

MARKET-BASED OPTIONS TO IMPLEMENT GREEN INFRASTRUCTURE RECOMMENDED FOR THE NORTHEAST OHIO REGIONAL SEWER DISTRICT



June 2018

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1.0 EXECUTIVE SUMMARY

This project, funded by the Great Lakes Protection Fund (GLPF), provides practical frameworks for establishing a market-based, public-private partnership to deliver and finance large-scale integrated green infrastructure (GI) within the Northeast Ohio Regional Sewer District (NEORS) service area. NEORS is a Ohio-based wastewater utility that has committed substantial resources to the use of green infrastructure in improving their operations. This commitment has positioned NEORS to build upon its experience of building a collection of nine large green infrastructure projects at the cost of over \$60 Million, to seek implementation of integrated green infrastructure for stormwater management on a broader scale.

Stormwater credit trading framework is the preferred solution to the challenge of delivery of large-scale green infrastructure that meets NEORS's vision

This report details three options available for market-based, private delivery and/or financing, which include:

- Community-based public-private partnerships (CBP3)
- Environmental impact bonds (EIB)
- Stormwater credit trading

These options are presented and contrasted in Table 1-1. While all options are considered relevant and useful, Stormwater credit trading emerged as the most attractive option as information specific to NEORS was collected.

This report presents a set of market-based public-private partnership options for NEORS to lead to large-scale deployment of green infrastructure. Options presented herein include CBP3, EIBs, and stormwater credit trading. Of these, stormwater credit trading emerges as the preferred partnership model for NEORS.

Reasons why stormwater credit trading is well suited include a) it is an extension of NEORS's current impervious cover fee program, b) it is able to strengthen areas of lower economic growth and thus better address environmental justice, c) costs of such a program are largely borne by developers; d) it is a flexible framework that will allow access to private properties in the service area; and e) it will lead to a distributed network.

A credit trading program will enable property owners who are subject to an impervious cover fee to meet a portion of their requirements by buying stormwater credits from other property owners rather than building all needed green infrastructure on their own property. By doing so, they introduce flexibility into "on site rules" and if designed correctly, can create equal or better water quality outcomes than simple on-site retention requirements. Effectively, credit programs allow a larger number of smaller Stormwater Control Measures (SCM) which, in comparison to a smaller number of larger SCMs, help distribute the ecological, social, and human health co-benefits of green infrastructure throughout a watershed and capture more stormwater annually.

Table 1-1: A comparison of three options for NEORSD’s green infrastructure program

BENEFITS	STORMWATER CREDIT TRADING	EIB	CBP3
Existing Statutory Authority			
NEORSD Retains Governance and Control of Program			
Performance Based-Fee Structure			
Long-Term Operation and Maintenance Included			
Private Partner Assumes Risk For Construction, Financing, and Maintenance (EIB may include or exclude maintenance at Borrower’s option)			
Fully Scalable Solution			
Flexible Public Commitment			
Shifts Costs To Developers			
Provides Data Collection On GI Effectiveness and Includes latest innovative practices			
Opportunity For NEORSD Member Community To Assess GI			
Provides Long-Term Socio-Economic Benefits			
Potentially Reduces Fee Increases			
Enables Economies Of Scale And Program Efficiency			
Target Most Cost-Effective, High-Impact Private Parcels			
Exceeds NEORSD’s 20% local business utilization requirements			

KEY

 - Full benefit  - Partial benefit  - No benefit

PROPOSED FRAMEWORK FOR NEORSD'S STORMWATER CREDIT TRADING

Proposed framework is a variation of Title V's existing credit system: We propose incentivizing additional green infrastructure by combining the existing Title V fee and credit system with an ability to sell excess stormwater management capacity to other regulated buyers who cannot meet their stormwater retention requirements on-site.

1. What stays the same:

- a. **Title V fee structure:** The Project Team does not believe that it is practical for NEORSD to put in far more stringent fee structure.
- b. **Revenues for NEORSD:** NEORSD's policies allow fee credits to 100% of a property owner's total stormwater fee. A trading scheme would encourage parcel owners who could inexpensively reduce impervious surface area or otherwise control stormwater on their parcel to build excess green infrastructure, with credit purchases by other private property owners repaying the green infrastructure investment above NEORSD's fee credits. This would result in additional green infrastructure installation in its service area without reducing NEORSD's fee revenues beyond what is currently contemplated in Title V.

2. What changes:

- a. **Low-Impact Development ordinances for new developments:** The driver behind a credit trading market is the cost of compliance for certain properties. Because raising the Title V fees are infeasible, the cost that NEORSD can increase is the one borne by new developers in meeting the LID ordinances that the communities could pass.
- b. **An in-lieu fee option:** This is necessary in a credit trading market because regulated developers who choose to go off-site need to know that, should there be no off-site retention available for purchase, they can achieve compliance through paying a fee to their regulator. This fee would be set at the amortized price per credit that NEORSD can build SCMs.
- c. **Purchase Guarantee:** NEORSD needs to set aside a small amount of money that guarantees purchase of credits and ensures that the market has enough liquidity. A one-time appropriation of \$10 million would be sufficient to start the program. Additional funds could be added annually with money that NEORSD would have otherwise spent on its own green infrastructure SCMs.
- d. **Optional:** To increase liquidity in the market, NEORSD can deploy a number of strategies:
 - Build SCMs on public land and sell them as credits to increase the number of available credits in the market,
 - Buy credits to ensure a "floor price" below which credits do not fall, and
 - Enable multi-year credits.

3. Credit Trading Specifics:

- a. **Credit denomination:** A credit corresponds to a certain amount of retention capacity supplied by a SCM over a certain period of time. Depending on their preference, NEORSD may choose a credit in terms of volume of capture in gallons (e.g. 1 credit = 3,000 gallons of retention capacity) or on a spatial basis (e.g., 1 credit = 1 inch of stormwater retention capacity over 500 square feet of impervious area).
- b. **Credits should be tradable throughout NEORSD's service area:** This allows the market to take advantage of price discrepancies between various watersheds and recognizes that all of NEORSD watersheds and sub-watersheds ultimately feed into Lake Erie.
- c. **Allow for credit banking for purchasers:** Credit banking occurs when credits are not used immediately after they are generated but are rather stored for later use (either by credit generator, credit purchaser, or a third party). Banking credits allows purchasers to view credit purchases in an apples-to-apples way with on-site SCMs. However, for credit generators, it is important to *not* allow banking of credits beyond a reasonable window of maintenance (every three years, for example).

Applicability of a stormwater credit trading framework for NEORSD

Trading is an extension of NEORSD's current stormwater fee program that provides the necessary "stick" to incentivize green infrastructure on private properties and will enable the "carrot" of stormwater credits. NEORSD's existing codes (Title III for sanitary sewers, Title IV for combined sewer, and Title V for stormwater management) are well crafted and can be leveraged to promote green infrastructure. In addition, like the rest of the nation, the NEORSD service area has seen significant rise in real estate prices that are largely uneven across communities. A trading framework can be very effective in helping distribute the SCMs where they are best suited, within a watershed.

Finally, because a large percent of NEORSD service area is impervious, trading will be very effective in engaging private parcel owners.

Barriers to the use of a stormwater credit trading framework for NEORSD

Barriers to using stormwater credit trading include:

- At \$5.15 per month per equivalent residential unit (ERU) of impervious areas, NEORSD charges only 2 cents per square foot per year. Valderrama et al (2013) shows that estimates of SCM cost between \$0.33 to \$63.97 per square foot. In other words, at this rate, the payback period to recoup investment will take from 16 to over 100-years and is simply not economically viable (and thus needs to rely on new development).
- While the real estate market in NEORSD's service area is on an upswing

like in the rest of the country, it is neither a high value market, nor does it have sufficient density to drive exceptionally high value from offsite trading.

Next steps

NEORSD will need to undertake the following steps to successfully execute a trading framework:

- A visioning process to identify goals associated with long-term investments
- Establish a baseline of current expenditure
- Purchase guarantee and defining public revenue stream which could include dedicated fees, loans, grants, and hybrid funding combinations
- Define private demand for credits
- Establish guidelines for green infrastructure credit generation
- Reach out to similar communities in size and resources that have adopted a credit trading approach
- Evaluate and/or develop internal capacity staffing, new systems to track and maintain inventory of credits, outside training, and resource needs
- Build community trust through workshops for stakeholders and interested parties

Report Outline

In what follows, Section 2.0 outlines public and private financing options, Section 3.0 summarizes three different transactional frameworks, and Section 4.0 showcases success measures for both NEORSD and the private partner. Lastly, Section 5.0 discusses a set of next steps for NEORSD.

2.0 FINANCING & DELIVERY OF NEORSD'S STORMWATER INFRASTRUCTURE

A summary of NEORSD's responsibilities, its regulatory needs, key green infrastructure initiatives, existing codes that provide relevance to green infrastructure, and benefits of already built green infrastructure is presented in Appendix A. Also, because parallel activities are also being undertaken by the city of Cleveland, the largest municipality that NEORSD serves, a summary of greening activities (such as the Tree Plan and Green Streets) is summarized in Appendix B.

As discussed in Appendix A, NEORSD has committed to the implementation of green infrastructure as a cost-effective means of regulatory compliance, water quality improvements and improvement on the quality of life for its residents. The method of delivery and financing of this investment, so far, has been through traditional procurement using low-cost, tax-exempt public finance options. For the future, NEORSD is open to assessing alternative delivery and frameworks.

New public funding options for NEORSD include establishing new revenue sources like stormwater user fees, utilizing newer 'green' bonds, or obtaining grants. In addition to public financing sources, there are a number of private financing structures to consider. Private financing has traditionally been more expensive than public financing. However, it offers several potential advantages including:

1. Risk transfer to private sector

2. Flexibility to pursue alternative service delivery models
3. Access to broader variety of financing options
4. Significantly more scalable than public financing
5. Quicker access to innovative practices

The following sections outline public and private finance options, as well as delivery frameworks that are relatively recent introductions in the U.S. water infrastructure market.

2.1 PUBLIC REVENUE/FINANCING OF GREEN STORMWATER INFRASTRUCTURE

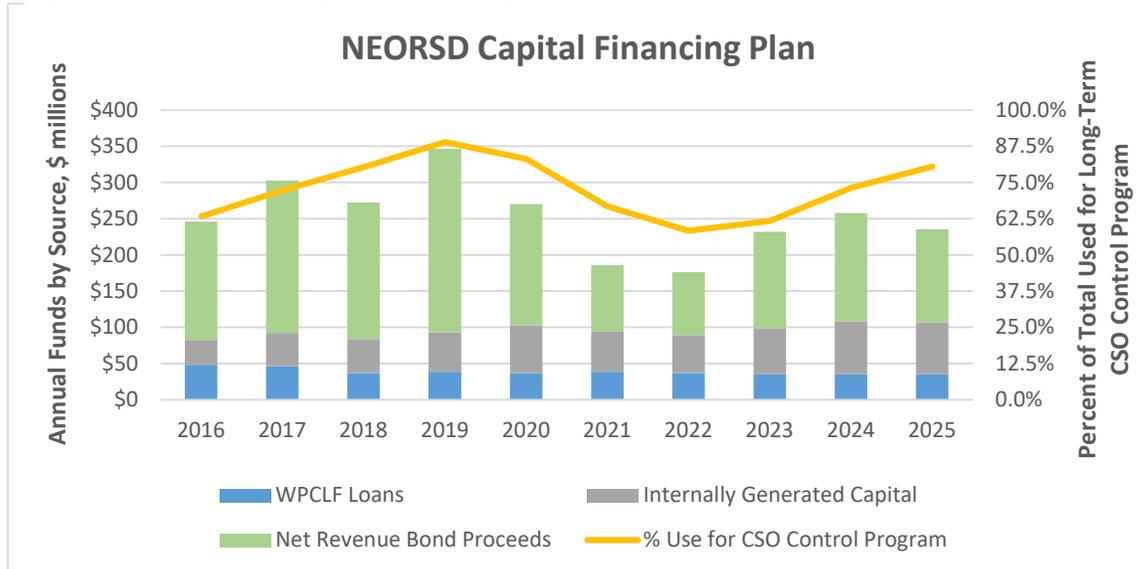
2.1.1 CURRENT REVENUE/FINANCING SOURCES

Since 1990, NEORSD, like all major water utilities, has shifted away from federal grants and loans for its capital financing plans, following the discontinuation of the federal construction grants program. Instead, it has pursued loans at below-market rates from the Water Pollution Control Loan Fund (WPCLF) program, the State of Ohio's version of a Clean Water State Revolving Fund (SRF) (see Table 2-1). As shown in Figure 2-1, NEORSD expected only about 15 percent of its financing needs from 2016-2025 to be met through the WPCLF. However, this information changes frequently, and in 2018, NEORSD's updated 10-year plan showed that nearly 75% of its capital financing needs are expected to

Table 2-1: Ohio’s Water Pollution Control Loan Fund (WPCLF)

TOPIC	DESCRIPTION
Agency	Ohio Environmental Protection Agency (Ohio EPA)
Types of Projects	The Water Pollution Control Loan Fund provides financial and technical assistance for improving surface and groundwater resources. These funds can pay for wastewater collection and treatment, stormwater activities, and nonpoint source water pollution. In addition, Ohio EPA allows a loan recipient to dedicate interest processed from a large infrastructure project to finance the protection and restoration of ecological resources within the state under the Water Resources Restoration Sponsor Program (WRRSP).
Eligible Applicants	The different sub-programs under the WPCLF have different eligibility requirements. While most of their subprograms are restricted to public entities, the nonpoint source water pollution program is open to applications from both public and private entities.
Application Deadline	Applications that were submitted by August 31, 2018, are eligible for funding in State FY 2018, which begins January 1, 2018, and ends December 31, 2018. Certain project activities related to priority projects, such as projects that address Harmful Algal Blooms, can be submitted year-round.
Loan Interest Rate & Terms	Ohio’s WPCLF’s program offers different interest rates based on the financial status of the applicant and the program being applied for. As of September 2017, the program’s standard interest rate is 1.81%, and varies based on a rolling average derived from the Bond Buyer 20 General Obligation Bond Index. Smaller communities, with either a total population or service area smaller than 5,000, qualify for an interest rate 0.5% less than the standard long-term interest rate. Communities with a service population equal to or less than 2,500 with a median income of \$48,750 qualify for an interest rate of 0%. Communities with a population between 2,500 and 10,000 with a median income of \$44,425 will receive an interest rate of 1%.
Amortization	The loan repayment period may be for no longer than 30 years and as few as 5 after the date of the financial assistance agreement, depending on the activity the loan is financing.
Loan Fund Priority Ranking	Projects are ranked using the Integrated Priority System (IPS) which assigns points how the project impacts the protection of human health, the protection or restoration of water resources, and the economic need of the community.

Figure 2-1: NEORSD Capital Financing Plan, 2016-2025 (NEORSD 2016b)



come from WPCLF, and NEORSD wasn't planning to issue any bonds for capital projects. NEORSD had issued \$337 million of revenue bonds in 2010, \$250 million in 2013, \$419 million in 2014 (refunding a portion of 2007 bonds), and \$25 million in 2016 (also a refunding issue).

Revenues from these bonds are used for financing and refinancing of NEORSD's wastewater improvement programs at-large – such as the traditional gray infrastructure programs. None of these bonds have been earmarked specifically for green infrastructure in general or via Project Clean Lake (see Appendix A for details). In addition, these bonds have not been certified as “green bonds.”

Per NEORSD (2016a), the long-term CSO control program, which comprises of consent decree activities and Project Clean Lake, will account for the majority of spending from 2016-2025, ranging from 58-89 percent per year. A small but growing portion of NEORSD's capital financing comes from internally-generated capital. These internally generated funds account for about 22 percent of total funding over 2016-2025, with an average growth in absolute funds from internally-generated capital at 9.5 percent per year over that period (NEORSD 2016b). This increase in internally-generated capital reflects the 10-11 percent rate increases beginning in 2011 (NEORSD 2016c, NEORSD 2016d).

In 2010, NEORSD passed a resolution to establish a stormwater utility fee, and a subsequent 2015 court ruling has allowed NEORSD to collect them. To set up the fees,

Top four funding sources for NEORSD are municipal revenue bonds, low-interest loans from Ohio's SRF fund, sewer fees, and stormwater utility fees.

NEORSD carried out a careful study to ensure they were sufficient, stable, defensible, easily understandable, minimized rate impacts, and had equity among various consumer classes. These fees amounted to an operating revenue of over \$41 million in 2016. NEORSD allowed 100% rebates if appropriate SCMs were used.

Finally, sewer fee in NEORSD service area comprised of a monthly base charge, and a fee per 1,000 metered cubic feet. In 2017, the base charge was \$3.60, and the fee per 1,000 metered cubic feet was \$83.10 in Cleveland, and \$84.60 in other suburbs. The fee increases have been approved at the rate of 8.3% every year until 2021 and are projected to increase at 9.6% from 2022-2026.

2.1.2 OTHER TRADITIONAL OPTIONS

A summary of various revenue and financing options is presented in Table 2-2, and details follow below.

2.1.2.1 Property Taxes/General Fund

Many communities and agencies fund stormwater management through property taxes paid into their general funds. The funds generated based on property values do not correlate to the amount or quality of the runoff generated and therefore does little to encourage on-site control.

Table 2-2: Summary of Pros and Cons of Funding/Financing/Revenue Options for Large-scale Implementation of Green Infrastructure

OPTION	PROS	CONS
Traditional Public Revenues and Financing Options		
Service Fees	- Reliable revenue source	- Potentially divorced from stormwater impact
Property Taxes / General Fund	- Reliable revenue source	- Not specifically designated for stormwater and thus difficult to allocate for stormwater projects - Does not capture tax-exempt properties
System Development Charges	- Easy implementation	- Dependent on new development (less reliable) - Potentially divorced from stormwater impact
Stormwater Management Rules	- Shifts responsibility for stormwater management to developers - Potentially reduces fee increases	- Public sector does not control stormwater management implementation
Grants & Low-Interest Loans	- Low-cost financing	- Limited availability which makes it challenging to scale up
Stormwater utility	- Cost for stormwater management borne by property owners with impervious surfaces - Dedicated revenue source towards stormwater management	- Ability to establish utility depends on local and state regulatory context
Tax increment Financing (TIFs) & Linkage Fees	- Cost for stormwater management borne by new development	- May be challenging to implement for regional entities unless they have taxing authorities
Clean Water State Revolving Fund	- Low interest rates	- Ceiling is dependent on state where project is being executed
Water Infrastructure Finance and Investment Act	- Low interest rates	- Ceiling is 49% of a project cost - Highly competitive
“Green” or Private Financing		
Green Bonds	- Structurally similar to traditional public bonds - High levels of investors demand	- Uses bonding capacity - Transaction costs if green bond certification is pursued - Cost to certify doesn't add value
Qualified Public Infrastructure Bond	- Low-cost financing	- Unproven structure
Environmental Impact Bond	- Shifts burden of risks associated with green infrastructure innovation - Provides rich data on effectiveness of intervention - Flexible structure	- Variable repayment - May require statutory authority

Furthermore, this source of funding has been found to be unreliable. In the competition for general fund dollars, stormwater management improvements are typically considered low priority and obtaining a dedicated, long-term commitment of property tax or general fund dollars to stormwater is a challenge.

Finally, under this option, tax-exempt properties -- including governmental properties, schools, colleges, and universities-- are not required to support the cost of stormwater management although many of them can be major contributors to stormwater runoff.



2.1.2.2 System Development Charges (SDCs)

Municipalities and agencies could develop stormwater system development charges (SDCs), also known as connection fees or tie-in charges. These one-time fees are commonly charged to new customers connecting to a water or sanitary sewer system. In this way, new customers buy into the existing infrastructure and/or the infrastructure expansion necessary to serve them. The amount of the new customer's SDC is typically based on the customer's estimated water demand. The challenge is that while water and sewer systems are supported into the future based on the existing water and sewer rates, stormwater rarely has a similar supporting rate.

2.1.2.3 Stormwater Management Ordinances

Many municipalities or agencies have chosen to establish a stormwater management control requirement for existing as well as all new development and major redevelopment projects. This is most often done in one of two methods: 1) establishing a stormwater fee for all property owners with an ability to reduce that fee through on-site controls (like in Detroit) and/or 2) requiring new development and/or redevelopments to capture stormwater on-site as part of the

development agreement (like in Washington DC).

