EXPLORING ALTERNATIVE MODELS FOR GREEN INFRASTRUCTURE MAINTENANCE

2019 GCS REPORT

PREPARED BY ALICIA KINGDON

PREPARED FOR KRISTEN HUDSON, PLANNER I, CITY OF VANCOUVER &
ROBB LUKES, CIVIL ENGINEER II, CITY OF VANCOUVER

AUGUST 2019

ACKNOWLEDGMENTS

The author would like to thank the following individuals for their contribution, feedback, and support throughout this project.

Kristen Hudson, Planner I, City of Vancouver

Robb Lukes, Civil Engineer II, City of Vancouver

A special thanks to all the interview participants for their time, contribution, and feedback throughout this project, which was essential in completing this report.

This report was produced as part of the Greenest City or Healthy City Scholars Program, a partnership between the City of Vancouver and the University of British Columbia, in support of the Greenest City Action Plan and the Healthy City Strategy.

This project was conducted under the mentorship of City staff. The opinions and recommendations in this report, and any errors, are those of the author, and do not necessarily reflect the views of the City of Vancouver or The University of British Columbia.

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EXECUTIVE SUMMARY

In 2016, City of Vancouver Council adopted a long-term target to capture and treat 90% of Vancouver's average annual rainfall by using green infrastructure (GI) on public and private property.[1] Much of this investment in GI is occurring within the City's streets and public spaces, which make up approximately 30% of Vancouver's total area and account for over 37% of the City's total impervious surface.[2] By investing in GI the City can adapt its infrastructure for a changing climate, reduce flooding, support biodiversity and provide cleaner rainwater runoff to our surrounding rivers, oceans, and last remaining streams. Despite the benefits promised by these nature-based solutions, many jurisdictions have not adequately planned or budgeted for GI operations and maintenance (O&M), leaving many municipalities uncertain how city-owned GI assets will be maintained over the long-term.

Like traditional infrastructure, GI requires adequate and consistent maintenance to function properly. Similar to many other municipalities, the City of Vancouver lacks a formal long-term maintenance framework for its municipally-owned GI assets. Other jurisdictions across North America have created innovative solutions for GI O&M, leveraging this new work to increase community engagement and provide training, capacity-building and employment opportunities for youth and vulnerable populations.[3] As the City continues to develop GI, this new maintenance work represents an opportunity for the City to position the care of GI to advance economic, environmental and social sustainability for all Vancouver residents.

This report seeks to examine the barriers to effective GI O&M and aims to document strategies and best practices that municipalities, practitioners, non-profits and other community groups are using to develop and manage alternative O&M frameworks that expand beyond the traditional city/contractor approach.

Research Questions

The objective of this report is to help the City develop an O&M program and identify potential delivery models for various GI asset types in the public realm, which contribute to the City's economic, environmental and social sustainability. More specifically this report will seek to answer:

» What O&M frameworks are currently being used in our region and in municipalities across North America?

» How can GI O&M be leveraged to create training, capacity-building and job opportunities for vulnerable populations?

» How can GI stewardship be leveraged to increase public education and awareness of GI and promote community engagement?

Research Approach

To answer the research questions listed above, this report will seek to understand the landscape of traditional and alternative methods for GI maintenance by:

» Conducting interviews with local municipalities and documenting existing

models of GI O&M in the Pacific Northwest Region.

» Conducting interviews with municipalities who have leveraged alternative models of GI O&M, including workforce development and/or community stewardship models.

» Summarizing best practices in GI O&M in the areas of community stewardship and workforce development and any lessons learned.

» Proposing strategies for the City of Vancouver to explore alternative models for GI O&M.

GI in Vancouver

The first section of the report provides an overview of GI in Vancouver, outlining how the City of Vancouver defines GI, providing a breakdown of the categories of GI in Vancouver's streets and public spaces, and discussing the state of GI O&M at the City.

Assessment of Current O&M Frameworks

The second section of the report documents the current structure of GI O&M programs across North America. While these programs are still in development across many municipalities, there are two emerging trends in the sector: specialized GI maintenance crews and a shift towards alternative strategies, beyond the traditional city/contractor approach.

Community Stewardship

This third section of the report documents key findings from stakeholder interviews with municipalities engaged in community stewardship programs, including volunteer stewardship (or adopt-a-bioretention garden) programs and school engagement programs. Many municipalities with limited capacity are using this model to provide additional maintenance, shifting the responsibility of GI maintenance needs to residents.[4] Other programs leverage the community stewardship model to build community support for a public GI program.

Workforce Development Programs

This section of the report documents an emerging model for GI O&M, workforce development programs, and provides key findings from interviews with stakeholders engaged in this type of work. These lessons learned illustrate how public investment in GI O&M can be leveraged to provide social and equity benefits, by offering training and soft skills to people who experience barriers to employment.

GI IN VANCOUVER

image: City of Vancouver

What is GI?

GI is an umbrella term for rainwater management approaches and technologies used to protect, restore, and mimic the natural water cycle. GI uses vegetated practices (including trees, plants and soils) and engineered systems (such as permeable pavement and stormwater tree trenches) to slow, absorb, infiltrate, evaporate and clean rainwater run-off. While grey infrastructure treats rainwater as a waste product, moving it away from the urban environment as quickly as possible, GI captures and cleans rainwater at its source, before returning it to the ground, atmosphere, and our surrounding waterways.

In addition to the water management functions of GI, it also provides many other ecological, economic and social benefits. Using GI to supplement a city's existing grey infrastructure can reduce the urban heat island effect through shading and cooling; enhance biodiversity and habitat for wildlife and pollinators; improve public health and mental well-being by increasing access to greenspace; and enhance resilience to climate change.

GI practices can be used at multiple scales and site contexts, including practices in residential neighbourhoods, commercial sites and in streets and public spaces. Streets and public spaces represent a significant impervious area for cities and as a result, jurisdictions across North America are implementing GI within its public right-of-way to help restore the city's natural hydrology.

Vancouver's Context

In the natural environment, rain is captured and filtered by soils and plants, allowing it to be absorbed back in to the ground or returned to the atmosphere and surrounding waterways. In cities, this natural water cycle is disrupted, as rainwater flows across pavement, limiting the groundwater replenishment and evapotranspiration. Before Vancouver's urban development water was managed within its natural watersheds. In the 19th and 20th century, Vancouver developed with little regard for its natural water cycle –filling ravines and culverting streams – disrupting and dissecting the City's watershed and watercourses.[5]

image: The Heather Street Creek overflowing Ninth Avenue, Vancouver Archives

Vancouver's expansion of its road network, urban areas, and construction of grey infrastructure altered and replaced the City's 19 natural watersheds with sewersheds.[6] Vancouver, which once had a network of salmon-bearing streams, now has two remaining visible streams.[7] The addition of GI in these areas helps to include more natural systems into the City's water management strategy and to restore some of the features more traditionally part of a natural watershed.

GI in Vancouver

Cities across North America are investing in GI in their streets and public spaces to support their existing grey infrastructure and restore some of the natural water cycle. In Vancouver streets and public spaces make up approximately 30% of Vancouver's total area, and over 37% of the City's total impervious area; therefore, the continued development of GI in our streets and public spaces will help to restore the natural water cycle and achieve rainwater management targets specified in the City's Rain City Strategy.

The City of Vancouver has been constructing GI within its street right-of-way for the past 20 years. As of 2019, the City has an estimated 238 GI assets in the public realm in the form of: bioretention practices; permeable pavement; subsurface infiltration trenches; and stormwater tree trenches.[8]

The following chart provides a breakdown of the categories of GI in Vancouver's streets and public spaces as of 2019.

TABLE 1: CITY OF VANCOUVER GI AS OF 2019[9]

GI asset category	# of Assets	% of Total GRI Assets
Bioretention	140	59%
Permeable Pavement Areas	39	16%
Subsurface Infiltration Assets	51	21%
Stormwater Tree Trenches	7	3%
Total	**238**	**100%**

image: City of Vancouver

PERMEABLE PAVEMENTS

Permeable Pavement has a high porosity, which allows rainwater runoff to infiltrate into drainage layers and the underlying soils. Porosity can be achieved through gaps in the pavement, which are filled with vegetation or aggregate, or through pavement that is manufactured to be permeable.[10] Permeable pavement is the City's third largest asset category and includes permeable concrete pavers, pervious concrete, porous asphalt, grid pavers/ country lane, permeable rubber.

image: City of Vancouver

SUBSURFACE INFILTRATION

Subsurface infiltration includes infiltration trenches, dry wells, soakaways, and chamber systems, which store stormwater underground and temporarily holds rainwater prior to it infiltrating into the subsurface soils. Subsurface infiltration practices reduce rainwater runoff and contribute to ground water recharge.

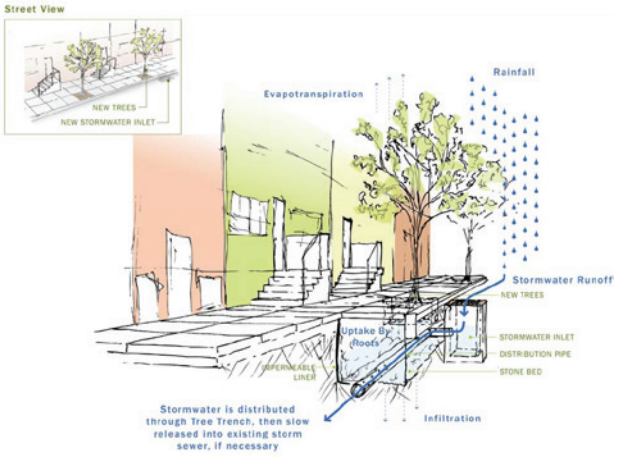


image: Philadelphia Water Department

STORMWATER TREE TRENCHES

Stormwater tree trenches are modified tree trenches that incorporate drainage components. The drainage components give the stormwater tree trench the ability to take rainwater runoff from surrounding drainage areas, such as streets, parking lots, sidewalks, plazas, and rooftops, where it can be filtered through the soil, used by the tree or infiltrated into the native soils, supporting the health of the tree.[11]

Soil cells and structural soils are the two categories of stormwater tree trenches. Both methods provide extra rooting volume for trees.

BIORETENTION

Bioretention GI is the City's largest asset category, making up 59% all GI assets in Vancouver. Bioretention practices are among the most common GI practices constructed in streets and public spaces across North America. Bioretention systems are vegetated, engineered landscapes that filter and either infiltrates or temporarily detains rainwater runoff.[12] Examples include bioswales, bioretention corner bulges (which are bioretention practices that also offer traffic calming measures), and bioretention cells/ gardens.

The majority of bioretention facilities are usually composed of some or all of the elements listed above.

These GI assets represent a significant investment in Vancouver's rainwater management network; however, like many municipalities across North America, the City of Vancouver lacks a formal maintenance framework for its GI assets, leaving some uncertainty as to how they will be maintained.

GI Maintenance

In 2017, the City of Vancouver conducted a comprehensive field evaluation of its existing bioretention practices and found that over half of all GI assets were largely underperforming due to a lack of regular maintenance and outdated design standards.[13] Other local municipalities are producing similar findings when examining their GI programs. Research in the Pacific Northwest region suggests that GI that does not receive adequate and routine maintenance risks failure, including flooding and pollutant accumulation.[14] Just like grey infrastructure, adequate O&M of the City's GI assets is critical to their long-term success and performance. GI provides important water management solutions and therefore must be treated and maintained as part of our rainwater infrastructure. Assets that are not adequately maintained risk compromised functionality, which can result in economic and health impacts, including flooding and pollution to our waterways. Assets that are not adequately maintained also risk the following: spread of urban invasive species, rodents, issues with traffic safety and sightline obstructions, and most importantly the possibility for the public to dismiss these practices as a viable solution due to their diminished aesthetics and lack of 'cues to care'. Providing adequate funding for operating and maintaining GI promises to extend their level of service and protect the City's investment in rainwater infrastructure.

Maintenance Tasks

O&M programs for GI must take into account how maintenance tasks vary from other infrastructure asset types.[15] Frequency and costs of GI maintenance can differ greatly due to factors including asset type, scale of project, project location, proximity to pollution, sedimentation, and plant material.[16] In urban areas, like Vancouver, GI may be exposed to challenging environmental conditions, including intense rainfall, temperature extremes, pollution, road salt applications, trash and debris accumulation, heavy sedimentation and an aggressive weedy plant community.[17] As a result GI can require more frequent —but not necessarily more costly—maintenance than grey infrastructure, requiring additional labour for optimal performance.

The following section describes typical maintenance tasks for GI facilities found along Vancouver streets and in Vancouver's public spaces.[18]

BIORETENTION

Action	Frequency
Remove weeds and invasive species	Monthly
Irrigate	Only during extreme drought, once established
Mulch	Annually
Remove trash and debris (including leaf litter) from the inlets, catch basins	Monthly
Remove accumulated sediment	As needed (annually)
Prune	Quarterly

STORMWATER TREE TRENCHES

Action	Frequency
Inspect inlets, outlets and clean outs	2 times a year
Remove trash, sediment and debris	Quarterly to annually
Vacuum clean inlets and pretreatments structures	As needed
Apply mulch and prune trees	Annually

PERMEABLE PAVEMENT

Action	Frequency
Require vacuuming or dry sweeping once a year to prevent surface clogging	1 to 2 times a year
Remove leaf litter to prevent ponding and surface clogging	As needed
Manage vegetation encroachment and weeds to prevent large root systems from damaging subsurface structural components and weeds to reduce impacts to pervious pavement	As needed
Replace paver pore space with aggregate loss	As needed
Inspection	At least once a year

INFILTRATION TRENCH

Action	Frequency
Inspect inlets, outlets and clean outs	2 times a year
Remove trash, sediment and debris	Quarterly to annually
Vacuum clean inlets and pretreatments structures	As needed
Apply mulch and prune trees	Annually

OPERATIONS AND MAINTENANCE (O&M) FRAMEWORK

image: City of Vancouver

Over the course of the study period, 29 municipal and non-profit GI experts were interviewed to discuss the state of their GI O&M programs (see Appendix A for complete list of interviews). Interviews were conducted with municipalities and other organizations across North America who are engaged in the development or management of an alternative maintenance framework for GI. Local municipalities in the Pacific Northwest were also contacted to discuss existing and planned GI O&M programs. The following sections document the result of the phone interviews.

GI is an emerging approach to rainwater management; therefore, many municipalities surveyed are in the early stages of developing their GI O&M programs. As a result, many municipalities reported that maintenance costs were unknown; crew sizes and responsibilities were in flux; and maintenance responsibilities and agreements across departments are still to be determined. In addition, several municipalities with GI assets noted that their assets have not transitioned to a long-term maintenance plan.

Bioretention GI was the most common GI asset used across the municipalities, therefore many municipal alternative GI O&M strategies were focused on how to maintain their most ubiquitous asset. As a result, this paper focuses primarily on the O&M of vegetated GI; however, it documents maintenance practices of other, non-vegetated GI practices.

The following section builds on the research of others in the field, documenting short-term and long-term O&M models used throughout North America, while also identifying and detailing an emerging category for GI maintenance: alternative maintenance strategies.[19]

The O&M frameworks of the surveyed municipalities included a combination of one or more of the following maintenance models.

Establishment Warranty Period

Like other vegetated practices, an establishment/warranty period follows the installation of most GI practices. The warranty/establishment period is typically a contractually-obligated period where the contractor responsible for installation is also responsible for maintenance of the GI, for a predetermined length of time. The vegetated system is not fully functional until the establishment period is complete; therefore, this period is part of the construction/ installation process and is paid for through capital funding. The establishment period can also be undertaken by the municipality where contractor agreements are not developed or to extend the establishment/warranty period provided by the contractor.

Maintenance for vegetated GI practices should begin immediately following installation to ensure adequate care is provided while the root systems establish.[20] Establishment maintenance reduces the failure rate of vegetation and reduces future maintenance activities, which are associated with improper plant establishment. Establishment period maintenance activities typically include maintaining, watering, repairing, and/or replacing vegetation; structural or functional repairs; and the general maintenance of the facility as outlined by the municipality.[21]

Table 2 provides a list of establishment periods for municipalities in the Pacific Northwest and other surveyed municipalities across North America.

