally have had fewer connections to educational institutions or parks and open spaces, and to work with them in developing a green infrastructure workforce development program [3, 26].

According to estimates, the U.S. green infrastructure IMI workforce is mostly male and is composed of 12% Black and 16% Hispanic workers who average 14 years of schooling [1]. These proportions reflect the overall racial and ethnic composition of the U.S. workforce, which was 13% African-American and 17% Hispanic and Latino in 2018 [43]. For these populations, race and ethnicity may not be factors affecting access to green infrastructure jobs.

Nationally, compensation for entry-level jobs in green infrastructure IMI is around minimum-wage levels [4, 44]. In some locations, the minimum wage is not a living wage, which is defined as the minimum income a worker requires to meet their basic needs, including food, shelter, and clothing. While minimum wage is often less desirable, some people with barriers to employment, as mentioned above, may find that green infrastructure jobs offer an access point. Another report found that in 2015, the median wage for about one-third of green infrastructure IMI occupations was less than \$15 per hour, for another third it was \$15–\$20 per hour, and for the remaining third it was \$20–\$26 per hour. The lowest median wage was \$11.50 for landscaping and groundskeeping workers, and the highest was \$26 for construction and building inspectors, with annual full-time pay between \$21,300 and \$55,000 [1].



## **B Greater Boston**

Further research is needed to determine the current (and potential) green stormwater infrastructure projects in the Boston area and beyond, as well as their pay scale. We have identified some starting points to obtain this information.

The Boston Water and Sewer Commission (BWSC) operates in accordance with Clean Water Act requirements regulated by the EPA. To meet the City of Boston’s water quality goals, the BWSC, Parks and Recreation Department, and Public Works Department cooperate to create and maintain projects. The BWSC has a key role in designing, building, and inspecting green infrastructure installations and establishing guidelines. Its map of existing public and private green infrastructure projects may be a good starting point for a list of potential green infrastructure jobs [45]. In initial discussions, the BWSC has expressed a need for NGICP-certified workers to maintain and inspect an annual percentage of the over 2,500 public and private green infrastructure projects around the City and ensure that they are functioning properly.

Another option is to determine which anchor institutions, such as schools, universities, and hospitals, among others, have projects and jobs that could involve green infrastructure installation, maintenance, or retrofit. For example, at five Boston Public Schools, BWSC partnered with the landscape architecture firm OffShoots to install green infrastructure facilities that will require ongoing maintenance [46, 47]. The Boston Medical Center (a CSNDC partner) has a rooftop farm, and although most workers are volunteers [48], there may be other rooftop installations that can provide employment.

CSNDC will participate in the Massachusetts Clean Energy Center’s Clean Energy Internship Program, which helps prepare the next generation of clean energy workers by funding internships at Massachusetts clean energy and water innovation companies [49]. To identify additional employers (e.g., contractors with the City of Boston and other businesses) in the green infrastructure sector, one approach would be to contact city agencies such as BWSC; Boston Public Works [50], which implemented the South End Porous Alley [51]; the Boston Transportation Department, which has a Green Links program [52]; and Boston Parks and Recreation, which has green infrastructure projects in several parks [53]. These contacts may also be able to provide information on the levers for increasing the number of green infrastructure projects and jobs in the City of Boston. For green roofs, contractors in the Boston area include Recover Green Roofs [54], Apex Green Roofs [55], and Omni Ecosystems Boston [56].

The BWSC was a founding partner of the NGICP [57]. Charlie Jewell, Director of Planning & Sustainability at BWSC, was a member of the NGICP Technical Advisory Group, and John Sullivan, Chief Engineer at BWSC, was a member of the NGICP Strategic Advisory Group. It may be helpful to review periodically how well NGICP’s approach and content fit with the City of Boston’s overall approach to green infrastructure jobs, and with CSNDC’s current and projected goals.