Many municipalities/agencies that choose 2) above seek to establish or strengthen regulation requiring developers to manage a certain amount of rainfall, either by installing SCMs on-site or by paying an "in-lieu fee." This regulation works well in a situation where there is sufficient demand for new development or redevelopment to overcome the incremental costs (often modest) to developers.

As of 2017, Title V of NEORSD's Code of Regulations, which governs the Regional Stormwater Management Program, does not impose any specific requirements beyond those required for certain construction, industrial, and MS4 activities through the Ohio EPA National Pollution Discharge Elimination System (NPDES) permitting program.

However, Section 5.0601(b) of NEORSD's Code of Regulations allows it to promulgate additional stormwater standards "as may be necessary and reasonable to protect the Regional Stormwater System" (NEORSD 2016e). Many municipal sewer districts have used similar authority to impose regulations on new construction and

Title V of NEORSD's Code of Regulations, which governs stormwater management, does not impose any specific requirements beyond those required for certain construction, industrial, and MS4 activities. However, Section 5.0601(b) of NEORSD's Code of Regulations allows NEORSD the ability to promulgate additional stormwater standards "as may be necessary and reasonable to protect the Regional Stormwater System"

redevelopment based on threshold limits of impervious surface on the finished property. These districts include the Milwaukee Metropolitan Sewerage District, the San Francisco Public Utilities Commission, and the District of Columbia Water and Sewer Authority.

A well-crafted ordinance allows developers to assess the cost of compliance, and potential design implications, leading to cost effective compliance either through onsite green infrastructure or by paying for offsite retention (an attractive option for site-constrained developers). This fee can be pooled and used by the public sponsor to implement green infrastructure projects in priority areas. However, the regulation must be sufficiently stringent (and the in-lieu fee substantial) to make offsite compliance an attractive financial option. Implementing an offsite allowance is also a fundamental component of establishing stormwater retention credit trading, a private financing tool available to public sponsors addressed in Section 2.3.2.

2.1.2.4 TIFs or Linkage Fees

Tax increment financing (TIFs) can also be used to assess a fee on real estate owners in an area for a specific purpose. TIFs assume that the investment in green infrastructure will increase property values in the area that will generate additional tax revenue for the city. In this case, a project would be financed and constructed, and the repayments would be drawn from this stream of future tax revenue cash flows. Similarly, a city could establish a linkage fee that would assess a fee on developers who were developing new properties in the area or were significantly redeveloping existing buildings. This linkage fee would be used for repayment under the assumption that there

According to the U.S. EPA's Environmental Finance Advisory Board (EFAB), each dollar of recycled State Revolving Fund (SRF) program equity can generate \$3 to \$14 of SRF guarantee capacity for green infrastructure projects. Nationwide, this translates into \$6 billion to \$28 billion in added potential green infrastructure funding capacity (Lueckenhoff and Brown 2016).

is a connection between the new development and its impacts on infrastructure – including stormwater management – in the area.

2.1.3 GRANTS & LOW-INTEREST LOANS

Stormwater management grants and low interest rate loans are available for various types of projects on a state-by-state basis. However, as of now, NEORS does not fund stormwater program via debt financing, and supports it by the fees collected. Clean water or drinking water state revolving fund (SRF) dollars can be used to develop capital projects. As discussed previously in Table 2-1, Ohio SRF funds provides low interest rate loans to municipalities or agencies seeking to fund wastewater and stormwater infrastructure projects. In addition to SRF, the newly established WIFIA funds are also a lucrative low-interest loan option for NEORS.

2.1.4 NEWER "GREEN" FINANCING OPTIONS

2.1.4.1 Qualified Green Building Sustainable Design Project Bonds

Newer bond options include Qualified Green Building Sustainable Design Project Bonds ("Green Bonds") that have been created to generate increased investment in LEED rated building projects and redevelopment of brownfield sites.

2.1.4.2 Qualified Public Infrastructure Bond

In January 2015, the White House announced the creation of a new type of bond vehicle, the QPIB, which has been tailored to enhance public-private partnership investments. QPIBs are similar to Private Activity Bonds (which are tax-exempt bonds issued by or on behalf of local or state government for the purpose of providing special financing benefits for qualified projects, most often for projects of a private user, and the government generally does not pledge its credit), however, they are expected to have no expiration dates, no issuance caps, and the interest on these bonds is not subjected to the alternative minimum tax with the overall effect of lowering financing costs for private participation in public infrastructure investments (USEPA 2015).

2.1.4.3 Green Bond Issuance

Public sponsors can issue a green bond to fund green infrastructure projects in their area. Similar to a regular bond issuance, private investors would buy the green bond that would provide up-front capital to build or maintain green infrastructure projects. If the issuer has a strong credit rating, issuing the bond under the full faith and credit of the organization will generally allow the organization to access a better cost of capital. Alternatively, repayment could be based on revenues generated by the project or by a particular revenue stream, assuming investors had enough confidence in the stability of the revenue stream. For example, if the bond would be financing a park or recreational area that would involve charging a fee to users, the income created could be allocated to serve as repayment for the bond. However, depending on the size of the project and the project usage levels, it may be unlikely that usage fees

While typically more expensive than public financing, private financing is lucrative because it transfers risk, it is scalable, and it can significantly reduce overall costs due to quicker access to innovative practices.

alone would generate enough reliable revenue to fully cover bond repayment. As an indication of the appetite for green bonds, some investors have been willing to support very long-dated bonds because of their environmental benefit and the ability to spread costs over a longer time frame. One example of this approach in the water sector is the Green Century Bond. The District of Columbia Water and Sewage District announced the issuance of \$350 million in taxable Green Century Bonds in July 2014, which extend the maturity date to 100 years compared to the usual 30 or 35 years for municipal bonds. Another benefit of green bond issuance is that it can bring new investors to the table. Finally, there is some recent evidence that issuers are getting a lower cost of capital with green bonds such as Massachusetts MBTA Sustainability bond that achieved a pricing advantage over traditional bonds, due to aggressive investor interest and strong market demand (MBTA 2017).

2.2 FINANCING OF GREEN STORMWATER INFRASTRUCTURE VIA ENVIRONMENTAL IMPACT BONDS

An environmental impact bond (EIB) uses private capital to de-risk innovative public projects. An EIB is a short-to- medium-term financing tool designed to assist borrowers in making better long-term financial and capital planning decisions. One such decision may be whether—and on what terms—to enter into a CBP3 (presented in Section 2.3).

2.2.1 ORIGINS OF EIBs

The EIB structure is based on financial innovation in the social sphere, where social impact bonds are an increasingly popular way of financing high-impact, early-stage public-private partnerships (Hartley 2014).

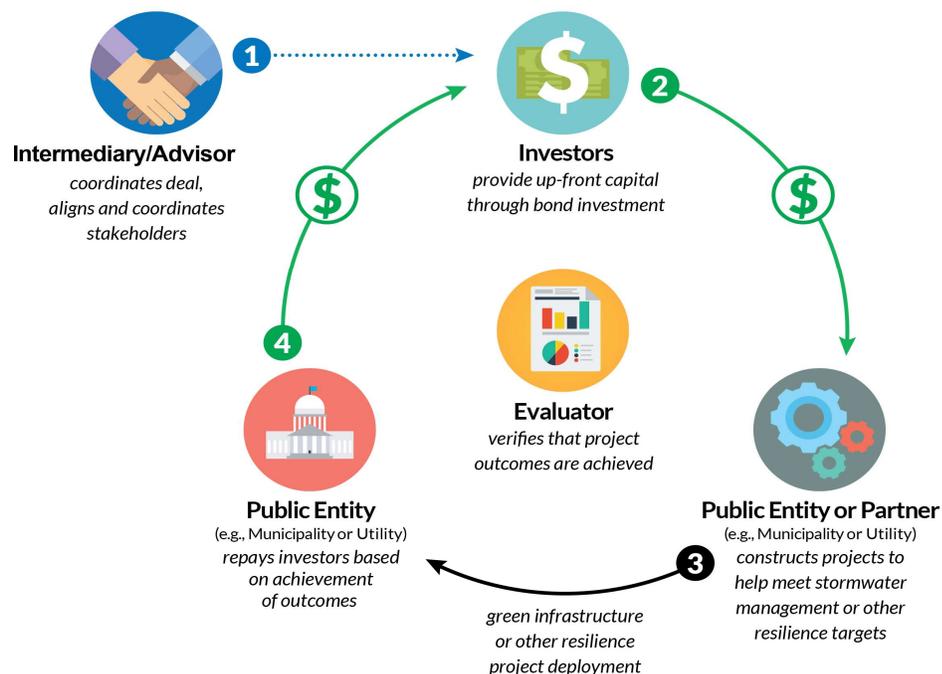
In the social impact bond model, private investors fund, through an intermediary who structures the transaction on behalf of investors, deliver social services to the government. This is typically an innovative approach that is perceived as risky, but which if successful can result in cost savings and improved outcomes. Examples of existing social impact bonds include reducing prisoner recidivism, improving early childhood education, and better patient healthcare outcomes. The government, who benefits in the event social services can be improved through

these innovations, repays investors a variable amount based on performance.

Similarly, EIBs are a tool for helping cities finance innovative programs and projects where traditional sources of financing may be harder to access. These bonds draw in private capital for investments in environmental projects such as green infrastructure for improving water quality and are repaid based on the relative success of the project in achieving anticipated outcomes. In addition to financial de-risking, key benefits of the impact bond model are ease of execution, which can accelerate funding for innovative uses, lack of a long-term privatization, or encumbrance of an asset, and a very high degree of flexibility. The structure of an EIB is shown in Figure 2-2.

In September of 2016, the D.C. Water and Sewer Authority (D.C. Water) issued the

Figure 2-2: Overview of an EIB Transaction Structure



first-ever EIB for \$25 million, to address combined sewer overflows through investments in green infrastructure (Quantified Ventures 2017). The tax-exempt bond was sold in a private placement to Calvert Foundation and Goldman Sachs Urban Investment Group. At the time, D.C. Water was under a consent decree with the U.S. Environmental Protection Agency—as green infrastructure emerged as a viable, innovative alternative to grey infrastructure tunnels for managing urban storm water volume, D.C. Water wanted to test the effectiveness of green infrastructure through a pilot project in place of its existing tunneling plan. As green infrastructure had not been deployed at scale before, D.C. Water chose to issue an EIB to better offset and manage the risks of their proposed project. Working closely with team member Quantified Ventures, a pay-for-success broker, D.C. Water structured the EIB so that core project risk would be transferred to investors and the city would gain an evidence-based understanding of expected outcomes and

EIBs have gained significant traction recently. As of April 2018, aside from DC Water, cities of Atlanta and Baltimore had announced plans to use EIBs to fund green infrastructure.

costs before considering future investments in green infrastructure projects.

While standard municipal bond holders invest in an issuer’s ability to repay on schedule, DC Water’s EIB investors bet on whether the green infrastructure pilot would produce outcomes ‘as expected’, ‘better than expected’ or ‘less than expected’. Investor returns were tied to project outcomes, such that D.C. Water would pay interest at a fixed rate, with potential performance payments based on stormwater captured on-site by the green infrastructure interventions (see Figure 2-3 and Table 2-3 below):

- Tier 1: If the interventions were to perform better than expected, DC Water would pay investors principal and interest plus an outcome payment

Figure 2-3: Pay-For-Success Performance Tiers for the D.C. Water EIB (Neighborly 2017)

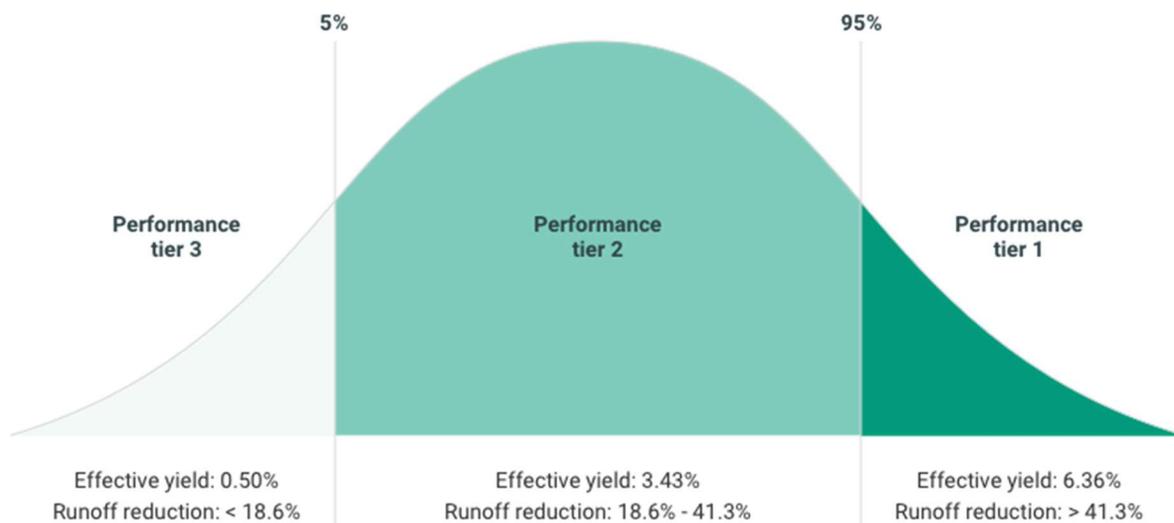


Table 2-3: Pay-For-Success Performance Tiers for the D.C. Water EIB (Neighborly 2017)

TIER	OUTCOME RANGES	CONTINGENT PAYMENT
1	Runoff reduction: > 41.3%	DC Water will make an outcome payment to investors of \$3.3 million
2	Runoff reduction: 18.6 - 41.3%	No contingent payment
3	Runoff reduction: < 18.6%	Investors will make a risk share payment to DC Water of \$3.3 million

- Tier 2: If the interventions were to perform as expected, investors would receive principal and interest, but no additional payments would be made by either party.
- Tier 3: If the interventions were to perform less than expected, investors would receive principal and interest but pay a risk sharing payment to DC Water

By identifying, quantifying, and transferring project risk, DC Water’s EIB created the incentives to deploy an innovative solution to a historical public policy problem by “de-risking” the project.

2.2.2 STRUCTURE OF AN EIB for NEORSD

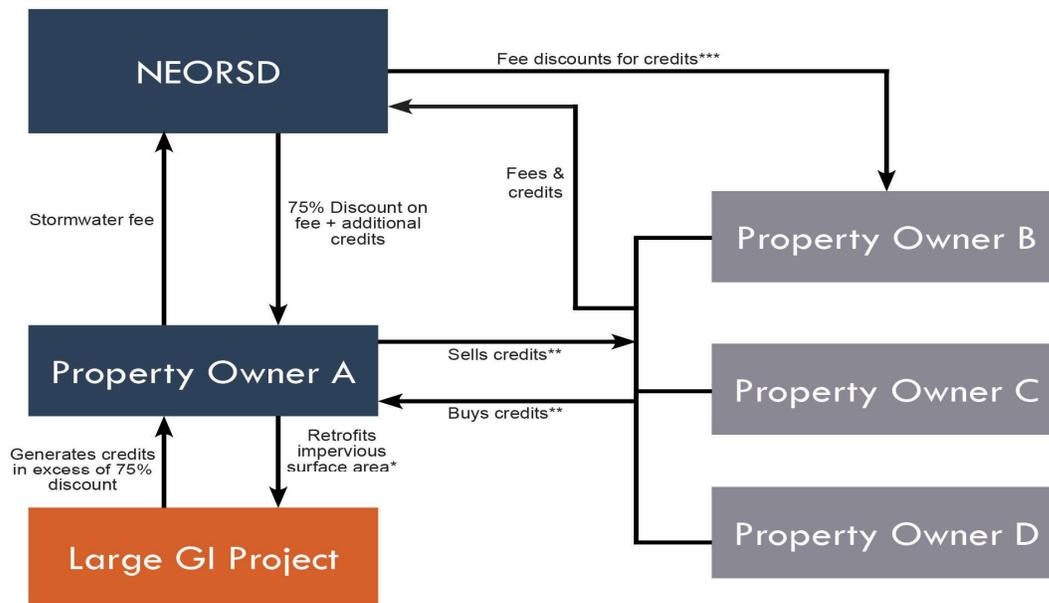
The purpose of an EIB is to demonstrate the cost effectiveness and co-benefit value of green infrastructure for borrowers who may be determining when and to what extent to incorporate green infrastructure into the capital plan. Given NEORSD’s Appendix 3 mandate of capturing 44 million post-gray gallons and Appendix 4 opportunity to offer green-for-gray substitutions (US versus NEORSD 2011), a green infrastructure EIB may be used to help refine its green infrastructure capital plan or to secure additional buy-in from its municipalities.

Should NEORSD be interested in pursuing a CBP3, an EIB could still be used to better assist NEORSD in negotiating fee structures

with a private developer. An EIB could also be used to establish a baseline cost for different SCMs or for green infrastructure in certain watershed areas, and this baseline could be used to ensure the grant program is funding efficient projects. Figure 2-4 outlines the structure of a stormwater EIB. Note, an EIB can be flexibility structured to accommodate a variety of performance-based scenarios. In its simplest form, which may be most attractive to NEORSD given its strong credit rating, proven track record of project delivery, and O&M arrangement with its municipalities, the private investor would fund only the agreed-upon, upfront capital costs of the project and performance monitoring expenses. NEORSD would be responsible for delivering the project and would retain construction risk. Following a monitoring period, NEORSD would repay the investor a variable amount based on performance. NEORSD would be

EIBs are among the most flexible forms of public-private partnerships, with wide latitude to customize the structure to meet the borrower’s environmental and social objectives. EIBs can be incorporated into a variety of preferred delivery methods, with the public borrower retaining or transferring construction risk and maintenance to the private partner.

Figure 2-4: Environmental Impact Bond for Stormwater Management at NEORSD



* Investment repaid by NEORSD fee discounts + credit sales
 ** Credit sale price below value of NEORSD fee credit
 *** Net neutral revenue to NEORSD

responsible for ensuring maintenance of the project, whether completed by NEORSD itself or by the relevant municipality(ies). This is to ensure that data collected during monitoring is accurate.

If the green infrastructure does not perform to expected levels, NEORSD would still be responsible for making a payment to the investor. However, this investment would not recoup the investor’s initial capital and NEORSD would receive the green infrastructure project at a reduced cost. Table 3-4, later in the document, demonstrates a range of repayments based on performance thresholds. The table reflects an *indicative example repayment rate* for an NEORSD EIB, reflecting the lower risk of a green infrastructure project and NEORSD’s exceptionally strong credit. The ultimate parameters of a project would depend on the location(s) and SCMs selected by NEORSD and may vary considerably from those shown. As contemplated, the EIB would be issued as a 30-year, tax-exempt, multi-modal bond with a 5-year mandatory redemption. The

mandatory redemption price adjusts investors’ return based on performance. This structure allows NEORSD to easily incorporate EIB into its outstanding debt under its bond indenture, and to re-issue the bonds in any desired mode under the same CUSIP following mandatory tender.

2.2.3 EIB FOR MAXIMUM STRUCTURING FLEXIBILITY

EIBs’ most notable feature is their flexibility. Unlike a CBP3, EIBs can be structured as shorter-term, public-private partnerships, typically lasting three to seven years, including construction and monitoring. Additionally, EIBs can be structured to meet the needs and objectives of the borrower. For some public partners, a compelling feature of an EIB-funded project is the ability to incorporate a temporary design-build-finance-operate-maintain (DBFOM) delivery model, where the public sector transfers construction cost risk to a private delivery entity and the operations and maintenance contract is incorporated into

the EIB (with transfer back to the public sector at the completion of the monitoring period). This can be particularly attractive for borrowers inexperienced at delivering green infrastructure or uncertain of the operations and maintenance cost associated with green infrastructure. For potential partners such as NEORS, where there is considerable project delivery capacity and where the bifurcation of capital and maintenance dollars may make a DBFOM model complex, an EIB may be structured purely as a financing vehicle that transfers performance risk away from NEORS.

2.2.4 EIB METRICS FOR VALUING PERFORMANCE & CO-BENEFITS

The success metrics negotiated between NEORS and the investor can be related to one or more measures of success. This business plan assumes the relevant metric is gallons managed per dollar spent. Projects funded with this EIB could be used to inform optimum SCM selection and siting, to maximize NEORS's cost effective use of green infrastructure throughout the region. For example, given NEORS's concerns over the effectiveness of porous concrete, an EIB could be structured to quantify the effectiveness of that SCM by its cost per gallon of stormwater retained.