TABLE 2: ESTABLISHMENT PERIODS

Municipality	Establishment and warranty period
Kansas City, Missouri	3-year establishment; 2-year warranty for plants
Portland, Oregon	2-year establishment
Seattle, Washington	3-year establishment
San Francisco, California	6-month establishment (began as 2 year and then reduced to 6 months)
Philadelphia, Pennsylvania	8-week establishment; 1-year warranty for plants
Montgomery County, Maryland	no establishment maintenance period; 1-year warranty for plants
New York City, New York	3-year establishment and warranty for plants
Columbus, Ohio	2-year establishment
Tacoma, Washington	1 year establishment
North Vancouver	2-year establishment
Vancouver	2-year establishment and warranty for plants
Victoria	1 to 3-year establishment (each bioretention facility's establishment period is negotiated individually by city staff)
Surrey	1-year establishment
Township of Langley	1-year establishment
Delta	None, bioretention gardens are installed in Fall to minimize watering requirements. Newly planted gardens receive same maintenance schedule as existing planted areas.

ESTABLISHMENT PERIOD LENGTH

The majority of surveyed municipalities have establishment periods of two years, however many municipalities noted increased periods of drought and increased temperatures, which extended the length required for their establishment period. Some city staff indicated that they are exploring a longer establishment period to allow plants to form a deeper root system, which will enhance their resiliency in the face of climate change.[22] The City of Seattle noted that they are considering a five-year establishment period because well-draining soils (with 60% sand component) selected for their facilities pose challenges to establishing healthy vegetation.[23]

LACK OF STAFF RESOURCES AND/OR NEGOTIATING POWER HAVE LED TO SHORTER ESTABLISHMENT PERIODS

Cities that used an establishment period of less than two years often did so because of a lack of staff resources to manage contracts or due to a lack of negotiating power with the property developer.[24] Some cities noted that the establishment period negotiated with the property developer or contractor was not suitable for plant establishment; therefore, the city continued establishment maintenance after the handover of maintenance responsibilities.[25]

Long-term Maintenance

Following the establishment period, a long-term O&M program is required. Continued and on-going maintenance for vegetated GI is required to ensure the city's assets are protected against risks of failure.

All the municipalities surveyed used a combination of one or more of these maintenance models to care for their GI assets. The following section describes the typical municipal approach to GI maintenance.

ANOTHER CITY DEPARTMENT PERFORMS MAINTENANCE WORK (E.G. CITY'S PARKS DEPARTMENT, STREETS, SEWERS)

In this model, the department responsible for the GI program provides maintenance oversight, while another city department performs the maintenance activities, often as part of an agreement with the GI branch.

This is the most common method of maintenance model among surveyed municipalities and is often the result of a newly established GI program, where maintenance responsibilities are still being defined, or is the model used in municipalities that have a small number of GI assets, which do not warrant a specialized crew. Using this model, GI branches will establish agreements with other departments in the city to act as the maintenance provider to serve in the maintenance role they are most familiar with as these departments often have established maintenance protocols and the skilled staff required to maintain GI practices.[26] For example, prior to the formation of the GI branch within the City of Vancouver, responsibilities and oversight of GI were distributed between branches. With the formation of the GI branch, oversight and management of the City's GI program now lies within the branch, however maintenance activities remain distributed across various departments, including Street Activities, the Park Board, Streets and Sewers.

A disadvantage of this model is that crews often do not have a specialized knowledge of GI maintenance tasks. As GI programs within cities expand in size and new projects are built, additional maintenance responsibilities are often downloaded to crews who do not have the capacity to take on additional work. In addition, this model often results in multiple departments being responsible for maintaining various parts of the GI asset, which can create challenges for coordination of maintenance activities and asset inspections.

SPECIALIZED GI CITY-CREW PERFORMS MAINTENANCE WORK

In this model, a specialized, in-house crew provides maintenance for the municipality's GI assets and the department responsible for the planning and implementation of the city's GI program provides maintenance oversight.[27]

Specialized internal crews provide maintenance for city-owned GI assets, focusing on the care of vegetated bioretention gardens. This model appears to be an emerging trend for GI maintenance, as municipalities are discovering the care of these assets requires specialized skills, knowledge, and equipment.

The following municipalities have developed a specialized GI maintenance crew:

- The Township of Langley
- San Francisco
- Kansas City, MO
- City of New York
- Portland (in fiscal year 2020)

Challenges to employing this model include determining the asset ownership, coordination of equipment with other city departments and securing funding for this new, specialized maintenance model.

CONTRACTOR CARRIES OUT MAINTENANCE WORK WITH OVERSIGHT FROM DEPARTMENT RESPONSIBLE FOR GI PROGRAM

In this model, the city department responsible for the GI program serves as the administrative and oversight entity to a contractor crew, who performs maintenance tasks.

In response to the growing demand for GI O&M there is an emerging industry of landscape contractors that also specialize in GI. This demand for skilled and trained workers has also led to education and certification programs in GI, including the National Green Infrastructure Certification Program (NGICP), which provides entry-level training on the construction, inspection and maintenance of GI.[28]

Examples include:

» The City of Portland

» Montgomery County, MD

ADJACENT PROPERTY OWNERS

Several municipalities leverage municipal by-laws to put the responsibility of GI maintenance onto the adjacent property owner. These property standards were typically used to manage standard sidewalk sweeping and planter maintenance; however, with the growing use of GI adjacent property owners are increasingly caring for GI assets, including bioretention gardens and porous pavement.

Several municipalities have adjacent property owners maintain GI facilities:

» Seattle: street sweeping for porous pavement

» North Vancouver: light maintenance for bioretention areas in public areas, including trash and debris removal, light duty clearing.

» Township of Langley: maintenance of bioretention gardens

Alternative Service Delivery Model

To support the city's maintenance efforts, several municipalities have started to engage in alternative maintenance programs. An alternative maintenance framework represents a new approach to GI maintenance, supporting or replacing a traditional city/contractor maintenance program. Thirteen municipalities and non-profits with alternative programs were interviewed. These programs include the workforce development and community stewardship programs, which will be described in more detail in the next section.

COMMUNITY STEWARDSHIP

image: Maël Castellan

The community stewardship maintenance model consists of programs that offer the potential to educate and train residents, school groups or other community members in GI practices and maintenance. In this model the GI department will partner with non-profits, schools, and/or residents to perform GI maintenance. Community stewardship programs either replace or supplement a city's maintenance efforts. Municipalities with limited capacity and resources will leverage community stewardship programs to provide additional maintenance, shifting the responsibility of GI maintenance activities, such as trash and debris removal, pruning, and inspections to residents.[29] Other programs leverage the community stewardship model to educate residents on how GI practices work, communicate the benefits of GI, and build public support for these projects.[30]

Overcoming Barriers to GI Development

Research indicates that local acceptance of bioretention facilities is hindered by resident's lack of knowledge about the function and benefits of GI.[31] While some residents are aware of the functions of GI in their community, there is a general lack an understanding of their co-benefits.[32] Therefore several municipalities have identified that a major barrier to implementation is the lack of general knowledge and misconceptions about GI.[33]

Fostering public awareness of GI and associated benefits can help overcome this barrier and lead to increased support for future projects. Developing programs that are structured to provide residents with a basic understanding of how GI works and its associated co-benefits promise to address this barrier. Community stewardship programs offer the opportunity to educate the public on GI, building support for these practices, while providing maintenance activities for the municipality.

A recent study by Everett et. al (2018), which examined Portland residents' perceptions of local bioretention gardens, discovered that many residents wanted more frequent maintenance for local GI than what was provided through the City's quarterly maintenance schedule.[34] As a result, several residents sought some control over maintenance, to help make these facilities more aesthetically pleasing.[35]

Volunteer Risks and Liability

Liability concerns are often raised in the management of volunteer programs, especially when residents conduct maintenance and/or routine inspections.[36] Risks for volunteers contributing to bioretention maintenance include: working in high traffic areas, coming in contact with contaminated sediments and soils, exposure to bio-hazardous trash and debris (including needles), and digging near utilities. Municipalities interested in similar programs should consider working with their risk management office or other appropriate departments before administering such a program.[37]

Portland and San Francisco have helped to mitigate these risks and liability through comprehensive volunteer training. For example, Portland provides maintenance guides on how to safely handle and dispose of sediment and debris through online videos, San Francisco provides volunteer training on how to safely work near busy streets.

Community Stewardship Interviews

To determine municipalities engaged in GI stewardship programs a scan of municipalities was conducted. Through a combination of an online review of local municipal websites, stakeholder interviews and literature reviews, a total of seven people who participated in six community stewardship programs were identified and interviewed. Participants


image: Deborah Jones

included city staff, non-profit partners and/or volunteers who help administer GI stewardship programs. Of the municipalities surveyed, three main models of community stewardship were identified:

» Volunteer stewardship programs

» School engagement/maintenance

» Residential design programs and other supporting programs

Key findings from stakeholder interviews are described below.

Volunteer Stewardship Programs

Volunteer stewardship programs engage with residents, businesses, and other volunteer groups to assist with the maintenance of city-owned bioretention gardens.

The adopt-a program model is common in municipalities across North America and is frequently used to maintain catch basins and gardens along city streets. An emerging trend is for municipalities to leverage this model to provide GI maintenance for city-owned assets. Through the program, volunteers will sponsor one or more of a city-owned GI facility. The following GI sponsorship programs were identified:

» Vancouver, Green Streets

» Delta, Adopt-a-Rain-Garden

» Portland, Green Streets Stewards

» San Francisco, Rain Guardians

» Washtenaw County, Ann Arbor, Rain Garden Stewards

» New York City, Green Streets Community Maintenance

Interviews were conducted to gain insight into the opportunities and challenges associated with GI volunteer sponsorship programs. Detailed case studies of each program are

listed in Appendix B. Key findings from interviews are described below.

PROGRAM STRUCTURE AND VOLUNTEER RESPONSIBILITIES

Many municipalities limited volunteer responsibilities in their bioretention sponsorship programs to maintain control over city-owned infrastructure. For example, Portland, San Francisco and New York limit maintenance responsibilities of city residents and continue on-going city maintenance for sponsored bioretention gardens. Sponsored gardens still receive maintenance visits by city crews; however, sponsored gardens often require less time and care. This model, where the city maintains responsibility for the maintenance of bioretention gardens, allows for the city to retain control over the infrastructure assets and perform skilled maintenance duties, ensuring their functionality.

The majority of municipal programs surveyed included only bioretention gardens in their scope. Vancouver's Green Streets program was the only program that included both bioretention gardens and non-bioretention gardens as 'adoptable' assets. While many municipalities included a wide range of asset categories in their "adopt-a" programs (including catch basins, baseball diamonds, rivers, etc.), no programs were identified that included sponsorship programs for non-vegetated GI (e.g. stormwater tree trenches, or porous pavement).

Programs where bioretention gardens still receive city-maintenance visits, encourage volunteers with a variety of commitment levels. This maintenance structure also allows for volunteer support at various levels. Because city crews still conduct maintenance visits, the city does not require a minimum number of volunteer's hours to participate in the program, allowing everyone from the casual volunteer to the dedicated gardener to care for bioretention gardens in their neighbourhood. This model reduced the responsibility of the volunteer and lowers the barrier to entry, encouraging more volunteer participation.

Interviewed municipalities engaged residents in a variety of maintenance tasks. The following chart illustrates the various responsibilities that each municipality gives to their volunteer base. Some municipalities, like Delta, require volunteers to commit to performing on-going

TABLE 3: VOLUNTEER STEWARDSHIP - MAINTENANCE RESPONSIBILITIES

Volunteer Responsibilities	Portland (establishment maintenance)	Portland (post establishment maintenance)	Vancouver	San Francisco	NYC	Delta	Washtenaw County/ Ann Arbor
trash and debris removal	x	x	x	x	x	x	x
sediment removal	x	x	x		x	x	x
clear top of overflow drain	x	x	x		x	x	x
watering	x	x	x		x	x	x
weed removal		x	x			x	x
trimming/ pruning			x			x	x
additional planting		x	x			x	x

maintenance tasks, while other municipalities (e.g. Portland and San Francisco) do not require a minimum level of commitment.

Volunteer training is important to ensure volunteers know how to adequately perform maintenance tasks. For example, Portland provides optional one-on-one training to new volunteers and San Francisco created online videos and volunteer program brochures (available in three languages – English, Spanish and Chinese) to communicate volunteer responsibilities and make the program accessible to the City's diverse resident population.

VOLUNTEER SUPPORT AND ENGAGEMENT

Other city-led sustainability programs and public meetings present an opportunity for volunteer recruitment. Portland has engaged its business community through the City's sustainability certification process, and its residential community through neighbourhood design meetings. Engagement in the design phase is an opportunity to teach residents about the benefits of GI and can create a sense of ownership, leading to engagement in community stewardship programs.[38]

Volunteer support and appreciation is essential to a successful program. Creating a network of engaged community gardeners can be fostered through volunteer appreciation events and awards. For example, the City of Vancouver hosts an annual Green Streets Garden Party, where the City celebrates the achievements of Green Streets volunteers.

Large volunteer stewardship programs can result in increasing administrative and volunteer management duties. To manage the administration responsibilities of the program, the City of Portland has two dedicated full-time staff. To reduce the administrative duties of their program, the City of San Francisco has developed an online portal to manage volunteer sign-up.

Many municipalities reported that complex planting palettes increase maintenance tasks and can make it more difficult for volunteers to identify weeds. Some municipalities found that a simple planting palette allows volunteers to more clearly identify weeds for removal.[39]

Many volunteers are keen to plant in their bioretention gardens. While some programs do not allow for planting in bioretention gardens almost all municipalities received requests from volunteers to plant in their sponsored facility. Planting also helps to create a sense of ownership and enhance the biodiversity and aesthetics of the bioretention garden. Some municipalities noted that planting was not currently included or limited in their volunteer program because there was a lack of staff capacity to provide adequate training to volunteers.[40] Volunteers who plant in city bioretention facilities should be supported with the proper training, which includes training on plant selection (e.g. avoiding annuals, edibles, and invasive species) and plant placement.

Volunteer sponsorship programs require a time commitment that not all volunteers or organizations are willing/able to meet. Offering a range of volunteer programs can help overcome this barrier to participation, allowing everyone from the casual participant to the dedicated gardener to become involved in GI stewardship. For example, Washtenaw County supports its volunteer sponsorship program with private group and public workday events, where groups of volunteers will perform maintenance activities over a two to three hour period. Alternatively, residents who can commit more time to stewardship activities can participate in volunteer sponsorships programs.

School Engagement Program

School engagement programs include students, teachers and parents in the maintenance of GI facilities on schoolyards, or on city-owned property, near schools. Through the program, municipalities will work directly with schools or through a local non-profit organization to maintain GI. The following programs with school engagement were identified:

» Delta, Rain Gardeners Classroom Program

» Washtenaw County, School Program

» New York City, Gowanus Canal Conservancy (GCC) School Program

Interviews were conducted to gain insight into the opportunities and challenges associated with GI school engagement programs. Key findings from interviews are described below.

Successful programs with high participation connect GI program to school curriculum. For example, the GCC has high participation in the organization's service learning because the GCC matched the service-learning program to the school's learning objectives. Schools in New York have an annual requirement for learning objectives, part of which can be met through participating in the GCC's service-learning program. As a result, the GCC does not have to advertise their program; rather teachers seek it out.

School curriculum developed in partnership with teachers helps to ensure the lesson plans are connected to required learning objectives and that they are used. To support their program, the GCC provided teachers with a stipend to help develop a relevant and appropriate lesson plan. A school maintenance program requires ongoing engagement to maintain interest in GI stewardship. New students need to be educated about the function of the GI. Supporting schools with lesson plans and resources can help tell this story.

Program for participants ages 10 to 14 engages kids and their parents in stewardship activities. Through experience, the GCC found that creating school curriculum for children ages 10 to 14 was the most effective strategy for engagement. Students in this age where most interested in learning about GI practices. Targeting this age group also increased adult engagement in GI, as students and their parents would often co-participate in volunteer days for GI stewardship.

Design and planting is an important engagement tool in environmental stewardship. Including school community members in planting design and/or planting days help create a sense of ownership and encourages students and parents to participate in ongoing care for GI. For example, the City of Delta received the highest level of community engagement in the years immediately following the construction of the bioretention gardens near school property. However, after students who participated in the planting of the bioretention gardens graduated from the school, participation in maintenance activities dropped off.