Potential discussion topics with the city agencies and anchor institutions might include:

- The factors, including equity, that impact the selection of green infrastructure sites
- The number and types of green infrastructure installations, monitoring of installations, and maintenance frequency
- The contractors and terms for existing contracts for lawn mowing, gardening, general landscaping, tree planting and maintenance, etc.
- The projected number and type of green infrastructure installations in the next 1, 2, 5, 10, and 25 years



- The projected amount of green infrastructure maintenance needed (after identifying low- and high-maintenance projects)
- The number and role of union workers who currently provide green infrastructure installation and maintenance, and
- Whether a new union dedicated to green infrastructure workers is needed.

Since green infrastructure jobs are often filled through word-of-mouth recommendations [1], it may be difficult to obtain a comprehensive jobs list. A potential resource is the MassHIRE JobQuest Green Jobs site [58]. Given the seasonality of green infrastructure work, a search in the spring or summer may yield more results than at other times of the year.

Additional ideas for job opportunities for green infrastructure trainees and/or sources of revenue for a CSNDC program include:

- The Massachusetts Greening the Gateway Cities [59] program. The contact in Brockton is Conor Michaud, who works for the Wildlands Trust.
- Neighborhood-scale tree planting and maintenance projects. The Trust for Public Land, TNC, and CSNDC are discussing the feasibility of such work on properties that lack trees and that are owned by the City of Boston and/or private citizens. The properties would form clusters of easements that would receive green infrastructure installations, including tree plantings, and would be maintained by the city.
- NGICP trainings offered by CSNDC for landscaping and maintenance staff at anchor institutions.

For privately owned sites, potential contacts include real estate managers, local small businesses, residential building managers, developers, and landscape companies.

Further data on the size of the green infrastructure workforce may be available from the Boston Mayor's Office of Workforce Development [60] and the Massachusetts Executive Office of Labor and Workforce Development [61], which administers the state's Workforce Training Fund [62] and Workforce Competitiveness Trust Fund [63]. The Massachusetts Governor has established a Black Advisory Commission [64] and a Latino Advisory Commission [65] to advise on issues relating to the economic prosperity and well-being of the Black and Latino communities. In 2018, each Commission created a first set of priorities and recommendations that included expanding targeted workforce development programs and growing the competitiveness of Black- and Latino-owned businesses. These Commissions may be interested in green infrastructure workforce development.

The compensation range for entry-level green infrastructure jobs in Boston is not known. The Massachusetts minimum wage is \$12.75 per hour, with increasing steps to reach \$15 per hour by 2023. As stated by the Boston Jobs and Living Wage Ordinance [66], the Boston living wage [67], defined as the hourly wage sufficient for a family of four to live at or above the federal poverty level, is \$15.31 per hour. All workers on city contracts are required by law to be paid at least the living wage.



# Section 5: Future prospects for green infrastructure jobs and careers

## **A National context**

It is not possible to calculate projected green infrastructure job growth specifically because green infrastructure IMI is often a small part of broader job categories, but it is possible to look at overall trends. One report looked at projected growth in the United States for IMI occupations between 2015 and 2020. Calculations for selected occupations are shown in Table 5a (but keep in mind that green infrastructure work is a small proportion of some occupations) [1]. Another report published in 2013 looked at projected growth between 2010 and 2020 of some of the same types of occupations in operations and maintenance (Table 5b) [4]; here again, the growth cannot be attributed entirely to green infrastructure work. Both reports identified landscaping and groundskeeping as the occupation with the highest number of projected job openings in 2020.

Sources of money for green infrastructure projects include financing and funding [3]. Financing options include green and municipal bonds and green banks (e.g., Rhode Island Infrastructure Bank [68], which finances water, wastewater, energy efficiency, and renewable energy projects, among others). Funding options include the Massachusetts Clean Water Trust's State Revolving Funds [69], which use money from the U.S. EPA, supplemented by state matching funds and loan repayments, taxes, and fees. Over 1,600 stormwater utilities in the United States and Canada charge property owners fees based on the amount of impervious cover on their property [70]. While only nine Massachusetts communities have such fees, they represent an effective sustainable funding mechanism.