However, another element of EIB flexibility is the ability to consider other metrics, or inclusion of additional metrics. For example, NEORS could contemplate an EIB for water quality improvements. Additionally, NEORS could consider incorporating a secondary impact metric around green infrastructure co-benefits. For green infrastructure, the most likely co-benefit metric would be assessing green workforce

Because EIBs are deliberately shorter-term partnerships, they are ideal for determining a borrower's value and interest in a public-private partnership. The borrower may choose to build upon an EIB with a CBP3, or use data and best practices learned through an EIB to scale using conventional public finance.

development in conjunction with green infrastructure projects.

2.2.5 EIB AS A PRECURSOR TO A CBP3

A CBP3 may be an attractive implementation vehicle for NEORS's Appendix 3 green infrastructure mandate. However, CBP3s are intentionally long-dated partnerships that hinge on key performance payments for green infrastructure delivery and maintenance. EIBs provide value to public entities considering such long-term partnerships because they provide data on metrics that will be negotiated as part of a CBP3 agreement. An EIB could be used to find the "true" cost, in dollars per gallon managed, of at-scale green infrastructure for certain elements of the regional vision that could potentially be undertaken by a CBP3. This would give NEORS additional information to negotiate payments to the CBP3 private entity.

An alternative EIB structure could also be a guaranteed payment from NEORS, but where the private investor would reserve a portion of its investment to offset maintenance costs for the municipalities where the EIB-funded project(s) are located. This would result in a similarly variable return to investors but would de-risk green infrastructure projects for the municipality or agency ultimately

responsible for maintenance. This could be used to demonstrate value of green infrastructure to NEORSD's communities, with a longer- term view towards incorporating those communities into a CBP3 if there is demonstrated value from green infrastructure.

Overall, a summary of the advantages of EIBs is presented below:

- **Flexible Execution:** Projects funded by impact bonds can be delivered publicly or privately, can include or exclude a component of operations and maintenance funding, and can be negotiated to measure performance of one or more impact metric. This flexibility of execution will be reflected in the cost to NEORSD.
- **Flexible Scaling:** EIBs are best utilized as a means of financing a pilot or scaling initiative, as they include additional monitoring and some complexity of issuance. Once EIB has provided learning as to the performance of green infrastructure, then traditional and more straight-forward approaches to financing like a municipal or green bond could be employed. NEORSD retains discretion as to how and when to incorporate successful innovations into an overall capital plan and can retain flexibility as to the type of financing.
- **Financial Transparency:** This model is based on the private partner receiving a variable performance-based fee, based upon key impact metric(s) as agreed to by the partners. The partners work together jointly to agree upon impact metric(s) and the return to the private partner. The objective is to reduce the long-term

EIBs are best utilized as a means of financing a pilot or scaling initiative, as they include additional monitoring and some complexity of issuance. Once EIB has provided learning as to the performance of green infrastructure, then traditional and more straight-forward approaches to financing like a municipal or green bond could be employed.

capital program cost to the borrower. An EIB may be a more expensive form of financing than NEORSD public debt or, possibly, a CBP3. However, it is intended to finance smaller projects in this case, which provide data allowing NEORSD to make more cost-effective decisions in the future, ultimately resulting in cost savings.

- **Flexibility of Partnership:** NEORSD remains an active participant in the partnership throughout the term.
- **Shared Values:** Through a relationship built on long-term trust and confidence, the partners discuss and develop a common set of values used to establish performance metrics, which may include socio-economic targets.
- **Limited Commitment:** The term of an impact bond is flexible and driven by the project timeline and timeframe the partners determine necessary to test performance. In general, however, impact bonds are a much shorter contractual relationship than CBP3s, typically 3-7 years including construction, if any. As with the flexible execution component, this allows a NEORSD to test the potential benefits of a public-private partnership prior to committing to a long-term concession.

2.3 DELIVERY FRAMEWORKS OF STORMWATER INFRASTRUCTURE

This section highlights two delivery alternatives which could accelerate or enhance NEORSD's green infrastructure plan. They include CBP3s and a stormwater credit trading program. Additional details follow.



2.3.1 CBP3 Program Approach

In EPA Region 3, which regulates the Chesapeake Bay region, Prince George's County, Maryland, has implemented the first CBP3 focused on stormwater infrastructure. This model offers several advantages and is easily adaptable to the needs of NEORSD. In particular, the model allows NEORSD to undertake a CBP3 as either a region-wide program, or some subset of NEORSD's communities.

A CBP3 is a long-term partnership between a public and private entity to design, build, operate, and maintain stormwater infrastructure. The partnership provides a flexible, adaptive project delivery model that ensures long-term project financing, incorporation of socio-economic goals, and faster, lower-cost implementation of green infrastructure. A CBP3 is easily scalable and can use financing that defers upfront costs and enables NEORSD to immediately implement significant green infrastructure.

2.3.1.1 *Benefits of a CBP3*

A CBP3 offers several unique benefits over the other private financing structures discussed in this document, including:

- Ability to fully scale, fund, and implement NEORSD'S vision for green infrastructure.
- Full program management, from design to long-term maintenance.
- Enhanced project delivery capacity and increased pace of implementation.
- Robust community engagement through a tailored, community outreach plan that collaborates with both members and non-members, as well as their stakeholders.
- Savings of 30-40 percent over traditional piece-meal implementation of green infrastructure (PG County 2016).
- Long-term economic development through the implementation of a socio-economic plan driven by performance-based metrics.
- Flat performance-based fee that drives achievement of NEORSD's goals while returning program savings to NEORSD through a reserve account.

An expanded discussion of these benefits is outlined below:

2.3.1.2 *Socio-economic Benefits*

A properly-constructed CBP3, secured by long-term commitment, has the potential to become an anchor institution that supports and builds resilient, sustainable communities. This is best achieved by aggregating NEORSD's thousands of individual drainage and stormwater

management projects into an integrated service model. This model creates economies of scale, streamlines procurement processes to reduce barriers to entry for small businesses, and creates a pipeline of workforce demand that ultimately drives local long-term wealth building opportunities.

2.3.1.3 Socio-economic Plan

Through ongoing discussion with NEORSD and its stakeholders, a long-term, metric-oriented socio-economic plan could be developed that expands the breadth and depth of NEORSD's existing socio-economic efforts. The plan is tailored to address the unique culture and challenges of the member and non-member communities served by NEORSD, and could include issues such as:

- Workforce development for re-entry residents, disadvantaged, or low-income residents including career laddering opportunities.
- Increased subcontractor utilization and development including increasing the percent of small, local, and disadvantaged businesses participating in construction and O&M activities to as much as 50%.
- Community revitalization that addresses blight and localized flooding through project prioritization.
- Community outreach and education about stormwater management.

To achieve these benefits, it is important that the plan engage both the demand and supply side of the local workforce with two objectives in mind: a) to strengthen the local workforce and its skill set, and b) to increase the participation of local, small, and minority businesses across all competencies and phases of the program.

Benefits of a CBP3

Variety of Financing Options

Utilize public and/or private funding

Reduce Price Risk

Faster implementation reduces risk

Retain Residual Cash Flow

NEORSD retains savings

Scalable

Achieve large-scale implementation goals

Performance-based fees

Drive results

The engagement can best be accomplished by working collaboratively with existing local and regional organizations, whose mission is to identify and develop existing and potential small, local, and minority-owned businesses.

Supply Side of Workforce Development

Building a strong, local workforce with the necessary 'green' skills, requires a program that works with local trade schools and community colleges to develop green infrastructure curriculum and certification programs. One option is to work with local workforce development boards that use Workforce Investment Act funds to develop and implement workforce development programs and initiatives. In addition, by working with local businesses to identify

CBP3 partnerships can be set up to obtain a highly efficient, low-cost form of financing known as "limited recourse" or "non-recourse" financing. This type of financing is not treated as an NEORSD borrowing. Instead, it resides within the partnership structure as a limited liability or special purpose entity and therefore limits investor recourse to NEORSD.

the specific skills needed, a CBP3 can help shape curricula at local community colleges and training programs to ensure local residents have a clear path to success including career-laddering opportunities. Connecting residents to these development opportunities in a green economy is best accomplished through a robust outreach program to actively recruit locally. Working with local non-profits and community organizations, this outreach builds the pipeline of potential participants.

Demand Side of Skills Needed

The aggregation of all the thousands of projects into a single, well-defined, well-scheduled, fully-funded program creates significant demand through the creation of a project pipeline scheduled for delivery over a known period of time. This “pipeline” of work allows small, local, and minority-owned businesses to invest and grow capacity and ‘green’ skills over that period of time. These smaller but consistent projects allow developing contractors to gain experience and create a resume of green projects. More importantly, these businesses are able to build the capabilities needed to compete for larger projects both within and beyond the program.

A key component in reducing barriers for small business is to reduce bonding requirements. Since the CBP3 obtains the necessary bonding for the program, this burden is eliminated, enabling small businesses to bid on and participate in projects regardless of the company’s size. This arrangement provides the protection necessary for NEORSD to assure performance while relieving the contractor of the cost of obtaining these bonds (which are often not available at any cost). To further enhance the positive impacts to

small, growing businesses, NEORSD should consider offering a variety of project procurement sizes.

Another serious challenge for small, local, and minority-owned businesses can be the bid and procurement processes, which require small businesses to maneuver through certification paperwork and bidding processes that demand more time or effort than a small business can invest. In addition, in order for new and small business to grow, they need to build their experience on project sizes that fit their workforce and estimation skills. To help avoid these challenges, a socio-economic plan associated with a CBP3 program can include business concierge services to assist businesses with prequalification requirements and obtaining all required certifications and coverage needed to participate in the program. A known pipeline of projects of varying sizes is also important and allows local, small businesses to bid on progressively larger projects as their experience and capabilities grow. Finally, having a pipeline of projects which follow a clear and consistent bidding and payment processes allows small businesses to plan for expansion and obtain additional capital when needed.

Another serious challenge for small, local, and minority businesses can be the bid and procurement processes, which require small businesses to maneuver through certification paperwork and bidding processes that demand more time or effort than a small business can sacrifice. CBP3s can deal with this challenge by including business concierge services to assist businesses with prequalification requirements and obtaining all required certifications and coverages needed to participate in the program.

Examples of CBP3s include Prince George's County in Maryland and City of Chester in Pennsylvania.

2.3.1.4 Pay-for-Performance

Compensation to the private partner in the CBP3 can be based on performance metrics tied to both stormwater management performance and local socio-economic goals. As part of ongoing tracking, an economic analysis tool can be used to measure the results of the program.

At an appropriate point in the program, a regional economic study can be conducted using the IMPLAN model. The intention is to provide a concise qualitative analysis that includes improvements in the region and the utilization of local businesses. IMPLAN is a widely-respected model that has the ability to assess both small and regional geographies. A baseline for the region is established by taking a census of all participating subcontractors in the program during the first months of the partnership, including key indicators such as:

- Current number of employees.
- Percent of total purchase value with local minority or disadvantaged enterprise businesses.
- Percent of total purchase value with county minority or disadvantaged enterprise businesses.
- Percent of total purchase value with local business enterprise.
- Percent of the total number of hours logged by individuals performing services in connection with the construction, operation, and maintenance of the project (i.e., administration, maintenance, or activity that may not contribute to the physical construction).

2.3.1.5 Financial & Legal Structures

By developing a partnership structure that drives surety of execution and lifecycle asset management, NEORSD can access a wider variety of financing options, and is not limited to either public or private financing. In fact, NEORSD can also choose a hybrid of funding types that offers the best value for money. The private partner in a CBP3 is usually agnostic to the type of financing or funding used by the partnership.

There are several ways the legal framework of the partnership can be structured and Figure 2-5 outlines one method – a special purpose entity (SPE). A public-private partnership that is constructed as a SPE has the right to carry out the construction and operation of the CBP3. This enables the partnership to obtain a highly efficient, low-cost form of financing known as “limited recourse” or “non-recourse” financing. This type of financing is not treated as a NEORSD borrowing. Instead, it resides within the partnership structure and therefore limits liabilities and investor recourse.

With this type of structure, a dedicated revenue or funding stream can be leveraged to raise the debt required to fund the entire program with no recourse back to NEORSD. Historically, this type of project financing has raised capital at 13.5-to-1 leverage ratios (Lueckenhoff and Brown 2016).

It is important to note that, with this structure NEORSD retains control of project funding through the trustee lock box, as well as program oversight and budget approvals.

Figure 2-5: Legal Framework Structure of a CBP3 Partnership



Additional key aspects of a CBP3 structure can include:

- **Transfer of Risk:** Financial risk is transferred to the private sector if they are providing the financing of the program. The new partnership will bear the burden of debt and default. NEORS D’s only financial contribution to the program is a committed revenue stream. This separation of financial risk limits the impact to NEORS D’s credit rating. Despite the transfer of risk to the partnership, the public partner retains governance and authority.
- **Surety of Funding:** In addition to long-term O&M being fully funded through the life of the partnership, this model returns residual cash flow to NEORS D through deposits into a residual return reserve, which can be used for: 1) additional investment in this program, 2) addressing unforeseen conditions, and/or 3) meeting future additional USEPA or WPCLF requirements.
- **Surety of Execution:** The proposed structure protects NEORS D by ensuring all funds will be used solely for long-term stormwater management. The structure includes a third-party lockbox agent to oversee the distribution of funds per a servicing agreement.
- **Program Scalability:** The financial and operational structure of this type of partnership has the flexibility to scale up to meet project demands and financial funding requirements.
- **Financial Transparency:** This model is based on the private partner receiving only a fixed, incentive-based fee, based upon key performance indicators as agreed to beforehand by the partners. In addition to approving fees, the NEORS D also has approval rights on annual budgets, and would

receive regular progress reports and updates from the partnership.

- Flexibility of Partnership: The public partner remains an active participant in the partnership in all aspects of the project through the 30-year term, and the legal structure enables the re-alignment of goals and objectives as needed over the partnership term.
- Shared Values: Through a relationship built on long-term trust and confidence, the private partner and NEORSD discuss and develop a common set of values used to establish performance metrics including socio-economic targets.
- Program Transparency: The partnership is managed through adaptive management with regular meetings and online performance dashboards to ensure projects and program goals are governed.

Washington, D.C., is the first major U.S. city to pioneer a stormwater credit trading program. The Department of Energy and Environment implemented the trading program in conjunction with their 2013 Stormwater Rule, which dramatically increased the requirement for stormwater retention on private property. As of October 2017, there had been 22 trades for 121,503 credits.

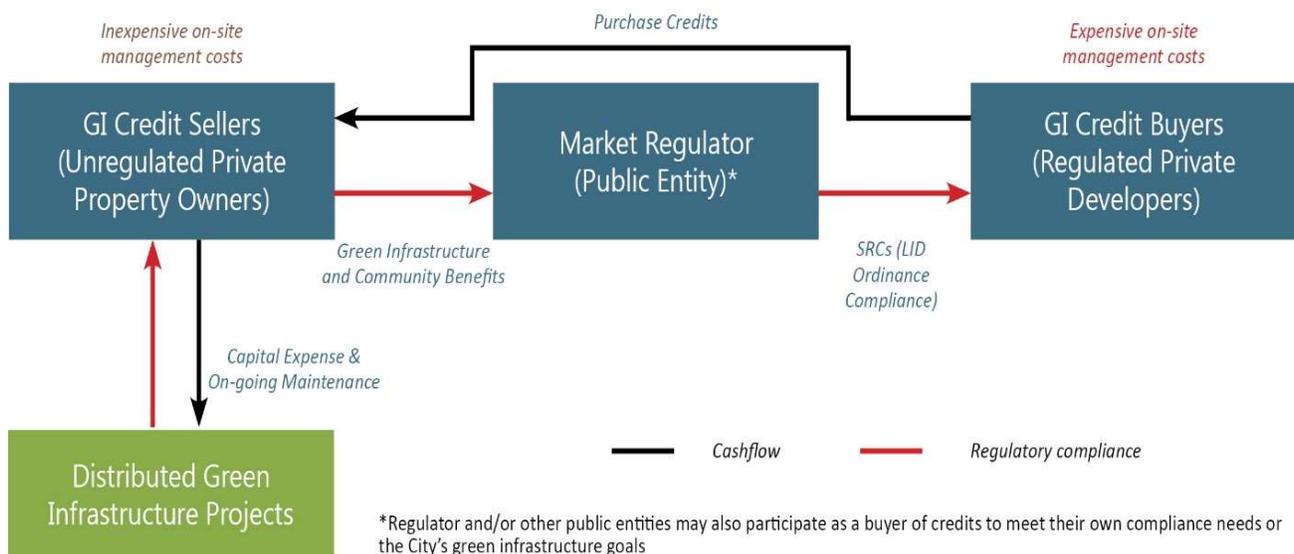
environmental degradation caused by stormwater through a market mechanism that encourages least-cost mitigation. This approach has been implemented in Washington, D.C., and compares to nutrient credit trading systems in the Ohio River Valley and other watersheds. This mechanism uses an open market in which developers can purchase off-site stormwater mitigation credits to achieve a high level of stormwater management at the lowest cost possible.

2.3.2 STORMWATER CREDIT TRADING

Credit trading (see Figure 2-6) is an innovative approach to reduce the

The primary driver of value for stormwater credit trading is progressive onsite requirements for managing stormwater. In

Figure 2-6: Stormwater Credit Trading Program



general, the more stringent this regulation, the greater the opportunity for offsite compliance to be cost-effective, and the more feasible will credit trading be. For example, Washington, D.C., implemented stormwater credit trading as part of the Department of Energy and the Environment's (DOEE's) 2013 Stormwater Rule. The 2013 rule quadrupled the requirement for on-site retention for new real estate developments and major renovations, increasing the regulatory retention requirement for new projects from 0.3 inches to 1.2 inches. This standard means that regulated properties will retain all the stormwater generated in up to a 90th percentile storm event in the District.

Recognizing how difficult this retention standard can be, especially for projects on space constrained sites, DOEE allowed developers to meet up to 50% of their stormwater retention off-site. Developers must build at least 50 percent of their mitigation requirement on-site to account for localized issues, such as flooding and heat island effects. For the other half, developers can pursue off-site mitigation through buying credits or paying an in-lieu fee. Developers that find that meeting the full 100% of the compliance on-site adds meaningful costs to a project can purchase equivalent credits on a market where off-site, lower-cost options may exist.

Implementing credit trading programs also means develop an in-lieu fee option for the market to be feasible. This is because regulated developers who choose to go off-site need to know that, should there be no off-site retention available for purchase, they can achieve compliance through paying a fee to their regulator. Absent an in-lieu fee, developers are unlikely to take

advantage of an off-site option, regardless of the cost-savings, due to concerns about inability to remain compliant in the future. The in-lieu fee also serves as a cap on the market, allowing developers opting for off-site mitigation to assess their future cost of compliance in a worst-case scenario and incentivizing off-site mitigation projects to reduce costs as much as possible through economies of scale and optimization of technology and location.

In addition to a strong regulatory environment, other key value drivers for stormwater credit trading are a healthy pace of real estate (re)development, variability of land cost, and variability of SCM installation costs across NEORSR's service area. A strong real estate market may drive density, land cost variability, and, potentially, SCM installation cost variability. Each of these are value drivers for credit trading by widening the spread between the price regulated developers are willing to pay for off-site retention. Developers are facing limited site flexibility and high costs to use the land for something other than stormwater retention.

In an ideal enabling environment, a stormwater credit trading program would create a "win" scenario for all parties involved. The sewer utility would transfer the costs of stormwater runoff mitigation to private sector developers. Developers, in turn, would have the flexibility to meet mitigation requirements in the cheapest and least intrusive way possible by pursuing off-site credits. Many of these credits could be generated in areas where economic growth is slow, providing economic and social co-benefits of green infrastructure where it is most needed.

Key reasons why NEORSD seems well suited to a stormwater credit trading framework include:

1. Ability to use green infrastructure to strengthen areas with lower growth;
2. Trading is an extension of NEORSD's current stormwater fee program; and
3. It will allow access to private properties in the service area.

Finally, ability to guarantee purchase of credits also ensures that the market has enough liquidity. In 2016, for this reason, Washington DC announced a \$11.5 Million for credit purchases, and an additional \$500,000 to support technical and outreach work by credit generators to identify cost-effective GI sites.