Non-profit organizations are often key partners in delivering school programs. For example, Delta engages with partner volunteer organizations, the Cougar Creek Streamkeepers, to administer the City's school program. They played an essential role in the engagement of school community members, organizing volunteers and presenting to the classroom the importance of GI. An effective school maintenance program requires continued engagement, and partnering with a local non-profit can help manage this engagement work.

Volunteer school maintenance programs require support from many different actors, including the school district, school principal, school maintenance crews, teachers, the city and local volunteers. Before the implementation of the school program, the City of Delta met with the school stakeholders to receive support for the program. Outlining

the roles and responsibilities of the bioretention garden is important. School maintenance can promote meaningful engagement but requires additional maintenance support. A summer maintenance plan should be identified to ensure the garden is cared for while the school is closed.

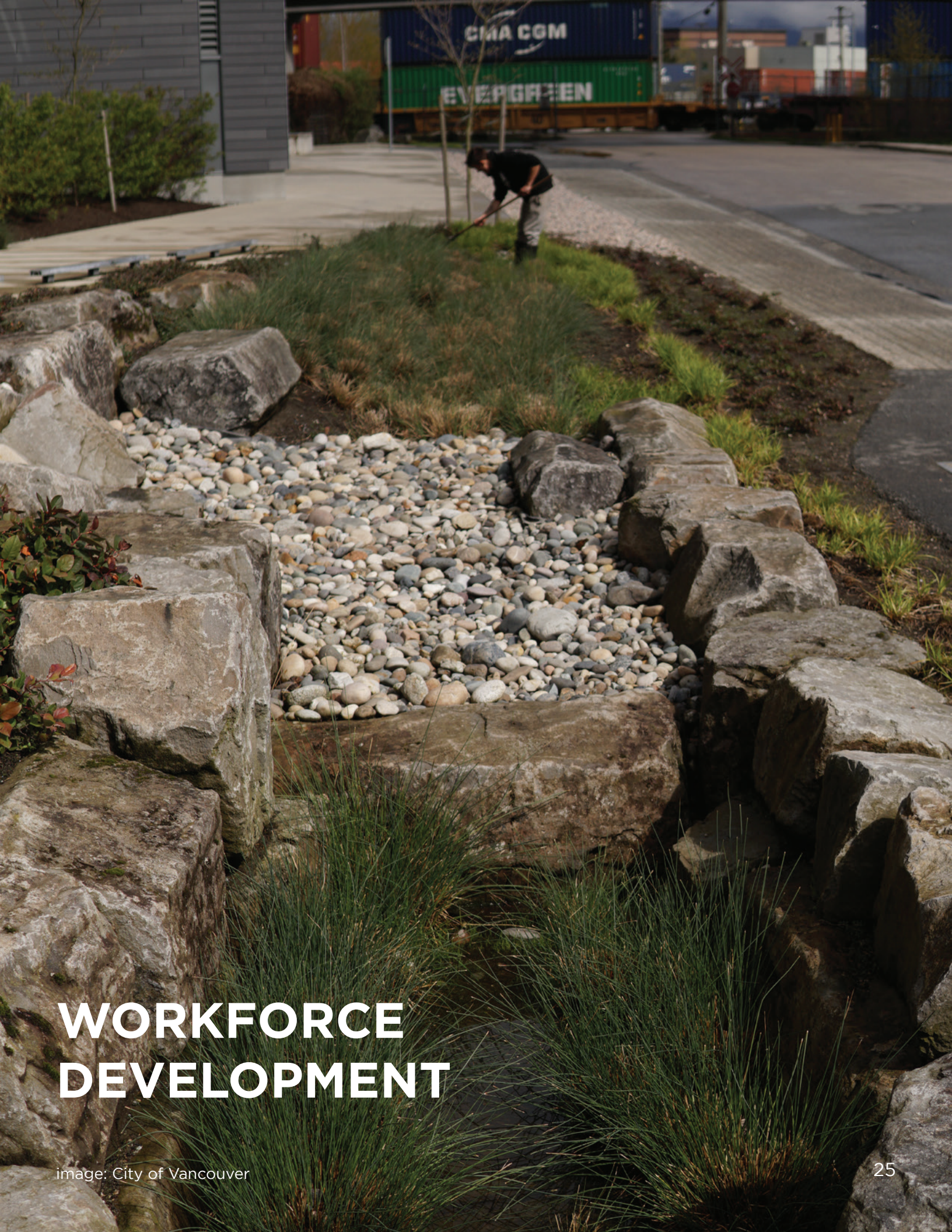
Residential Design Programs

During a phone interview with the County of Washtenaw, the County discussed how their residential bioretention design program, (where the municipality helps residents with the design and construction of a bioretention garden on private property), ultimately supports the City's publicly-owned GI program.

Key findings from the interview are described below.

A private program compliments a public GI program. Residents who designed their own GI learned how they worked and saw their effectiveness firsthand. Residents who built their own bioretention garden became the biggest advocates for GI in public meetings, helping to support the public program.

Engaging in multiple stewardship programs can create positive spillover effects, which help to support a public GI program. The County of Washtenaw and the Gowanus Canal Conservancy leverage several public GI programs to educate residents about the positive benefits of GI. These programs engage community members, creating a network of residents who advocate and care for GI in their community.



WORKFORCE DEVELOPMENT

image: City of Vancouver

In this model, the city's GI department provides administrative and oversight duties while a non-profit partner, branch of the city (or other agency) or social enterprise manages the maintenance crew. This model is unique in that it provides social and equity benefits, training people who experience barriers to employment to perform GI maintenance. Municipalities and jurisdictions work internally, or with external partners to identify candidates, deliver soft skills and work readiness training and provide technical training and ongoing social support services.[41]

GI Workforce Development Programs focus on the creation of green jobs for under-employed, hard-to-employ and/or vulnerable populations. These programs often have low barriers to entry and have targeted hires, for example people experiencing homelessness, at-risk youth, minority groups, etc.

Several municipalities have identified GI O&M work as the ideal candidate for workforce development programs.[42] GI O&M offers an important opportunity to hire and train the under-employed and disadvantaged groups and support the work done by city crews. This work also provides an opportunity for the creation of a workforce development program because:

» Low barriers to entry this type of work typically does not require extensive or expensive training.

» Provide a decent wage: jobs in this field frequently pay a living wage and may create career pathways to union employment.

» GI O&M is an emerging field: it represents a new type of work that requires a new talent pool of workers. The growing field also presents opportunities for career advancement.

» GI O&M compliments work done by city union works: low skilled work is often outside the purview of existing city crews, where the non-mechanized labor supports the efforts of the city staff.[43]

In addition, workforce development programs also can help create a more diverse workforce, identifying talent in places that may have not traditionally attracted much attention.[44]

Program Training & Support

Training and support services help prepare under-employed, hard-to-employ and/or vulnerable populations for current and future employment. The workforce entity provides training and support in one or more of the following areas:

SOFT SKILLS

Soft skills training focuses on developing skills that prepare participants to enter the world of work. These skills include but are not limited to:[45]

» basic literacy skills (math, financial, English, writing, computer, oral presentation, basic communication skills)

» life skills, time and anger management, conflict resolution

» world of work skills, including interview skills and work ethic, and

» diversity and sexual harassment training.

HARD SKILLS

Hard skills training provides program participants with hands on training to develop skills and knowledge required on the job.[46] Hard training skills should be coordinated with the city, union and other potential future employers to ensure program graduates acquire the necessary skills for employment.

HIGH SCHOOL EQUIVALENCY

High school requirements may present a significant barrier to future employment. Workforce development programs may include an option for participants to receive high

school equivalency to provide them with the skills and requirements needed.

WRAP-AROUND SUPPORT SERVICES

Wrap-around or human support services are comprehensive case management services provided by trained counselors or social workers.[47] These services are essential for helping program participants overcome barriers to employment. Through workforce development programs, counselors and/or social workers work individually with participants to ease their transition to employment by providing support services such as child care, transportation, housing, and mental health services.[48]

Program Structure

There are several program structures for leveraging workforce development programs within a municipal environment. Program structures for GI workforce development programs may include a combination of one or more of the following.

INTERNALLY MANAGED PROGRAM

In this model, the city develops and manages an internal workforce development program. The department responsible for managing the workforce development program is typically separate from the GI implementation team. In this case, the workforce development department hires and trains employees to perform work within the city. Program managers, program support staff (including case managers and councillors) and crew members are all city staff.

Examples of this model include: Seattle Conservation Corps.

EXTERNALLY MANAGED PROGRAM: REQUEST FOR QUALIFICATIONS/ PROPOSAL (RFQ/P)

In this model the city who seeks to create a workforce development program will send out an RFQ/P for a local non-profit organization to provide administration. Through the program the local non-profit will manage, hire and train a crew to perform GI maintenance. The city will often work with the selected non-profit partner to develop the work plan and measure outcomes.

The GI implementation team will manage the city's GI maintenance program and will perform oversight of the maintenance activities completed.

Examples of this model include: Kansas City, MO, Green Stewards

EXTERNALLY MANAGED PROGRAM: GRANT

In this model, the city (or other agency) identifies a non-profit partner to manage and administer the workforce development program. The city will provide the non-profit organization with a grant to support workforce development training and provide city maintenance work.

Examples of this model include: Philadelphia's PowerCorpsPHL, Vancouver's Street Cleaning Grant Program (a non-GI program)

SOCIAL PROCUREMENT

In this model the city, often through a social procurement policy, will hire an existing social enterprise organization to perform maintenance activities. Select municipalities will leverage their city-spending to support businesses that promote social value and improve economic value. This program structure is similar to the externally managed program; however the city hires an established business with a workforce development component; and therefore has less control over the structure of the program. Examples of this model include: Verde, Portland

Workforce Development Interviews

While there is much research documenting the potential social and economic benefits of a GI workforce development program, relatively few cities/regions have implemented such programs. The majority of examples appear in the United States, where federal oversight bodies mandate GI maintenance for individual cities/regions.

Over the course of this research eight people who participate in six workforce development programs were interviewed. Participants included people managing the workforce development program, people managing the city's GI department, non-profit partners and people in the private sector.

The following programs with GI workforce development were identified:

- Vancouver Street Cleaning Grant Program (a non-GI workforce development program)
- Seattle Conservation Corps
- Kansas City, Missouri, Green Stewards
- Philadelphia PowerCorpsPHL
- Verde Landscapes, Portland
- Nikibii Dawadinna Giigwag, TRCA, Toronto

Detailed case studies of each program are listed in Appendix C. Key findings from stakeholder interviews are described below.

PROGRAM STRUCTURE

Internally run, city programs provide applicants with in demand work experience, creating sought after employees entering the job market. For example, the Seattle Conservation Corps Program Manager could not overstate the impact of having the City listed as a year-long employer on a resume in creating employment opportunities for graduates. As a City employee, Corps members have access to municipal training opportunities, including the City's training portal, and receive paid training in areas from Excel to conflict resolution.

Internally run programs provide applicants with access to high quality technical training. Training provides program applicants with technical skills that help them prepare for future careers with the city or other city contractors. Some externally run programs partner with the city to provide technical training to program participants in order to overcome this barrier.[49]

An external partner can help bring capacity and skills not available in the city. Many municipalities partnered with a non-profit organization to leverage workforce development training capacity that was not available in house. For example, the Kansas City Water Department did not have the capacity to develop a workforce development program for people facing employment barriers. Partnering with a non-profit allowed the City to leverage capacity, experience and knowledge in the non-profit sector to manage this program externally.

Oversight of GI crews working on city-owned projects was seen as an important factor for many municipalities. External programs do not have direct oversight of employees, which some program managers discussed as a disadvantage of the externally run program model.

PROGRAM FUNDING/SUPPORT

Workforce development programs need the support and championship from the city's leaders. The majority of programs interviewed were born out of initiatives from the Mayor's office or were a part of a federally mandated combined sewer overflow control plan.

Program funding was frequently earmarked as part of a larger grey/GI plan. Several successful programs received consistent and dedicated funding for administration. In addition, several non-profit organizations discussed inconsistent or short-term funding as a significant barrier to program development.[50] Providing long-term and consistent funding to workforce development programs allows program managers to invest in training programs.

Collaboration and support from all program stakeholders is essential to long-term success. Interviewees stressed the importance of working across departments and organizations for the program development. This includes establishing ties with non-profit partners, unions and industry leaders to develop the program structure, training curriculum and to identify pathways to long-term employment.

HIRING PROCESS

To ensure low barriers to employment some municipalities maintain minimal requirements for hiring. For example, the Seattle Conservation Corps only requires applicants to provide an appropriate ID for employment and verify that they are members of target-hire population (i.e. adults experiencing homelessness).

Some organizations provided hiring support to help applicants overcome barriers to employment. Recognizing formal interviews and resumes can be barriers to employment, some programs provide resume support to assist program applicants in navigating the hiring process.[51]

EMPLOYMENT SUPPORT

Many programs provide high school equivalency training to help program participants overcome barriers to future employment. For example, the NGICP certification requires a high school diploma or equivalent and completion of a GI training course. Participants without a high school diploma or equivalent may experience employment barriers in their future careers as many skilled positions and training in GI require these credentials.

Flexible employment and schedules are imperative to help program participants. A significant barrier to traditional employment for many people is an inflexible nine to five work schedule. Crew members should be provided the flexibility needed to maintain employment.

Several successful programs provided work to multiple city departments, including the GI department. Completing work for multiple departments allows for a larger workforce development program, helping to achieve economies of scale in providing soft skills development and wrap-around services.[52]

Few programs provide comprehensive wraparound services; however, programs with these supports have the highest success rate. For example, the Seattle Conservation Corps, which provides case management support for its crew members, has a high rate of post program success. On an annual basis, about 65% of the people who enter the program successfully finish, 80% leave with secure stable housing, 10% are hired by the City, and 90% of the people who complete the program find long-term employment that pays a living wage with benefits.[53]

GI TRAINING / MAINTENANCE WORK

All surveyed programs had internal crews, which supported their GI workforce development crews. Internal city crews often performed underdrain maintenance and/or provided inspection.

GI workforce development crews specialized in bioretention maintenance. Maintenance for other GI projects, including permeable pavement and stormwater tree trenches remained under the purview of city crews. Some workforce development crews performed establishment maintenance for stormwater tree trenches, including trash and debris removal and watering.

Some municipalities discussed experiencing a challenge in structuring their work to include more than just trash and debris removal. The Seattle Conservation Corps discussed overcoming this barrier through a robust training program with a skilled crew lead. For example, Corps members are trained under the supervision of an experienced horticulturist and landscape architect, who teaches members about horticulture, ecology, landscape design and rainwater management. The passion from the senior supervisor translates to the Corps members, who are trained and encouraged to explore careers in GI upon program completion.

CAREER PATHWAYS

Many GI workforce development programs are still in their early stages of development; therefore, few organizations are reporting statistics regarding program successes.

Partnerships with city departments create well-defined career paths into city employment. For example, the Seattle Conservation Corps and PowerCorpsPHL have developed close partnerships with City departments, which have led to long-term employment for program participants into the City. 10% of Corps members are hired by the City and between 2013 and 2017, 16 PowerCorps alumni were employed in permanent or trainee positions within the Philadelphia Water department.[54]

Programs must understand the job market and tailor training to emerging markets and in demand jobs. PowerCorpsPHL tailored work programs and training to emerging markets. For example, in response to an emerging market and job opportunities for solar energy, PowerCorpsPHL developed a track for solar and electrical energy.

