



GREEN STORMWATER INFRASTRUCTURE

Challenges and Opportunities in Baltimore

A Blue Water Baltimore Report
December 2019



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ABOUT BLUE WATER BALTIMORE

Blue Water Baltimore's mission is to restore the quality of Baltimore's rivers, streams and Harbor to foster a healthy environment, a strong economy and thriving communities. Since 2010, our scientists and environmental specialists have worked to address water quality issues at local and state levels.

To learn more, visit us at www.bluewaterbaltimore.org.

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Cover image: In 2015, Blue Water Baltimore installed a rain garden at the Cathedral of the Incarnation in Baltimore's Guilford neighborhood.



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Pictured: A youth member of Amazing Grace Lutheran Church in Baltimore's McElderry Park neighborhood moving plants for a rain garden. Credit: Carolyn Millard.

EXECUTIVE SUMMARY

Stormwater runoff is the leading cause of nutrient and sediment pollution to Baltimore's waterways.

In this highly urbanized region, pavement and other impervious surfaces cover more than 45% of Baltimore's landscape, preventing rain from soaking into the ground.¹

Instead, rain is diverted along city streets into a network of drains and underground pipes and is discharged into the nearest stream or waterbody.

This stormwater runoff picks up trash, oil and debris, and other pollutants from lawns, roadways, and other hard surfaces delivering pollutants to our streams, Harbor, and ultimately the Chesapeake Bay. Underground stormwater pipes are often adjacent to underground sanitary sewer pipes, both of which are old, leaky systems.

During rain events, stormwater and sewage combine and discharge directly into our streets and waterways. Even when functioning as designed, this network of drains and pipes - often called "gray infrastructure" - does not treat or remove pollutants from the stormwater runoff it transmits. In order for regional efforts to reduce pollution to our rivers and the Chesapeake Bay to succeed, stormwater must be better managed, reduced, and treated.

One approach to managing stormwater pollution that is gaining popularity across the Chesapeake region and the country is "Green Stormwater Infrastructure" (GSI). GSI is the practice of treating and replacing impermeable hardscape with plant-based and water harvesting systems like rain gardens, trees, and rain barrels that reduce the volume of stormwater, facilitate infiltration into the ground and through root systems, and reduce the rapid delivery of pollution to our waterways.

Growing research indicates that such practices cannot only manage stormwater, but can also provide a multitude of co-benefits that can make cities healthier and more desirable places to live. Use of GSI in Baltimore is not yet widespread.

In this report, Blue Water Baltimore identifies several barriers reported by residents and other stakeholders to implementing GSI projects in the city. This report describes three specific case studies where GSI implementation either failed outright or was hindered, due to processes that can be fixed.

Blue Water Baltimore interviewed engineers, civic organizations, and residents; we spoke with city agency personnel and other nonprofits working on GSI projects. We looked at other cities and regions to identify where lessons could be learned and models duplicated.

Blue Water Baltimore and other experts across the region believe that GSI approaches to stormwater management are a meaningful part of the solution to our water pollution and gray infrastructure challenges, while also providing myriad, often unaccounted for, co-benefits for our environment, our communities, and our city.

The challenges and solutions discussed in this report are as follows:

CHALLENGE #1: UNCLEAR REGULATORY AND PERMITTING PROVISIONS FOR VOLUNTARY GSI

There is no provision for voluntary GSI in the city code, which has resulted in an ad hoc permitting process for community-led greening projects that lacks clarity and predictability. This lack of standardization has resulted in liability and maintenance requirements that place an undue burden of finance and labor on communities and stakeholders striving to improve local environmental health.

Many of the GSI projects voluntarily brought to the city are funded through grant dollars. The permitting, liability, and maintenance barriers have contributed to the cancelation of GSI projects, resulting in a loss of financial investment in Baltimore.

Recommendation: Update the city code to define and promote voluntary GSI and develop a streamlined, time-bound, and transparent permitting process. Establish reasonable liability and maintenance requirements commensurate with GSI project scopes and benefits.

CHALLENGE #2: POOR COMMUNICATION AMONG CITY AGENCIES AND WITH CITY RESIDENTS

Currently, GSI consideration is largely limited to the Department of Public Works (DPW) for the purposes of meeting regulatory requirements.

This narrow focus inhibits collaboration, communication, and value for GSI between City departments and with residents and stakeholders. An example of poor communication with the public is an incentive program meant to reduce Stormwater Utility Fees for landowners who implement GSI on private property. The process for receiving this incentive is burdensome and may discourage property owners from pursuing future GSI projects.

Recommendation: Develop a collaborative GSI Task Force composed of relevant city agencies and external stakeholders to improve communication, encourage innovation, and engage broader participation in GSI planning, execution, incentives, and evaluation. Having an official venue for different sectors to share responsibility and ideas for stormwater management could break down silos and allow Baltimore to better recognize the benefits of GSI to environmental, public health, and community development challenges.

CHALLENGE #3: INSUFFICIENT FUNDING FOR GSI

Baltimore City has a dedicated fund for stormwater remediation through the Stormwater Utility Fee, yet much of the fund is spent on general operations like street sweeping, with very little being allocated to GSI.

Using ratepayers' stormwater payments to fund existing city services robs Baltimoreans of the opportunity to benefit from transformative GSI projects. Baltimore City's financial support for GSI is significantly lacking compared to neighboring jurisdictions that have a similar fund.

Recommendation: Substantially increase the portion of Stormwater Fee revenue that supports GSI.