NEORSD exhibits some of the makings of an ideal enabling environment for stormwater credit trading for the following reasons:

- Ability to use green infrastructure to strengthen areas with lower growth:
The real estate market is rebounding

throughout the Cleveland metropolitan area. As one recent study from the Western Reserve Land Conservancy indicates (Ford 2016), the number of vacant residences began dropping significantly in 2015, and 2016 vacancies reached their lowest point since 2010 (see Figure 2-7). Further, both price and volume of housing sales have been recovering steadily although unevenly since the 2008 financial crisis (Ford 2016, Jarobe, 2016; see Figures 2-8 and 2-9). This recovery provides much of the market demand for a potential stormwater credit trading market. Dense urban developments may find the cost of on-site compliance to be challenging and housing in relatively affluent parts of the region may find it simply easier to pay a fee for off-site compliance.

Figure 2-7: Number of Vacancies in Different Regions of the Cleveland Metro Area (Source: Ford 2016)

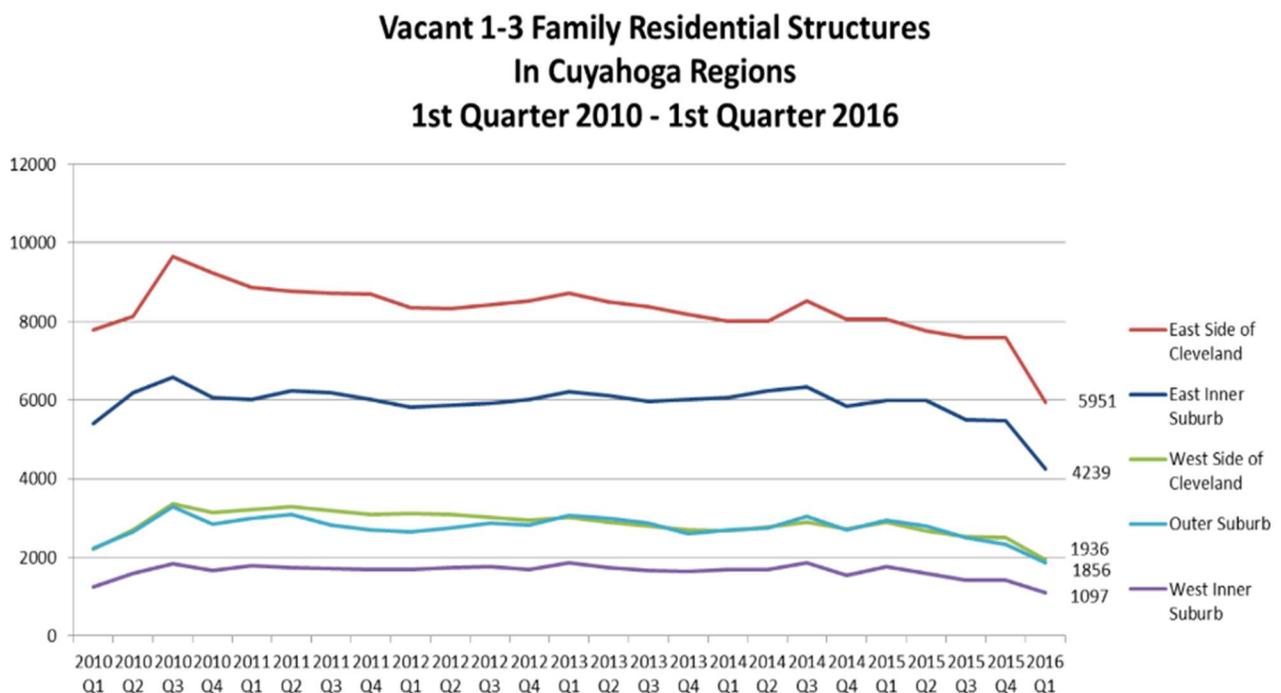


Figure 2-8: Median Prices of Housing Sales in the Cleveland Metro Area (Source: Ford 2016)

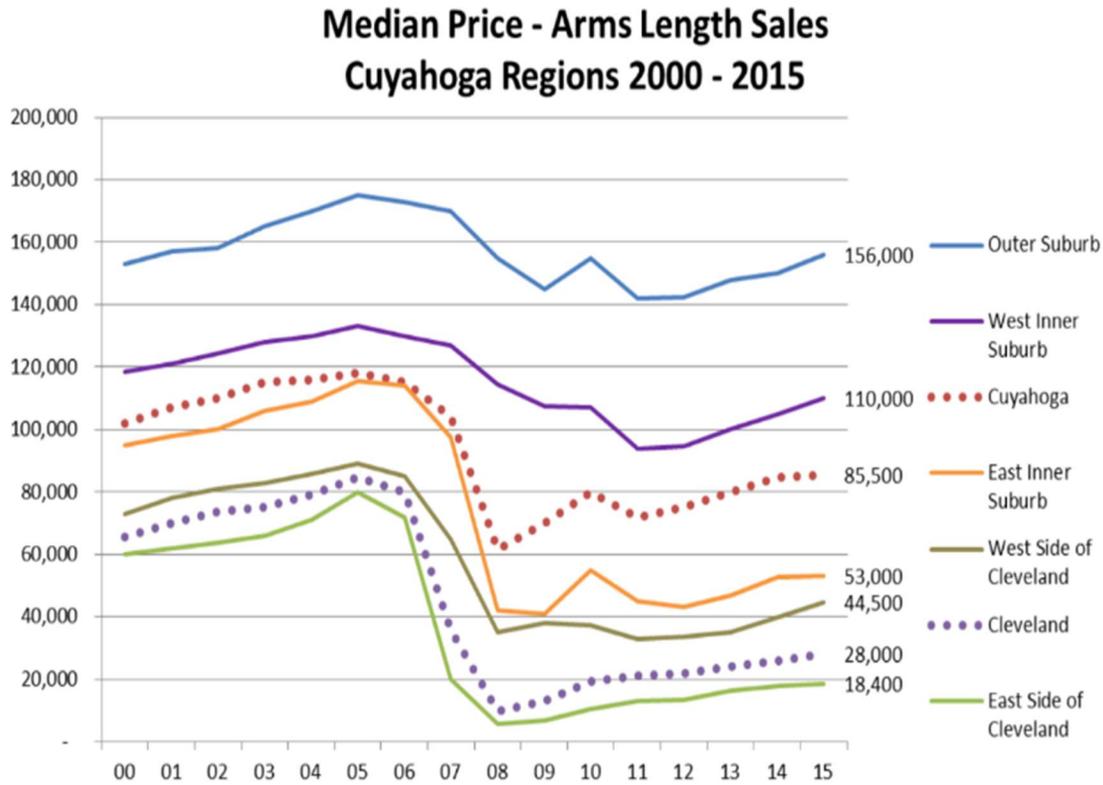
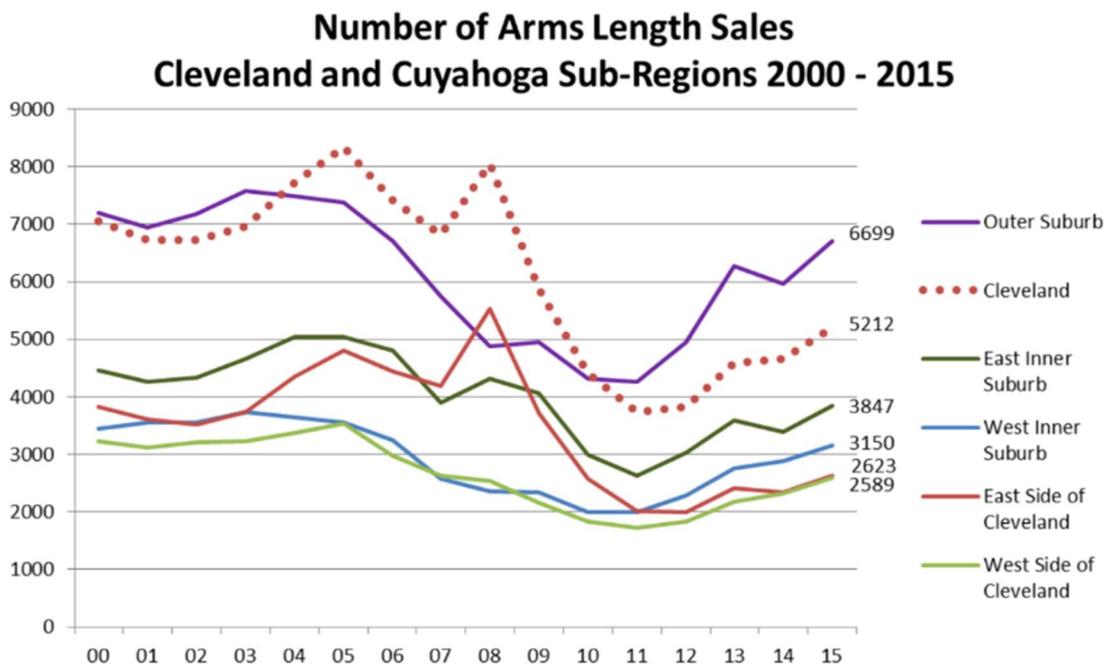


Figure 2-9: Number of Housing Sales in the Cleveland Metro Area (Source: Ford 2016)



A credit trading system may help ameliorate this unevenness because it would help produce more equitable growth throughout the region, since the responsibility and costs for green infrastructure would be borne by areas of high development, while the economic and social benefits of green infrastructure could be realized by areas of lower growth where it is actually installed.

- *Costs are allocated to developers not NEORSD:* A stormwater credit trading program would fit within NEORSD's strategic priorities. NEORSD has indicated a shift from capital expenditures on large green infrastructure projects in public spaces (the "green giant" projects) toward a more decentralized green infrastructure strategy on private and community property, for example through scaling up the green infrastructure grants program. A stormwater credit trading program would further aid this shift, as the responsibility for green infrastructure is allocated to individual new and redevelopments, and as the market determines the most effective and cost-efficient locations and technologies. Further, as developers and not NEORSD would be bearing the costs of this green infrastructure, this would relieve the pressure of trying to extract 10-11 percent per year average rate increases out of an eroding rate base.
- *Trading is an extension of NEORSD's current stormwater fee program:* NEORSD's current regulatory framework would lend itself to a stormwater credit trading program. NEORSD already has a different kind

of credit program, in the form of its stormwater fee credits. Like stormwater ordinances on new and redevelopment, NEORSD's stormwater fees provide the necessary "stick" to incentivize green infrastructure installation on private property when coupled with the "carrot" of stormwater fee credits for such installation. However, based on our analysis, in its current state avoided stormwater fees are likely insufficient to incentivize private installation of green infrastructure at scale. NEORSD assesses roughly \$5.15 per month per equivalent residential unit (ERU) of impervious area on both residential and non-residential properties (NEORSD 2012a), or about \$0.02 per square foot per year. However, estimates of stormwater control measures (SCMs) range from about \$0.33 to \$63.97 per square foot (Valderrama *et al.*, 2013), meaning the payback period for private property owners to recoup green infrastructure costs through avoided stormwater fees could range anywhere from 16 to over 100-years, an unlikely time horizon to spark significant decentralized investment in green infrastructure.

- *A credit trading program will open up and provide access to private properties in the service area:* Credit trading incentivizes voluntary installation of green infrastructure on private property in areas that would likely not otherwise benefit from the stormwater management ordinance. This is often an attractive element as it incentivizes green infrastructure on private property without requiring the public sector to encumber private

property through easements. For example, NEORSD could purchase credits from private property owners who developed voluntary sites. These owners would, through the sale process, commit to maintaining their green infrastructure for a period of time. This would mimic NEORSD funding green infrastructure capital spending on private property, without requiring an easement. In this example, should the private property owner who sold credits redevelop the property to remove the green infrastructure, they would be required to pay the in-lieu fee. Fee revenues could fund additional green infrastructure projects undertaken by NEORSD or be used to fund more credit purchases.

However, NEORSD's service area has two challenges to implementing stormwater credit trading that include:

- While the general real estate dynamic is improving, the area lacks significant density to drive exceptionally high value from offsite trading.
- Secondly, as identified above, the real estate market is improving unevenly.

Considering these challenges, the advantages of credit trading must be balanced against the relatively high regulatory burden such a program places on individual property owners. If there is a high degree of confidence that going offsite produces economic value (driven by density) and stringent regulations will not impede economic growth and development, credit trading is an ideal solution. Because we do not believe that is the case in NEORSD's service area, we have proposed a variation of credit trading that takes advantage of Title V's existing fee credit system to incentivize additional green infrastructure development without the potential for depressive regulation. This is described in more detail in chapter 3.

3.0 TRANSACTIONAL FRAMEWORKS & REVENUE SOURCES FOR NEORSD

After reviewing the information provided by NEORSD, as presented in Appendix A, the team identified three possible transactional frameworks that could be pursued to initiate a public-private partnership into green infrastructure that include a CBP3, an EIB, and stormwater credit trading.

Each framework offers a different level of private sector involvement and focuses only on delivery, finance or both. CBP3s have been proven to be highly efficient so far as costs and risk transfer. EIBs shift much of the risk to the private sector, though, like a traditional public-private partnership, it requires public funds to repay investors. Credit trading allocates the least risk to NEORSD but requires a strong regulatory framework. In the absence of public buying, credit trading will need to be privately financed. Although there is no precedent for a stormwater bank, the concept is a hybrid between a CBP3 and stormwater credit trading and may allow NEORSD to achieve large-scale green infrastructure installation at lowest cost, while transferring considerable development risk to the private sector.

Flexibility within these three frameworks are discussed below:

3.1 CBP3 – OPTION 1

This option proposes the formation of a 30-year, formal, community-focused public-private partnership with NEORSD to design, build, finance, operate, and maintain

(DBFOM) green infrastructure on behalf of NEORSD. Such a partnership typically includes the implementation of a tailored, socio-economic plan that provides local economic development and community revitalization benefits as outlined by NEORSD. For more information on the types of benefits a socio-economic plan can provide, please refer to Section 2.3.1 of this document.

The partnership will be in the form of a project or special purpose entity (SPE), typically in the form of a Limited Liability Company (LLC). The SPE is structured specifically for the public purpose and benefit; allowing for the SPE to be flexible and take on a variety of structures such as a Joint LLC, where both the public and private partner serve as members in the LLC, or a Service Concessionaire Agreement (SCA) where the public entity retains full ownership and contracts with the private sector to design, finance, construct, maintain and/or operate varying facilities or assets for a specified length of time. It is the uniqueness of this partnership structure that allows NEORSD to separate itself from the financial risk of the program while still maintaining an appropriate amount of control and oversight. The partnership will be a separate entity with independent financial accountability and rights of access to implement the actual work for contract/project performance. NEORSD will retain control over funding through a lender-appointed, third-party lockbox that is setup on behalf of the partnership and

managed according to a mutually agreed to servicing and lockbox agreement.

The partnership structure, shown in Figure 2-5, allows for access to a variety of low-cost financing structures, including SRF/WIFIA, tax-exempt bond financing and grant funding sources, which can provide debt to the project at very low interest rates and, more importantly, may not impact NEORSD's debt capacity or rating. This leaves NEORSD free to pursue other programs that may require debt financing. Utilizing a revenue stream that is determined during the collaboration phase with NEORSD, the partnership will leverage the funds and raise the debt required to implement these programs with no recourse back to NEORSD. While the revenue stream has not yet been quantified, historically this type of partnership has raised capital/annual revenue at 13.5-to-1 leverage ratios (Lueckenhoff and Brown 2016).

The private partner's compensation will be in the form of performance-based incentive fees to be awarded with approval of NEORSD based on the achievement of key performance indicators to be determined by the partnership and will only be paid if the parties perform. Unpaid fees will be invested back into these programs to be used as a source for construction or for future infrastructure upgrades at the discretion of NEORSD. Limiting and incentivizing return, as opposed to sharing in the overall profitability of the project, accomplishes several important goals: aligned interests rather than competition for cash flow, maximized project funds to be reinvested, a sustainable financing structure, and a flexible approach.

3.1.1 LEGAL STRUCTURE & FINANCING

The partnership carries out financing as a Special Purpose Entity (SPE) or SPE subsidiary. If the partnership defaults on a debt, the lender/trustee can either foreclose under a security instrument or remove the managing member from the partnership, substituting its own managing member. In the latter case, the partnership's status as the borrower and the municipality's or agency's standing with the borrower would be unaffected. The debt would not be treated as a municipality or agency borrowing and limiting any investor recourse to the municipality or the agency.

The structure allows for access to low-cost, private financing, which will provide debt to the project at very low interest rates and, more importantly, does not impact the local jurisdiction's debt rating or debt ceiling, leaving the local jurisdiction free to pursue other challenges that may require public debt financing. To ensure the lowest interest rate and the lowest cost of capital (resulting in maximum funds for the program), the debt will be sized to keep coverage levels in line with "Investment Grade Financing". Furthermore, debt payments can be interest only for the initial construction phase of the program further helping reduce the amount needed to be contributed to the capitalized interest account. This helps fund initial debt payments during the construction phase while lowering the required debt and required revenue stream. A cash-funded Debt Service Reserve Fund (DSRF) can be put in place to ensure the ability to meet short-term principal and interest obligations on the debt. This has the effect of lowering the program's risk profile, further protecting against downgrades in rating on

the debt, and securing the lowest cost of capital.

Based on the goals and objectives of the local jurisdiction, a long-term debt financing structure that allows upfront, private capital to be supplied immediately to fund construction costs eliminates the need for a large contribution or investment by the local jurisdiction during the initial construction phase. This initial phase is normally when a majority of execution risk is realized. Instead, payment is repaid over the life the program, including the maintenance term, through a long-term, fixed revenue stream (based on size of the program) that not only repays the long-term financing, but also funds long-term O&M. This ensures the long-term commitment to the regulatory community that a program goal is to maximize the life cycle benefits of green infrastructure/low impact development practices installed and constructed.

Payment sources can be partnership earnings plus either capital contributions from the designated member or contractual service payments from the municipality/agency. The municipality/agency payments can come from either a designated source (e.g., stormwater utility fund) or general fund. The long-term, fixed payments are the only financial commitment made by the municipality/agency.

It also transfers financial risk while still allowing the local jurisdiction to retain influence and control over the program funding through lender-appointed, third-party lockboxes setup on behalf of the partnership and managed according to a mutually agreed to Servicing and Lockbox

Agreement. This agreement governs the use of all project funds and ensures funds are used for their designated purpose of meeting regulatory stormwater requirements.

3.1.2 STORMWATER REVENUE STREAM

Whether utilizing a dedicated municipality or agency revenue stream, or general obligation revenue, this fixed annual payment from the municipality/agency is leveraged in such a way as to maximize funds available to the partnership in the short-term for construction to address the stormwater backlog while also ensuring funding for the long-term sustainability of the program through the creation of reserves, the funding of long-term O&M, and at the agency's/municipality's option, returning all savings in the form of residual cash flow back to the local jurisdiction or reinvesting it into the program.

Similar constructs have historically raised capital at 13.5-to-1 leverage ratios (capital raised/annual revenue). It is critical to reinforce that, within this partnership construct, the loan proceeds and equity proceeds, along with all cash flows, are retained in lockbox accounts and controlled by NEORSD. This gives NEORSD the needed oversight and control of funds, as well as regulators the confidence that the necessary funding needed to ensure execution and long-term maintenance of the stormwater infrastructure is protected from potential competitive uses and needs within the local jurisdiction for the long term.

3.1.3 PROGRAM & ASSET MANAGEMENT

Program and asset management is identified, implemented, and maintained through agreements between: 1) NEORSD

and the partnership, and 2) the partnership and specified service providers. These agreements would clearly outline the scope and delivery of the identified work. The private member is paid for performance, with a portion of the compensation tied to meeting specified incentive criteria.

One reason for the role of the private member in a P3 is the guarantee of continued maintenance, repair, and replacement of the public asset. Deferring maintenance needs can cause the total cost of improvements, once finally made, to increase 15 to 40 times the original cost. Thus, decision makers must consider future maintenance when determining whether to proceed with new projects. Because future maintenance costs are accounted for within P3 contracts, they are removed from the general budget debate. This means the project O&M costs are guaranteed and continued maintenance is not in jeopardy.

