Sustaining Green Infrastructure through Community Engagement: A Call to Action.

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Executive Summary

The adoption of green infrastructure as a crucial infrastructure within cities and municipalities across the United States is increasing, given the functions and benefits they provide to humans and the environment. These benefits and functions range from providing stormwater management, ecosystem services, improving quality of life and health of the public, aesthetics, and improving water quality flowing to local creeks and rivers. However, the effective and regular maintenance of the system is essential to ensure that it continues to deliver these benefits and functions to the neighborhoods in which they are installed.

The current approaches to green infrastructure implementation need to be changed because of their neglect to effectively address the critical aspect of maintenance challenges of green infrastructure long after installation. Lack of proper maintenance of green infrastructure leads to the system's ineffectiveness, making it a nuisance to community members and their neighborhoods.

Recommendations for actions to be taken by policymakers include collaborative partnership and communication, availability of maintenance manuals and guides, availability of funds, community engagement and involvement, education and outreach programs, and monitoring and evaluation process, as these recommendations can ensure proper maintenance and longevity of green infrastructure systems.

Context and Importance of the Problem

The maintenance of green infrastructure systems is essential and requires long-term care to sustain and effectively provide its technical functions and achieve other benefits it offers. The lack of proper maintenance after installation leads to the dilapidation of the systems, which affects their ability to provide functional benefits such as stormwater management, habitat creation, and aesthetic values.

According to the Water Infrastructure Improvement Act, "*Green Infrastructure can be defined as a range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest, and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters*."

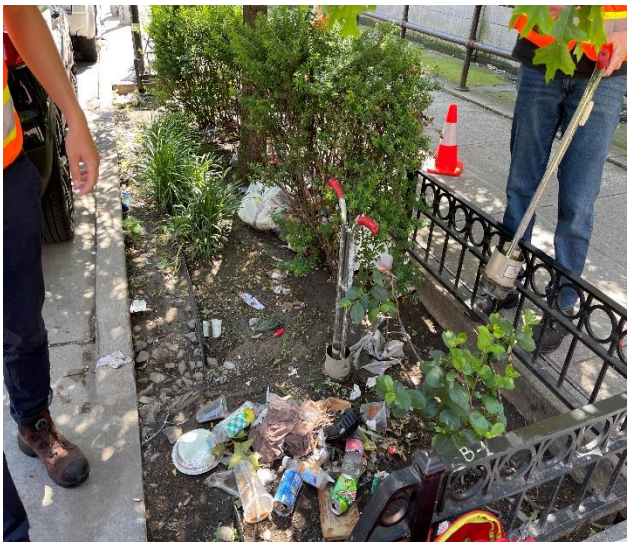
The Importance of green infrastructure within communities is emphasized due to increasing impervious surfaces caused by urbanization and population [1] and the effect of climate change. Consequently, cities and municipalities are interested in improving green spaces within their communities to achieve climate change mitigation, stormwater management, community aesthetics, and habitat creation [2, 3]. The benefits and functions of the systems have led to their adoption within neighborhoods or on residents' properties. Also, Integrating green infrastructure to increase green spaces within cities and municipalities improves the quality of life of humans and animals [4] and local climate conditions [5].

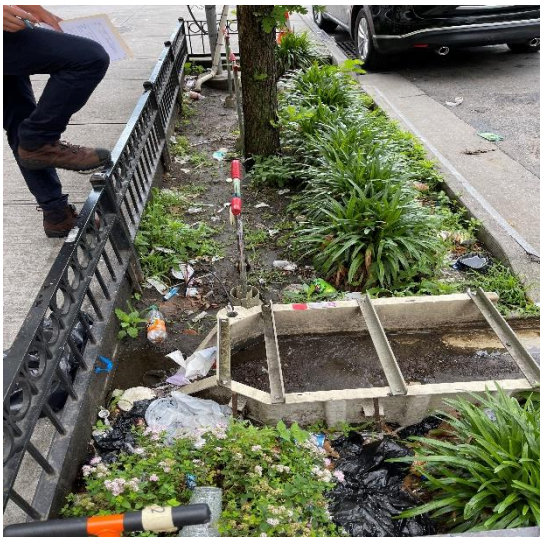
In Virginia, the Virginia Department of Environmental Quality (DEQ) policy on MS4 permits highlights the need for restoring and protecting the Chesapeake Bay, which runs through Virginia and five other states, including Virginia. The municipal separate storm sewer system (MS4) permit regulates discharges from separate municipal stormwater within the state and determines the Total Maximum Daily Load (TMDL) discharged by communities around the bay. The policy is regulated under the Virginia Stormwater Management Act, the Virginia Stormwater Management Program (VSMP), and the Clean Water Act.