BACKGROUND

In 2018, Baltimore City experienced its wettest year on record with over 71 inches of rain - almost double the city's average annual precipitation.²

Nearly half of Baltimore's landscape is made up of concrete, asphalt, and other hard surfaces that prevent rain from soaking into the ground. These large volumes of stormwater are then carried by an old network of storm sewer pipes to the nearest stream. As stormwater washes over parking lots and streets, it picks up trash, oil, debris, and chemicals that it dumps into our waterways.

Baltimore's separate sanitary sewer and stormwater pipes were first built over 100 years ago and have been poorly maintained.³ Even modest rains can cause leakage from stormwater and sanitary sewer pipes through cracks and fissures, causing untreated sewage to flow into our streets and streams.

Hundreds of millions of gallons of sewage mixed with stormwater spilled into Baltimore's streams and harbor in 2018,⁴ sending nutrients, sediment, and other pollutants into our waterways and ultimately the Chesapeake Bay.

Stormwater, especially stormwater contaminated with untreated sewage, has environmental, economic, and public health impacts on the city and its residents including high bacteria loads into waterways,⁵ sewage back-ups into homes,⁶ nuisance flooding of streets,⁷ restricted access to waterways due to pollution, and consumption advisories on locally caught fish and crabs.⁸

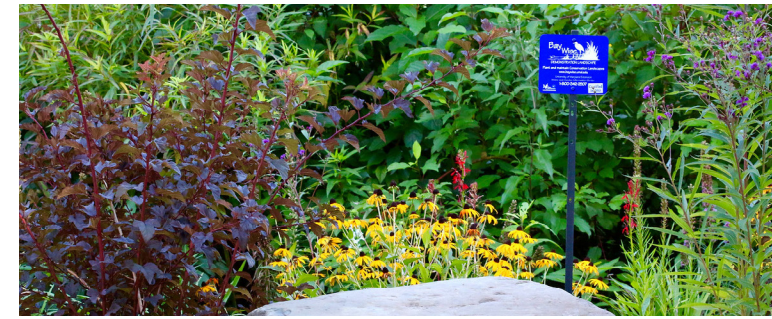
Cities across the United States, including Baltimore, are required to invest in programs and practices to reduce stormwater pollution to our waterways under the federal Clean Water Act. Compared to the "gray infrastructure" of underground pipes, "Green Stormwater Infrastructure" (GSI) is a relatively new approach that captures and treats stormwater with natural and plant-based systems to reduce stormwater runoff through infiltration, evaporation, and water reuse, mimicking the natural water cycle.⁹

Applications of GSI vary greatly depending on site conditions. In a densely urban environment with significant existing hardscape like Baltimore, small-scale, decentralized practices that capture stormwater before it enters the storm drain are often most effective.

All of the practices seen on the right (pg. 4) are part of an expanding GSI toolkit to capture and manage stormwater in urban areas where there is limited space. Increasing the use and distribution of these kinds of practices throughout Baltimore benefits the quality of Baltimore's streams and Harbor.

Credit (pictures right): *Green Roofs*, U.S. Environmental Protection Agency; *Trees*, Ron Sanderson; *Rain Gardens*, *Rain Barrels*, and *Pervious Pavement*, Blue Water Baltimore.

EXAMPLES OF GREEN STORMWATER INFRASTRUCTURE



Rain Gardens

Rain gardens can be scaled to fit into a variety of settings and intercept stormwater next to parking lots, buildings, or between a sidewalk and street, to capture stormwater before it enters the sewer.



Green Roofs

Green roofs are plant beds that reduce runoff from the tops of buildings. In addition to being a rainwater buffer, they purify the air and can help regulate ambient and indoor temperature, which provides energy cost savings.



Rain Barrels and Cisterns

Cisterns and rain barrels come in a variety of shapes and sizes and connect to downspouts to collect rainwater for later use, reducing reliance on drinking water.



Trees and Tree Pits

Trees and expanded tree pits along streets are another effective GSI practice, reducing pavement and allowing soils and vegetation to absorb runoff.



Pervious Pavement

Replacing pavement with pervious or porous paver technology allows water to soak into the ground while still providing a hard surface for pedestrian, bike or auto use.

GSI can directly improve water quality in waterways. For example, a watershed-scale study in Baltimore County, Montgomery County, and Washington, D.C. determined that areas with concentrated GSI practices showed significant reductions in nutrient concentrations and runoff volume compared to areas without them.¹⁰

In Baltimore, the U.S. Geological Survey analyzed long-term water quality datasets from the Gwynns Falls and found that GSI practices were correlated with lower levels of pollutants like phosphate and sulfate.¹¹ Both studies concluded with recommendations for more investment in GSI as a practical approach to water quality improvements.

Increasing green infrastructure also provides numerous co-benefits to city residents beyond improved water quality. GSI that incorporates native trees, perennials, and shrubs is credited with improving air quality, fostering social cohesion, improving mental health, restoring wildlife habitat, and building climate change resilience.¹²

Paved surfaces absorb and retain heat, producing a “heat island effect”, which makes urban areas without trees and other plants hotter than surrounding areas with vegetation. National Oceanic Atmospheric Administration researchers documented up to a 17-degree difference between city locations with and without trees.¹³ Trees and vegetation reduce urban heat by providing shade and evapotranspiration, improving health outcomes and energy savings.¹⁴

GSI also builds urban resilience to the increase in extreme weather events resulting from climate change.¹⁵ Trees and vegetation have been correlated with improved air quality and reduced incidents of asthma.¹⁶ And, exposure to natural environments has been demonstrated to reduce stress, create positive affective states, and improve attention span.¹⁷ The interrelated mental and social benefits of increased green infrastructure are even shown to reduce health care consumption and sick leave.¹⁸