## **B Greater Boston**

Further research is needed to project the demand for green infrastructure work and identify financing and funding sources for the Greater Boston area. In addition, we need a more comprehensive understanding of the City of Boston's priorities and drivers for green infrastructure work. For example, one way to minimize green infrastructure maintenance costs is to design and install green infrastructure such as bioswales that only require mowing, and/or to include low-maintenance plants appropriate for the region. We need to know whether Boston is likely to take this approach or whether it will choose projects that require more intensive maintenance. Agencies that may be able to provide input include BWSC and other City departments specified in Section 4. BWSC may have an estimate of the potential need for installation, maintenance, and inspection workers, and as a founding member of NGICP, it may have information about mobilizing certified contractors and workers of color for green infrastructure projects. In addition, we need to understand the extent to which existing workforce development programs and green infrastructure-related occupations can meet the anticipated demand in Boston, and whether there is scope for additional growth.



It would also be helpful to determine whether green infrastructure skills are included in current union requirements; whether existing unions in Boston cover the green infrastructure workforce; and if so, what the unions' growth projections are in the sector. If no existing unions encompass the green infrastructure workforce, potential resources for organizing a group within an existing union or forming an entirely new union include the following:

- Wiki-How: How to Form a Union [71] for an overview
- National Labor Relations Board [72], which provides detailed information about unions
- Massachusetts AFL-CIO, which has information on affiliate unions [73] and workforce development [74]
- MA Community Labor United [75]
- City of Boston Department of Labor Relations [76], which may be able to share whether green infrastructure is covered by an existing union that works with the City of Boston
- Boston Mayor's Office of Workforce Development [77]
- Boston Public Workers Union Local 445 [78], to determine whether they cover any aspects of green infrastructure





**TABLE 5A** | Projected growth for green infrastructure IMI occupations in the United States, 2015–2020; selected occupations from [1]

OCCUPATION	2015 JOBS	2020 JOBS	NET GROWTH	% CHANGE, 2015–2020
Environmental Engineering Technicians	17,572	19,184	1,612	9
Tree Trimmers and Pruners	61,429	66,174	4,745	8
Landscaping and Groundskeeping Workers	1,258,251	1,348,696	90,445	7
Pesticide Handlers, Sprayers, and Applicators, Vegetation	31,578	33,656	2,078	7
Helpers: Installation, Maintenance, and Repair Workers	129,984	137,988	8,004	6
Maintenance and Repair Workers, General	1,452,611	1,532,707	80,096	6
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	143,789	150,778	6,989	5
Forest and Conservation Workers	13,356	14,011	655	5
Paving, Surfacing, and Tamping Equipment Operators	53,316	55,701	2,385	4
Segmental Pavers	1,466	1,523	57	4
Forest and Conservation Technicians	32,405	32,376	(29)	0

**TABLE 5B** | Projected growth for green infrastructure operations and maintenance occupations, 2010–2020; selected occupations from [4]

OCCUPATION	JOB OPENINGS <sup>^</sup>	PROJECTED GROWTH (%)
Pavement, Surfacing and Tamping Equipment Operators	2,200	22
Landscaping and Groundskeeping Workers	44,440	21
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	6,010	15
Maintenance and Repair Workers, General	37,910	11

<sup>^</sup> Job openings here most likely represent net growth.



## Section 6: Prospects for green infrastructure workforce development in Codman Square

To help determine potential pathways for creating a green infrastructure workforce development program tailored to the Codman Square neighborhood and to learn what foundational elements are already present, we looked at CSNDC’s existing relevant activities and learnings from their experiences. We wanted to prioritize the whole-community approach as part of the CSNDC-TNC partnership.