Alternative O&M Program Staffing Structure

Municipality	# of Bioretention assets	Traditional Maintenance Framework			Alternative Maintenance Framework		
		Type	Size	Staffing Structure	Type	Size	Supporting Staff
Kansas City, Missouri	22 ha (total footprint of all GI. 4.5 ha of GI is maintained by Green Stewards workforce development program	Internal Green Infrastructure Crew (Water Department)	8	6 positions are housed within the Stormwater Maintenance Division, which include 2 landscape technicians and 4 equipment operators. Coordination occurs with project managers and landscape architect and landscape technician, who are responsible for oversight of green infrastructure maintenance of selected sites.	Workforce Development	5-6 workforce development trainees	1 full time Program Manager (from non-profit) 1 field manager (from non-profit) Oversight from City program manager
Seattle, Washington	3.3 ha	Internal Crew	unknown	1 full time city employee from the SPU (with the support of two temporary workers) oversees management of maintenance program.	Workforce Development	11 workforce development trainees	1 senior crew supervisor 2 supervisors supported by larger SCC human services support team
Philadelphia, Pennsylvania	Approximately 800 GI assets (not exclusively bioretention), approximately 300 are maintained by the workforce development crew.	Internal Crew	unknown	There are approximately 12 city staff people that are tied to administrative maintenance efforts, including inspection, one is oversight of the PowerCorps maintenance.	Workforce Development	4-8 crew members who specialize in GI maintenance, which includes 1 foreman, 1 assistance, and 2-6 maintenance techs	1 PWD PowerCorps Contract Manager, 1 PWD Maintenance group manager to oversee PowerCorps maintenance efforts, 1 PowerCorps crew supervisor (foreman) to manage in-field maintenance efforts and complete PWD work orders. Supported by larger PowerCorpsPHL staff.
San Francisco, California	60	Internal Crew	3	The 3 team crew is housed in the waste water department and is responsible for GI maintenance. The crew will look after all GI and will coordinate with other crews to arrange for equipment (e.g. vac for subsurface drainage).	Community Stewardship	38 volunteers 38 gardens adopted	1 part-time program manager
Portland, Oregon	2315	Contracted crew	unknown	3 full time City employees manage contracted crew, including writing work for contractors, and conduct ing maintenance inspections.	Community Stewardship	221 volunteer gardeners take care of 522 gardens	1 full time Program Coordinator 1 full time AmeriCorps member
Delta, British Columbia	40+	Internal Crew	unknown	1 full time City employee manages the maintenance of the City's bioretention assets.	Community Stewardship	6 volunteers and 1 local community group maintain 28 gardens	Program management supported by local community group
New York City, New York	4000	Internal Crew	103	To maintain the City's expanding GI network, the City developed the ROW GI Maintenance team. In 2018, consisted of 103 full time and seasonal people crew members who provide care for the City's GI assets.	Community Stewardship	in development	in development
Vancouver, British Columbia	140 (47 are available for sponsorship)	Internal Crew	from various departments	Maintenance of GI is overseen by various departments across the City, including , including Street Activities, the Park Board, Streets and Sewers	Community Stewardship	31 of 47 available bioretention gardens are sponsored	1 full-time staff member, supported by 1 temporary staff member manages garden and bioretention garden program

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RECOMMENDATIONS

image: City of Vancouver

RECOMMENDATIONS FOR COMMUNITY STEWARDSHIP PROGRAMS

Vancouver's very own Green Streets initiative serves as a successful example of a garden sponsorship model and can be leveraged to provide additional care for the City's bioretention assets. The implementation of a school engagement program and an expansion of the City's Green Streets program provides the City with the opportunity to educate the public on the benefits of GI and engage residents in the care of GI, helping to meet the City's strategic goals. These recommendations are based on the lessons learned from research, industry reports, and interviews with community stewardship stakeholders.

Elements of a Successful Program

Interviews with community stewardship stakeholders offered valuable lessons on program elements that contribute to a successful community stewardship program. The following were identified as elements of a successful community stewardship program.

COMMUNITY SPONSORSHIP

» City maintains responsibility for care of GI facility and performs quarterly maintenance and annual inspection.

» Program is tailored to encourage participation from a range of volunteers from the casual participant to the experienced gardener.

» Online portal provides streamlined volunteer management and communication.

» Community members and volunteers are provided opportunities to comment on GI design.

» Volunteer responsibilities are clearly defined and communicated through comprehensive training.

SCHOOL ENGAGEMENT

» Partner with the school district, teachers, and grounds crews to ensure internal support and engagement in the program.

» City supports the school with relevant lesson plans and provides on-going support to encourage continued school engagement.

» Leverage volunteer programs to develop a summer maintenance plan.

Recommendations for the City of Vancouver

1. AMEND GREEN STREETS PROGRAM TO INCLUDE QUARTERLY MAINTENANCE AND ANNUAL INSPECTION BY CITY CREWS FOR BIORETENTION FACILITIES.

The success of Vancouver's Green Streets program structure and volunteer network can be leveraged to assist in the care of the City's bioretention gardens; however, recognizing that GI requires additional care over and above typical landscape areas, maintenance of bioretention gardens will need to be supported by City crews. Bioretention facilities are functioning assets that need quarterly maintenance and annual inspections. Sponsorship programs that rely on volunteers to maintain these facilities themselves risk failure. Volunteers who sponsor GI sites should be supported by the City and/or contracted crews, who conduct regular maintenance.

2. ENGAGE RESIDENTS IN THE DESIGN PHASE TO SOLICIT FEEDBACK, EDUCATE THEM ON THE FACILITY, AND ENCOURAGE VOLUNTEERISM.

The City of Vancouver GI Branch is scheduled to rehabilitate 10-15 City-owned bioretention gardens on an annual basis. This work presents an opportunity for the City to engage residents in the planting design.

Following Portland's design engagement model, the City of Vancouver should leverage its bioretention rehabilitation project to engage with local residents and neighboring property owners. This would provide the City with an opportunity to engage the public about rainwater management goals, while giving community members a chance to share comments, voice concerns, and have a say in the ultimate look and feel of the finished landscape. This process can also help to expand the City's Green Streets program, engaging new residents in GI maintenance, who after participation in the design of the bioretention garden may be encouraged to continue and care for the new, rehabilitated facility in their neighbourhood.

3. EXPLORE OPPORTUNITIES FOR ONLINE MANAGEMENT SYSTEM, ALLOWING FOR MANUAL MANAGEMENT BY STAFF TO SUPPORT THOSE WITHOUT ACCESS TO COMPUTERS.

Managing a successful volunteer sponsorship program requires staff capacity. To reduce the administrative duties of the Vancouver Green Streets program, explore the creation of an online volunteer portal to manage participant enrollment, where volunteers can view bioretention gardens available for sponsorship. This will also ease access to sign-up or member cancellation, lessening the burden on the volunteer.

4. PARTNER WITH THE VANCOUVER SCHOOL BOARD TO DEVELOP SCHOOL COMMUNITY ENGAGEMENT PROGRAM FOR GI MAINTENANCE.

School programs that teach students about GI can help to foster an interest in urban ecological stewardship and lead to higher participation in volunteer programs, including maintenance activities. Developing a school program with the School District of Vancouver can tie curriculum requirements to GI maintenance.

Implementing or rehabilitating bioretention gardens near school sites presents an opportunity to engage school groups in the design, planting and maintenance of the GI asset, creating a sense of ownership over the garden. Such programs require support from many different actors, including the school district, school principal, school maintenance crews, teachers, the city and local volunteers. It also requires outlining the roles and

responsibilities of the bioretention garden's maintenance program.

School maintenance can promote meaningful engagement but requires additional maintenance support. A summer maintenance plan should be identified to ensure the garden is cared for while the school is closed.

Finally, a school maintenance program requires on-going engagement to maintain interest in GI stewardship. New students need to be educated about the function of the GI. Developing a supporting curriculum can help to serve this function.

5. DEVELOP CURRICULUM IN PARTNERSHIP WITH EDUCATORS, WHICH CAN BE USED TO TEACH CHILDREN ABOUT THE URBAN WATER CYCLE AND USE AS AN ENGAGEMENT TOOL FOR GI MAINTENANCE.

GI lesson plans fulfill the British Columbia BC Curriculum for Science Grade 2, which seeks to teach the 'big idea' that "water is essential to all living things, and cycles through the environment.[55]" GI provides the opportunity to fulfill BC Curriculum learning outcomes of Science Grade 2 and teach the basic elements of the water cycle through GI, including: water sources, and local watershed, water conservation and the water cycle.

The Vancouver Canucks, Fin's Friends offers a successful model on how to develop a lesson plans for BC teachers. The program, supported by the Vancouver Canucks, partnered with local educators and school districts to develop and introduce the education program, which teaches grades K to 3 about social responsibility. To incorporate the program into local schools, teachers are provided with a free curriculum guide paired with associated lesson plans, activities, and several teaching aids, free of cost.[56]

6. SUPPORT PUBLIC GI PROGRAM WITH A RESIDENTIAL PROGRAM TO INCREASE GI ON PRIVATE PROPERTY AND ENHANCE COMMUNITY ENGAGEMENT.

A residential program, which includes incentives and support for GI implementation can help support the goals of a public GI program. As illustrated by the County of Washtenaw, residents who were provided with GI design support and resources, created GI on their property, and saw the effectiveness of it firsthand. Residents who built their own rain garden became the biggest advocates for GI in public meetings, helping to support the public program.

RECOMMENDATIONS: FOR WORKFORCE DEVELOPMENT PROGRAMS

While the environmental benefits of GI and GI maintenance have been well documented, this new type of work also presents the opportunity to address local social and economic issues. GI workforce development programs deliver triple bottom line benefits, looking beyond rainwater management, and increasing economic opportunities to improve social conditions of disadvantaged groups.[57] These programs leverage public investment to assist people who experience barriers to employment, while providing them with training, supporting a transition to higher-skilled, higher-earning work.[58]

A GI workforce development program supports the following City of Vancouver Strategies:

» Resilience Strategy – Create a Capacity Building Action Plan and Non-profit Partnering Framework

» Healthy City Strategy – Making Ends Meet Along With a Target To Reduce Poverty

» Greenest City Action Plan – Supporting a Green Economy

Elements of a Successful Program

Interviews with workforce development stakeholders offered valuable lessons on program elements that contribute to their success. The following were identified as elements of a successful workforce development program.

» Funding is identified and maintenance costs are known.

» Candidates are recruited through non-traditional methods and/or are provided hiring support.

» Targeted population is identified and support services for this population group are developed to respond to needs of workers.

» Training and work experience are linked to existing or emerging job markets.

» Career pathways within the city are identified and trainees are connected to jobs in other city departments.

» The city administers training program or work closely with non-profit partner to a provide comprehensive training program, helping prepare participants for careers with the city or external contractors.

» Work training is supplemented with soft skills development and wrap-around services, including support for high-school equivalency.

» Workforce development program extends beyond one city department, helping to achieve economies of scale and providing multiple job placement opportunities.

» Engage multiple stakeholders in the process.

APPENDIX A: INTERVIEW LIST

Name	Title	Organization	Date
Ben Mulhall	Landscape Architect	City of Vancouver	May 9, 2019
Liz Nowatschin	Engineering Assistant III	City of Vancouver	May 9, 2019
Kim Buksa	Sustainability & Ethical Procurement Manager	City of Vancouver	May 15, 2019
Kristina Hausmanis	Project Manager, Green Streets	City of Toronto	May 15, 2019
Jen-Sion Tan	GIS Analyst	City of Toronto	May 15, 2019
Ruth Blaw	Program Manager	Seattle Conservation Corps	May 29, 2019
Sheila Boudreau	Senior Landscape Architect	TRCA	June 3, 2019
Lucia Piccinni	Project Manager	TRCA	June 3, 2019
Dave Matsubara	Design Engineer, Engineering Parks and Environment	City of North Vancouver	June 3, 2019
Drena Donofrio	SPU staff member	City of Seattle	June 4, 2019
Deborah Jones	Rain Gardens Coordinator	Cougar Creek Streamkeepers	June 5, 2019
Lisa Tresse	Senior Landscape Architect	City of Kansas City	June 5, 2019
Svetlana Pell	Green Street Steward Coordinator	City Portland	June 6, 2019
Amy Motzny	Watershed Manager	Gowanus Canal Conservancy	June 11, 2019
Polly Crocker	Utility Planning Division staff member	San Francisco Public Utilities Commission	June 13, 2019
Ken Parker	PUSH Blue Program Manager	PUSH Buffalo	June 13, 2019
Carlina Arango	Landscape Program Coordinator	Verde Landscape	June 17, 2019
Brianne Czypyha	Stormwater Management Specialist	City of Victoria	June 18, 2019
Marie Fechik-Kirk	Manager of Sustainability and Special Projects	Northeast Ohio Regional Sewer District	June 19, 2019
Julia Hillengas	Director of Strategic Innovation	PowerCorps Phildelphia	June 24, 2019
Susan Bryan	Rain Garden Coordinator	Washtenaw County Water Resources Commissioner's Office	June 25, 2019
Lisa Sasso	Project Manager	Milwaukee Metropolitan Sewerage District	July 2, 2019
Alex Warwood	Apprenticeship and Workforce Development Director	Philadelphia Water Department	July 3, 2019
Seth Charde	Green Infrastructure Manager	DC Water	July 10, 2019
Eric Fong	Superintendent, Trees, Trails, Horticulture and Natural Areas	Township of Langley	July 17, 2019
Harvey Takhar	Engineering Project Technologist	City of Delta	July 18, 2019
Wayne Chung	Project Engineer	City of Surrey	July 23, 2019
Jonathan McDermott	Manager, Solid Waste Programs	City of Vancouver	July 28, 2019

APPENDIX B: COMMUNITY STEWARDSHIP CASE STUDIES

VANCOUVER, BRITISH COLUMBIA

Green Streets

image: City of Vancouver

Volunteer Stewardship

maintenance framework

Bioretention

gi asset maintained

Street Activities, City of Vancouver

key players

trash and debris removal; re-grading; sediment removal; planting; weeding; pruning; fertilizing; watering

maintenance tasks performed

997

gardens available for sponsorship

607 / 61%

gardens maintained by volunteers

47

gi assets avilable for sponsorship

31 / 66%

gi assets maintained by volunteers

Vancouver's Green Streets program began in 1994 as a pilot project in the Mount Pleasant Neighbourhood after a group of residents asked City Hall if they could plant the network of traffic circles and corner bulges in their community. Following the success of the pilot project, the green streets program expanded to other areas of the City. Since then, Green Streets has grown and currently has over 500 gardeners planting and maintaining traffic circles and street corners across Vancouver.[59]

Prior to the development of the program, traffic circles and corner bulges were typically landscaped with low monocultures of juniper shrubs, minimizing maintenance for City crews, but providing little in the way of aesthetic or ecological contributions.[60] Through the Green Streets program, the City encourages local residents to sponsor traffic circles or corner bulges, to beautify their streets and provide year-round care for gardens in their neighbourhood. For a newly planted Green Streets Garden, the City will provide structural plants, including drought-tolerant varieties and evergreens for year-round cover and interest.[61] Gardeners are encouraged to add their own plants to increase local biodiversity and ornamental value. Gardeners also provide routine maintenance tasks, including weeding, pruning and trash removal. While the City enforces some practical rules regarding the height of plants for traffic safety, the gardener is given the autonomy to design and plant their garden as they wish[62].

[Include images of green streets garden]

Of the gardens cared for by Green Street volunteers, 31 are bioretention gardens and bulges, which have been managed and maintained as part of this program.[63] Similar to gardens that do not provide an engineered rainwater function, volunteers can sponsor a bioretention facility and provide maintenance activities. In 2018, a small pamphlet guide was introduced to Green Street gardeners on how to care for their GI asset. Gardeners who look after bioretention facilities provide the following maintenance activities: remove trash and debris, re-grade after a storm, sediment removal, planting, weeding, pruning and fertilizing.

The City of Vancouver supports Green Streets gardeners by providing a recommended plant list (including drought tolerant, easy-care species), a bi-monthly newsletter, and garden design expertise. The City also provides compost (supplied twice a year), hosts a bi-annual bulb pick up event, plant swap events and plant sales where plants are offered at cost.[64]

There are approximately 2,000 planted areas in the street right-of-way that are managed and maintained by the City of Vancouver, Street Activities Branch.[65] About half of these planted areas are along local roads and are available for sponsorship or are currently sponsored by a Green Streets volunteer. Gardens along arterial roads and other high traffic areas are not available for stewardship under the Green Street program. These gardens are maintained by the City of Vancouver Park Board or City-contracted landscape crews.

What makes this program a success

The Green Streets volunteer program serves as a successful model of how to leverage community capacity to provide a level of design and care outside the scope of City's design and maintenance program. Given the success of the program (60% of all available gardens sponsored), the managing department is not actively seeking additional uptake due limited staff capacity to manage and support volunteers.

The Green Streets program helps maintain roadway and GI, reducing the City's maintenance efforts, improving traffic safety, and increasing community engagement. The Green Streets volunteer network provides eyes on the street, helping to monitor the traffic safety of intersections, as volunteers frequently alert the City to plants that are impacting traffic sightlines. Allowing volunteer's autonomy over planting design has created

a network of beautiful gardens across the City, which enhances biodiversity, improves public space and reduces litter, encouraging neighbourhood pride and community engagement.