Research has found that greening vacant lots is associated with a reduction in violent crime and increased feelings of safety among residents in their neighborhoods.¹⁹ In comparison to barren paved spaces, green areas tend to attract larger and more heterogeneous groups of people with increased social activity and stronger social bonding across race, age, and gender.²⁰ Well-managed green infrastructure can also increase property values.²¹

By 2021, Baltimore City is expected to have spent more than \$2 billion on repairs to its leaky gray stormwater infrastructure since 2016.²² Much of that expense is paid by residents through general taxpayer funds and the City’s stormwater utility fees on water and sewer bills.²³

In addition to providing co-benefits like improving public health, installing GSI may save capital costs when compared to the construction, operation, and maintenance expenses associated with gray infrastructure.²⁴ Baltimore has an opportunity to supplement upgrades to its pipe network with GSI to address pressing environmental, economic, and health priorities in the city and increase the return on investment for Baltimore residents by meeting multiple goals simultaneously.

EXISTING STORMWATER POLLUTION REGULATIONS

Baltimore, like other large jurisdictions, is regulated under the federal Clean Water Act as a “point source” of pollution.

The City’s network of storm sewers and pipes is permitted as a Phase I Municipal Separate Storm Sewer System (MS4),²⁵ by the Maryland Department of the Environment (MDE) under the Clean Water Act’s National Pollutant Discharge Elimination System (NPDES) permit program.²⁶ Under the permit that ended in December 2018, Baltimore City must remove or treat 20% of its impervious surfaces to address water pollution associated with stormwater runoff.²⁷

In order to meet this stormwater pollution reduction, Baltimore City developed a Watershed Implementation Plan (WIP) with the stated goal to “educate and involve residents, businesses, and stakeholder groups in achieving measurable water quality improvements.”²⁸ Although the WIP is managed by DPW, implementation should include coordination between many City departments that manage public lands like parks, schools, public rights-of-way, public housing, and streets, as well as collaboration with private property owners.

GREEN STORMWATER INFRASTRUCTURE IN MARYLAND

In 2007, Maryland’s General Assembly passed The Stormwater Management Act of 2007,²⁹ which prioritized the use of GSI (referred to as Environmental Site Design of “ESD”) to manage stormwater. The Act required MDE to develop a set of implementing regulations and a model ordinance for local integration of nonstructural, vegetative stormwater management into development and redevelopment projects. The resulting regulations require ESD to the Maximum Extent Practicable for the treatment of stormwater from development and redevelopment via local implementation programs.³⁰

In December 2010, the U.S. EPA finalized the Chesapeake Bay TMDL, a comprehensive “pollution diet” to improve water quality in the Bay and its tributaries. Maryland released a statewide WIP to meet the state-based pollution reduction targets. As part of this WIP, Maryland cited its statutory requirement of ESD to treat stormwater from all new development after 2010, as well as “... one of the most progressive set of stormwater requirements for a stormwater (MS4) permit in the Bay Watershed”³¹ as evidence of its ability to meet assigned pollution load reductions by 2017. In 2012, Maryland’s General Assembly passed House Bill 987 entitled the “Stormwater Management - Watershed Protection and Restoration Program,” which required all Phase I MS4 permit-holding jurisdictions to create a dedicated funding source for permit implementation through the development of a stormwater utility fee.³² Baltimore City created its own stormwater utility fee, based on the amount of impervious surface that exists on a property in order to maintain a dedicated fund to support the City’s MS4 implementation.³³

Since the establishment of the TMDL and requirement for a 20% reduction or treatment of impervious surfaces, Blue Water Baltimore has worked with a variety of property owners and community groups to plan and construct GSI projects throughout the region. During this work, we have experienced impediments to project implementation that, after discussing with other stakeholders, we learned were not unique to us. BWB interviewed local engineers, residents, and community groups, and met with City departments regarding different GSI projects to better understand these obstacles.