CSNDC has several green infrastructure-related projects and trainings:

- The Oasis on Ballou is an urban agriculture site that CSNDC developed in 2008, with strong neighborhood participation and City of Boston support. It transformed the site from an abandoned lot into a flourishing green space that provides fresh, affordable, organic food; education about healthy food; and job training for men of color. The CSNDC Farm Manager maintains the site, along with support each year from men of color who are re-entry citizens.
- As part of their partnership [79], CSNDC and TNC have organized tree planting classes and events for residents. They have used the Healthy Trees, Healthy Cities application developed by TNC and the U.S. Forest Service to monitor existing trees and have used Geographic Information Systems to map new tree locations in order to measure the impact of the plantings. The partnership is creating fact sheets for each resident tree owner and planning a tree pruning class. The Talbot-Norfolk Triangle Neighbors United and Boston Project Ministries also have been involved in this project. As part of this effort, CSNDC has also planted trees on some of its properties.
- CSNDC plans to include a rain garden in its new Talbot Commons affordable housing units. Previously developed and renovated properties [80] include solar panels, rainwater irrigation, stormwater management, green space, and/or more plants and trees in place of hardscape.
- CSNDC covered the costs for three selected area residents to attend Earthwatch’s 2019 Green Infrastructure 101 Rain Garden Training course [81] at the nearby Franklin Park Zoo. This short course covered the process of creating a rain garden. CSNDC will follow up with these residents to get their feedback and plans for next steps.
- CSNDC’s Dave Queeley is certified by NGICP in green infrastructure construction, inspection, and maintenance. Both Dave Queeley and Danilo Morales of CSNDC are certified to conduct NGICP training sessions and plan to conduct trainings for builders and contractors who are people of color, and for CSNDC Salesforce clients who express an interest in green jobs.

***“Residents are the foundation for strong communities. If you don’t have great residents willing to participate, you don’t have community.”***

—JAMES DARBY, NEIGHBORHOOD ACTIVIST,  
ASPINWALL ROAD



Tree planting, hosted by CSNDC and TNC, in Codman Square's Oasis on Ballou urban agriculture site. Courtesy of CSNDC photo archive.

In addition, CSNDC offers well-being and employment resources for people of color:

- As part of CSNDC's overarching Male Engagement Network initiative, the Brothers Building group aims to bring men and young people of color together as a community to receive and give support, learn and teach, heal and be healed, and proactively address quality of life mentally, physically, spiritually, and financially. The group's goal is to improve health outcomes for men of color throughout Boston and beyond, through events such as sunrise hikes with meditation, a Men's Wellness Program Conference [82], and a program called Making Amends: A Celebration of Black Men and Fatherhood. The group also partners with other local organizations.
- Daughters of the Dust GirlTrek Codman Square is a walking program supported by CSNDC, originally in collaboration with Jazz & Juice. The program aims to reclaim the streets for walkers and empower women. The group's Women of Color Circle organizes gatherings and community dialogues; the group has also posted signage showing walking and cycling routes.
- CSNDC's Ready, Set, Work Program at the Codman Square Computer Learning Center [83] assists community members with job searches. It provides research on wages, skills, and projected job growth by industry and sector, conducts career assessments, and helps people with career development.
- Over the past three years, CSNDC has worked with 10 re-entry citizens and court-involved men (men of color). They were referred to CSNDC by Community Resources for Justice [84], the Massachusetts Community Outreach Initiative [85], and New Start Project (now defunct). They served as interns at the Oasis at Ballou site and learned the basics of tree care and gardening. As part of their experience, they developed habits and skills to maintain employment, such as punctuality, accountability, ability to complete tasks, communication, and customer relations. In addition, in 2018 two court-involved young men referred by STRIVE [86] worked with the Eco-Innovation District to plant over 150 trees and shrubs in neighborhood yards and at CSNDC properties.