A major benefit of this public-private structure is that through greater private involvement and use of market forces (e.g., competition, efficiencies, flexibility, economy of scales), green infrastructure and flooding controls can be implemented more affordably. This structure keeps the infrastructure sustainable and modernized throughout the 30-year program through the continual funding of O&M, and, at the NEORSD's option, the reinvestment of residual net cash flow into future infrastructure projects.

The program carries reserves that could be tapped if needed and agreed to by both the partners for unforeseeable and force majeure events. These reserves include the debt service reserve, which can be drawn upon to make any debt payments if there is

a shortfall in available cash, and the operating reserve, which can be drawn upon to cover any shortfall in operations or O&M thus keeping cash flow stable. In addition, construction estimates include construction contingencies to protect the program against cost overages. The overall structure is intended to be redundant to provide security and assurance. Additional reserve accounts can be added depending on the risk exposure the partnership deems necessary taking into consideration the type of work being implemented.

As the private partner only receives a fixed, incentive-based fee for their role in the partnership, all savings are returned to NEORSD throughout the life of the project. This is very different from other P3 structures where most of the residual cash flow goes back to the private partner through shared cash flow agreements or additional returns to equity providers.

This flexible financial structure allows NEORSD to direct funds into things like capital improvement, new green technologies, SCM upgrades, or performance testing for TMDL loads as they see fit. This approach ensures that at the end of the 30-year program, the infrastructure aligns with future 30-year standards and does not simply reflect 30-year-old infrastructure. These reserves further serve as a contingency in the event there are gaps in financing due to unforeseen circumstances or the timing of expense.

Using preliminary information that will need to be discussed and further refined, two financial scenarios were created below. These are intended as examples for discussion. Both options include long-term

maintenance and operation for the 30-year partnership term.

3.1.4 SCENARIO – NEORSD CBP3 VIA EASEMENTS

In the scenario below, the partnership constructs and maintains the watershed and other stormwater-related projects, as feasible under a \$1.5 million annual revenue pledge. The following pro forma calculates the annual dedicated revenue source needed to support the debt service payments and maintenance expenses and fees for the 30-year life of the program. It is assumed that the partnership will be able to treat approximately 400 acres for \$22 million at an approximate cost of \$55,000 per acre, and also provides annual maintenance at an expense equal to 3 percent of the partnership’s construction costs (see Tables 3-1). Under the partnership structure, NEORSD transfers the ‘price risk’ associated with typical project-based initiatives, since there would be no price escalation in the partnership’s construction cost estimate.

To service the \$22 million of construction debt with an assumed 1.2x debt service coverage ratio (DSCR) target, \$1.5 million revenue is needed in year one (revenue and costs escalate at 2 percent per year). At the end of the 30-year partnership, this option provides NEORSD with a reserve balance (i.e. residual cash flow or savings) of \$8.7 million which can be applied to NEORSD capital or operations projects as needed (Table 3-2).

3.2 EIB – OPTION 2

NEORSD has an existing green infrastructure grant program and has indicated an interest in growing this program. An EIB could be of value to NEORSD in determining performance metrics and rightsizing incentives for grants, ultimately increasing the efficacy of the program. A typical EIB would fund a \$20-50 million green infrastructure project but is flexible so NEORSD could evaluate a larger project or a portfolio of smaller projects. This size allows NEORSD to test green infrastructure at scale, without allocating its entire green infrastructure plan to this structure.

Table 3-1: Cash Flow Projection

Assumptions & Key Results		30 Year Projection			
		Construction Period	Reinvestment Period	Total	
		(years 1 - 3)	(years 4 - 30)		
Escalation Rates					
Revenue	2.0%	\$4,590,600	\$56,261,519	\$60,852,119	
Expenditures	2.0%				
Cost per Acre					
Construction Costs	\$21,970,000				
Acres Treated (@ \$55,000 per acre)	399				
Year 1 Revenue	\$1,500,000				
Operating Expense as a % of Construction Costs	3.0%				
Debt Service Coverage Ratio					
Average - Project Life	2.0				
Minimum	1.2				
		Revenue			
		Interest Income	\$3,239	\$123,010	\$126,248
		Operating Costs	(659,100)	(23,295,444)	(23,954,544)
		Loan Proceeds, net of fees	21,750,300	0	21,750,300
		Debt Service Reserve	(982,775)	0	(982,775)
		Debt Service Payments	(615,160)	(26,534,938)	(27,150,098)
		Residual Cash Flow to Construction/Reinvestment	24,087,103	6,554,146	30,641,250
		Average Residual Cash Flow Available per Year		242,746	

Model allows for ongoing Operating Costs totaling \$24.0 million and \$30.6 million to be invested into BMP Construction over 30 years (\$22.0 million during construction period and \$8.7 million of residual cash flow available during Reinvestment Period).

Table 3-2: NEORS D 15-year and 30-year Projections

Assumptions & Key Results	
Escalation Rates	
Revenue	0.0%
Expenditures	0.0%
Operating Expense as a % of Construction Costs	
	3.0%
Construction Costs	\$81,291,740
Year 1 Revenue	\$8,950,000
Debt	\$78,000,000
Tenor	30-years
Interest Rate	5.0%
Debt Service Coverage Ratio	
Average - Project Life	1.2
Minimum	1.2

30 Year Projection			
	Construction Period	Reinvestment Period	Total
	Years 1-3	Years 4-30	
Revenue	\$26,850,000	\$241,650,000	\$268,500,000
Interest Income	\$9,123	\$446,389	\$455,512
Operating Costs	(11,154,000)	(69,498,000)	(80,652,000)
Loan Proceeds, net of fees	77,220,000	0	77,220,000
Debt Service Payments	(7,800,000)	(143,822,657)	(151,622,657)
Residual Cash Flow to Construction/Reinvestment	85,125,123	28,775,732	113,900,855
Average Residual Cash Flow Available per Year		1,065,768	

Model allows for ongoing Operating Costs totaling \$80.7 million and \$113.9 million to be invested into BMP Construction over 30 years (\$81.3 million during construction period and \$32.6 million of residual cash flow available during Reinvestment Period).

Assumptions & Key Results	
Escalation Rates	
Revenue	0.0%
Expenditures	0.0%
Operating Expense as a % of Construction Costs	
	3.0%
Construction Costs	\$65,034,111
Year 1 Revenue	\$8,950,000
Debt	\$54,990,000
Tenor	15-years
Interest Rate	4.2%
Debt Service Coverage Ratio	
Average - Project Life	1.2
Minimum	1.2

15 Year Projection			
	Construction Period	Reinvestment Period	Total
	Years 1-3	Years 4-30	
Revenue	\$26,850,000	\$107,400,000	\$134,250,000
Interest Income	\$15,341	\$96,044	\$111,385
Operating Costs	(7,863,570)	(21,776,040)	(29,639,610)
Loan Proceeds, net of fees	54,440,100	0	54,440,100
Debt Service Payments	(4,619,160)	(71,129,994)	(75,749,154)
Residual Cash Flow to Construction/Reinvestment	68,822,711	14,590,010	83,412,721
Average Residual Cash Flow Available per Year		540,371	

Model allows for ongoing Operating Costs totaling \$29.6 million and \$83.4 million to be invested into BMP Construction over 30 years (\$65.0 million during construction period and \$18.4 million of residual cash flow available during Reinvestment Period).

Regardless of the size of the EIB, this structure reduces NEORS D’s performance risk for the project, as their pay back is dependent on the project’s effectiveness. It also provides a rich data set to assess the cost effectiveness of various types of green infrastructure.

As outlined in Section 2.2, an EIB is similar to a social impact bond, allowing the government to transfer the risk of trying

something new partially or wholly to the private sector. Private-sector investors, typically motivated by impact investments, would provide capital to fund the construction, and, if desired, a portion of the maintenance of green infrastructure projects, and the government would repay the loan based on how successful the program was at generating stormwater retention and management.

Indicative cash flows for a \$20 million EIB shown in Table 3-3 demonstrate the responsibility of NEORSD and private investors. Table 3-4 shows the potential performance payments that NEORSD would pay based on the performance of the project.

3.2.1 ENABLING CONDITIONS

An EIB could be issued as a traditional tax-exempt municipal bond, depending on investors available, at NEORSD’s long-term cost of capital. A successful EIB would require NEORSD to work with all other relevant actors – including investors, bond

counsel, project developers, and, potentially, philanthropy or private property owners – to agree upon what metrics should be used to determine the “success” of the project. Generally, with green infrastructure, this would be related to the ability of the project to control stormwater at a given cost, but other metrics could be related to the actual implementation of the project, such as workforce development. Based on these metrics, the parties would need to agree on several scenarios (e.g. “underperformance,” “performance,” “overperformance”) that would correspond to differing levels of

Table 3-3: NEORSD Costs for a \$20 Million GI Project Funded Through an EIB

ANNUAL CASH FLOWS TO INVESTORS						
Date:	10/1/17	10/1/18	10/1/19	10/1/20	10/1/21	10/1/22
Year:	0	1	2	3	4	5
Principal Outlay:	(\$20,000,000)					
Interest Payment:	\$0	\$702,000	\$702,000	\$702,000	\$702,000	\$702,000
Tender Payment:	\$0	\$0	\$0	\$0	\$0	\$20,000,000
Principal Payment:	\$0	\$0	\$0	\$0	\$0	\$0
Principal Outstanding:	\$20,000,000	\$20,000,000	\$20,000,000	\$20,000,000	\$20,000,000	\$0
Interest on Escrowed Payment:	\$0	\$0	\$0	\$0	\$0	\$0
Performance Payment:	\$0	\$0	\$0	\$0	\$0	\$0
NET CASH FLOW	(\$20,000,000)	\$702,000	\$702,000	\$702,000	\$702,000	\$20,702,000
INVESTOR IRR:	3.51%					

Table 3-4: NEORSD Cost & Investor Returns for a \$10 million GI Project Funded Through an EIB

<i>Indicative Project</i>			
	Performance Payment	Investor Return	Incremental Annual D/S Cost to NEORSD(*)
<i>All scenarios assume a 3.51% Interest-only payment made on the “underperform” amount from construction completion through payout.</i>			
EIB Performance Outcome			
Underperform	(\$4,128,506)	-.67%	(\$120,270)
Perform	\$0	3.51%	\$0
Outperform	\$4,128,506	7.09%	\$169,550
*Incremental annual debt service cost to NEORSD calculated assume that NEORSD would finance its own \$20 million green infrastructure project using 30 year debt at an interest rate of 3.51%, versus financing the payout of the EIB at the same rate			

return to the investor. These parties would also need to agree on how and when those metrics should be measured, and what different levels of repayment should be based on each scenario.

A potential challenge with reimbursement programs is lack of transparency as to what constitutes a cost-effective project. Projects applying for NEORSD's grant program cannot be expected to be comparable to its past nine large green infrastructure projects, as they are of different scale. However, this does not mean that all projects are an equal use of NEORSD's limited grant budget. EIBs are the ideal financial tool for assessing which types of SCMs or locations are most cost effective for managing stormwater and could be used to either assess grant requests or, ideally, to offer a flat grant amount based on gallons retained that would incentivize the most cost-effective projects and deter high cost, low impact projects.

3.2.2 REVENUE GENERATION

The primary value proposition of impact bonds is avoided cost. A compliment to avoided cost, and of particular opportunity for NEORSD or other public entities interested in grant programs, is optimizing dollars spent. By providing NEORSD with performance data, an EIB would support better choices with respect to the overall green infrastructure plan and specifically the green infrastructure grants program. For example, if NEORSD were to enter into an EIB comprised of a portfolio of small projects, the data gleaned from the monitoring period could be applied to future grant requests. NEORSD could use this information to move towards reimbursing projects on a per gallon or per greened acre basis. Potential grantees

contemplating inefficient projects would be deterred, while property owners that could cost effectively manage stormwater through green infrastructure would be eager to apply. In aggregate, this would lead NEORSD to fund additional green infrastructure with its same grant budget.

3.2.3 BENEFITS TO THE PUBLIC SECTOR

3.2.3.1 *Risk Transfer*

EIBs transfer performance risk to the private sector. Investors receive a highly variable return based on the actual cost effectiveness of the project. This is in comparison to a traditional, publicly financed, project where the public sector retains all project delivery and performance risk, and CBP3s where delivery risk is transferred to the private sector but performance risk—i.e. whether the project is cost effective as conceived—is not transferred. In addition to transferring performance risk, which is always a hallmark of EIBs, EIBs can be structured to transfer or retain delivery risk if a transfer of delivery risk is of interest to NEORSD.

3.2.3.2 *Community Engagement & Buy-in*

EIBs require collaboration and cooperation between a range of stakeholders, as outlined above. As a result, the process of setting up an EIB can provide an opportunity for NEORSD to build relationships and also to engage relevant stakeholders to better understand the importance of stormwater management and the economic, social, and environmental benefits of green infrastructure projects. One idea that may be of interest to NEORSD—and would almost certainly be of interest to regional philanthropic stakeholders—would be integrating a social metric into a green

infrastructure EIB, such as workforce development.

3.2.4 OBLIGATIONS OF THE PUBLIC SECTOR

3.2.4.1 *Repayment to Private Sector*

The costs to NEORSD are mostly in the form of repayments to investors. NEORSD will need to be able to set aside the funds to repay investors across all performance outcomes. However, we do not see this as a large cost component as EIBs are structured similarly to traditional tax-exempt bonds and NEORSD enjoys a strong credit profile.

3.2.4.2 *Coordination & Administrative Costs*

As outlined above, the process of setting up an EIB will require stakeholder engagement and ongoing assessment of the performance of the project, which will require some allocation of resources and time from NEORSD. In general, the cost and time to execute an EIB is markedly lower than a CBP3, reflecting the more modest project scope and length of the public-private partnership.

3.3 **STORMWATER CREDIT TRADING – OPTION 3**

The success of a stormwater credit trading system rests heavily on the existence of a strong regulatory environment. For NEORSD, this would come in the form of revisions to its Title V Stormwater Management Code.

Stormwater credit trading is a market platform through which developers can buy and sell credits based on stormwater retention. Washington, D.C.'s District Department of the Environment currently has the most robust and well-developed stormwater credit trading scheme in the country. D.C. requires property developers

to implement green infrastructure SCMs on all newly developed and substantially renovated parcels over a certain size.

While NEORSD is unlikely to adopt green infrastructure requirements on private parcels that are as stringent as those in D.C., the current credit element in NEORSD's Title V could be adapted to create similar incentives and leverage private funds.

Section 5.08 of Title V is concerned with Stormwater Control Measures (SCM) credits. NEORSD retains the ability to adjust Stormwater Fees, calculated based on a parcel's impervious surface, if NEORSD determines that an applicant has invested in adequate SCMs that result in reduced impact on the overall system. NEORSD could amend this program to allow private parcel owners facing high fees to purchase fee credits from *other* private property owners, which would then be accepted by NEORSD.

NEORSD's policies limit fee credits to 100% of a property owner's total stormwater fee. A trading scheme would encourage parcel owners who could inexpensively reduce impervious surface area or otherwise control stormwater on their parcel to build excess green infrastructure, with credit purchases by other private property owners repaying the green infrastructure investment above NEORSD's fee credits. This would result in additional green infrastructure installation in NEORSD service area without reducing its fee revenues beyond what is currently contemplated in Title V.

3.3.1 ENABLING CONDITIONS: STRONG REGULATORY ENVIRONMENT

3.3.1.1 *Strong Regulatory Environment*

Central to the success of a stormwater credit trading system is the existence of regulations that underpin stormwater retention standards, credit issuance, and the assessment of off-site credits. The public sector must also have the resources and capabilities to enforce adherence to these stormwater management requirements and to hold non-compliant developers accountable.

NEORS D will also have to operate the credit trading market itself. Washington D.C. has created boilerplate documents for credit trades, private sector O&M contracts, and other useful legal documents that both lower transaction costs for private participants and ensure the legality of the market. These can be leveraged to NEORS D's advantage.

3.3.1.2 *Credit Trading System Administration*

Establishing and operating a stormwater credit trading system requires the public sector to play a role in monitoring and evaluating to ensure the validity of the credits being traded on the market, such as ensuring that these projects are continuing to provide retention over time.

In Washington, DC, the regulating entity DOEE has also had to take on an educational role in making the market a success. Neither real estate developers nor independent landowners would naturally engage in a market that is both untested and outside of their direct business area. To bring these parties into the market, DOEE spent several years engaging both sides of

A key obligation to the public sector is that it may need to become a buyer in the market – either as a way of deploying its green infrastructure spending or by serving as a buyer of last resort for private developers of green infrastructure.

the market through webinars, meetings, and informational documents.

3.3.2 REVENUE GENERATION: FUNDING FOR GREEN INFRASTRUCTURE PROJECTS

Credit trading shifts the responsibility of developing and maintaining green infrastructure projects to the private sector. As envisioned for NEORS D, this would be a partial shift as fee credits would still comprise the main repayment mechanism for private green infrastructure investments.

Private sector buyers will only enter the market if they deem the savings to be high enough. As such, the funding will come from a higher impervious surface area fee that can generate private sector demand.

3.3.3 BENEFITS TO THE PUBLIC SECTOR: SHIFTING COSTS TO PRIVATE SECTOR

Green infrastructure projects frequently benefit from economies of scale not only with respect to cost, but also with respect to stormwater control benefit. Incentivizing development of large-scale stormwater control through allowing off-site purchases could result in highly cost-effective green infrastructure projects.

Additionally, by allowing for the lowest cost compliance for stormwater regulations, NEORS D can indirectly encourage investment in green infrastructure in under-invested neighborhoods where the cost of

SCMs is likely to be lower. This has the effect of improving disadvantaged neighborhoods without burdening them with additional costs of compliance. Spreading the co-benefits of green infrastructure into under-invested neighborhoods can spark revitalization and improve local environments.

3.3.4 OBLIGATIONS OF THE PUBLIC SECTOR

While the public sector may not be required to provide capital for green infrastructure

projects, the public sector will incur costs related to the ongoing administration of the program, including setting rules for trading within and across watersheds, verifying the credits that are being traded, and ensuring long-term credit validation and compliance.

Additionally, the public sector can become a buyer in the market – either as a way of deploying its green infrastructure spending or by serving as a buyer of last resort for private developers of green infrastructure.

4.0 MEASURES OF SUCCESS

4.1 POTENTIAL MEASURES OF SUCCESS FOR NEORSD

NEORSD has already proven its ability to meet applicable environmental regulations. Building upon NEORSD's success and further improve the local environment, the following is a summary of what NEORSD may consider a successful venture:

1. *Continues its role as a national leader by supporting and expanding its vision for green infrastructure:* First and foremost, any venture, whether funded privately or publicly, must allow NEORSD to meet regulatory commitment of nearly doubling available stormwater storage volume, substantially reduce Total Suspended Solids (TSS) and phosphorus discharges, and reduce urban heat island effect, all while increasing the green space in its service area.
2. *Provides cost savings for its rate payers:* Life-cycle cost savings from nine Project Clean Lake projects indicate 30-year savings of over \$82 Million. Additional triple-bottom line benefits also accrue which are presented in Appendix A.
3. *Maintains their strong balance sheet:* NEORSD maintains a strong bond rating (AA+ (Standard & Poor's) and Aa1 (Moody's)). Any future financing alternatives initiated by NEORSD should support its current use of funds and maintain NEORSD'S high liquidity and low leverage position.
4. *Builds a broad-based coalition of customers potentially with other organizations, such as Cleveland Water Alliance:* Proposed alternatives

Benchmarks for partnership success for NEORSD include:

1. *Continued role as a national leader for green infrastructure*
2. *Savings for its rate payers*
3. *Maintenance of a strong balance sheet*
4. *Creation of an anchor institution for innovation and visionary partnerships*
5. *Efficiency enhancement, long-term maintenance, and risk management, and*
6. *Workforce development and community revitalization*

could be utilized by NEORSD to establish and support innovative and visionary partnerships to leverage the ongoing efforts of the Cleveland Water Alliance and others.

5. *Enhances efficiency, provides long-term maintenance, and continues to manage risk:* The private sector can provide specialized, stormwater project management expertise to aggregate hundreds of individual projects into a single, DBFOM delivery model that can deliver significantly streamlined processes and allow economies of scale that can yield great efficiencies. In addition, a well-crafted contract vehicle can allow the public party to allocate the risk to the private entity. The use of "pay for performance" contracts allow the private entity to manage and maintain the green infrastructure project for a long, well-defined period of time allowing the municipality/agency to allocate the compliance and performance risk to the contractor in

a manner that the private entity can manage and accept.