What made it work?

Green Streets gardeners are engaged and supported with volunteer appreciation events. The City of Vancouver has a high number of engaged community gardeners, which has helped to create a network of well-cared for Green Streets gardens throughout the City. The City supports these volunteers with the Green Streets coordinator, who provides material supports and hosts an annual Green Streets Garden Party, which highlights and celebrates the achievements of Green Streets volunteers.

Green Streets gardeners are encouraged to undertake planting design. Green Streets gardens have enhanced public space along the City's streets, providing well-cared for and aesthetically pleasing gardens. The City supports gardener's efforts by hosting plant swap events and providing access to garden design support. Allowing gardeners to undertake planting design has resulted in unique gardens across the City, provide more a visually interesting and diverse network of gardens than would have been provided through the City's standard landscaping plan for traffic circles and corner bulges.

Key takeaways

» Allowing volunteers to plant in sponsored gardens enhances public space and increases biodiversity and design novelty along city streets.

» Managing a successful volunteer garden sponsorship program requires staff capacity. Volunteer adoption programs should be structured to provide the funding that scales along with the success of the program. Expanding the number of gardens sponsored will require additional support from staff managing the program.

» GI maintenance requires more support and guidance than typical street gardens. Bioretention gardens require maintenance programs that provide GI planting recommendations, sediment removal, etc.

DELTA, BRITISH COLUMBIA

Rain Gardeners Classroom Program

Volunteer Stewardship
School Engagement

maintenance framework

Bioretention

gi asset maintained

Engineering Operations, City of Delta
Cougar Creek Streamkeepers
Delta School District

key players

trash and debris removal; sediment removal; weeding; pruning; mulching

maintenance tasks performed

28

gi assets avilable for sponsorship

28 / 100%

gi assets maintained by volunteers

To support the City's GI maintenance program the City of Delta engages local residents in the care of their bioretention through two streams: Adopt-a-Rain-Garden and the City's Rain Gardeners Class Programs.

ADOPT-A-RAIN-GARDEN

Through the City's Adopt-a-Rain-Garden maintenance program, individual residents and local groups can volunteer to care for one of Delta's 40 City-owned bioretention facilities.[66] The City's Engineering Department administers the program, including volunteer support and small supplies (e.g. gloves and litter bags). Volunteers participating in the program agree to provide year-round maintenance for these GI facilities, including trash and debris removal, weeding, pruning, etc.[67]

RAIN GARDENERS CLASSROOM PROGRAM

In addition to the volunteer program, the City of Delta manages a Rain Gardeners classroom program in partnership with a local volunteer group, the Cougar Creek Streamkeepers. Through the program, the collaborators design, install and maintain bioretention gardens at Delta's elementary schools.

Cougar Creek Streamkeepers is a local volunteer group dedicated to restoring and maintaining the health of Delta's natural waterways. The organization focuses on improving ecological habitat and water quality through a variety of projects, including streamside restoration, instream enhancements (weirs), salmon release, litter cleanup, invasive species removal and the installation and maintenance of bioretention gardens in the City of Delta.

In 2005, Cougar Creek Streamkeepers approached the City of Delta with a request to collaborate on a pilot rain garden project in Cougar Creek Watershed. Delta Engineering Dept suggested retrofitting the parking lot of Cougar Canyon Elementary School so that it would drain into a Delta-designed rain garden in the adjacent municipal boulevard. In 2006, the pilot rain garden was installed – with design, earthwork & infrastructure modifications by Delta, planting by Streamkeepers and students, and the help of a $12,300 grant from Pacific Salmon Foundation.

SCHOOL PROGRAM

After seeing the success of Cougar Canyon Elementary School Rain Garden and hearing positive feedback from the community, Delta Mayor and Council committed to installing a bioretention garden at every elementary school in the City. The same collaborative formula as above (Delta Engineering, Streamkeepers, Delta School District, Pacific Salmon Foundation) was replicated in these additional projects.[68]

Given the technical design and associated flood risks of the bioretention garden, the City of Delta maintained control over the engineered design component of the facility. However, to encourage engagement and help foster a sense of ownership in the community, the program included students in the plant selection and installation. Students and school community members participated in the development of the bioretention garden through shrubs and ground covers planting under the supervision of the Streamkeepers.[69]

13 years later, the City of Delta now has 28 school and community bioretention gardens. Bioretention gardens are located within the City right-of-way and on community property.[70]

ONGOING MAINTENANCE

Since the construction of the first bioretention facilities in 2006, the Cougar Creek Streamkeepers has participated in ongoing maintenance of these GI. Gardens on City property are owned by the municipality, but can be sponsored by residents or community groups, who perform ongoing maintenance tasks. Presently six gardens are maintained by volunteers, who sign up through the

City's Adopt-a-Rain-Garden.[71] The remaining bioretention gardens on school property that are not sponsored are maintained by the Cougar Creek Streamkeepers to ensure regular maintenance is provided, including during summer months.

SCHOOL MAINTENANCE

To encourage school participation in the maintenance of the gardens Delta staff has developed a complementary bioretention gardener curriculum for Grade 4 and 5 students. In addition, teachers at schools with bioretention gardens were given an instruction manual with activities and lessons that can be used to maintain the garden with the students in connection with the curriculum.

City of Delta and Streamkeepers originally envisaged that bioretention garden adopters would serve as "team captains", working with small or large groups of students to undertake ongoing maintenance. At a few schools, this model has worked successfully; at most schools, adopters have preferred to work on their own, outside of school hours.[72]

The Cougar Creek Streamkeepers note that interest in school maintenance has dropped off with some of the more established bioretention gardens. New facilities generate high engagement, as seeing construction and participating in planting helps to cultivate interest in maintenance activities. When students enter a school with an existing bioretention garden, there is less interest from the students, parents and teachers in providing maintenance. To overcome this barrier Streamkeepers has worked actively to engage school community members, including coordinating with teachers to conduct in-classroom presentations on rainwater management.[73]

EVOLUTION OF THE PROGRAM

Following the success of their partnership with Delta, the Cougar Creek Streamkeepers designed and constructed a number of bioretention gardens on community property not owned by the City. Locations include four local secondary schools, two churches and two highway mitigation sites adjacent to South Fraser Perimeter Road (Highway 17).[74] All these were designed by Streamkeepers in consultation with others and planted by students.

Two of the secondary school projects were initiated by Delta elementary alumni, who after seeing the benefits of GI at their elementary schools, wanted to construct bioretention gardens at their new schools. All excavation of secondary school gardens was provided "in kind" by Delta School District Facilities Branch. Small grants from the Nature Trust of BC Rain Garden Fund covered other expenses.

What makes this program a success

The Delta Rain Garden program illustrates how successful community engagement can create spillover effects, promoting City-wide community stewardship. The installation of bioretention facilities in the City of Delta, with community participation and educational support encourages residents to not only help in the maintenance of bioretention facilities, but also helped inspire the implementation of GI practices in community areas not owned-by the City, creating City-wide benefits in rainwater management.

What made it work?

Partnering with a non-profit with dedicated volunteers. The Cougar Creek Streamkeepers played an essential role in the engagement of the local community groups, organizing school volunteers and presenting to classroom on the importance of GI. An effective school maintenance program requires continued engagement, and partnering with a local non-profit can help make this work.

Planting participation helped create a sense of ownership. Connection with design

and planting encouraged students, parents and teachers to participate in maintenance activities. The City and non-profit received the highest level of community engagement in the years immediately following the construction of the bioretention gardens.

Key Takeaways

» Design and planting are an important engagement tool in environmental stewardship. Planting days help create a sense of ownership and encourage students and parents to participate in ongoing care for GI.

» Community engagement in GI can have positive spillover effects, promoting city-wide community stewardship.

» Volunteer school maintenance programs require support from many different actors, including the school district, school principal, school maintenance crews, teachers, the city and local volunteers.

» Outlining the roles and responsibilities of the bioretention gardens is important. School maintenance can promote meaningful engagement but requires additional maintenance support. A summer maintenance plan should be identified to ensure the garden is cared for while the school is closed.

» A school maintenance program requires ongoing engagement to maintain interest in GI stewardship. New students need to be educated about the function of the GI. Supporting schools with lesson plans and resources can help tell this story, however lesson plans should be developed with input from teachers to ensure its relevance to the curriculum and its continued use.

PORTLAND, OREGON

Green Street Stewards

image: BES Portland image via Flickr https://www.flickr.com/photos/besportland/

Volunteer Stewardship

maintenance framework

Bioretention

gi asset maintained

Bureau of Environmental Services, City of Portland

key players

trash and debris removal; sediment removal; planting; weeding; pruning; watering

maintenance tasks performed

2234

gi assets available for sponsorship

522 / 23%

gi assets maintained by volunteers

In an effort to reduce the City's combined sewer overflows and reduce the volume of rainwater runoff, in 1999 with the adoption of the Stormwater Manual, the City of Portland began to install bioretention facilities along local streets. After the installation of these facilities, Portland's Bureau of Environmental Services started to receive calls from local residents, asking how they could participate in the care of their new neighborhood gardens. Shortly thereafter, in 2010 Green Street Stewards Program was born.

Through the Green Street Stewards program City residents or businesses can volunteer to adopt one of the City's 2315 bioretention gardens.[75] The Green Street Stewards program currently has 221 volunteers who manage and care for over 500 of Portland's GI assets. While the Green Street Stewards volunteers represent a robust maintenance network, the program does not replace City run maintenance. Portland's Bureau of Environmental Services maintains responsibility for the care of its bioretention facilities. City-owned GI maintenance is done through external landscape contractors, supported by an internal O&M crew, who oversee the inspection and management of these contracts.[76] In 2020, an internal maintenance crew will augment the contracted maintenance crews.[77] Currently, contractors typically visit/maintain each bioretention facility once every three months, including gardens adopted by a Green Street Steward. Green Street Stewards support rather than replace the City's O&M program, performing maintenance activities between crew visits. The following chart illustrates the maintenance responsibilities of the Green Street Stewards and the City maintenance crews:

VOLUNTEER RESPONSIBILITIES

Table adapted from the City of Portland's Green Street Stewards Maintenance Guide

	City or its Professional Landscaper		Green Street Steward	
Activities	**2-year establishment**	**Long-term Maintenance**	**2-year Establishment**	**Long-term Maintenance**
Clear curb openings of leaves, trash and debris	yes	yes	yes	yes
Push aside sediment from inlets	yes	yes	yes	yes
Clear top of overflow drain	yes	yes	yes	yes
Water during periods of drought	yes	yes	yes	yes
Remove weeds (after completing training)	yes	yes	no	yes
Trim trees and plants	yes	yes	no	no
Remove replace plants and trees	yes	yes	no	no
Remove sediment	yes	yes	no	yes
Add additional plants with City approval	yes	yes	no	yes

Planting: If interested, volunteers have the option to plant within the bioretention facility, however all plants have to be reviewed and approved prior to the planting to ensure functionality is not compromised.[78]

Trimming: Volunteers are asked to not trim plants in the bioretention garden to preserve the integrity of the City-owned asset. In the past volunteers improperly trimmed plants and grasses, destroying the plant material, limiting the functionality of the rainwater management facility as a whole.[79]

Stewardship during establishment period: Bioretention gardens can be adopted in the establishment phase, however volunteer maintenance during this phase is limited to trash and debris removal and watering during the summer and periods of drought.[80]

VOLUNTEER MANAGEMENT AND TRAINING

Sign-up is managed through an online portal, where volunteers can view and select bioretention facilities available for stewardship. Through this portal, volunteers will sign a liability waiver and take part in safety training, which provides guidance on how to care for facilities on busy roadways. Once a volunteer signs up they are offered an optional one-on-one maintenance training session with the Green Street Steward's program coordinator, where the program coordinator will meet them on site to provide a 15 min orientation to their bioretention garden and the maintenance responsibilities involved.[81]

VOLUNTEER SUPPORT

Maintenance crews are also deployed to support the volunteers in their maintenance efforts. Volunteers can request, through the Program Coordinator, curbside pickup for organic material and debris collected from the bioretention gardens.[82] This pickup supports volunteers who manage large facilities, which require heavy weeding and debris removal, and businesses who do not have access to yard waste disposal bins.

The administration and coordination of the Green Street Steward volunteers is managed by one full-time staff member, with the support of a full-time AmeriCorps member, who works 11 months a year, 32 hours a week.[83] Administration of the program includes volunteer management and training, volunteer support and community outreach.

COMMUNITY AND BUSINESS OUTREACH

In addition to volunteer recruitment through social media and other traditional avenues, Green Street Stewards also participate in public engagement and business outreach.

During the design of a new bioretention garden along a local street, the City of Portland will reach out to adjacent property owners, through an open house, to solicit feedback on the design and placement of the rainwater facility. Through this process, community members have an opportunity to provide feedback at three design stages: 30%, 60% and 90% of the design.[84] The City has received positive feedback on this process, which allows the City to communicate the benefits of GI, and residents to contribute to the design of the facility during multiple stages of the design process. This practice has recruited several Green Street Stewards who, after engaged in the design of the bioretention garden, want to continue and care for the new facility in their neighbourhood.

The Green Streets Stewards program partners with Portland's Bureau of Planning and Sustainability in the recruitment and engagement of local businesses. The Bureau offers the Sustainability at Work certification, a process where businesses are recognized for reaching sustainability targets, contributing to the health of their local community and environment.[85] Participation in the Green Street Stewards program helps businesses reach their certification and has expanded the program's connection to the business community.[86]

What makes this program a success

With over 23% of the City's 2234 bioretention gardens adopted by 221 residents and businesses, Portland's Green Street Stewards program is one of North America's largest and most established GI programs of its kind. Adopted gardens have contributed to a higher standard of care, where volunteers provide additional upkeep, over and above maintenance provided from quarterly City crew visits. Local volunteers also provide an 'extra set of eyes', alerting the City to damage, vandalism or a loss of functionality to these municipally-owed assets.

What made it work?

City maintenance crews maintain responsibility for the care of its bioretention assets. The Green Street Steward's program supports City maintenance efforts, rather than replacing it. This model, where the City maintains responsibility for the maintenance of bioretention gardens, allows them to retain control over the infrastructure assets and perform skilled maintenance duties, ensuring their functionality. This framework also allows for volunteer support at various levels. Because City crews still conduct maintenance visits, the City does not require a minimum number of volunteer's hours to participate in the program, allowing everyone from the casual volunteer to the dedicated gardener to care for gardens in their neighbourhood. This model reduced the responsibility of the volunteer and lowers the barrier to entry, encouraging more volunteer participation.

Volunteer responsibilities are clearly defined and communicated. Volunteers who adopt a bioretention garden are provided with a comprehensive maintenance guide – which outlines in detail volunteer responsibilities– and are offered one-on-one training at the site of their adopted garden. Clearly outlining these maintenance responsibilities and providing training helps to create a skilled volunteer base, ensuring the City's infrastructure is adequately cared for and retaining the functionality of these gardens.

Full-time staff and streamlined volunteer management help to ensure the program has the capacity needed to support volunteers. The Green Streets Steward program has two full-time staff dedicated to the management and maintenance of this program. The staff are supported by a streamlined online signup process and volunteer management system, which allows staff to easily communicate with their volunteers. Adequate staffing and infrastructure allows the programs coordinator to focus on training, volunteer support, community outreach and program expansion.

Volunteers are recruited through other City led sustainability programs and public meetings. The Green Street Stewards has engaged its business community through the City's sustainability certification process, and its residential community through neighbourhood design meetings, which has helped to create strong network of Green Street Steward volunteers.

A simple and adaptable planting palette can reduce maintenance and create opportunities for volunteer planting. Through trial and error, the City has found that a complex planting palette did not perform well their bioretention gardens. Maintaining a simple palette (1 to 4 species in one facility), improves the rainwater functionality and eases maintenance, as it allows volunteers to more clearly identify weeds for removal.[87] Green Street Stewards are permitted and encourage to expand this planting palette (with review and approval from the City) enhancing the biodiversity and aesthetics of the bioretention garden.

Key takeaways

» A volunteer bioretention stewardship program can complement a city maintenance program, not replace it. Regular maintenance for city-owned assets, including bioretention gardens should be conducted to ensure facilities are working properly.

» Engagement in the design phase is an opportunity to teach residents about the benefits of GI and can create a sense of ownership, leading to engagement in community stewardship programs.