These activities have provided learnings and potential opportunities to engage Codman Square residents and create a green infrastructure workforce development program.



## **RECOMMENDATIONS ABOUT ENGAGEMENT AND MOTIVATION OF RESIDENTS**

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- The level of resident engagement with community green projects ebbs and flows, with lulls when a lead resident organizer moves or passes away. Connecting with residents in existing neighborhood groups, identifying and establishing relationships with enthusiastic and capable residents, educating residents, and/or forming a residents' group focused on green projects may help to sustain support for a green infrastructure workforce development program.
- Given the research connecting green space and health outcomes, the high levels of engagement within CSNDC's Brothers Building and Daughters of the Dust groups that focus on health and well-being, and the interest of its Salesforce clients, these groups may be starting points to engage the community on a green infrastructure workforce development initiative.
- For the tree plantings, residents' primary motivations were to beautify their homes and harvest fruit; the environmental benefits of trees were a secondary factor. Residents were required to attend a training class in order to obtain a tree for their property. A certificate to mark their participation in the program and their achievement also helped to engage residents. A priority now is to provide continuing education on tree care to Codman Square residents and employees of the management company for CSNDC properties.

## **RECOMMENDATIONS ABOUT CREATING A GREEN INFRASTRUCTURE WORKFORCE DEVELOPMENT PROGRAM**

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- Obtain residents' input to understand their needs, then co-create a program with their buy-in and continuous feedback.
- Integrate green infrastructure workforce development into the overall CSNDC strategic plan, if it is not part of the plan already, to build organizational capacity and identify collaborations within and external to CSNDC to support a program.
- Align with and gain leverage from City of Boston departments (BWSC, Parks, Transportation, and Public Works) on both the policy and employment fronts.
- Continue to engage firms owned by people of color and women in building and renovating CSNDC's properties, and support the growth of firms that focus on green infrastructure and can bid successfully on city contracts.
- Increase awareness of the entry-level jobs, the possibility for advancement, and the wages associated with green infrastructure work. Some residents were hesitant to participate in the rain garden training because they did not have this information. As we noted from the literature scan, providing this information verbally and in writing, along with career counseling, can help potential trainees to make informed choices.

On the basis of the success themes discussed earlier, we developed some questions to consider regarding a Codman Square-based program (Table 6). Various partnerships will be necessary to develop and support a program that is rooted in the Codman Square community. Table 7 lists potential local anchoring institutions, champions, funders, partners for program development, partners for non-technical program components, and mentors.

In addition, we recommend using the learnings described above, from CSNDC and other TNC partnerships, to take a holistic look at the TNC–CSNDC partnership and revisit or further define the partnership roles.