6. *Utilize contract requirements to assure workforce development and community revitalization:* Because large scale green infrastructure implementation requires substantial investment and effort, NEORS could link the need for green infrastructure related "green jobs" to contractually required commitments for:
 - a. Workforce development for re-entry, disadvantaged, or low-income residents
 - b. Local economic development by increasing subcontractor utilization that targets small and/or minority-owned businesses
 - c. Community outreach and education about stormwater management

4.2 POTENTIAL MEASURES OF SUCCESS FOR PRIVATE PARTNERS/INVESTORS

A private partner is willing to invest in large scale green infrastructure if it can manage risk and receive a return on investment. The private investor – a delivery and financing partner – can determine the attractiveness of the investment (and therefore the “cost of money”) by evaluating the return expectations, the risk, and the market size/scalability. Some investors may also incorporate “impact” metrics, such as environmental or social outcomes, into their success criteria which has the practical result of further reducing the cost of money.

Private partners may consider a project a success so long as the project’s return is commensurate with the amount of perceived risk. The most important consideration in determining risk is

revenue, or repayment, certainty.

Therefore, the most meaningful lever for a public sponsor of a privately-financed infrastructure project is providing contractual certainty and evidence of future revenues to repay the investment. In some cases, this certainty can be further supported by a guarantee from a philanthropic foundation. Other levers available to the public sector to reduce the perceived risk of an investment—and, therefore, the investor’s return expectation—are guaranteed siting and planning permission. Typically, pre-approval of permitting is also considered.

In some cases, when a public-sector partner has a poor credit rating, there is an equity investment required for privately-financed projects. This equity has a return expectation higher than the debt, typically 12-20 percent. This is not the case for NEORS. However, overall return expectations to all private investors, which include a mix of debt and equity providers, is frequently much lower and typically in the range of 8-12 percent.

The cost of money can be further reduced for privately-financed projects by utilizing tax-exempt debt, government grants, low-interest loans, or other concessionary forms of capital. This will further reduce the project cost to the public sector while meeting the private investor’s return objectives.

Benchmarks for partnership success for private partners may include return expectations commensurate with risk taken and market size/scalability. Some investors may also incorporate “impact” metrics, such as environmental or social outcomes, into their success metrics.

The size of the project/marketplace is also important for investors as the cost to implement investments—particularly, distributed green infrastructure—can be high.

When seeking private financing, the public sector is best served if several private entities compete for the opportunity to invest in a given location. Private investors can accept and assume the substantial upfront administrative costs associated with large scale green infrastructure implementation – most of which is provided at no cost to the public sector. The upfront costs associated with investing in green infrastructure would be considered far

more manageable and reasonable if investors believed early investments would help catalyze replicable projects in other municipalities/regions.

Finally, while most private investors determine success purely by financial outcomes, a subset of investors called *impact investors* ascribe value to non-financial outcomes such as social and environmental benefits. These investors will clearly identify expected outcomes prior to making an investment and will determine the success of a project across multiple metrics. Some of these investors may be willing to accept financial returns lower than those expected by a traditional private investor in exchange for these outcomes.

5.0 PARTNERSHIP CHECKLIST & NEXT STEPS

In this report, the following three options for public-private partnerships to implement green infrastructure by the NEORSD are presented:

- Option 1 – Community Based Public Private Partnership (CBP3)
- Option 2 – Environmental Impact Bond (EIB)
- Option 3 - Stormwater Credit Trading

Of these, Option 3 is deemed best suited to aid NEORSD in delivery and potentially finance of large scale green infrastructure in a timely manner. NEORSD’s strong financial capability and ability to deliver services makes the first two options less attractive. Stormwater Credit Trading, however, can cause more investment on private property in a manner that reduces costs and supports community development. The added value of stormwater trading is the result of easier access to private property and the technical advantages that provides. To enable a trading framework, this chapter provides a list of resources such as a checklist and a set of next steps, that NEORSD’s staff may find useful.

5.1 TRADING FRAMEWORK CHECKLIST

Several communities have implemented and/or are implementing a stormwater trading effort and NEORSD can learn from these programs. NEORSD staff should review the following checklist to help guide the development of a trading framework:

- **Identify existing sustainable and predictable revenue streams:** A predictable and reliable revenue stream is required to sustainably fund construction, operations, reporting,

and maintenance. These revenue streams can be augmented by grant, loans, or gifts to help lower capital and/or financing costs. However, operation and maintenance of these facilities must be assured. Typical revenue streams include:

- ✓ Funding streams generated from property taxes, utility fees, or fee-in-lieu of programs.
- ✓ Private funding streams such as avoided stormwater fees and/or fee-in-lieu-of payments.
- ✓ Public and private revenue streams can be augmented by grant, loans, or gifts to help lower costs, including:
- ✓ Significant grants, state revolving loan funds, and philanthropic donors.
- ✓ Multi- sector grants and loans (e.g., stormwater and energy).

- **Identify private participants:** A goal of a credit trading system is to incentive a change in practice on private property in a manner that reduces the overall cost to the property owner while providing the level of control needed by the public utility. This is often done by leveraging public support with private investment. To be effective, NEORSD will need to engage both private green infrastructure developers, as well as private fee payers. These groups are driven to reduce peak runoff volumes and can provide the supply for the private market. These same “buyers” can also generate additional demand

beyond NEORSD's purchases. A focus on the following is useful:

- ✓ Are there real estate developments that are required to capture stormwater at a price that is substantial and potentially less costly in another location. These developers can generate demand for credits?
 - ✓ Will the communities either implement a stricter LID or a higher stormwater fee in order to generate private sector demand?
 - ✓ Will NEORSD encourage private investment in GI projects? Will NEORSD offer a purchase guarantee for credits generated?
 - ✓ Will NEORSD engage landowners who may be good candidates for green infrastructure retrofits that can generate credits?
 - ✓ Will NEORSD encourage private investors to establish a supply of credits and, if so, what level of involvement do they expect in the sale of those credits.
 - ✓ Will NEORSD purchase credits through a guarantee?
- **Identify the measures of success through specific measurement and verification:** Private investors, private landowners and public utilities all have a reason to need quantifiable measurements to assure compliance and assure repayment of loans/investments. All three entities are best served with a cost effective and efficient implementation strategies and SCMs that achieve the required reduction in flow volumes and pollutant loads. The process for measuring success can be streamlined through innovation and adaptive

management for planning and design of the SCMs. To apply compliance (and repayment) these innovations must be evaluated and verified, with reports on the progress of the effort that can quantify the results and satisfy the requirements of regulatory agencies. A focus on the following is useful:

- ✓ Establish monitoring programs that accurately determine volume and load reduction benefits for innovative and conventional SCMs at both the site and watershed level.
 - ✓ Establish a means of converting load and volume reductions into regulatory (or financial) credit.
 - ✓ Determine if reductions from new sources show realize different/additional credits from traditional pollutant reduction and legacy pollutant removal.
 - ✓ Determine if credits will be available for retrofitting and enhancing existing systems.
- **Identify specific areas for targeted intervention:** Investors and contractors will naturally target the lowest cost areas to achieve impact. If NEORSD wishes to target its impact in particularly imperiled watersheds, premium credits can be placed on certain areas. Additionally, NEORSD could decide to restrict credit purchases to within the regulated developers own watershed (or, perhaps the developers own watershed, plus 1 particularly imperiled watershed). This could add to costs and may dissuade some private entities from participating in a

given project area. A focus on the following is useful:

- ✓ Does NEORSRD have particular targets watersheds/sewersheds that will provide additional relief to the NEORSRD operation?
 - ✓ Is NEORSRD willing to offer a larger rebate to GI built in these areas?
 - ✓ Will NEORSRD restrict the purchase of credits to specific watersheds related to either the development's own watershed or particularly imperiled ones?
- **Prioritize and include other community benefits:** NEORSRD also has the opportunity to craft the contract documents to encourage community development. Green infrastructure can satisfy the requirements of other infrastructure and regulatory programs while providing additional community development opportunities. NEORSRD may consider including the following in any proposed credit trading system:
 - ✓ Opportunities for water reuse and conservation (i.e. complete removal from the sewer system) could receive additional credit?
 - ✓ Programs targeting investment in the underserved communities?
 - ✓ Flows and volume reductions to support resiliency planning while preserving infrastructure capacity?
 - ✓ Creation of community greenspace?
 - **Include requirements that support local jobs:** A successful credit trading system can support the creation of local "green jobs", workforce development, and the more efficient management of local government

stormwater programs. The demonstration of the benefits to the community in the number, quality, and predictability of benefits provide continued support of the partnership. As the credit trading system is implemented, NEORSRD should consider:

- ✓ Maximizing the work performed by local contracting/maintenance firms.
 - ✓ Establishment or adoption of certification and training process for local companies to support the GI work.
 - ✓ Establishment of a requirement/incentive for hiring local firms.
- **Build broad-based support through outreach and transparency:** The credit trading model allows landowners, contractors, and stakeholder groups in the community to build green infrastructure on their own properties and at their own expense. Thus, for a successful credit trading system, transparency and broad participation are necessary:
 - ✓ Provide opportunities for stakeholders, property owners, businesses, and institutions to become partners in planning and implementation.
 - ✓ Provide stakeholders access to all relevant documents, plans, meetings, and reports.
 - ✓ Measure, evaluate, and report all outreach efforts.
 - ✓ Require and/or provide additional stormwater credits for effectively implementing outreach programs?
 - ✓ Educate and invest in outreach efforts with key stakeholders

5.2 STEPS TO ESTABLISHING A TRADING FRAMEWORK

The development of a credit trading system requires a series of activities that engage a wide-range of partners and stakeholders in order to be successful. Listed below are a set of potential activities accompanied by a summary of the goals and objectives that could be accomplished to support the community and partnership efforts.

- **A visioning process to identify goals associated with long-term investments:** The public has a lot of questions – most of which can be anticipated. A visioning process can help answer many of these questions, including:
 - ✓ How many acres should be addressed?
 - ✓ What funding is available? From NEORSR or from private sector?
 - ✓ Potential short- and long-term fiscal benefits to the community (e.g., fee reductions, new sources of income, job creation, triple bottom line, and community development benefits)?
- **Establish a baseline of current expenditure:** Anticipated success factors should be identified early. To do this, a baseline is useful. Establishing a baseline can help answer:
 - ✓ How much is NEORSR currently spending on stormwater management and/or green infrastructure?
 - ✓ Can some portion of these costs be shifted to private developers/property owners? Could this money be more

efficiently spent by using private property?

- ✓ Should private real estate developments be asked to shoulder more of the stormwater burden?

- **Purchase guarantee and defining public revenue stream which could include dedicated fees, loans, grants, and hybrid funding combinations:** The private market should determine the least cost means of reducing peak flows. However, the anticipated cost of a credit is wholly unknown until a market is established. Recognizing this challenge, Washington DC chose to establish the market price by setting the (high) cost of failing to comply with their design standards (i.e. pay the “in-lieu fee”). Establishing an NEORSR funded purchase guarantee would significantly improve the likelihood of success of a credit trading system.

There are numerous public and private sector revenues/funding streams and opportunities that are available to NEORSR including federal grants and local financial institution sources. All viable options and mix of predictable and dedicated funding streams should be considered for the program in both short-and long-term.

- **Define private demand for credits:** In addition to a public purchaser, one of the main benefits of a credit trading model is its ability to engage private purchasers of green infrastructure. This allows the NEORSR to grow faster and have a larger reach. It also passes some of the burden of green

infrastructure on to regulated private actors. Questions to consider include:

- ✓ For NEORS, who might these private actors be?
 - ✓ Is there enough real estate development in the region to support an LID ordinance that increases their stormwater liability?
 - ✓ If not, are fees high enough on large impervious surfaces to compel investment in green stormwater infrastructure?
- **Establish guidelines for green infrastructure credit generation:** To encourage private involvement in a credit trading program, the establishment of a credit must be transparent, well defined, simple, and measurable. While a credit trading model will allow NEORS to be less involved in the creation of green infrastructure, it will still have to establish a list of acceptable SCMs, acceptable locations, and a process for certification.
 - **Establish guidelines for green infrastructure credit certification:** Key items include:
 - ✓ What are the requirements to establish a credit (and when can a credit be sold/purchased)?
 - ✓ For how many years will NEORS allow a project to receive certification?
 - ✓ What is the process for re-certifying credits?
 - ✓ For how many years in advance will NEORS allow a purchaser of credits to bank their credits?
 - **Establish guidelines for green infrastructure credit trading:** Key items include:
 - ✓ What level of approval will be retained by NEORS?
 - ✓ Will NEORS restrict trading between watersheds?
 - ✓ Will NEORS incentivize (or preclude) trading across watershed or sewer systems (CSS vs MS4) in order to achieve some desired ecological outcome?
 - **Reach out to similar communities in size and resources that have adopted a credit trading approach:** Discussions with communities such as Washington, DC, and Chattanooga, TN, would be useful to NEORS to minimize the “getting up to speed” aspects of this program. This would support their contract and procurement language workshops on progress, training, local products; and monitoring resources can be reviewed and shared in advance.
 - **Evaluate and/or develop internal capacity staffing, outside training, and resource needs:** The transition from the NEORS’s conventional program approach to a credit trading system may require a modification to the resource and capacity plan. If done early in the process, NEORS can ensure that the process can be properly managed and that the overall governance goals and requirements of the local government infrastructure needs are met.
 - **Build community trust through stakeholders and interested party’s workshops:** The success of a strong

credit trading system is more likely with a long- term commitment to the program by both NEORS and the community (local groups, nonprofits, and environmental advocates). The

involvement and interest of these groups will be very dynamic raising the need for an open and continuous process for communication that is accessible to all groups.

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APPENDIX A: NEORSD & Green Infrastructure

A.1 BACKGROUND

NEORSRD provides sewage collection and treatment of more than 365 million gallons of wastewater per day at three plants serving Cleveland and the surrounding Cuyahoga, Summit, Lake and Lorain counties (Figure A-1). Since 1969 when the Cuyahoga River famously caught fire, NEORSRD has taken great strides to meet the regulatory requirements while improving the quality of service for the more than one million residents that depend on their services. Recent efforts to reduce the impact of stormwater and the resulting sewage overflows have established an excellent foundation for considering a comprehensive green infrastructure program. NEORSRD's history, current regulations, and recent steps to implement green infrastructure throughout the community has led the leadership to consider expanding the use of green

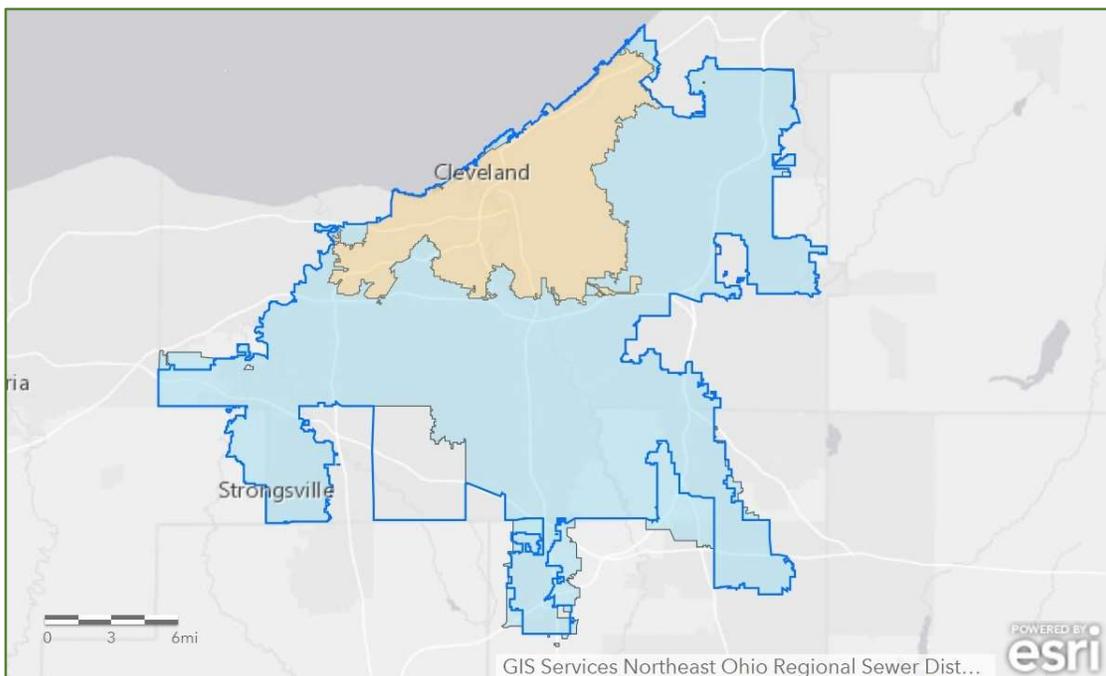
NEORSRD Snapshot

- *Political subdivision of the state of Ohio*
- *Created by court order in 1972*
- *Separate and distinct from the city of Cleveland and Cuyahoga county*
- *Service area of 355 square miles, serving Cleveland and 61 other communities*
- *Own, operate 3 wastewater treatment plans*
- *1 million customers*
- *90+ billion gallons treated annually*
- *330 miles of sewer*
- *420 miles of regional stormwater system*
- *Wet weather programs include Project Clean Lake (a \$3 Billion, 25-year program that seeks to address CSO control via sewer fees), and a regional stormwater management program (a \$41 million a year program that seeks to address flooding and erosion via impervious cover fees)*

infrastructure to address regulatory requirements in a cost-effective manner.

The land use in NEORSRD's service area is predominantly developed (urban and

Figure A-1: NEORSRD Service Area



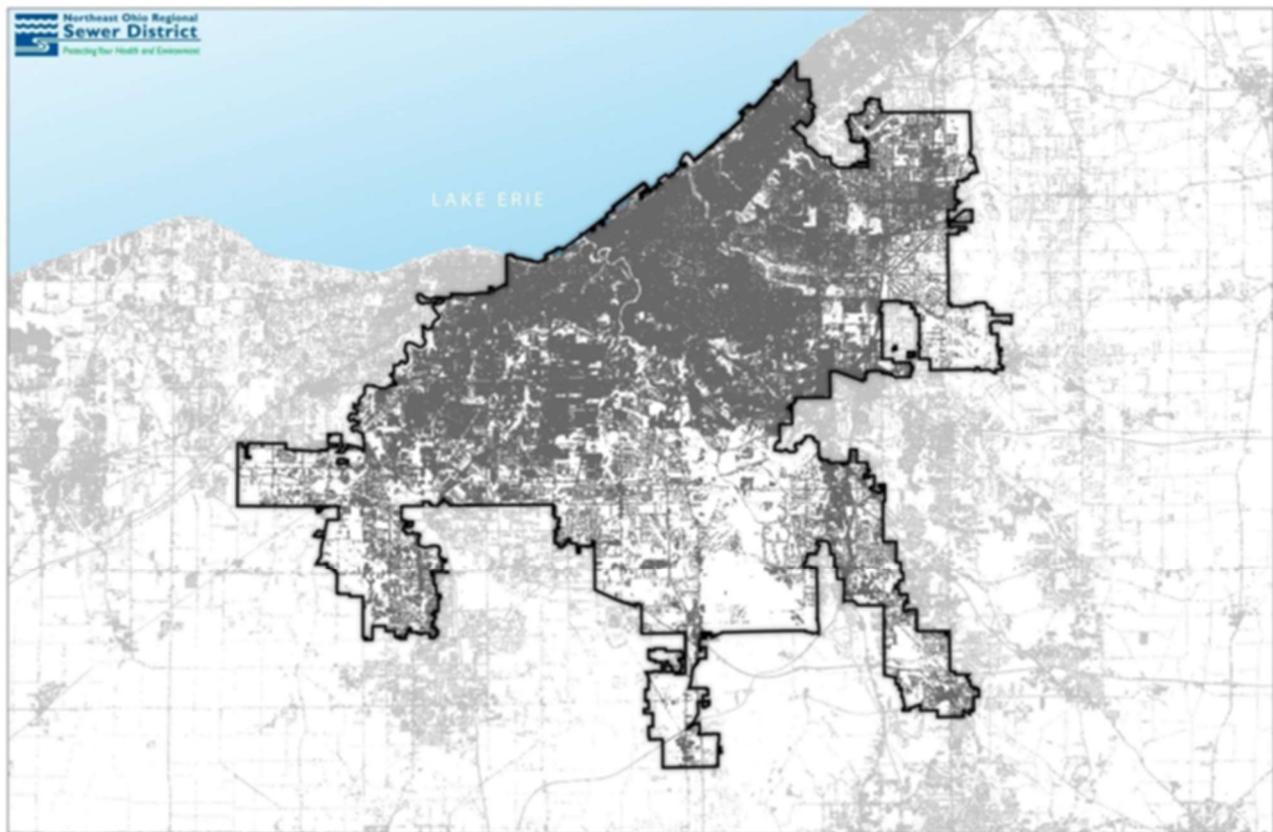
suburban) and contains nearly 207 square-miles of impervious surfaces as shown in Figure A-2. The area is served by three wastewater treatment plants - Easterly, Southerly, and Westerly - that have a total plant design capacity of 365 million gallons per day and treat an average combined daily flow of 244.45 gallons (NEORSD, 2010a). The service area is subject to combined sewer overflow (CSO) permits, municipal separate sewer systems (MS4) permits, and total maximum daily load (TMDL) regulations.