» Bioretention facilities are functioning city infrastructure and improper maintenance can compromise city-owned assets. To ensure adequate care through a volunteer sponsorship program, the following are need:

» A comprehensive maintenance guide supported with in person training to create a clear division of volunteer and city maintenance responsibilities.

» Staff capacity to support maintenance efforts, outreach and education, provide training opportunities, and expand the sponsorship program.

SAN FRANCISCO, CALIFORNIA

Rain Guardians

image: SFPUC

Volunteer Stewardship

maintenance framework

Bioretention

gi asset maintained

San Francisco Public Utilities Commission

key players

trash and debris removal

maintenance tasks performed

60

gi assets available for sponsorship

38 / 63%

gi assets maintained by volunteers

Following the success of the City's adopt-a-drain program, the San Francisco Public Utilities Commission (SFPUC) established Rain Guardians, a program that allows City residents to adopt one of San Francisco's 60 rain gardens, or gardens.[88] The community stewardship program launched February 2019 supports the City's GI maintenance efforts and engages local residents in the care of GI in their community. The Rain Guardian volunteer program is set to grow with the City's GI network. Within the next five years more than 350 bioretention gardens will be constructed in San Francisco, helping to contribute to SFPUC's long term sustainability goal to capture 1 billion gallons of rainwater through GI by 2050.[89] These new projects will represent a significant new body of work, which SFPUC will have to operate and maintain.

As the City's GI network expands, the Rain Guardian program provides an opportunity to promote community engagement in the stewardship of local bioretention gardens and provide additional care over and above the City's existing maintenance framework. While volunteers can "adopt" bioretention gardens, the SFPUC maintains responsibility for the GI maintenance activities.[90] Volunteers care for GI facilities they adopt by removing trash and debris between City crew maintenance visits. Maintenance teams will visit the GI sites on a quarterly basis to provide trash and debris removal not completed by volunteers (program managers recommend that volunteers clean the bioretention garden twice between quarterly visits).[91] The City provides volunteers a safety vest, gloves and a trash picker for each bioretention garden adopter during volunteer community events.[92]

In July 2018, the City received funding approval for a specialized internal GI crew.[93] The three-team crew will be housed in the City's wastewater department and is responsible for maintaining San Francisco's GI assets. [94] The crew will look after all SFPUC GI assets, including bioretention facilities adopted in the City's Rain Guardian program. The crew will also oversee subsurface GI and will coordinate with other crews to arrange for the use of specialty equipment (e.g. vac for subsurface drainage). Historically the City's street team manages street sweeping for permeable pavement, but with the new GI maintenance team the street team will continue doing maintenance and the GI team will undertake annual inspections.

The City's Rain Guardian program is planned to grow in size and scope of volunteer maintenance responsibilities along with San Francisco's expanding GI network. Existing volunteers have expressed interest in taking on more maintenance tasks, including pruning and planting; however, the City is not having volunteers undertake this maintenance, in part because they do not have the staff to support the training for volunteers. As of now the focus of the program is to keep trash out of the bioretention gardens and engage residents and businesses to take an active role in the stewardship of GI in their community.

What makes this program a success

While small in size and scope the San Francisco Rain Guardian program maintains a high level of volunteer adoption (63%) and provides a model of a resourceful program that supports the City's GI maintenance efforts. The Rain Guardian program provides San Francisco with a 'second set of eyes' on City-owned GI. The SFPUC found that their volunteers are more likely to report sewer emergencies or service problems such as clogged catch basins, standing water, street flooding, sewer backups or wastewater odors, providing a network of on-the-ground GI inspectors. In addition, the SFPUC's use of an online portal illustrates how to efficiently manage program volunteers, serving as a volunteer management system and communication system, where volunteers can sign-up or discontinue their volunteerism with the City.

What made it work?

GI City maintenance crews maintain responsibility for the care of its bioretention assets. Adopted gardens still receive quarterly maintenance visits by specialized City GI crews. The Rain Guardian volunteer program supports City maintenance efforts, rather than replacing it, providing a network of volunteers who remove debris and trash and alert the City to emergency issues (if any) with their GI assets.

Comprehensive training documentation clearly communicates volunteer responsibilities. Online videos and volunteer program brochures (available in three languages – English, Spanish and Chinese) communicate volunteer responsibilities and make the program accessible to the City's diverse resident population.

Online program streamlines volunteer sign up and communication. Volunteers can view bioretention gardens available for adoption and can un-adopt gardens when they no longer wish to continue maintenance. This online portal allows community members to view GI facilities in their area and reduces staff administrative duties involved in volunteer management. Through the online management system, volunteers are also emailed notifications of major storm events, which may require maintenance activities, allowing streamlined communication with the City's network of volunteers. The success of the program's volunteer management is tied in part to its website, which was intended to be accessible, easy-to-use and adaptable to volunteer feedback.

Key takeaways

» Volunteer maintenance programs can provide a second set of eyes on the GI facility, providing a network of on-the-ground GI inspectors.

» An online volunteer management portal reduces staff administrative duties, allowing the program to scale in size, and streamlines communication with volunteers.

WASHTENAW COUNTY, MICHIGAN

Master Rain Gardener Course

Volunteer Stewardship
School Engagement
Residential Design & Ownership

maintenance framework

Bioretention

gi asset maintained

Washtenaw County

key players

trash and debris removal; re-grading; sediment removal; planting; weeding; pruning; fertilizing; watering

maintenance tasks performed

12 hectares

gi assets available for sponsorship

Since 2015, Washtenaw County has worked with the public to maintain GI within streets and public spaces. Through a network of volunteers and contractors, the County cares for its 30 acres of GI.[95] The County has several volunteer programs, encouraging volunteers to care for GI on public and private property including:

RAIN GARDEN STEWARDS

Rain Garden Stewards adopt a bioretention garden and provide ongoing care and maintenance. Activities include: weeding, pruning, trimming, sediment removal and trash and debris removal.[96] Residents can adopt a local garden within the public right-of-way or help maintain a bioretention garden at a nearby school as part of the schoolyard bioretention garden program. Through this program volunteers will often work with teachers and school staff to involve students in caring for and learning about bioretention gardens.

GROUP RAIN GARDENS VOLUNTEER WORKDAYS

To assist in maintenance efforts, the County will organize group workdays with private groups and the public. Through groups of individual volunteers or volunteers from organizations including schools, businesses, non-profits, churches, and Boy & Girl Scout troops, volunteers will participate in workdays for GI maintenance. Workdays last between two to three hours and involve maintenance tasks, including weeding, planting, transplanting, seed collecting, pruning and sediment removal.

SCHOOL PROGRAM

Since 2014, the Water Resources Commissioner's Office been engaging schools in GI design and maintenance, providing resources and support to teach students about water quality, rainwater management and bioretention gardens.[97] Through the program the County will encourage volunteers and schools to build bioretention gardens on school grounds.

The County provides teachers with lesson plans on GI and the Water Resource staff will teach classroom lessons on 1) GI functionality and rainwater management and 2) how to design a bioretention garden. Students and volunteers then build and/or plant a bioretention garden on their school's property.

MASTER RAIN GARDEN COURSE

Washtenaw County's Master Rain Gardener program began in 2005 with the Michigan Department of Environmental Quality grant funding. Through the program the County offers training to homeowners on how to plan, design and construct GI their property. Through a five-session class, residents are provided personalized design advice and technical guidance related to GI design. The program has helped residents design and install over 450 bioretention gardens on private property.[98]

In addition to technical and design support, the County also provides resources, including free compost, and organizes plant swap events, connecting bioretention garden designers together to reduce building costs. Participants who do not own property are encouraged to build and design GI on public sites, including school grounds (through the County's School Program) and libraries.

What makes this program a success

With over 450 bioretention gardens built on private property, the Washtenaw County's Master Rain Garden program leverages a private program to expand the GI within the County.[99] Local examples of GI on private property help demonstrate the effectiveness of GI in rainwater management to residents and neighbours. The County has found that people who build GI become advocates for GI, encouraging their neighbours to build bioretention gardens on their property, attending public meetings and advocating for the expansion of the County's public GI program.[100]

What made it work?

Residential design program supported public GI program. Residents who designed their own GI learned how they worked and saw their effectiveness firsthand. Residents who built their own bioretention garden became the biggest advocates for GI in public meetings, helping to support the public program.

Volunteer programs, which offer different levels of engagement. The County offers volunteer programs that allows everyone from the casual participant to the dedicated gardener to participate in GI stewardship. Residents who can commit more time to stewardship activities can participate in adoption programs, while residents who are interested in GI stewardship but cannot commit to regular maintenance can participate in workdays organized by the County.

Key Takeaways

» A private program compliments a public GI program. Design and planting is an important engagement tool in environmental stewardship. Bioretention gardens in people's community can demonstrate their effectiveness. People who witness how bioretention gardens work can become the biggest advocates for it, creating a network of advocates for GI.

» Providing a range of commitment opportunities for GI stewardship can encourage people who do not have time to commit to on-going maintenance to participate in GI stewardship.

NEW YORK CITY, NEW YORK

NYC Bioretention Stewardship

İmage: Chris Hamby via Flickr https://www.flickr.com/photos/chrishamby/

Volunteer Stewardship
School Engagement

maintenance framework

Bioretention

gi asset maintained

NYC DEP
Gowanus Canal Conservancy

key players

trash and debris removal; sediment removal; planting; weeding; pruning; watering

maintenance tasks performed

4,000

gi assets available for sponsors

In late 2010, New York City released the NYC Green Infrastructure Plan, which set forth a series of rainwater management initiatives. As of early 2019, the City's GI program has committed over $600 million in capital funds (since fiscal year 2012) and has approximately $1 billion currently budgeted through fiscal year 2029 for the development of GI within the private and public realm.[101] As a result of the City's commitment to invest in GI, NYC's Department of Environmental Protection (DEP) has constructed over 4,000 bioretention gardens on NYC's streets, sidewalks and other public sites.[102] To maintain the City's expanding GI network, the City developed the ROW GI Maintenance team. In 2018, the team consisted of 103 full time and seasonal crew members.[103]

ALTERNATIVE MAINTENANCE PROGRAM

With a rapidly expanding portfolio of GI assets, NYC has turned to residents and non-profits for help. In 2019 the NYC Department of Environmental Protection maintenance crews launched a bioretention stewardship program with local community groups and residents, to assist in the maintenance and management of the City-owned bioretention gardens.

Residential Program: Through the program the DEP trains volunteer residents to perform simple maintenance tasks for bioretention facilities in their area, including litter and sediment removal, weeding, and curb cut maintenance.[104]

Community Program: As part of the program, the DEP is working with four community groups to assist with GI maintenance in their neighbourhood. Partner community groups will work with their community to help care for these GI assets, providing maintenance tasks beyond the scope of the residential program. As the program develops, NYC plans to expand the number of community groups in the program, including the Gowanus Canal Conservancy (GCC). [105]

GCC OVERVIEW

The GCC is a community-based non-profit organization, in Brooklyn New York, that serves as the environmental steward for the Gowanus Canal Watershed.[106] The GCC's mission is to advocate for, build, and maintain innovative GI around the Gowanus Canal by engaging local residents and schools through service learning and curriculum programs.

NYC GREEN STREETS COMMUNITY MAINTENANCE PROGRAM

The Gowanus Watershed is a 1,700 acre area that contributes to 377 million gallons of combined sewer overflow (CSO) into NYC's waterways per year.[107] The watershed has 116 bioretention facilities built by the NYC DEP.[108] Given the organization's local role in GI stewardship, the GCC was identified as one of the community groups to take on the ownership of NYC's GI maintenance, providing full-service care for the City-owned bioretention gardens. The Gowanus Canal Conservancy is seeking a grant from the City to help administer the organization's maintenance program.[109] In addition to their potential role in maintenance, the GCC is also involved in several stewardship programs including:

VOLUNTEER STEWARDSHIP

The GCC is currently engaged in bioretention maintenance practices. Each year, the Conservancy works with approximately 1,000 volunteers in a variety of green stewardship activities, including garden installations, bioretention and tree maintenance and native plant propagation gardens.[110] Currently the organization provides day-to-day maintenance for GI in their neighbourhood. During spring and fall they have volunteer days about every weekend, where volunteers will work to provide maintenance and care for trees and GI sites in their community. Rather than adopt-a-programs, where a volunteer will be responsible for maintaining their own GI, the GCC organizes group events, where volunteers

as part of a team will perform maintenance tasks for GI in their area on an as needed basis.

APPRENTICESHIP PROGRAM – THE GREEN TEAM

The Gowanus Green Team is a high-school apprentice program, which seeks to expand green job opportunities in Gowanus. Through paid work-experience, high school students are introduced to careers in the environmental sectors, engaging in work in the areas of rainwater management, urban forestry and horticulture.[111] The program provides participants with skills in gardening, infrastructure maintenance, and plant identification. The training program is an important part of the GGC's efforts to maintain GI in their neighbourhood.

SCHOOL CURRICULUM

In partnership with three schools, the GCC provided a stipend for teachers to help develop a GI design curriculum. The program introduced students to watershed and sewershed management, culminating in a student developed GI design concept for their school. The goal of the program is to increase interest in STEM (science, technology, engineering, and mathematics) fields and build awareness of GI and GI stewardship in their community.[112] As part of the curriculum, teachers will conduct field trips to key sites in their local watershed and will encourage students to participate in stewardship activities organized by the Gowanus Canal Conservancy.

SERVICE LEARNING:

Gowanus Canal Conservancy's student service-learning program engages grades 3 to 12 in the stewardship of street trees and bioretention gardens in their community. Through outdoor field visits, students are introduced to the Gowanus Canal, ecological history, and steps to making a healthier ecosystem through hand-on community stewardship.[113]

What makes this program(s) a success

The Gowanus Conservancy Canal provides successful community engagement in GI stewardship. Leveraging their school curriculum program, the GCC engages youth in environmental issues in their neighbourhood and encourages students and their parents to engage in other aspects of GI stewardship undertaken by the organization. With an impressive network of over 1,000 volunteers, the GCC's model illustrates how a comprehensive engagement program can create an expansive network of volunteers.

What made it work?

The GCC is engaged in multiple stewardship programs, which helped to create spillover effects. The GCC leverages their school program to teach students about GI, which ultimately boosts the organization's maintenance efforts, where students and parents will participate in the GCC's community stewardship programs.

Connecting stewardship activities with school learning objectives. The GCC has high participation in the organizations service learning because the GCC matched the service-learning program to the schools learning objectives. Schools in New York have an annual requirement for learning objectives, part of which can be met through participating in the GCC's service-learning program. As a result, they do not have to advertise their program, rather teachers seek out the GCC.[114]

Program for kids ages 10 to 14 engages kids and their parents in stewardship activities. Through experience, the GCC found that creating school curriculum for children ages 10 to 14 created interest in GI and encouraged parents to participate in volunteer stewardship days.

Key Takeaways

» Non-profits often have the capacity to engage communities in multiple areas of GI stewardship, often beyond the capacity of municipalities. Partnering or providing support to these organizations can help develop a network of citizen advocates.

» Green maintenance requires resources. While partnering with a non-profit can help provide care for city-owned infrastructure, it will often require financial support from the municipality.

» School programs which teach students about GI, can help to foster an interest in stewardship and lead to higher participation in the volunteer program, including maintenance activities.

» School curriculum developed in partnership with teachers helps to ensure the lesson plans are connected to required learning objectives and will help ensure they are used. Providing teachers with a stipend to participate in this work is helpful.

» Leveraging school service-learning or volunteer requirements can help create a pool of engaged participants. Look for opportunities to connect GI stewardship to school volunteer requirements.

APPENDIX C: WORKFORCE DEVELOPMENT CASE STUDIES

VANCOUVER, BRITISH COLUMBIA

Street Cleaning Grant Program

Workforce Development

maintenance framework

N/A

maintenance tasks performed

N/A

gi asset maintained

1999

program established

City of Vancouver
Save Our Living Environment (SOLE)
Coast Mental Health Foundation
Mission Possible Enterprises Society
Family Services of Greater Vancouver
The Kettle Friendship Society
Tides Canada Initiatives Society

key players

Established in 1999, Vancouver's Street Cleaning Grant Program was created to supplement the City's street cleaning services.[115] The program is administered by several local non-profits, who hire and train adults who experience barriers to employment to perform micro-cleaning services throughout Vancouver's streets.