CHALLENGES AND OPPORTUNITIES

CHALLENGE #1: UNCLEAR REGULATORY PROVISIONS AND PERMITTING PROCESS

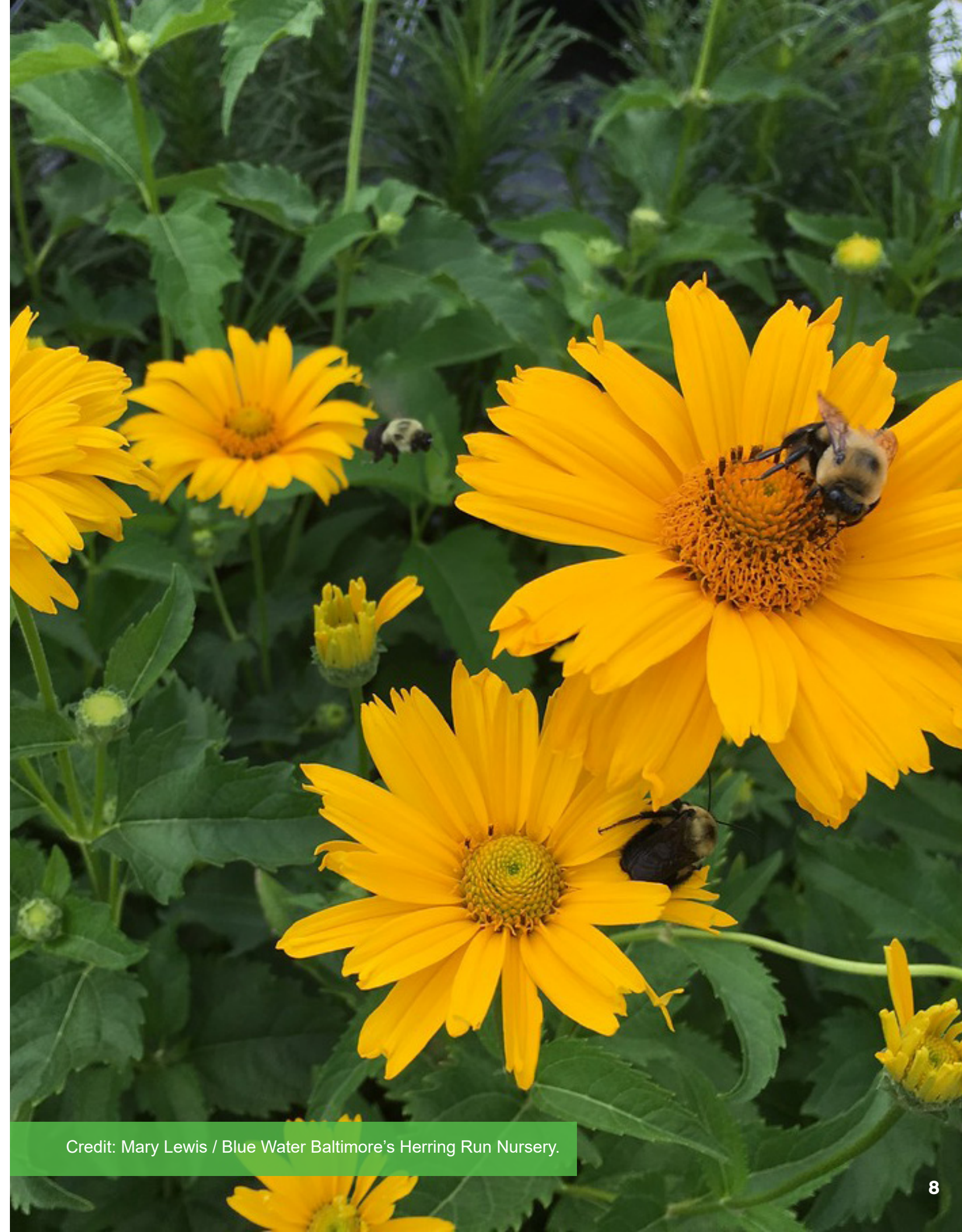
In accordance with state law, Baltimore City's Code includes language requiring GSI for new development or redevelopment.³⁴ Holding developers accountable for managing stormwater runoff from construction projects is important.

But the first, and perhaps most difficult barrier to implementing GSI in Baltimore, is the absence of a specific regulatory pathway for voluntary implementation of GSI by private landowners, community groups, and nonprofit organizations. Without such a regulatory framework, often modest GSI projects are held to regulatory requirements that are designed for large-scale development projects.

Lack of city code specificity or programmatic guidance for voluntary GSI projects has resulted in a cumbersome permitting process that is often difficult for community members to navigate. There is no way to know how long design review will take or what standards the design must meet to be approved for a permit.

This lack of clarity is especially problematic since voluntary GSI projects, like a church installing a rain garden or a neighborhood association adding stormwater landscaping to a street, are primarily funded by outside grants that include strict budgets and timelines.

Without a clear sense of permitting timeframes, it can be quite difficult to successfully manage and comply with grants, leading to squandered funding on prolonged or redundant design reviews that delay or even prevent implementation.



Credit: Mary Lewis / Blue Water Baltimore's Herring Run Nursery.

CASE STUDY: REGULATIONS GO AWRY

In 2015, Pigtown Main Street,³⁵ a small business development nonprofit, secured grant funding to install stormwater bump-outs along the Washington Boulevard corridor to beautify the neighborhood and treat stormwater runoff as part of their Master Plan.³⁶

Stormwater bump-outs are small rain gardens that “bump out” into the street, treating runoff from the road while slowing traffic near intersections to make crossing safer for pedestrians. This project was designed to disturb less than 5,000 square feet of land.

The designers contracted by Pigtown Main Street met with the City Departments of Transportation (DOT) and Public Works (DPW) early to determine the process for permitting. Yet, when the design commenced, project designers reported a lengthy back and forth process of partial design review, revision, and resubmission, followed by new and different comments months later that could have been addressed during the previous review.

With each revision and resubmission, design documents had to be printed and physically delivered to DPW offices, where no receipt or confirmation of delivery was provided. Further complicating the matter, each agency required the other’s final approval before issuing their own final approval, creating a circular logjam that lasted for more than six months.

During this process, Pigtown Main Street learned that DOT would require a signed Developer’s Agreement, a contract usually reserved for construction projects like new roads, sidewalks, or sewer connections in the right-of-way, that establishes requirements for liability and maintenance.³⁷

A positive element of the Developer’s Agreement was the requirement of one year of stormwater facility maintenance, after which, the city would issue a Final Acceptance and presumably assume maintenance responsibility for the bump-outs.

Unfortunately, this limited maintenance obligation was voided by another contract required by DOT, a Memorandum of Understanding (MOU)³⁸ that obligated Pigtown Main Street to perpetually maintain the stormwater facilities, despite their location within a public right-of-way.

Not only was it saddled with maintaining the bump-outs in perpetuity, the MOU even made Pigtown Main Street responsible for repairing or reinstalling the project if damaged by city street repairs or resurfacing. The MOU also required \$1 million in liability insurance for the stormwater facility.