**TABLE 6 | Guiding questions to support development of a green infrastructure workforce development program**

STRATEGY AND STAKEHOLDERS
What are the program’s vision and mission? What are the program’s specific social/community goals and environmental goals, and how do they intersect?
What is the potential for green infrastructure in Codman Square? This question is based on the premise that when people can see the benefits of green infrastructure in their community, they may be more likely to engage with and support the program (e.g., by sharing training and job opportunities with people they know).
What opportunities exist for green infrastructure projects and jobs (current and projected)? Current city initiatives such as Climate Ready Boston – Dorchester [87], Boston’s Climate Action Plan [88], Greenovate Boston [89], Resilient Boston Harbor – Dorchester [90], Imagine Boston 2030 [91], Carbon Free Boston Summary Report [92], Carbon Free Boston Social Equity Report [93], and/or others may offer guidance.
Who in the Codman Square community will provide input in developing the program to meet its goals?
What program components, including technical and soft-skills trainings, wraparound services, and other elements, are needed to tailor the program to meet the short- and long-term outcomes and needs for each participant population?
What are the pros and cons of establishing a stand-alone program, as opposed to being part of a national network such as Groundwork USA? What is the feasibility of a hybrid model with stand-alone work and partnerships with other organizations?
What cost-benefit analyses are needed? Resources for conducting these analyses include Earth Economics’ Projects to Portfolio report [26] and Benefit-Cost Analysis [94], and Green Infrastructure Leadership Exchange’s Co-benefits Valuation Tool [95].
What is the appropriate business model to follow? Potential options include a social enterprise; a fee-for-service business run by a nonprofit to support programs for social good [3]; a worker-owned cooperative such as Dig Cooperative [3]; a benefit corporation (B Corp), a for-profit entity whose legally defined goals include positive impact on society, workers, the community, and the environment, in addition to profits; and a limited liability company (LLC) [96], a flexible business structure that has limited liability and pass-through income taxation.
What aspects of CSNDC’s existing work dovetail with a green infrastructure workforce training program?
What elements of Codman Square enable or hinder development of a program?
What metrics and impacts will be meaningful for the program as a whole and for its participants, and which might be incorporated to track what works well, what could be better, and what not to do?
POLICIES AND FUNDING
What local policies or funding mechanisms exist to promote green (stormwater) infrastructure projects?
What policies should be implemented to meet the city’s and program goals? For example, commitments based on the DC Water program might include: <ul style="list-style-type: none"> <li>• At least 51% of new jobs and 35% of total apprentice hours doing green infrastructure work will be filled by Codman Square/Dorchester residents</li> <li>• Co-sponsoring, with local businesses, a minimum of two job fairs for Dorchester residents annually for green infrastructure opportunities</li> </ul>
What regulations and measures are needed to protect outdoor workers (e.g., from heat-related illnesses/death)? [97]



**TABLE 6** *continued*

PARTNERSHIPS AND RESOURCES
What capacity and resources (e.g., people, relationships, property, overhead) does CSNDC have to create, lead, and support such a program? (CSNDC owns around 20 properties with approximately 100 buildings, 971 units, and 50,000 square feet of commercial space.)
What partnerships are needed to achieve the intended outcomes and to advocate for and strengthen the program?

**TABLE 7 | Potential partners, mentors, and groups to engage through outreach for a CSNDC-led green infrastructure workforce development program**

LOCAL AND ANCHORING INSTITUTIONS, INCLUDING THOSE WITH LAND ASSETS
Botanical gardens for knowledge of plants (e.g., Arnold Arboretum)
Churches and faith-based organizations (e.g., Boston Project Ministries)
Codman Square Farmers' Market
Codman Square Health Center
Codman Square Public Library
Franklin Park and Zoo
Others, including health institutions and public schools
CHAMPIONS: GRASSROOTS TO GOVERNMENT
Black Economic Justice Institute [98]
Boston city government agencies and leaders (Boston Water and Sewer Commission; Transportation; Public Works; Chief of Streets/Transportation/Sanitation, Chief of Energy/Environment/Open Space, Director of Workforce Development, City Councilors)
Boston Ujima Project [99]
CSNDC Eco-Innovation District Board members
GreenRoots, Chelsea, MA [100]
Massachusetts AFL-CIO [74]
Massachusetts Legislature [101]
Metropolitan Area Planning Council [102]
U.S. Environmental Protection Agency Green Infrastructure Collaborative [103]
Others, including anchoring institutions, foundations, green infrastructure employers, neighborhood residents, nonprofit organizations