NEORSD's treated effluent is discharged into the Cuyahoga river and/or Lake Erie. Expanding the green infrastructure program

can support compliance with each of these permits and/or regulatory requirements.

As an independent political subdivision of the State of Ohio, NEORSD enjoys consistent, strong credit ratings through its history and at the end of 2015, maintained AA+ (Standard & Poor's) and Aa1 (Moody's) ratings on outstanding revenue bonds (NEORSD 2016c). In 2016, NEORSD budgeted to spend \$257 million on capital expenses, and \$130 million on operating expenses. After a 2015 supreme court ruling, NEORSD could charge for stormwater management that totaled \$11 million in 2016 (NEORSD 2016f).

Figure A-2: NEORSD Service Area Impervious Surface Area: 207 sq. mi. (NEORSD, 2010a; Dreyfuss-Wells, 2015)



NEORSD's service areas have all three usual drivers that typically have led to the use of green infrastructure elsewhere in the country. They include:

1. CSOs: CSOs are the largest and most costly regulatory challenge facing NEORSD. It is estimated that every year nearly 4.5 billion gallons of stormwater/sewage are discharged from CSO in Cleveland and surrounding communities into Lake Erie and local waterways (NEORSD, 2012b). A majority of the CSO events originate in Cleveland. Of NEORSD's remaining permitted outfalls, 20 of 24 with overflows exceeding a million gallons or more, originated within that city.

NEORSD provides service for many member communities across four counties - each with differing motivations, drivers, and legal frameworks that make adopting green infrastructure on a regional scale challenging. A single CSO permit covers a nearly 80 square miles collection system (23 percent of NEORSD's service area) and includes 126 permitted outfalls. In addition, two member communities (Euclid and Lakewood) also have their own CSO permits (NEORSD, 2012b; Ohio EPA, 2016).

2. MS4 permits: NEORSD's member communities are also subject to stormwater permits under the MS4 program. Furthermore, because of persistent water quality challenges, TMDLs have been completed providing water body specific regulatory requirements. MS4 permitted communities include townships of

Brecksville, Sagamore Hills, and Lynhurst, among others.

3. TMDLs: A TMDL for the lower Cuyahoga River defines water quality guidelines within the watershed for nutrients (phosphorus, nitrogen, and ammonia), total suspended solids (sediment and siltation), bacteria, dissolved oxygen and organic enrichment, and flow (NOACA, 2015). This TMDL simultaneously regulates water quality and assigns limits to the volume of contaminants that can be discharged into the effective water body.

**NEORSD's Green Infrastructure Policy
(adopted by Board of Trustees, October 1, 2015)**

"NEORSD will actively pursue opportunities across its program areas to advocate for strategic and cost-effective implementation and maintenance of green infrastructure technologies and innovations that protect, preserve, enhance and restore the natural hydrologic function of our region's watersheds. In addition, NEORSD will seek to maximize the co-benefits provided by green infrastructure projects including opportunities to expand urban natural areas, enhance air quality, and improve quality of life in Northeast Ohio."

Project Clean Lake Green Infrastructure Definition

"The range of stormwater control measures that use plant/soil systems, permeable pavement, or stormwater harvest and reuse, to store, infiltrate, or evapotranspire stormwater and reduce flows to the combined sewer system."

Wet Weather Green Infrastructure Definition

"Stormwater source control measures that store, filter, infiltrate, harvest and reuse, or evapotranspire stormwater to increase resiliency of infrastructure by reducing stress on wet-weather drainage and collection systems which increase co-benefits in support of healthy environments and strong communities."

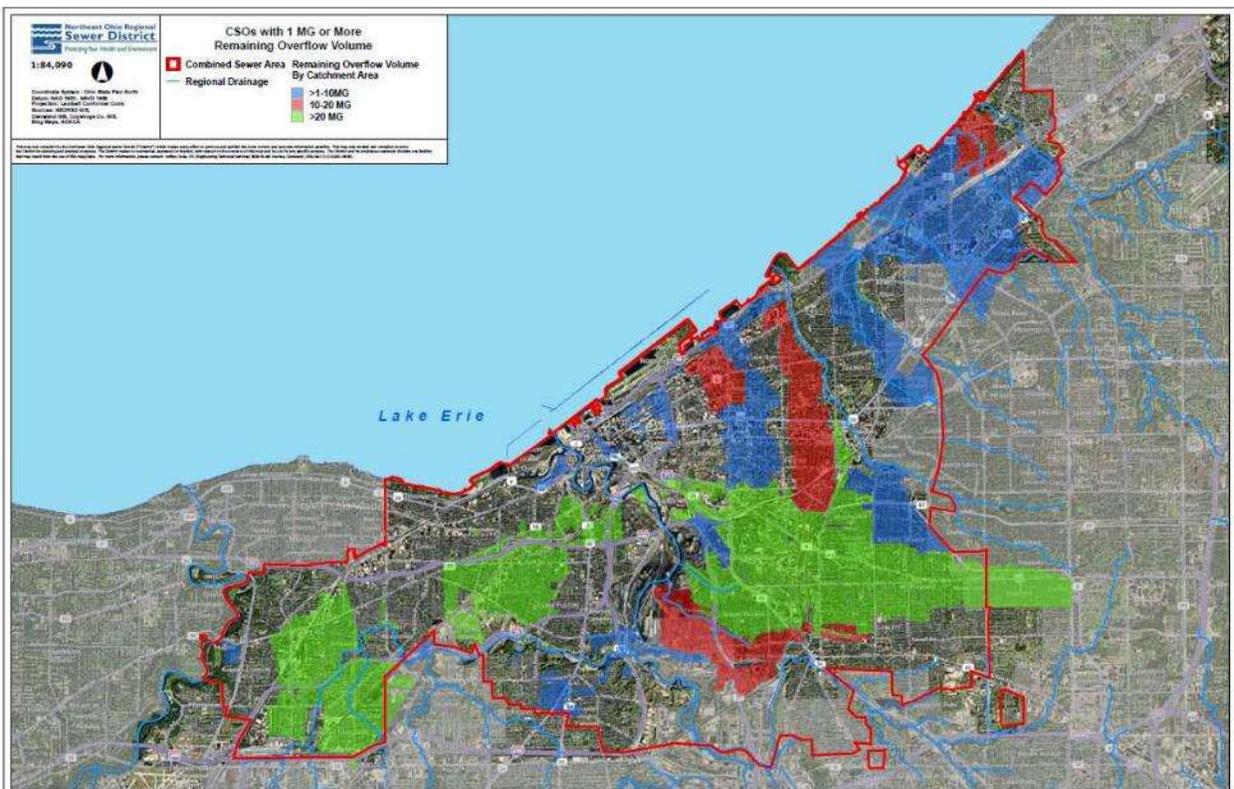
A.2 COMBINED SEWER OVERFLOWS & CONSENT DECREE: PROJECT CLEAN LAKE AND GREEN INFRASTRUCTURE

Between 1972 and 2010, NEORSD invested \$850 million in projects to capture 82 percent of stormwater runoff. This resulted in reducing the COS volume by half (from 9 billion gallons per year to 4.5 billion gallons per year). However, it wasn't enough and in 2010, a consent decree was entered requiring 98 percent of stormwater to be captured, allowing only about 494 million gallons of CSOs per year. Furthermore, the consent decree established the regulatory framework driving most of NEORSD's CSO mitigation programs. It restricted CSO events to less than four per year, and three or less per year at priority CSOs (NEORSD 2016c, EPA 2010a).

NEORSD entered into the consent decree negotiations relying on an original proposal for *Project Clean Lake* based on a 2002 capital improvement plan. That proposal focused exclusively on gray infrastructure to address CSOs and included the construction of seven large tunnel systems that represented 51 percent of the \$3 billion program. The remaining budget addressed treatment plant upgrades, pump stations, consolidation and relief sewers, and storage tanks. However, together, these projects were able to only bring NEORSD's CSO capture capacity to 97 percent, i.e., 1 percent less than what the EPA eventually mandated.

To capture the additional 63 million gallons, NEORSD began considering green infrastructure (Figure A-3). It conducted an economic study which found that the

Figure A-3: Opportunity for Green Infrastructure Following Planned Consent Decree Projects



additional gray infrastructure alone would cost \$182 million, while a combination of gray and green would cost \$95 million (NEORS 2012). Recognizing both the cost-saving and socio-economic-environmental benefits of green infrastructure, NEORS and the EPA formally adopted this plan for a green-gray mix to achieve the remaining CSO reductions (Appendix 3 of the consent decree in US versus NEORS 2011). This appendix requires NEORS to spend a minimum of \$42 million on green infrastructure by 2019 to reduce 44 million gallons (per year) of CSOs, with the remaining 19 million gallons per year coming from further gray improvements.

Recognizing the cost saving potential of green infrastructure through the economic study and building upon the “green plus gray” approach codified in Appendix 3, NEORS became interested in assessing if

green infrastructure could further improve performance and reduce cost by supplanting some of the gray infrastructure in the original plan. As a result, Appendix 4 was eventually adopted through the consent decree negotiations, which gives NEORS the flexibility to substitute its planned gray infrastructure projects with green infrastructure, provided that the “green for gray” exchange takes place within the same sub-watershed, and that the NEORS demonstrates that they can a) retain permanent access and sufficient control over the land used for green infrastructure, b) have a post-construction monitoring plan, c) have economic and hydrological models that support the changes, and d) prepare a community outreach plan (EPA 2010b).

The terms of the accepted consent decree require that NEORS maintain permanent

Program Areas through which NEORS implements green infrastructure

- **Capital Improvement & Operation and Maintenance Program:** Implement combined sewer overflow control green infrastructure projects and seek additional opportunities to invest in green infrastructure that enhances sewer infrastructure capacity as District projects advance.
- **Green Infrastructure Grants Program:** Partner with communities to promote, implement, and maintain water resource projects through the construction of green infrastructure to remove or detain stormwater from separate or combined sewer systems as such opportunities arise through development activities, neighborhood planning efforts, and other partner-driven projects to expand green infrastructure.
- **Community Infrastructure Program:** Assess and fund local sewer system improvements in its service area that effectively employ and maintain green infrastructure where appropriate to resolve water quality and quantity issues that impact human health and the environment.
- **Water Resources Restoration Sponsorship Program (WRRSP):** Work with District partners to sponsor projects that protect and improve water quality through preservation and restoration of ecosystem functions in the region’s watersheds, such as floodplain storage, habitat restoration, and streambank erosion control through participation in the Water Pollution Control Loan Fund program.
- **NEORS Code of Regulations Titles III & IV Community Discharge Permit Program:** Seek opportunities to use green infrastructure where appropriate to reduce stress on separate and combined sewer infrastructure and support permit compliance through the effective implementation of the Community Discharge Permit Program.
- **NEORS Code of Regulations Title V Regional Stormwater Management Program:** Advance the comprehensive management of the regional stormwater system to strategically implement and maintain green infrastructure to help achieve a minimum level of service across its service area to protect public safety, infrastructure and the environment from flooding, erosion, and water quality concerns.

access and sufficient control over land devoted to green infrastructure control measures implemented through the green infrastructure plan. NEORSD has sought to satisfy this requirement by entering into cooperative service agreements with public and private entities to aggregate parcels of land in which green infrastructure control measures are to be implemented. For instances where NEORSD is not the property owner, it seeks to obtain necessary easements to ensure permanent access and sufficient control of green infrastructure measures to allow for continual inspection, operation, and maintenance of implemented controls. These service agreements and easements allow NEORSD to ensure long-term operation and effectiveness of green infrastructure control measures on public and private property.

A.3 EXISTING CODES THAT PROMOTE GREEN INFRASTRUCTURE

NEORSD has developed a Code of Regulations to protect human health, the environment, and infrastructure investments. It is one of the ways that NEORSD is managing stormwater and water quality throughout its service area. Types of review required by the NEORSD Code of Regulations are contingent on the nature of the development. These may include:

- **Title III: Separate Sanitary Sewer Code** – applies to communities outside of the combined sewer system and enables NEORSD to review all connections to its sanitary sewers.
- **Title IV: Combined Sewer Code** – requires that development and re-development projects within the NEORSD combined sewer area are subject to review and approval prior to

beginning construction (NEORSD, 2015a).

- **Title V: Stormwater Management Code** - requires that member communities provide NEORSD with copies of the proposed Stormwater Management Plan for any project that is regulated by the member community's local stormwater management ordinance or resolution that is within the service area (NEORSD, 2013).

Together, these codes allow NEORSD to oversee/ reduce sanitary sewer overflows, peak flows, sanitary sewer overflows, combined sewer overflows, illicit connections and discharges, and infiltration/inflow (NEORSD, 2015a). The Community Discharge Permit Program (Titles III and IV) is designed to reduce the hydraulic load on combined and separate sewer infrastructure thereby supporting permit compliance through the use of green infrastructure (NEORSD, 2015a). The Title V Regional Stormwater Management Program advances the comprehensive management of the regional stormwater system by achieving a minimum level of service across NEORSD service area (NEORSD, 2013).

A.4 PROJECT CLEAN LAKE & NINE LARGE GREEN INFRASTRUCTURE PROJECTS

Project Clean Lake is an ambitious \$3 billion, 25-year capital improvement program initiated in 2011 as a result of an EPA consent decree mentioned previously. Much of NEORSD's stormwater control and green infrastructure programs are housed under this program (see Table A-1).

Following the adoption of Appendices 3 and 4 to the consent decree, NEORSD conducted a technical study to identify the most suitable areas for green infrastructure,

Table A-1: Initial Appendix 3 Project Clean Lake green infrastructure projects (Sources: Litt 2014, NEORS 2015b, NEORS 2016a)

Project	Capital Costs	Post-Gray Avoided		(Expected) Construction	
		CSOs (MG/yr)	Current Phase (January 2016)	Completion	
University Circle	\$259,788	0.1	Complete	July 2013	
Slavic Village	\$328,308	0.1	Post-construction monitoring	November 2014	
Fleet Avenue	\$2,313,765	0.5	Construction	July 2016	
Fairhill/MLK	\$7,137,894	2.4	Construction	December 2016	
Urban Agriculture	\$7,241,081	1.6	Construction	December 2016	
E. 140th Street	\$17,076,750	5.8	Design	2019	
Woodland Central	\$17,026,210	5.7	Design	2019	
Union	\$5,937,284	1.2	Design	2018-2019	
Buckeye	\$3,989,916	1.1	Design	2018-2019	
TOTAL	\$61,310,996	18.5			

based on two complex indices incorporating hydrological, land use, development potential, imperviousness, partnership potential, and environmental justice, cost, and local support characteristics of potential sites across NEORS (NEORS 2012b). Through this study, NEORS short listed nine large-scale “green giant” projects and began implementation.

These nine projects would cost an expected \$61.3 million once complete. This more than satisfies the \$44 million-dollar mandate laid out in Appendix 3 of the consent decree. The capture mandate is harder for these projects to satisfy. Using a scenario that ignores the existing tunnel project NEORS has already installed the projects would achieve “pre-gray” CSOs reductions of 67.8 million gallons per year. However, using a scenario which accounts for the existing tunnel project only yields a reduction of 18.5 million gallons per year. This indicates that these installations will only cover about 42 percent of NEORS’s 44 million gallons per year mandate. (NEORS 2015b)

Recognizing the financial and technical challenges with the larger region green infrastructure projects, NEORS has shifted

their efforts towards encouraging other green infrastructure programs and opportunities (Litt 2014, NEORS *personal communication*).

A.5 OTHER GREEN INFRASTRUCTURE & REGIONAL STORMWATER MANAGEMENT PROGRAMS

Beyond Project Clean Lake, NEORS has made a number of efforts to integrate green infrastructure efforts across communities and helped support regional planning for stormwater. This support has encouraged de-centralized planning, helping communities in executing individual priorities and bringing in private and public partners through financial incentives and service agreements.

A.5.1 GREEN INFRASTRUCTURE GRANTS

One of NEORS’s largest efforts to incentivize community-based green infrastructure has been its green infrastructure grants (GIG) program for projects within the CSO area.

This program provides funding for green infrastructure installations on parcels on which NEORS would not have access while allowing NEORS to retain control over design. The program is open to

communities and non-profit organizations in the combined sewer area for projects on private sites. Private, for-profit entities can also participate for projects in partnership with communities or non-profits. The primary requirement is that applicants must commit to the long-term ownership and maintenance of the green infrastructure installation. A schedule, list of maintenance tasks/activities, and an estimated annual cost report are required (NEORSD, 2016g).

The decentralized, flexible nature of the GIG program has allowed NEORSD to target its funding toward project ideas that provided the most cost-efficient flow reduction for NEORSD. Between 2009 and 2014, the average project cost \$108,000, and ranged in size from bioretention cells to green roofs to the 10-acre green renovation of Public Square in downtown Cleveland (Litt 2016). In 2015 alone, \$5 million was awarded for projects. In 2016, another \$2 million was awarded (Litt 2016).

Nearly 50 projects have been completed using GIG, and NEORSD plans to continue expanding the program based on its documented success.

A.5.2 MEMBER COMMUNITY INFRASTRUCTURE PROGRAM

Another regional effort through NEORSD is the community infrastructure program that is currently under development and review. This program would provide grants (requiring a 25 percent match) for communities desiring to assess and fund local sewer system improvements utilizing green infrastructure within NEORSD's service area under a community operating lease. Under the proposed conditions of the community operating lease, the community will lease an existing/planned asset to

NEORSD, who will then perform improvements while waiving permit fees for the community. In turn, the community is responsible for maintaining and operating the asset once control is returned (Dreyfuss-Wells, 2015). The program has generated interest because catch basins and small sewers have remained the responsibility of local communities despite NEORSD's regional stormwater management efforts (NEORSD, 2015a).

A.5.3 WATERSHED ORGANIZATION SERVICE AGREEMENTS

NEORSD has also sought to enter into 12-month service agreements with organizations within the watershed that demonstrate the ability to implement pollution-prevention techniques and SCMs to reduce stormwater entering combined or sanitary sewers. Eligible applicants include nonprofit watershed organizations that provide services to tributary watersheds within NEORSD service area. NEORSD is also interested in service agreements for projects that provide public education regarding stormwater management within the service area (NEORSD, 2016g).

Between 2009 and 2014, about \$1.2 million was awarded in operating support grants through the service agreements. Examples of services that watershed organizations may provide include:

- Promoting pollution-prevention techniques and SCMs to control runoff, minimize illicit discharges, and minimize stormwater introduced to sewer systems through on-site stormwater management.
- Educational programming on economic incentives associated with watershed management, pollution prevention, and conservation.

- Stream, wetland, and other landscape restoration that addresses water quality issues, such as flooding and erosion.
- Community engagement and education services on the region’s water quality challenges and SCMs to address these problems.

Through these programs and many others, NEORSD has encouraged green infrastructure implementation and fostered a climate of supporting regional planning and collaborative undertakings. This makes NEORSD and its surrounding communities excellent candidates for entering and maintaining a large-scale green infrastructure installation program.

A.5.4 STORMWATER FEE & CREDIT PROGRAMS

Separate from NEORSD’s consent decree plan is NEORSD’s Regional Stormwater Management Program. This program is designed to address stormwater flooding, erosion, and water quality issues resulting from stormwater runoff (NEORSD 2016c). The program establishes a stormwater fee to property owners for impervious surfaces. Property owners that manage stormwater onsite and reduce stress on the regional stormwater system are granted credits that reduce the fee (NEORSD, 2012a).