These expectations and requirements of a nonprofit business development organization seeking to improve a neighborhood’s vitality are overly burdensome and unfair. Pigtown’s stormwater bump-outs directly benefit the City in meeting its TMDL and WIP requirements, so the city has an incentive to support and maintain them.

Additionally, Pigtown Main Street secured their own grant funding for these bump-outs, saving the city resources to meet mandated stormwater reduction goals. It is inequitable for the City to place the burden of permanent maintenance and liability solely on a community nonprofit for what is essentially a public good.

Pictured: A stormwater bumpout in the Butcher’s Hill neighborhood.
Credit: CityScope Engineering LLC.



The design review process for Pigtown Main Street’s modest stormwater bump-out project took so long that two of the grants funding the project expired. Design requirements were poorly communicated and resulted in redundant review and resubmissions without predictable timetables for completing and returning reviews.

Despite Pigtown Main Street’s consistent efforts, the protracted review process in combination with the outsized liability and maintenance requirements ultimately killed the project.

This small non-profit striving to beautify their neighborhood wasted four years and upwards of \$400,000 on a GSI project that never broke ground. They could not manage the review process and the long-term costs.

RECOMMENDATIONS TO ADDRESS PERMIT CHALLENGES

#1: Update City Code

The Natural Resources Article of the City Code specific to Stormwater Management and Erosion and Sediment Control (Div. II-III, §21-35) includes provisions that could be amended to accommodate voluntary GSI not tied to new development or redevelopment projects.³⁹

Current code already requires stormwater management practices such as rain gardens and rainwater harvesting for certain new construction or modifications to existing buildings and structures.⁴⁰ However, there is no definition for voluntary stormwater management greening projects that communities in Baltimore pursue for the sole purpose of improving their neighborhoods and the broader environment. As such, Baltimore lacks a clear process for reviewing and approving voluntary GSI plans, which has resulted in a system that discourages voluntary GSI.

Baltimore City should revise the code to define and specify the steps necessary for planning, permitting, and constructing voluntary GSI. If voluntary GSI is addressed as a stand-alone process within the City's permitting procedures, it will enable City departments to issue clear standards and guidelines. This will support mutual accountability between the City and external stakeholders for quality greening practices that improve the health of Baltimore's watersheds and neighborhoods.

City agencies and external stakeholders should work together to undertake a comprehensive review of relevant city code provisions to not only define and develop a process for voluntary GSI, but also to identify and remove other potential barriers to implementing such projects in Baltimore City. Barriers might include building and fire code regulations that discourage rooftop gardens and rainwater harvesting, transportation infrastructure regulations that exclude consideration of GSI practices in the public rights of way, public safety regulations that prohibit standing water, and weed or pest control regulations that prohibit GSI practices for public health reasons or otherwise.⁴¹

City code revisions could go even further by requiring GSI retrofits in more situations, like major street projects, or on all private development and redevelopment projects, including single-family homes.

#2: Specify permit requirements and timeframes

Baltimore City should develop a specific, time-bound review process for voluntary GSI projects.

Standardized design specifications and streamlined permitting were identified within the 2019 Sustainability Plan as a means for increasing the implementation of GSI, especially projects disturbing less than 5,000 square feet, like Pigtown Main Street's project.⁴² As part of this process, the submission of designs and return of review comments should be electronic, utilizing the ePlans system already in place in Baltimore, to avoid the costs and time associated with printing and physically transporting designs.

Electronic submission and review would provide a time-stamp for receipt and verification of the reviewer assigned to the project, provide the framework for standardized design specifications, and establish a checklist for comprehensive review completion. E-filing would also improve transparency for project review progress, review fees and timeframes. Making this information readily and

electronically available will foster voluntary GSI project planning, budgeting, and execution with greater certainty within a reasonable period of performance for grantors.

#3: Update maintenance and liability requirements

The city should develop standardized maintenance and liability requirements that are proportional to the scale and benefits of the stormwater project.

A community group or private nonprofit may be expected to maintain a green stormwater project on public property for the first two to three years to ensure that it functions as designed. Afterwards, there should be options available for long-term maintenance by the City to ensure it continues to perform as intended. If a long-term City maintenance plan like this had been in place, Pigtown Main Street's stormwater bump-out project may have been completed.

As with other public utilities, GSI that exists on public property or within public rights-of-way should be integrated into the maintenance of the rest of the property by the responsible City agency. For example, rain gardens on school property can be maintained by students with assistance from groundskeepers. DOT should maintain any stormwater practices implemented on medians and streets they already maintain.

Proper training of maintenance personnel is necessary to ensure green infrastructure projects are not simply destroyed by indiscriminate maintenance activities.



Pictured: Students at Sudbrook Magnet Middle School are all smiles by a rain garden they helped Blue Water Baltimore install at their school.

CHALLENGE #2: POOR COMMUNICATION AMONG CITY AGENCIES AND WITH CITY RESIDENTS

Baltimore City's WIP and MS4 Stormwater permit are the responsibility of DPW. Yet successful implementation and public support requires cooperation with other departments that manage public assets like parks, schools, public housing, and streets, as well as communication and coordination with residents and city stakeholder groups.

Inter-agency communication and coordination regarding the planning, design, implementation, and maintenance of GSI projects can better ensure that proposed projects and long-term maintenance are consistent with other departments' plans and resources.

In order to meet its permit requirements, Baltimore DPW implements restoration projects on public lands. Outreach to potentially affected communities and stakeholders has generally been minimal before projects commence, resulting in confusion and frustration when parks and neighborhoods are impacted by a construction project they did not know about in advance. Ongoing communication with residents and stakeholders about City-implemented stormwater projects can help increase understanding of and support for GSI and possibly avoid conflicts among stakeholder groups regarding project scope.