**TABLE 7** *continued*

FUNDERS, ESPECIALLY OF PILOT AND EARLY-STAGE PROGRAMS
Barr Foundation [104]
City of Boston agencies, including Department of Corrections
National Fish and Wildlife Foundation [105]
U.S. Environmental Protection Agency [106]
U.S. Forest Service Urban and Community Forestry Program [107]
Other local foundations, including hospital foundations
PROGRAM DEVELOPMENT
Building Pathways Boston [108]: pre-apprenticeship training and apprenticeship placement in the building trades
Bunker Hill Community College, Boston, MA
City of Boston Mayor’s Office of Workforce Development [109]
LISC Boston [110]: funding, financing, and technical assistance to community development corporations (CDCs), nonprofit developers, grassroots organizations, as well as policy and advocacy organizations
New England Environmental Finance Center [111]
Roxbury Community College, Roxbury Crossing, MA
Tree Care Industry Association [112] Build Your Business tools and 2016 Workforce Development webinar [113]
X-Cel Conservation Corps, Boston [23]
YouthBuild Boston [114] program for young adults to start careers in the building trades
NONTECHNICAL PROGRAM COMPONENTS
Boston Society of Landscape Architects [115]
Ecological Landscape Alliance [116]
Massachusetts Nursery and Landscape Association [117]
STRIVE Boston [86], which works with chronically unemployed men and women ages 18-24 who are disconnected from the workforce due to layoffs, incarceration, military service, personal troubles, or other reasons; office in the Codman Square area
Suffolk County Sheriff’s Department Re-entry Services [118]
YouthBuild Boston [114]: OSHA 10 certification



**TABLE 7** *continued*

MENTORS
Advancing Green Infrastructure/GreenSkills, New Haven, CT [22] (Green Infrastructure Leadership Exchange benchmark region [15])
Clean Water Certificate, Baltimore, MD [119] (Green Infrastructure Leadership Exchange benchmark region)
Clean Water Partnership, Prince George’s County, MD [120] (Green Infrastructure Leadership Exchange benchmark region)
DC Water Clean Rivers Project [121], with TNC Maryland/DC
HABESHA [122], Atlanta, GA and TNC Georgia
Landforce [3], Pittsburgh, PA (similar demographic and intended participants as Codman Square)
PowerCorpsPHL [123], Philadelphia, PA (focus on youth and re-entry citizens; Green Infrastructure Leadership Exchange benchmark region)
Rhode Island Green Infrastructure Coalition [68] with TNC Rhode Island (Green Infrastructure Leadership Exchange benchmark region)





## Conclusions and future research

As municipalities increase their commitments to mitigate climate change and build resilient communities, an emergent workforce for green infrastructure construction, maintenance, and inspection represents an opportunity to improve the social and environmental resilience of historically underserved populations. The success themes gleaned from our literature search can help to inform strategic decisions on the path toward building an effective program. Other programs have taken a variety of paths, and there are many variables affecting a green infrastructure workforce development program, including but not limited to state and local government commitments to green infrastructure, availability of funding, presence of worker unions, seasonality, community engagement, and collaborations with partner organizations for wraparound services. Thus, a customized, iterative approach is needed to serve the intended participants in Codman Square and throughout Greater Boston.

This green paper should be considered a living document. While it surveys the current status of green infrastructure workforce development programs nationally, conditions in the Boston area, Codman Square demographics, and connections to existing CSNDC initiatives, a robust program will need to continuously evolve, and so it will depend on ongoing research.

Further research should seek a deeper understanding of the City of Boston's green infrastructure priorities; the green infrastructure jobs forecast and list of potential employers; the perspectives of the intended participants and the broader Codman Square community; the role of unions; and how CSNDC's resources, funder and partner resources, and activities can support this new program. Moreover, additional data on the social, environmental, and economic benefits of existing green infrastructure workforce development programs can help make the case for further investments in a Codman Square program.

One approach is to start small to learn what works and what does not; demonstrate early, high-quality successes to attract the support of local institutions and additional funding; and identify existing job and career opportunities while working with the city and state to develop a green infrastructure plan that benefits underserved populations. Such an approach might implement a pilot program while simultaneously working on strategic planning for the future. Our hope is that continuous learning, by regularly scanning the literature on green infrastructure and workforce development, receiving updates from NGICP, learning from managers of well-regarded workforce development programs, systematically documenting best practices and learnings, and updating this document, will help to clarify options for a Codman Square program.



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