The MS4 permits were developed in two phases; Phase I regulates large to medium operators serving populations of 100,000 people and above (individual permit), while Phase II focuses on urban areas

(general permit). In order to adhere to MS4 permit regulations and requirements and keep permits active, Virginia municipalities and cities adopt a wide range of green infrastructure to help protect, restore, and keep the Chesapeake Bay pollutants-free [11].

However, with the adoption of green infrastructure systems by cities and municipality stakeholders across Virginia, maintaining the systems remains challenging. The lack of adequate and regular care results in the systems becoming a nuisance to the community in which they are installed. They tend to accumulate trash, becoming an eyesore and source of concern for the neighborhood [6]. For example, figure 1 & 2 below shows a poorly maintained and trash-filled Right of Way Bioswale (ROWB).





Figures 1 & 2: Show examples of poorly maintained right-of-way bioswales (ROWB)

Photo credit: Tolu Adesoji

There needs to be a shift from the implementation and funding focus of green infrastructure systems within cities and municipalities as a policy to a green infrastructure maintenance policy, which is equally essential for ensuring the effectiveness and longevity of the systems. This policy will ensure that green infrastructure systems provide environmental, health, and other benefits to the communities and neighborhoods in which they are installed. In addition, prioritizing preventive measures like maintenance and primary care of the systems with the help of community engagement and involvement and regular monitoring of the systems can help with the system's longevity. Policies focusing on maintaining green infrastructure can help address maintenance issues and ensure longevity.

Overview of the cause of the problem

This policy will advocate for community-driven maintenance of green infrastructure to achieve sustainable, effective, and adequate benefits for communities. The involvement of community members in maintaining green infrastructure systems within their communities can help address the problem of lack of proper maintenance by involving residents, community groups or organizations, and local businesses to care for and manage green spaces around their properties and businesses. In addition, this will help create and promote a sense of ownership and stewardship within them and build trust among different stakeholders.

The following are the challenges facing community-led maintenance of green infrastructure within cities and municipalities where they are installed.

- **Lack of Funding and Expertise:** The maintenance cost is an ongoing challenge for many municipalities, resulting in green infrastructure maintenance being a nightmare from two perspectives. The first perspective is finding the appropriate expert to design or maintain the systems, as there is a lack of trained personnel with the expertise. The second is having the required funds for maintenance from the municipalities' point of view [7].
- **Lack of Technical Resources and Guidance:** The lack of standard guidelines regarding implementing and maintaining green infrastructure is a significant challenge for stakeholders willing to implement the systems within their communities. There are varying guidelines tailored toward specific locations with varying pieces of information [8].
- **Lack of Community Engagement and Involvement:** The lack of community engagement and involvement during the planning and design of green infrastructure leads to a lack of awareness of the benefits of the systems and makes their maintenance be seen strictly as the responsibility of municipalities from the community perspective [9].
- **Lack of Monitoring and Evaluation:** The lack of adequate monitoring and evaluation of green infrastructure systems long after installation affects their performance [10].

Critique of policy options

Current policies and proposed bills on green infrastructure implementation heavily focus on installing the systems within communities and how stakeholders can secure funding for their construction as innovative management techniques for protecting and restoring water quality. While also increasing climate change mitigation, providing green Jobs, serving vulnerable communities, and adding green spaces within neighborhoods. However, it is worth noting that no policy exists on maintaining the systems long after installation.

Existing policies and bills in Virginia are heavily focused on implementing green infrastructure by providing funds and laws regarding stormwater management. For example, the MS4 program by the Virginia Department of Environmental Quality (VADEQ) regulates the discharges from municipal storm sewer systems in Virginia. In addition, the HB 908 bill on Virginia's green infrastructure bank was created In Virginia's House of Legislative by Democratic delegate Alfonso H. Lopez. The bill supports promoting and investing in qualified projects that reduce greenhouse gas emissions, assist climate-impacted communities, and promote environmental justice. Lastly, the Clean Water Financing and Assistance Program (CWFAP) by the Virginia Department of Environmental Quality (VADEQ) administers four funding programs. The CWFAP includes the Virginia Clean Water Revolving Loan Fund (VCWRLF), Stormwater Local Assistance Fund (SLAF), Water Quality Improvement Fund (WQIF), and American Rescue Plan Act (ARPA) wastewater funds. The program provides flexible funding solutions and assistance to localities, organizations, and citizens of the commonwealth to help protect and enhance water quality within the Commonwealth of Virginia.

The New River Valley Regional Commission received a grant from the Virginia Department of Environmental Quality to develop the Crab Creek Beautification Project led by Nicole Hersch, Regional Planner II/Community Designer. The project is set up to provide funds to community members, particularly property owners within Christiansburg, Virginia, to connect with the Crab Creek Watershed

through watershed-friendly landscaping practices on private property. The program's primary focus is to provide cost-share and technical assistance to private property owners within the community.