Even though they pay for it, many city residents have no understanding of how their Stormwater Utility Fee is used and what benefits they may derive from green stormwater management in their neighborhoods. Likely fewer residents know how to take advantage of hardship assistance or opportunities to earn credits toward their stormwater fee. As part of its Stormwater Utility Fee program, Baltimore City DPW has a crediting system that reduces property owners' fees in exchange for implementing a GSI project.

Blue Water Baltimore promotes this program to property owners and communities with whom we work to build interest in voluntary impervious surface removal and restoration projects. Unfortunately, this program is not functioning as designed, and property owners are not receiving clear and consistent information regarding the process for validating and receiving the fee reduction as advertised.



Pictured: A rain garden at a private residence in Baltimore City.

CASE STUDY #1: COMMUNICATION BREAKDOWNS

Stream restoration is a core component of Baltimore City's approach to meet its MS4 permit because the practice is a cost-effective way to receive high treatment credit. Key goals of stream restoration often include bank stabilization to reduce erosion or bank grading to reconnect streams to their natural floodplain.

In the right places, and where stormwater volumes are controlled, these can be effective restoration remedies. Unfortunately, some stream restoration projects are being layered upon sanitary sewer realignment projects in order to gain MS4 permit credit, and upstream volume reductions are not accompanying stream bank grading or armoring.

In Fall 2018, Blue Water Baltimore learned that at least 70 trees we had planted on city park property along Chinquapin Run, a tributary to Herring Run, had been removed or severely damaged by construction and staging activities as part of a DPW sanitary sewer realignment and stream stabilization project.

These trees were planted with permission and funding from the City Department of Recreation and Parks Forestry Division (BCRP Forestry) between 2009 and 2015 and maintained as recently as 2018.

BWB met with DPW and BCRP Forestry to express concern that our work had been destroyed as a result of this stream stabilization project. In this meeting, we learned that communication with BCRP Forestry was inadequate and that Forestry staff were unclear about the extent of planned impacts along the stream's riparian corridor.

There was also poor communication with neighboring residents regarding the Chinquapin Run project. Blue Water Baltimore consulted with residents adjacent to stream segments undergoing sewer realignment and stabilization, as well as members of the City's Forestry Board and other nonprofit organizations and heard multiple concerns:

- Damage to trees that residents were promised would be protected.
- Ongoing and egregious erosion and sediment control violations during construction.
- Excessive soil compaction within the critical root zones of trees identified for protection.
- Poor communication between DPW and residents before and during construction.

Meaningful communication across City departments and between DPW and residents could have avoided, or quickly resolved, many of these problems. Collaborative planning may have resulted in a better forest conservation plan, better residential engagement in addressing concerns and violations, and greater collective support for critical sanitary sewer upgrades.

CASE STUDY #2: COMMUNICATION BREAKDOWNS

Shrine of the Sacred Heart is a congregation in the Mt. Washington neighborhood with which Blue Water Baltimore partnered to install three small rain gardens to treat runoff from their parking lot and beautify their property.

The church's green team leader sought the church's buy-in for the project by highlighting that the rain gardens would result in a reduction in the stormwater fee on the church's water bill, which is an incentive program advertised by DPW.

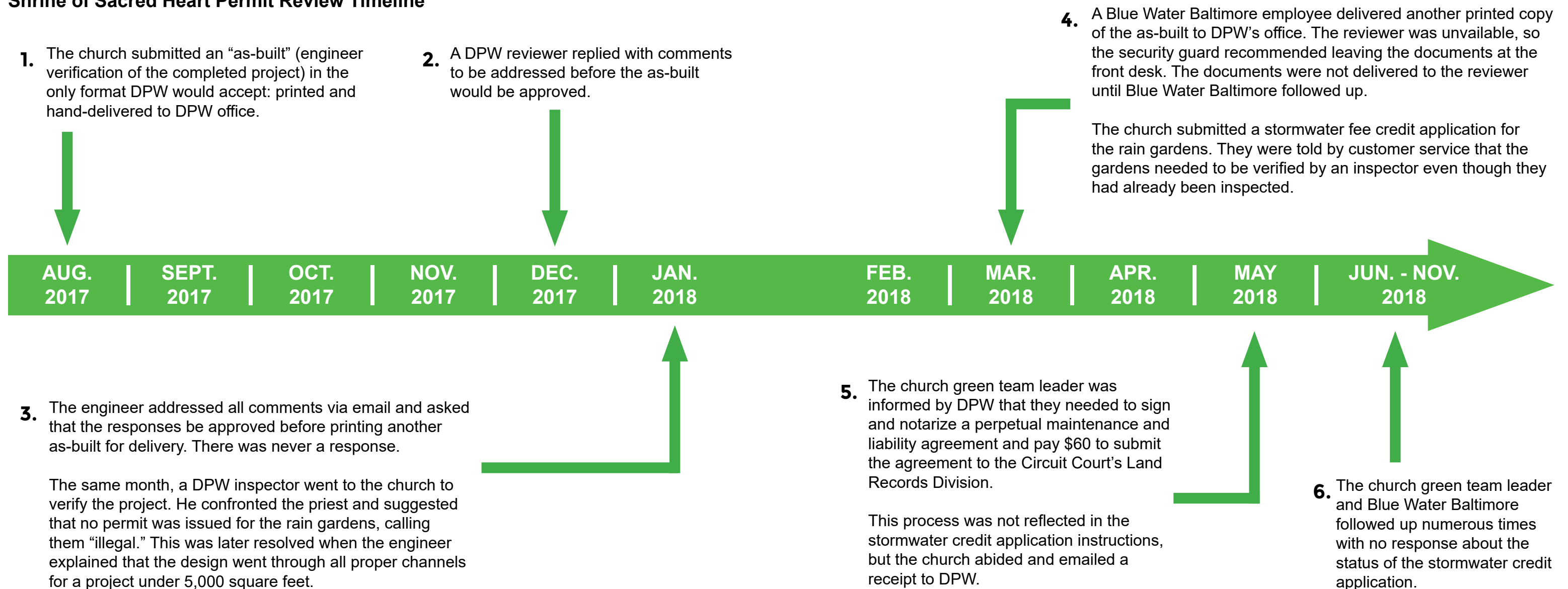
After installing the rain gardens, which disturbed less than the 5,000 square feet threshold that would trigger a rigorous permit review process, the following course of events transpired in the timeline below.