Micro-cleaning involves daily collection of litter and needles, on foot using brooms, shovels and wheeled garbage carts.[116] Crews clean lanes and streets throughout the Downtown Eastside, Commercial Drive, Strathcona, West End, Kensington-Cedar Cottage, and Broadway.[117] The work supplements the City of Vancouver's street cleaning program and is work outside the scope of services provided by City of Vancouver. In 2019 Vancouver City Council approved $1,615,000 of funding for the program, which will be provided to seven non-profit organizations for supplementary street cleaning services, waste diversion initiatives and related research.[118]

In addition to cleaning services, the Micro-cleaning Grant Program provides workforce development opportunities for Vancouver's vulnerable populations. The program supports low threshold employment for those who experience barriers to traditional employment, including adults experiencing homelessness, at risk youth and people with mental illness and addiction issues.[119] Crews work on a casual and part-time basis, receiving employment and soft skills training, which have helped participants transition to competitive employment. To ensure the success of the program, the City of Vancouver is exploring opportunities to help participants transition to full-time work within the City.

In 2018, the Street Cleaning Grant Program helped achieve the following:

- Micro-cleaning of 400 city blocks and 22 BIA areas
- 55,000 work hours to individuals with barriers to traditional employment
- 14,800 bags of litter collected
- 72,200 needles collected from streets and lanes
- 81,000 littered single-use items (plastic bags, coffee cups, foam take-out containers) collected[120]

What makes this program a success

The Street Cleaning Grant program serves as an excellent local example of social sustainability, where the City leverages public funding to provide City services, while creating workforce development opportunities for Vancouver's vulnerable population.

The City's non-profit partners report that "work crews benefit from a greater sense of pride and self-esteem developed through employment that makes a positive contribution to their own community."[121]

Below are some excerpts from program participants:

- *"I feel that I will be better qualified to handle other pursuits, such as education goals and career based interests."*[122]
- *"In talking with cleaners, some comments are universal. Virtually everyone will tell you that they are regularly praised and thanked for the work they do."*[123]
- *"This job gives me hope that someday I could possibly get a more responsible job."*[124]

What made it work?

Flexible employment and schedules for crews. A significant barrier to traditional employment for many people is an inflexible 9 to 5 work schedule. Crew members are provided flexibility needed to maintain employment.

Crews are supported with soft skills training, which can help participants transition to traditional, long-term employment. In addition to employment experience participants are provided soft skills, including life skills training and employment coaching, which help participants transition to long-term employment.

Collaboration and support from various stakeholders, including non-profit partners, City Council, Vancouver City staff, Business Improvement Areas and unions.

Key Takeaways

» Participants should be provided permanent and flexible schedules tailored to the individual to ensure they are given the flexibility needed to maintain employment.

» Collaboration and support is required from various actors across the organization.

SEATTLE, WASHINGTON

Seattle Conservation Corps (SCC)

Workforce Development

maintenance framework

Bioretention; Stormwater Tree Trench

gi asset maintained

Seattle Parks and Recreation
Seattle Public Utilities

key players

trash and debris removal; sediment removal; planting; weeding; pruning; watering

maintenance tasks performed

1986

program established

3.3 hectares

gi assets maintained by crew

$4.8 million

annual program budget

$887,300

gi maintenance budget

50 / 14

maintenance crew (total size) / gi crew

The Seattle Conservation Corps (SCC) is a yearlong pre-apprenticeship preparation program that provides full-time employment for adults experiencing homelessness. The program removes barriers to employment by providing intensive case management, housing support, work training and work experience in public works projects, including GI maintenance.

Established in 1986, the program, which began as a pilot project championed by a special assistant in the Mayor's office, now has a crew of over 50 people providing services for City departments. Each corps member agrees to one year's employment, and paid hours for education and life skills development, including high school equivalency, money management, nutrition, and job preparation skills such as resume writing and interviewing skills. Corps members work full-time on a crew averaging five people each with a supervising crew lead or staff supervisor to manage the work.

The program is primarily self-funded, where 75% to 80% of its costs are covered from fee-for-service work completed for various City departments, including the Seattle Department of Transportation, Seattle Parks & Recreation and Seattle Public Utility (SPU). Their work ranges from general landscaping to building demolitions and abatements. A significant portion of their work now comes from Seattle Public Utility, where the SCC acts as the primary GI maintenance provider for the department. To help fund the program the SCC charges a 2.4 multiplier for their labor, which covers the majority of indirect expenses, including case workers, housing assistance, and counseling services.[125] The remaining costs are covered by grant funding for support services, training, and educational opportunities. The grants include:

» $800,000 Community Development Block Grant (CDBG) from the U.S. Department of Housing and Urban Development

» $250,000 City of Seattle – General Fund

» $175,000 Community Services Block Grant (CSBG) from the Washington State Department of Commerce

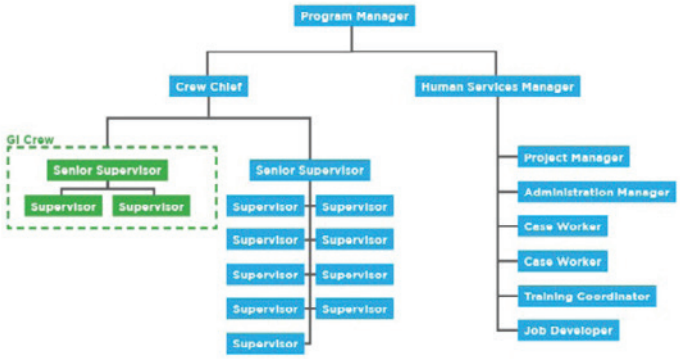
» Funding for City of Seattle Parks District safety equipment and training[126]

The City of Seattle has several GI practices, the majority of which are bioretention or porous pavement. Prior to developing a formalized operations and maintenance framework, Seattle Public Utility used the SCC to maintain their GI. In 2017, as the size and scope of the City's GI strategy expanded, SPU developed a memorandum of agreement with SSC to formalize the maintenance program.[127] The SCC now has a specialized crew, who maintain the City's vegetated GI. The SCC is supported by SPU City Crews, who manage all of the sub-surface infrastructure and structures. SPU works together with SCC crews when heavy equipment or specialized equipment or trades is required. Maintenance of the City's porous pavement remains as responsibility of the department of transportation.[1]

The SCC GI maintenance crew consists of an average of 14 members, including 1 senior supervisor, trained as a landscape architect and horticulturist, 2 supervisors, (one previous corps member, one trained in forestry) and 11 corps members.[128] The crew is supported by the human services team in the SCC and the work is overseen by SPU which consists of one full-time staff person (with assistance from temporary workers, including one full time temporary employee and one intern), who oversees and supports the GI O&M program.[129]

1 The City does not have a formal framework for the maintenance of porous pavement. Street sweeping is currently a responsibility of the Department of Transportation and adjacent property owners. As part of the City by-law adjacent landowners are responsible for the maintenance of sidewalks (i.e. street sweeping), therefore adjacent property owners are responsible for street sweeping of porous pavement on sidewalks.

SCC REPORTING STRUCTURE



What makes this program a success

The Seattle Conservation Corps represents a successful model of a municipally-run workforce development program. The program leverages municipally funded work, including GI O&M, to provide employment opportunities and support services for adults experiencing homelessness. On an annual basis, about 65% of the people who enter the program successfully finish, 80% leave with secure stable housing, 10% are hired by the City, and 90% of the people who complete the program find long-term employment that pays a living wage with benefits.[130]

The program has also developed a successful funding framework – 75 to 80% of the program costs are generated through fee for service, the remainder is paid for through grants, which fund the indirect costs of the program.

What made it work?

A municipal employer provides comprehensive training and work experience, creating skilled and sought after employees entering the job market. The City of Seattle has a reputation as a high-quality employer, having the City listed as a year-long employer creates new opportunities for program graduates. As a City employee, Corps members have access to municipal training, including the City's training portal, and receive paid training in areas from Excel to conflict resolution. While a non-profit may be able to provide more comprehensive human services support, the City is able to provide excellent employment training, which assists the members in finding jobs after program completion.[131]

Corps members are provided specialty training and education from an experienced professional. Training for the Corps members within the GI crew extends beyond general landscape maintenance. Corps members are trained under the supervision of an experienced horticulturalist and landscape architect, who teaches members about horticulture, ecology, landscape design and rainwater management. The passion from the senior supervisor translates to the Corps members, who are trained and encouraged to explore careers in GI upon program completion.[132]

Candidates are supported through the Conservation Corps hiring process, which seeks to remove barriers applicants face in traditional job interviews. Rather than conducting traditional interviews, applicants are selected through a phone screening process, where they are called to verify that they meet the two requirements of the program, which include they are homeless and have appropriate ID for employment. If requirements are met, applicants are put on a wait list, where applicants are drawn from when work becomes available.

Partnerships with city departments create well-defined career paths into city employment. The Seattle Conservation Corps connects corps members to employment opportunities with the City. This connection has helped cultivate a stream of qualified candidates for City departments, some who have noted that Seattle Conservation Corps members are the most qualified candidates for the position, resulting in approximately 10% of Corps members being hired by the City after completing the program.[133] Currently the program provides four career pathways into City employment, including:

» City of Seattle Parks and Recreation: Annually, approximately 10 corps members are hired by the Seattle Parks and Recreation department for seasonal and full-time employment. Work includes grounds crews, night maintenance. Workers are paid up to $24/hour.

» Shop Facilities - Annually the shop facilities hire five Corps members to shadow City staff and develop skills in plumbing and construction work. At the end of the term approximately one Corps member is picked to enter the City apprenticeship program.

» Seattle Department of Transportation (SDOT): SDOT hires approximately two Corps members annually for temporary positions, which has often transitioned into full-time employment.

» Seattle Public Utility: The Seattle Public Utility is an emerging career pathway for the SSC. While not many Corps members have been hired, the SCC is continuing to look for opportunities to transition graduates of the program into this department.

Key Takeaways

» A municipal employer provides high quality and sought after work experience. While a municipally-run program requires more city-managed human service infrastructure than partnering with a non-profit, it can lead to stronger career pathways for program participants. A municipally-run program provides participants with sought after employment experience and training. Having a municipal employer listed on their resume can help graduates secure long-term employment within the city and with external employers.

» A living wage and flexible hours are important to help people overcome barriers to transition into full-time work.

» Resumes and traditional interviews can be a barrier to employment. Applicants must be supported through the hiring process, which should include low barriers to program entry.

» Training beyond the requirements for standard GI care, including horticultural and ecology training, can prepare applicants for positions in other fields and create an engaged and knowledgeable maintenance crew.

PHILADELPHIA, PENNSYLVANIA

PowerCorps PHL

Workforce Development

maintenance framework

Bioretention; Stormwater Tree Trench

gi asset maintained

City of Philadelphia
Philadelphia Water Department
EducationWorks

key players

trash and debris removal; sediment removal; planting; weeding; pruning; watering

maintenance tasks performed

2012

program established

300

gi assets maintained by crew

$2.5 million

annual program budget

130 / 4-8

maintenance crew (total size) / gi crew

PowerCorps PHL is a workforce development program that seeks to provide Philadelphia youth, and young adults with barriers to employment with training and access to long-term employment opportunities. PowerCorps PHL is an AmeriCorps initiative administered in partnership with EducationWorks. The program began in 2013, originating out of the Mayor's Office, as a joint effort between the Justice Department, Commerce Department and the City of Philadelphia.[134] It was designed to address the mayor's environmental stewardship initiatives and the City's youth violence prevention and workforce development priorities. Participants in the program work with Philadelphia Parks & Recreation, or with the Philadelphia Water Department to engage in environmental service and workforce training, in one or more of the following areas: GI, Skilled Trades, Community Outreach and Leadership Development.

Annually, the program hires 136 at risk youth and young adults between the ages of 18 to 26 years to work on various public works projects.[135] To enter the program, participants must be a resident of the City of Philadelphia and have a high school diploma or equivalent. Corps members participate in a 4 to 18-month training program, developing skills career and technical skills in environmental stewardship, connecting participations to career pathways in civic employment, post-secondary education and careers in the green sector.

PowerCorpsPHL's training is designed to follow the apprenticeship model, where corps member 'earn and learn' through career-connected education and paid work experiences. PowerCorpsPHL members spend 6 months in full time-time service, followed by 3 months of job placement support.[136] Corps members are supported with in class training, which focuses on work-readiness, career exploration, and skill building.

PHILADELPHIA GI PROGRAM

In 2011 the City adopted the Green City, Clean water plan, committing the City of Philadelphia to spend more than $1 billion over the course of 25 years to reduce rainwater pollution through investment in GI.[137] The City's expanding GI network meant that the City of Philadelphia water department had increasing maintenance needs.

In early 2014, PWD partnered with PowerCorpsPHL to develop the GSI Aesthetic Maintenance Program in order to keep the City's GI assets aesthetically pleasing and functioning properly. The scope of work program included trash, debris and sediment removal, tree and vegetation maintenance, and site condition reporting.[138]

Staff at Philadelphia departments, including the PWD worked closely with PowerCorps staff to help provide technical training for this new type of work.[139] PWD developed and lead GI training and field maintenance exercises. To streamline work PowerCorps members use the City's asset management system, responding to work orders and scheduling for GSI maintenance activities. Work orders are created by PWD staff. There are 12 staff members that are tied to administrative GI maintenance efforts, including one staff member who is responsible for oversight of the PowerCorps maintenance.[140]

FUNDING

PowerCorpsPHL is funded through grants, provided by the municipality and the state, and revenue generated through fee for service work completed for the City and other public programs.

CAREER PATHWAYS

The PowerCorpsPHL model focuses on the development and identification of career pathways for people who complete the program. Upon completion of their service, graduates receive placement support and are

encouraged to enter employment (including apprenticeships and on-the-job training positions) or enter/continue postsecondary education.[141] To support the development of career pathways, Philadelphia Water Department expanded pathways to permanent employment for graduates of PowerCorps by increasing apprenticeship opportunities across the Department.[142]

While run by an external program partner, the PowerCorpsPHL program is seen as a feeder for civic employment opportunities. PowerCorpsPHL has provided the PWD and its contractors with a pool of entry level maintenance technicians experienced in GSI maintenance skills and terminology.

What makes this program a success

PowerCorpsPHL is a model of how to work with a non-profit, who can provide soft skills training, and illustrates how to work closely with the City to provide technical training. The program provided several successes for the PWD, including a pool of skilled applicants for City positions, improved GI aesthetics and functionality, and indirect benefits such as public engagement and support of the City's GI goals.

Between 2013 to 2017 the program employed 358 young adults – removed 230 tons of debris, planting 6,000 trees, and revitalizing 3,750 acres of public land by building trails, restoring creek beds, constructing bioretention gardens, elevating trees for safety, and removing invasive plants to allow native plants to thrive.[143]

"80% of PowerCorpsPHL participants who complete a six-month term transition to employment, post-secondary education and/or additional national service."[144]

What made it work?

Understand the job market and tailor training to emerging markets and in demand jobs. To ensure Corps Members alumni were hired into long-term employment, PowerCorpsPHL tailored work programs and training to emerging markets. For example, Corps members developed a track for solar and electrical energy in response to local demand.

Partnering with a non-profit provided Corps members with soft skills training that was beyond the capacity of the municipal employer. To mitigate some of the traditional downsides of external partnerships for workforce development, the City was able to overcome these barriers working closely with PowerCorpsPHL, including providing Corps members with hands-on training and integrating work order systems.

Applicants are recruited through alternative methods and supported through the hiring process. The majority of applicants are recruited through word of mouth, using the non-profits established channels with partner programs to help reach a broad applicant pool. Applicants are recruited through the following partners: Youth Violence Reduction Partnership (YVRP), Mayor's Office of Reintegration Services (RISE), Department of Human Services (DHS) - Achieving Independence Center, PYN's E3 Centers and YouthBuild Philadelphia Charter High School.[145] Applicants are supported through the hiring process, and while a resume is recommended, it is not required.

Training is structured to provide Corps members with transferable skills for future employment.

Key Takeaways

» Providing city training will help to develop qualified candidates for city work.

» Successful recruitment involves outreach to the community they are trying to work with and recruiting through word of mouth/ established channels.

» External employer has benefits and drawbacks, including being able to provide more social support services, however this model may result in less municipal oversight for workforce development employees working on public program.