These policies and bills have contributed to building resilient cities and municipalities while improving water quality and building ecosystems. However, these policies and bills are falling short in certain areas, including a lack of adequate funding for community-led maintenance of green infrastructure systems within their neighborhood.

Policy Recommendations

The policy recommendations to help mitigate the challenges of community-led green infrastructure maintenance include the following;

- Collaborative partnership and communication
- Availability of maintenance manuals and guides
- Availability of funding and incentives
- Community engagement and involvement
- Education and outreach
- Monitoring and evaluation process
- Creation of green jobs

These policy recommendations with a community engagement focus to help with the maintenance issues and longevity of green infrastructure are discussed below;

- **Collaborative Partnership and Communication:** There should be a joint partnership between different stakeholders, for example, a University-Community partnership, Municipal-Citizens group partnership, Citizen group-community partnership, and Municipal-community partnership. A collaboration between various entities and stakeholders plays a significant role in addressing maintenance issues, supporting stormwater-related matters, and building community resiliency. Also, these partnerships should provide effective communication for better understanding and care of the systems and mitigate the silo effect within the partnership.
- **Availability of maintenance manuals and guides:** The availability of expert knowledge-based published maintenance manuals and guides addressing the Importance and input of community-led maintenance. These maintenance manuals and guides should highlight the appropriate and non-damaging care to the systems that community members can carry out to green infrastructure systems adjacent to their property and within their neighborhood.
- **Availability of Funding and Incentives:** The availability of funds for maintenance should be prioritized after installing the systems for better care. Also, there should be a program that incentivizes community members who care for green infrastructure and encourages participation in the maintenance of the systems.
- **Community Engagement and Involvement:** Community members should be engaged in the planning and design of green infrastructure systems to be part of the decision-making of systems built within their neighborhood to create a sense of ownership and stewardship.
- **Education and Outreach:** Municipalities and cities should prioritize programs geared towards raising awareness and building support for green infrastructure amongst their residents. These

programs will help educate the public about the benefits of green infrastructure and motivate maintenance.

- **Monitoring and Evaluation Process:** Regular monitoring and evaluation of already constructed green infrastructure are essential to help inform their effectiveness, maintenance needs, and how to better design systems in planning for optimum performance.
- **Creation of Green Jobs:** Training workforce experience in maintaining green infrastructure systems is essential. Such programs will help create new jobs for community members and help with socioeconomic and employment sectors.

By implementing these recommendations, governments and organizations can help ensure the long-term effectiveness of green infrastructure systems after installation.

REFERENCES

1. Sandstrom, U.G., *Green infrastructure planning in urban Sweden.* Planning practice and research, 2002. **17**(4): p. 373-385.
2. Sukopp, H. and S. Weiler, *Biotope mapping and nature conservation strategies in urban areas of the Federal Republic of Germany.* Landscape and urban planning, 1988. **15**(1-2): p. 39-58.
3. Ulrich, R.S., et al., *Stress recovery during exposure to natural and urban environments.* Journal of environmental psychology, 1991. **11**(3): p. 201-230.
4. Botkin, D.B. and C.E. Beveridge, *Cities as environments.* Urban ecosystems, 1997. **1**(1): p. 3.
5. Gómez, F., N. Tamarit, and J. Jabaloyes, *Green zones, bioclimatics studies and human comfort in the future development of urban planning.* Landscape and urban planning, 2001. **55**(3): p. 151-161.
6. Meenar, M., et al., *"Green Enough Ain't Good Enough:" Public Perceptions and Emotions Related to Green Infrastructure in Environmental Justice Communities.* International Journal of Environmental Research and Public Health, 2022. **19**(3): p. 1448.
7. Jayakaran, A., et al., *Green infrastructure in western Washington and Oregon: Perspectives from a regional summit.* Urban Forestry & Urban Greening, 2020. **50**: p. 126654.
8. Tilt, J.H. and P.D. Ries, *Constraints and catalysts influencing green infrastructure projects: A study of small communities in Oregon (USA).* Urban Forestry & Urban Greening, 2021. **63**: p. 127138.
9. Girma, Y., et al., *Urban green infrastructure planning in Ethiopia: The case of emerging towns of Oromia special zone surrounding Finfinne.* Journal of Urban Management, 2019. **8**(1): p. 75-88.
10. McDonald, L., et al., *Green infrastructure plan evaluation frameworks.* Journal of Conservation Planning, 2005. **1**(1): p. 12-43.

11. Virginia DEQ." (n.d.). *Municipal Separate Storm Sewer System (MS4) Permit - Stormwater*, <https://www.deq.virginia.gov/permits-regulations/permits/water/stormwater-ms4> (Feb. 19, 2023).