It has been two years since the rain gardens were installed, and the church has never received indication that they were awarded the stormwater fee credit for voluntarily installing green infrastructure on their property.

Residents' stewardship efforts are marginalized by poor communication regarding the City's stormwater fee and credit system, the absence of an effective tracking system for paperwork submissions, and the lack of a dispute resolution process. These communication failures reduce the likelihood that other property owners will want to undertake such projects, for fear that promised incentives will not materialize.

These experiences also make it challenging for organizations like Blue Water Baltimore to recommend in good faith that residents utilize city programs like fee credits, when we have witnessed the enormous challenge that partners like Shrine of the Sacred Heart have faced.

Shrine of Sacred Heart Permit Review Timeline



RECOMMENDATIONS TO IMPROVE COMMUNICATION

#1: Increase ongoing communication between agencies and stakeholder groups

Frequent and diverse forms of communication with stakeholders and the public will improve transparency and increase stakeholder confidence in agency use of Stormwater Utility Fees and the protection of the city's natural resources.

#2: Update procedures and customer service training regarding stormwater fee incentives

A fee reduction program can be an effective strategy to motivate residents and institutions to implement GSI on private property, but it must function in order to have that effect. DPW should increase public understanding and restore faith in the stormwater credit incentive program through the following changes to its procedures:

- Identify a single point of contact within the agency who is accountable for ensuring stormwater fee credit applications are processed in a timely manner.
- Review and verify the application steps for stormwater credit to ensure that the application instructions are accurate, understandable, and well-advertised to property owners.
- Develop a transparent process for tracking applications and resolving disputes regarding application eligibility. No voluntary effort to improve stormwater management should leave a property owner feeling penalized or ignored.

#3: Establish a formal GSI Task Force

A formal GSI Task Force that includes external stakeholders, residents, and key City agencies would improve communication and decision-making to increase implementation of GSI across the city. Such a GSI Task Force could significantly improve the planning and execution of stormwater remediation projects and foster a more collaborative dynamic of environmental stewardship and MS4 compliance.

A GSI Task Force would also enable the achievement of other city goals, including increasing climate resiliency, reducing localized nuisance flooding, reducing the urban heat island effect, and increasing accessibility to green spaces for residential enjoyment. The City's 2019 Sustainability Plan calls for creating "a coordinating committee to evaluate and improve policies, processes, roles, and site evaluation for green infrastructure..." that "[ensures] engagement from those who will be most impacted, and [follows] best practices in transparency for all processes of the committee."⁴³ A GSI Task Force would fulfill this goal.

A GSI Task Force could also foster experimentation and evaluation of new or modified approaches to GSI. It would allow City agencies to share management and maintenance of public lands where GSI can be implemented, access private lands that complement and connect to city-owned green infrastructure projects and help fund long-term maintenance. GSI is still evolving as cities identify what practices work best as a complement or alternative to gray infrastructure.

Successful GSI implementation requires a municipal culture of "social learning" that rewards innovation within and across departments.⁴⁴ Baltimore City should embrace GSI as a viable option

for treating stormwater and meeting other existing city goals. Cities around the country are learning that the complex challenges of the 21st century require intergovernmental and cross-sector collaboration.⁴⁵ A GSI Task Force would encourage reciprocal relationships that build upon existing ties across City agencies and with community stakeholders.⁴⁶ Networking through a city-wide task force could substantially increase cooperation, build trust among stakeholders, help create norms of mutual benefit to reduce transaction costs, and facilitate an environment conducive for cooperation.⁴⁷

EXAMPLES OF SUCCESSFUL GSI TASK FORCES

Atlanta and Philadelphia demonstrate how GSI task forces can be used to break down silos and build cultures of collaboration, communication, and innovation.

Atlanta's Green Infrastructure Task Force is comprised of the Departments of Watershed Management, Parks and Recreation, and Planning and Community Development, as well as the Mayor's Office of Resilience, and a number of external stakeholders such as American Rivers and The Conservation Fund.