» Building career pathways is important, understand emerging and in demand jobs and tailor training and work experience accordingly.

KANSAS CITY, MISSOURI

Green Stewards

Workforce Development

maintenance framework

Bioretention

gi asset maintained

Kansas City Water Services Department Bridging the Gap

key players

trash and debris removal; sediment removal; planting; weeding; pruning; watering; mulching

maintenance tasks performed

2012

program established

4.5 ha

gi assets maintained by crew

5-6

gi workforce development crew

In 2017 the City of Kansas City, Missouri established the Green Stewards Program, a workforce development program, created to support the City in the care of a portion (4.5 ha) of its constructed GI installations.[146] The program originated as part of legal agreement with the United States Environmental Protection Agency (EPA) after the EPA took enforcement action against the City for repeated violations to the Clean Water Act, which included discharging untreated sewage into US waterways. In 2010 the City entered into a Consent Decree with the EPA, which required the City to reduce the volume and frequency of its combined sewer outflows (CSOs). To meet the new federal regulatory requirements, the City developed the Overflow Control Plan, a 25-year, $4.5 billion strategy to reduce CSOs.[147] The Plan promotes the use of GI to help reduce CSO events. It also earmarks $5 million to develop a workforce development program and provide green collar jobs training.[148]

Kansas City's workforce development program began as a pilot project, where the City, in 2016, released an RFP, for a local non-profit organization to administer the Green Stewards program for one year with the option for two additional 1-year renewal periods (based on performance of the program).[149] Bridging the Gap, a Kansas City-based non-profit, was the organization selected to administer the Green Stewards Program, supporting the City in the O&M of a portion of its GI facilities. While the non-profit did not have experience in fee-for-service landscape work, they did have experience in landscape restoration projects, volunteer management and educational programing.[150]

Once Bridging the Gap was awarded the contract, they hired a program manager and a field manager to administer and begin implementation, which included recruiting, hiring, screening and training new Green Stewards. The Green Stewards program does not target a specific population, but rather seeks to hire people who face barriers to employment and are residents of Kansas City, Missouri. The program provides 18 months to two years of employment and training in GI and landscape maintenance, providing an opportunity for Green Stewards to develop qualifications for long term-employment in those fields.[151] Training provides soft skills, including digital literacy, financial literacy, and technical training. Participants also have access to the National GI Certification Program (NGICP), which allows successful candidates to leave the Green Stewards Program with a credential in GSI construction, maintenance, and inspection.[152]

The Green Stewards team, which consists of five to six members, supports the City's internal GI crews, focusing on litter and debris removal and landscaping services, which do not include the use of power equipment or herbicides.[153] Maintenance activities outside of their scope of work are provided by the City's internal specialized GI maintenance crew, the Green Solutions crew. This crew is comprised of 6 positions, which are housed within the Preventative Maintenance Division. It includes two landscape technicians and four equipment operators, overseen by a utility supervisor.[154] The City also has project managers, a landscape architect, and a landscape technician, who are responsible for oversight of green infrastructure maintenance of selected sites. Work completed by the Green Stewards crew members is seen as complimentary to the work completed by the internal crew, and coordination between crews is crucial to ensuring the proper sequence of maintenance tasks. Oversight is managed by the program manager through an online dashboard, Survey123 for ArcGIS, which allows GI sites maintained by Green Stewards to be inspected and monitored online..[155]

What makes this program a success

The Kansas City Green Stewards Program provides a model for developing a robust maintenance framework in an emerging GI market. Leveraging capacity in the non-profit sector, the City was able to develop

a workforce development program without having to invest in the skillset internally. The program supports internal maintenance efforts, while providing jobs and training for people who experience employment barriers.

What made it work?

Program funding was earmarked as part of a larger grey/GI plan. The City's workforce development program is funded through the City's Overflow Control program infrastructure plan, which identified green solutions as a major part of upgrading the City's rainwater infrastructure. The plan, which is a regulatory requirement, earmarks $5 million to be used for the development and implementation of a training program, providing consistent funding for the program's administration. The funding is being used for multiple initiatives, however, $950,000 has been projected for the initial three years of Green Stewards program.

The City partnered with a non-profit organization to leverage workforce development training capacity. Partnering with a non-profit allowed the City to leverage capacity, experience and knowledge in the non-profit sector, especially related to soft skills training and one-on-one attention to assist Stewards with lifting barriers to gainful employment that are not common in the traditional workplace.

The Workforce Development Program started small, which allowed the City and non-profit partner to respond to program challenges. This allowed the City and non-profit partner to adjust to changing needs. The program has experienced high turnover from crew members on the team who were not able/interested in working outside for long periods of time.[156] The non-profit then adjusted their hiring and screening process and was able to fill positions.

The program maintains low barriers to employment and adjusts program training to crew members' education and experience. TTo achieve this, hiring requirements are limited to the following criteria: crew members are a resident of the City and are eligible to obtain a Missouri driver's licence within 18 months of hire. The program also provides soft skills development and technical training to help participants develop qualifications for long term-employment in the GI field. Bridging the Gap, in partnership with the City, provides National GI Certification Program (NGICP) training, to participants of the program.[157] A high school diploma or equivalent is required to take the NGCIP test, however those without a high school diploma or equivalent are still able to receive the training, though they are not eligible to test for certification.

Key Takeaways

» While an internally run program can provide sought after work experience, it requires significant human services capacity. An external partner can help bring unique workforce development capacity and skills not typically available in City operations.

» A challenge of a workforce development program is ensuring that maintenance crews are provided robust training and work experience. Additionally, long hours in the field providing GI maintenance work is physically demanding and can contribute to a high staff turnover.

PORTLAND, OREGON

Verde Landscape

Workforce Development

maintenance framework

Bioretention

gi asset maintained

Verde Landscape

key players

trash and debris removal; sediment removal; planting; weeding; pruning; watering; mulching

maintenance tasks performed

2005

program established

Established in 2005, Verde Landscape is a non-profit, Social Enterprise that hires and trains crew members from Portland's low-income neighbourhoods. Verde's business model supports its mission to "serve communities by building environmental wealth through social enterprise and advocacy."[158]

Verde provides training and employment in landscape construction and maintenance, which also includes GI. The crews are trained to conduct construction, restoration, and maintenance services for landscapes, including bioswales, bioretention and tree planting. Verde is hired by the City of Portland, to conduct GI installations and maintenance. On-going landscape maintenance represents a significant portion of the work they complete. In addition to municipal employers, Verde also works with affordable housing providers, commercial contractors and others.

Verde hires people with little to no landscaping experience. Prospective staff are only required to have employment authorization and complete a background check, although experience with the criminal justice system does not preclude someone from working at Verde.

Four-year training program, with three pathways for graduation:

1. continue to work for Verde,
2. acquire long-term employment elsewhere,
3. start your own business

Crew members are supported with classroom and on-the-job, paid training. Each trainee receives 80 hours of both hard and soft skills training, including technical, safety and industrial instruction, as well as English, financial literacy, computer classes, and conflict resolution. Verde aims to generate 90% of its revenue from fee-for-service and 10% from grants, which support workforce training provided to their employee.

What makes this program a success

Verde Landscape is a successful example of a social enterprise, which employs and trains low-income residents in landscape work, including GI maintenance in a municipal setting.

What made it work?

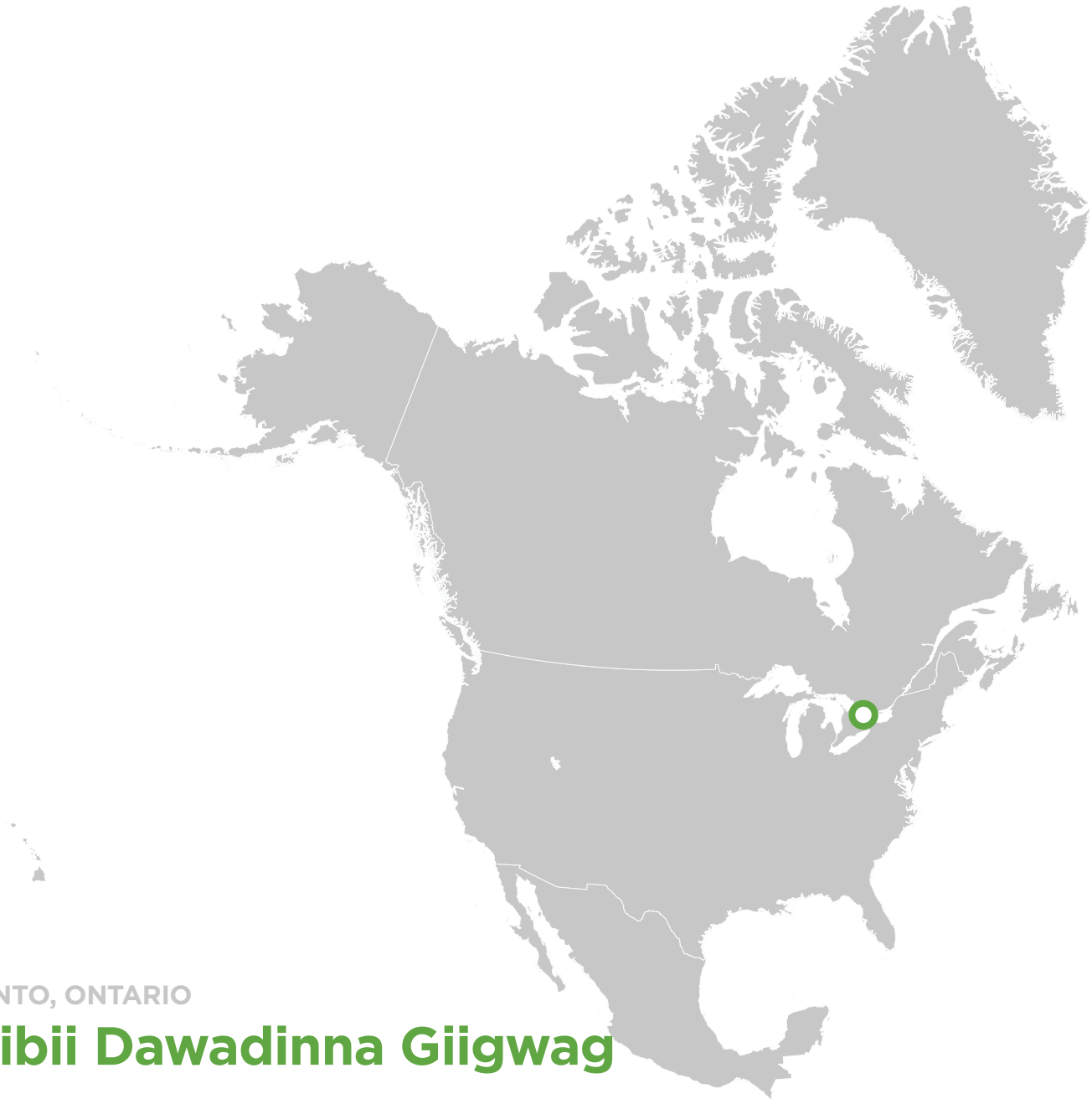
Grant funding from multiple organizations supports Verde Landscape's training program. Multi-year contracts have also allowed Verde to plan for long-term employment.

Support from employers looking for equity. Verde Landscape has had success competing against low-road contractors where a project owner requires prevailing wages, or is looking to achieve other social goals such as workforce diversity or training.[159]

Key Takeaways

» Navigating the municipal proposal process can be a challenge for non-profit organizations. Providing support to non-profits in bidding for municipal work would ease this burden.

» Consistent and stable funding is needed to allow non-profit organizations to invest in training programs and plan for long-term employment.



TORONTO, ONTARIO

Nikibii Dawadinna Giigwag

Workforce Development

maintenance framework

Bioretention

gi asset maintained

TRCA
University of Toronto
Elder Whabagoon
Native Canadian Centre

key players

2018

program established

Nikibii Dawadinna Giigwag (NDG; Flooded Valley Healing, in Anishinaabemowin, Manitoulin dialect) is a summer employment opportunity for indigenous youth to contribute design ideas for the revitalization of the Toronto and Region Conservation Authority's (TRCA) Bolton Camp. The initiative is an interdisciplinary employment and mentorship program, providing participants with an introduction into sustainable design building, ecological learning, and rainwater management.[160]

BOLTON CAMP

The camp was previously operated as a camp for underprivileged kids from Toronto in the 1920s. The camp ran for 75 years before closings its doors in the 1990s, and serves as an early example of social equity in the region. The TRCA purchased the 254-acre property, located 40 km north of Toronto in early 2011 and began to redevelop the site as a community cultural hub.[161]

The TRCA identified an opportunity to leverage their GI program to provide an employment program for indigenous youth. In conversations with the indigenous community, including the native Canadian centre of Toronto, elders, parents, high school teachers and indigenous architects and professionals, the following four challenges for the community were identified.

1. Lack of opportunities to be 'on the land', acknowledging spirit and connection to Land, essential principles of Indigenous world views, histories, learning processes, and teaching practices;

2. Intergenerational trauma and consequent loss of knowledges, languages, traditional practices, and cultural identity;

3. Limited pathways to post-secondary education and to professional career paths such as Architecture and Landscape Architecture; and

4. High unemployment rates[162]

PROGRAM STRUCTURE

The program was developed in collaboration with Elder Whabagoon, the Toronto and Region Conservation Authority (TRCA), the John H. Daniels Faculty of Architecture, Landscape and Design at University of Toronto, the Native Canadian Centre of Toronto and Great Lakes Waterworks Water Allies. The program seeks to serve as a participatory model for GI design, which includes the voices of Indigenous youth and Elders/Traditional knowledge keepers.[163] According to the project founders the project was motivated by three aspirations:

» *"to define the role of Landscape Architecture in responding to the Truth and Reconciliation Commission of Canada's Calls to Action"*

» *"to develop a 'learning-by-doing' example for integrating Indigenous Ways of Knowing including themes of Respect, Relationship, Reciprocity, Responsibility"*

» *"to help bridge the intergenerational gap on traditional knowledge."*[164]

For the inaugural year the six-week internship offered 4 high school students the opportunity to explore traditional teachings of the land and introduces them to potential education and career paths in the fields of Landscape Architecture, Indigenous studies and environmental science. As TRCA interns, the youth receive work experience in restoration activities, including tree planting, habitat protection and ecological field work. The youth are supported by mentors in the program, including Elder Whabagoon and various professional mentors in landscape architecture and adjacent fields.

ACADEMIC PARTNERSHIP

The program is developed in partnership with the University of Toronto and TRCA, where the University focuses on developing an academic program, while the TRCA focused on developing training opportunities. The program is funded through a grant provided

by the Laidlaw Foundation and the University of Toronto, LACF, and the City of Toronto, Urban Forestry.

What makes this program a success

The Nikibii Dawadinna Giigwag program provides a model of indigenous led work in GI design. Supported by two TRCA staff members and various mentors, the program provides employment experience for indigenous youth and an opportunity for the TRCA and program partners to learn from the indigenous perspective. The program was structured to begin small, where they could be responsive to the needs of the group and scale in size. Model is structured to allow for change based on their feedback.

What made it work?

Following the principle 'nothing for us without us' the program includes indigenous community members as program partners.

Program started small and then scaled up. The program partners wanted to get it right before they committed to making it too big and gave the program partners the opportunity to continually go back to the community for feedback.

Supported applicants through hiring process. Through program partners, the TRCA supported applicants through the employment process. They found many of the people they were targeting did not have resumes. To overcome this barrier they had a teacher at the school they reached out to (the Native Learning Centre) require an application to this program as part of a school project.

Outreach to indigenous youth included non-typical avenues. Indigenous youth typically do not respond to traditional marketing strategies (e.g. posted program). Youth were found mostly through word of mouth (friends, engagement with schools, etc.). Outreach to youth requires connection in the community and there is a need to develop a partner who can reach out through established channels.

Key Takeaways

» "Nothing for us without us" – including indigenous community members in indigenous work is essential.

» There is a need for more indigenous programming that connects traditional teachings to the land. GI programming can create this opportunity to Indigenous traditional, spiritual, land-based teachings with conceptual and technical architectural design skills, and environmental conservation field work. Such programing also supports the Truth and Reconciliation Commission of Canada (TRC) Calls to Action."[165]

» Identify people to use established channels to reach people for employment.

» Indigenous led programs in partnership with another organizations creates an opportunity to learn from the Indigenous perspective.

ENDNOTES

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