In 2018, the Atlanta GI Task Force published a comprehensive Green Infrastructure Master Plan that details policy, funding, and planning goals as well as implementation strategies for constructing GSI on public and private property throughout the city. They also launched a GSI design challenge to spur innovation among engineers, urban planners, and designers, which reflects a willingness to experiment and explore new ways to incorporate green infrastructure into the urban landscape. The task force strengthened communication between departments and fostered a culture of collaboration and shared values where the implementation of GSI relied on expertise from a diverse set of stakeholders.⁴⁸

Philadelphia was the first city in the United States to attempt to meet its federal stormwater mandates using solely GSI. Philadelphia is succeeding in GSI implementation because it is actively overcoming departmental silos, establishing official agreements with external partners and community stakeholders, and fostering a municipal culture that rewards experimentation and innovation.⁴⁹ With a GSI champion at the helm, the Philadelphia Water Department (PWD) recognized "a potential opportunity to improve coordination between drinking water, wastewater, and stormwater management to simultaneously address CSOs [combined sewer overflows], stormwater control, and drinking water protection."⁵⁰

PWD recognized it would not be able to execute the city's Green City Clean Waters plan alone. PWD coordinated with the Philadelphia Streets Department and Parks and Recreation to establish standards and protocols for stormwater practice implementation and maintenance. PWD recognizes that their GSI goals cannot be reached on public property alone. Thus, they work with external stakeholders like the Philadelphia Industrial Development Corporation, Philadelphia Horticulture Society, and the Sustainable Business Network to engage private property owners. All relevant agencies and stakeholders are included in planning processes as part of a "dialogue-rich atmosphere" in which mutual goals are cooperatively realized.⁵¹

Establishing a culture of cross-agency and cross-sector communication and cooperation in Baltimore City could dramatically increase understanding and support for successful implementation of GSI.

CHALLENGE #3: FUNDING FOR GSI IS INSUFFICIENT

Updating a 290-year-old industrial city with nature-based infrastructure will require significant investment.

There is no dispute that stormwater remediation in an ultra-urban setting where there are small parcels, concrete-covered and compacted soils, and underground utilities takes ingenuity and dedicated funding. Yet, from a triple bottom-line perspective that considers the financial, social, and ecological benefits, investing in green stormwater infrastructure provides exponential returns on investment.

Recent economic projections regarding Philadelphia's Green City Clean Waters plan found that the estimated \$1.8 billion in city expenditures over a 25-year period on GSI will lead to revenues of \$3 billion for the city, supporting 1,000 jobs each year and approximately \$1.5 billion in total labor income.⁵² When one combines these economic benefits with the co-benefits that greening projects play in minimizing crime and blight⁵³ and increasing health outcomes for residents,⁵⁴ there is a clear case to be made for dedicating dollars to GSI for the long-term vitality of a city, as well as its waterways.

According to 2018 expenditures, DPW is spending most of Baltimore's stormwater fee revenue on operational practices like street sweeping and trash removal. While these services are cheaper in the short-term compared to implementing GSI, they do not address the large volume of stormwater and resulting pollution to Baltimore's streams and rivers or offer the same co-benefits as green infrastructure.

Currently, a small portion of the city's stormwater fee is allocated to a grant program administered by the Chesapeake Bay Trust (CBT) for implementing voluntary restoration projects. In 2016 and 2017, approximately \$100,000 of city stormwater fees were directed to this grant program; this amount was doubled to \$200,000 in 2018.⁵⁵ Still, this represents less than 1% of annual expenditures towards Baltimore's MS4 permit last year.

According to CBT, more qualified applications for voluntary restoration projects are received than there are funds to award. In 2018-2019, nine 'fundable' proposals - projects that scored high enough in the CBT evaluation process to qualify for an award - were turned down due to a shortfall in funding.⁵⁶

By comparison, Anne Arundel County allocates roughly \$1 million each year to community-oriented GSI projects.⁵⁷ Dedicating more stormwater fee revenue to voluntary green infrastructure projects can help communities leverage grants and other funding sources, extending the value of the City's investment.

Considering the myriad benefits associated with green infrastructure, more funding should be available to community groups and property owners interested in greening their neighborhoods.

We are encouraged by DPW's work to develop and utilize an Environmental Impact Bond in order to raise capital for GSI projects on public land.⁵⁸ However, since most of the Baltimore's landscape is privately owned, it is critical that funding be in place to incentivize GSI implementation on institutional, business, and residential property.



Pictured: Community members planting a rain garden at Amazing Grace Lutheran Church in Baltimore's McElderry Park neighborhood. Credit: Carolyn Millard.

RECOMMENDATION TO INCREASE FUNDING

Baltimore City should increase its stormwater fee allocations to support voluntary GSI project grants to at least \$1 million annually.

Considering the growing demand for and interest in voluntary GSI project implementation, the increased allocation could be targeted to projects leveraging other funding resources.



Pictured: A rain garden installed in Baltimore's Frankford neighborhood at Baltimore International Academy.

CONCLUSION

Baltimore City has an opportunity to demonstrate leadership by embracing GSI to not only address its regulatory responsibilities to manage stormwater pollution, but also to improve climate change resiliency, public health, and quality of life for residents.

The recommendations within this report are not new ideas. Baltimore City's 2019 Sustainability Plan,⁵⁹ the Green Network Plan,⁶⁰ and the 2019 City Stormwater Fee Oversight Committee Report⁶¹ include similar or identical recommendations. Other metropolitan regions and municipalities are capitalizing on GSI to simultaneously address multiple challenges, and many organizations within Baltimore are seeking increased reliance on GSI to address similar needs.

Clarifying and simplifying regulatory and permitting requirements for voluntary GSI projects, improving coordination and communication among agencies and communities, and increasing resources from the City's dedicated fund will improve implementation of GSI in the city.

Proactively addressing existing challenges to GSI on public and private properties is a necessary step toward increasing the long-term vitality of Baltimore City and implementing meaningful, cost-effective solutions that meet more than a single regulatory requirement and instead leverage other resources to provide many co-benefits.

**Baltimoreans want and deserve a cleaner, greener Baltimore.
Green stormwater infrastructure can help us get there.**

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Pictured: In 2015, Blue Water Baltimore installed a rain garden at the Cathedral of the Incarnation in Baltimore's Guilford neighborhood.



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