NEORSD’s residential user fee operates on a three-tier system based on impervious surface, and annual residential fee is outlined below:

- Tier 1: \$3.09 for less than 2,000 sq. ft. of impervious surface
- Tier 2: \$5.15 for 2,000 to 4,000 sq. ft. of impervious surface
- Tier 3: \$9.27 for more than 4,000 sq. ft. of impervious surface

Non-residential user fees are calculated using a fee for equivalent residential units (ERUs) (NEORSD, 2012a). In 2017, the annual non-residential users fee is \$5.15 per ERU (equal to 3,000 square feet).

Customers that reduce the excess stormwater during wet weather events are granted relief from the stormwater fee. This credit program allows residential, commercial, industrial, and mixed-use customers to receive credit up to 100 percent of their total monthly stormwater fee for reducing peak discharge rates, detaining stormwater onsite, reducing runoff volume, and draining stormwater through NEORSD-approved stormwater control measures (SCMs) (NEORSD, 2012a). Specific credits are summarized below:

- Flat reductions of 25 percent are available to residential customers that implement a SCM. NEORSD-approved SCMs include rain gardens, impervious surface reduction, pervious pavement, vegetated filter strips, and onsite stormwater storage. This credit is only available to individual residential property owners.
- Stormwater quality credits that reduce the stormwater fee up to 25 percent can be obtained for SCMs that provide water quality treatment to stormwater that flows through the control from the property’s impervious surface. Credit is assigned based on the type of SCM installed with values ranging from 15%-25%. The credit is only applied to the impervious areas onsite. Thus credit is available to individual residential property owners, homeowners or condominium associations, commercial customers, public/private schools
- Stormwater quantity credit is available to any customer that reduces the rate

or volume of stormwater flowing from the impervious surface of the customer's property. This credit is divided into two categories, a) runoff volume credit up to 50 percent and b) peak flow credit up to 25 percent. This credit is available to individual residential property owners, homeowners or condominium associations, commercial customers, public/private schools.

- Finally, an education credit (25 percent flat reduction) is available to Ohio-recognized primary, elementary, and secondary schools for providing NEORS D-approved stormwater pollution prevention curriculum to their students.

A.6 BENEFITS OF THE NINE LARGE GREEN INFRASTRUCTURE PROJECTS UNDER PROJECT CLEAN LAKE

NEORS D is required to submit a report to the Ohio EPA and U.S. EPA that quantifies anticipated co-benefits of their green infrastructure measures for Project Clean Lake based on at least the following 10 parameters (EPA 2010c):

- Life-cycle costs
- Ecological benefits (ecosystem services)
- Socio-economic and/or quality of life benefits to low-income or minority populations
- Provision of recreational benefits
- Climate change-related effects, including change in carbon footprint
- Energy savings
- Air quality
- Aesthetics
- Jobs
- Property values

Based on this requirement, NEORS D submitted an analysis report of expected co-benefits from the nine Project Clean

Lake green infrastructure projects in October 2015 (NEORS D, 2015b). The report identified that the projects would produce the following co-benefits:

Environmental:

- **Ecological Benefits:** The establishment and protection of 18 acres of natural areas that includes 17,000 sq. ft. of blooming species for pollinators (like butterflies). Native plant species with 1,508 planted trees and any other enhanced connectivity to larger natural corridors further support a diverse mix of flora and fauna.
- **Climate Change Mitigation:** The creation of 39 acres of shaded and pervious surface area creates lower ambient temperatures. The reduced energy demand for wastewater treatment and the additional trees provides increased carbon sequestration for an annual reduction of 187 metric tons of reduced greenhouse gases at wastewater treatment plants, consequently combatting the urban heat island effect.
- **Air Quality Improvements:** An increase in trees, shrubs, and other vegetation provides direct improvements in air quality through their ability to trap air pollutants. An annual reduction of 6,662 pounds of air pollutants is expected, reflecting the reduced level of pollutant emissions as a result of reduced energy demand at the wastewater treatment plants.
- **Captured Stormwater:** The 17-acre reduction of impervious surface manages drainage from 579 acres, producing 209-million-gallon reduction of stormwater annually to reduce sewer overflow incidents. Annual reductions in CSO volume are 86.3 million gallons.

Economic:

- **Energy Savings:** The avoided cost of electricity and gas usage provides an annual energy cost savings of \$156,328 resulting from pumping and treatment of water at the wastewater treatment plants as a result of the reduced conveyance of flow. This is a savings of \$2,481 per acre of land improvements.
- **Job Creation:** Creation of more than six full-time equivalent jobs for inspecting, operating, and maintaining the green infrastructure and separated sewers.
- **Economic Development:** The annual economic impact of \$654,466 as a result of income, gross regional product improvement, and sales and property tax revenue of each new operation and maintenance (O&M) job created (direct and indirect).
- **Life-cycle Cost Benefits:** NEORS (2015a) presented a summary of cost comparisons of green versus gray solutions and indicated that green infrastructure was a more-costly way “to reduce CSO volume”. This report shows that green infrastructure, at \$4.45 cost per gallon of CSO capture, had a net present value that was \$35 million more than gray infrastructure that had a \$1.16 cost per gallon. However, it needs to be noted that proposed green infrastructure captured ten-times as much stormwater for every gallon of CSO volume reduction. When considering all the stormwater captured by the green solutions together, green infrastructure was able to capture stormwater at \$0.39 per gallon, i.e., less than half of what the grey solutions cost.

Social:

- **Community Engagement:** The integration of green infrastructure projects into residential areas puts 10,261 people within a five-minute walk from green space. NEORS is working with community groups on each project (22 community partners in total) to further integrate them into existing communities.
- **Recreational Opportunity –** The creation of 39 acres of public space provides recreational opportunities for residents. Amenities further enhances the recreational opportunities at the project sites: 5 bike racks, 38 benches, 2 seating walls, and an outdoor classroom.
- **Property Values:** The 231 parcels adjacent to the green infrastructure project sites can expect an increase in property values as a result of the increased vegetation and tree cover, recreational space, and additional cumulative benefits.
- **Aesthetic Improvements:** In addition to the ecological and recreational components, green infrastructure provides open, green space for neighborhood residents to enjoy. Project sites are strategically located for positive repurposing of 29 acres of distressed properties, making this benefit particularly important.
- **Socio-economic/Quality of Life:** Through investment in community infrastructure, 2,812 households are expected to experience increased levels of service and visible neighborhood improvements, including 7.9 miles of new stormwater sewer and 9.7 miles of improved roadway.

APPENDIX B: CITY OF CLEVELAND & GREEN INFRASTRUCTURE

B.1 BACKGROUND

Cleveland’s sewer system is comprised of 1,436 miles of sewer lines, 43,500 storm drains, and 15 pump stations. This system covers a drainage area of 75.6 miles and is composed of both combined and separated sewer systems. The separated sewer system, roughly 9 percent of the total area, drains directly to surrounding waterways, whereas the combined system conveys water directly to the city’s three treatment plants.

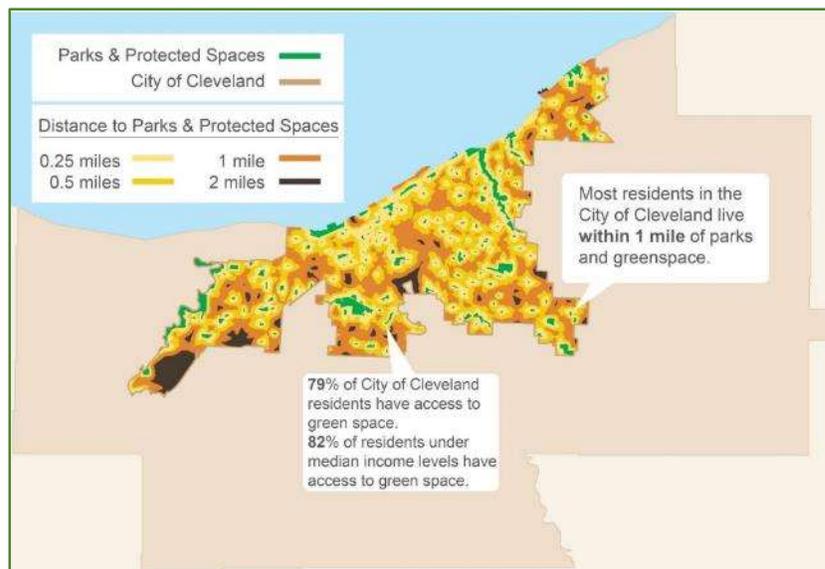
Cleveland Water Pollution Control (WPC) has the responsibility for the maintenance of the sewers and management of stormwater within the city’s system, and it annually invests millions of dollars on capital improvement projects to preserve and upgrade the city’s systems. WPC maintains a firm commitment to upgrade the city’s infrastructure to incorporate more green components, helping to reverse the trend in urban areas towards more imperviousness. WPC believes it can restore the city’s green area while simultaneously creating a water

infrastructure system providing the highest quality services to its citizens and customers.

Cleveland, nicknamed the “Forest City” in the late 1800s and early 1900s, has lost a significant portion (45 percent) of its canopy over the last 70 years. Previously covered by 220,000 street trees, Cleveland now only has 120,000 street trees. The current tree canopy cover is 19 percent (Figure B-1), but it continues to deplete at an estimated rate of 97 acres annually. At its current rate, tree canopy cover will drop to 14 percent by 2040. The reduction in tree canopy has the practical result of reducing stormwater infiltration and increasing peak runoff rates.

WPC is subject to the Clean Water Act mandates regarding runoff and water quality. These mandates stipulate that Cleveland reduce stormwater runoff in its MS4 areas, including wards 1, 3, 5, 7, 8, 10, 13, and 16. These areas drain directly to local waterways without treatment.

Figure B-1: Green Spaces in the City of Cleveland



The 2016 Stormwater Management Program was crafted to address the six minimum control measures in the permit.

These control measures include:

- Public education and outreach
- Public participation and involvement
- Illicit discharge detection and elimination
- Construction site runoff control
- Post-construction runoff control
- Pollution prevention/good housekeeping for municipal operations

B.2 SUSTAINABLE CLEVELAND 2019 & GREEN INFRASTRUCTURE

Sustainable Cleveland was established in 2009 and established a 10-year initiative that engages people from all walks of life, working together to design and develop a thriving and resilient Cleveland region that leverages its wealth of assets to build economic, social, and environmental well-being for its residents.

Its vision includes transformation of the city to a “Green City on a Blue Lake”, and it accordingly focuses heavily on green infrastructure and water quality improvements.

As a part of this plan, the city declared 2017 as the *Year of Vibrant Green Space*, and plans to take many initiatives, such as hosting Sustainable Cleveland Summit as well as Cleveland Metroparks Centennial Celebration. The city also plans to coordinate Forest City Working Group (to provide resources and expertise to assist in the reforestation of Cleveland and Northeast Ohio, and to raise awareness about the benefits of trees) and GardenWalks Cleveland (self-guided tours of gardens,

urban farms, vineyards and orchards in several Cleveland neighborhoods).

B.3 GREEN INFRASTRUCTURE INSTALLATIONS IN THE CITY OF CLEVELAND

To achieve the vision of Sustainable Cleveland, WPC has employed a variety of green programs in conjunction with conventional grey infrastructure stormwater control measures. A key aspect of these programs include proactive public outreach, and encouraging residents and stakeholders to adopt control measures to help reduce or eliminate contamination of waterways. Projects include:

- WPC Stormwater Management Demonstration Project: Located at Water Pollution Control Facility at 12302 Kirby Ave, this project includes a bio-swale, two rain gardens, pervious concrete and asphalt, and three cisterns that capture a total of 15,000-gallons of rainfall used for landscaping and washing the division’s vehicles.
- Climate Resilience Evaluation and Awareness Tool (CREAT): Created in 2015, the Climate Resilience Evaluation and Awareness Tool (CREAT) is a risk assessment application, which helps WPC do the following:
 - Find out which extreme weather events pose significant challenges and plan ahead by building scenarios to identify potential impacts.
 - Identify critical assets and the actions that can be taken to protect those assets from the consequences of extreme weather event on operations.
 - Generate reports describing the costs and benefits of risk reduction strategies for decision-makers and stakeholders.

- Only Rain Down the Storm Drain Ongoing Campaign: WPC has promoted its *Only Rain Down the Storm Drain* and *No Dumping* campaign to raise



awareness that everyone can make a difference by doing small things in their personal lives to help protect humans and the environmental.

- Rain Barrels: WPC promotes the City of Cleveland’s *Free Rain Barrel Giveaway Program*. The use of rain barrels is encouraged as a way to reduce the amount of stormwater runoff.

WPC is also engaging in a number of green infrastructure projects that seek to mimic pre-development conditions (Table B-1). Bio-retention projects comprised more than half of these projects as of March 2017.

A summary of the stormwater management projects, with some green infrastructure elements, by WPC include:

- Euclid Creek Lacustrine Wetland and Stream Restoration Project (2012-13): This Lacustrine Restoration Area was funded by Great Lakes Restoration Initiative (GLRI) through Cuyahoga Soil and Water Conservation District. The project restored important lacustrine wetlands for fish and wildlife, and stream and floodplain restoration of Euclid Creek. The restoration is allowing the project to reach ecological and biological goals associated with de-listing the creek from the Lake Erie Area of Concern. The area utilizes native vegetation, bio-engineering and natural stabilization methods.

Table B-1: Type of Permitted Green Infrastructure Projects within the City of Cleveland (2000-2017)

GREEN INFRASTRUCTURE TYPE	NUMBER OF PERMITTED PROJECTS
Bio-retention	47
Cistern	1
Enhanced Water Quality Swale	5
Filtterra Bio-retention System	1
Green Roof	4
Permeable Pavement	11
Pervious Concrete	4
Porous Asphalt	3
Reduced Imperviousness	7
Underground Cistern	1
Vegetated Bio-Filters	1
Wet Enhanced Water Quality Swale	1
Grand Total	86

- **Kerruish Dam Improvement Project:** The Kerruish Stormwater Control Facility Dam is on Mill Creek. The dam’s structure was repaired, including its primary spillway, and improved the hydraulics to properly channel water during major storms. A secondary spillway was constructed and access to the dam was improved to facilitate maintenance.
- **Wildwood Bioswale Project:** This project is located in Wildwood Lakefront State Park off Lakeshore Boulevard. Workers in the mayor’s Summer Youth

Employment Program constructed a 375-foot-long, six-foot-wide bioswale. It runs the length of the main parking lot and is populated with native plants. Now stormwater runoff from the parking lot drains into the bioswale, which eliminated standing water and improved the overall stormwater quality such that runoff does not adversely affect Lake Erie.

A comprehensive list of projects is presented in Table B-2.

Table B-2: Permitted Green Infrastructure Projects within the City of Cleveland (2000-2017)

PROJECT NAME	STORMWATER CONTROL MEASURE (SCM)
6305 Fleet Parking Lot	Pervious concrete and bio-retention cells
Cedar Redevelopment Phase 1	Bio-infiltration cells and detention
Colfax Green Links	Bio-retention cells, bio-swales, and rain gardens
Northeast Shores Collinwood Art District Headquarters Green Parking	Pervious concrete, bio-retention, and tree planting
Public Square	Permeable pavers, stormwater planters, and rainwater harvesting system for on-site irrigation
Smart Stormwater Utilization at the Family Ministry Center	Stormwater harvesting system, grass pavers, reduction of impervious surface; development of permaculture
West 19th Place Green Alley	Pervious pavement and bio-retention
West Garden Stormwater Basin	Stormwater bio-retention/ infiltration with rain garden plantings
West Side Market	Pervious pavers and bio-retention
Western Reserve Historical Society	Reduction of impervious surfaces, pervious pavement, and bio-retention
Milligan Avenue Riparian Zone Project	Improvement of the riparian zone, stream bank stabilization and floodplain enhancement
West 131st Street Rain Garden	Vacant property adjacent to Chevy Branch of the Big Creek is regraded and planted to manage stormwater that drains onto the sidewalk from the street and side walk. Neighbor reports no basement flooding since project completion.
Bio-retention Areas at Jefferson Branch Library	Bio-retention cells incorporated into the redesign of the parking area at the library
Collinwood Art District Outdoor Theater Green Parking Lot	Part of the Waterloo Streetscape; an overall reduction of stormwater (100-year/24 hour) for the area by installing bio-swales, pervious pavement and an infiltration basin for the parking lot.
Collinwood Art District Azure Green Parking Lot	This project required drainage modification to the existing parking lot, bio-retention, plant materials

PROJECT NAME	STORMWATER CONTROL MEASURE (SCM)
Mitchell's Ice Cream Kitchen, Store and Administrative Offices	Redirecting flow from the 7,800 sq. ft. roof to a 10,000 gallon underground cistern. Gray water to be used for toilets, urinals, dishwashing, and plantings.
Transformer Station Art Park	A new pocket park adjacent to the building will capture rain water from a 2,600 sq. ft. roof area and route it through a series of bio-swales and rain gardens.
Vineyards of Chateau Hough Bio-cellar	A vacant lot reuse project to develop an innovative growing facility that stores water that falls on the structure in an internal 2,000 gallon cistern with overflow to an adjacent rain garden
UCI Green Infrastructure	Courtyard by Marriott, Inc. Hotel roof runoff capture to underground detention and infiltration system. Permeable paver parking lot.
Slavic Village Demonstration Project	Bio-retention cells capturing street runoff via curb cuts and overland flow runoff.
Fleet Avenue Green Infrastructure	Infiltration basin that receives street stormwater runoff via new separated storm sewers.
Urban Agriculture Green Infrastructure	Two large-scale bio-retention basins that receive street stormwater runoff via new separated storm sewers.
Fairhill/MLK Green Infrastructure	One large-scale bio-retention basin that receives street stormwater runoff via new separated storm sewers.
Woodland Central Green Infrastructure	Two large-scale bio-retention basins that receive street stormwater runoff via new separated storm sewers.
Union Avenue Green Infrastructure	Two large-scale detention basins that receive street stormwater runoff via new separated storm sewers.
Buckeye Road Green Infrastructure	Four small-scale detention basins and one underground storage facility that receive street stormwater runoff via new separated storm sewers.

B.4 CLEVELAND TREE PLAN & GREEN STREETS PROGRAM

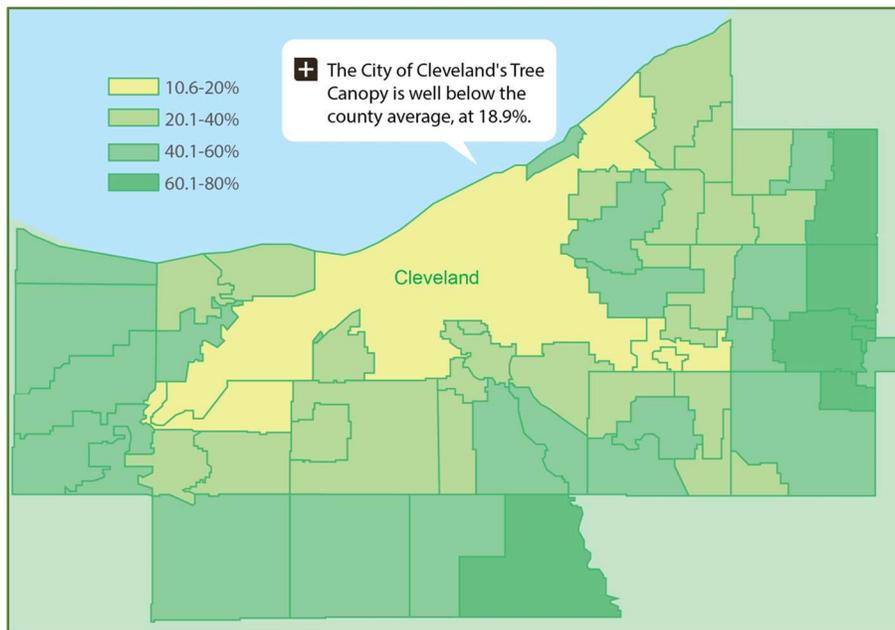
The Cleveland Tree Plan is an ambitious community-wide collaboration between the City of Cleveland, Cleveland Neighborhood Progress, Holden Arboretum, LAND Studio, and Western Reserve Land Conservancy. Figure B-2). Therefore, the City of Cleveland is taking steps to restore its natural tree cover, with the ambitious goal of achieving Cleveland is also making strides towards enacting ordinances that can help facilitate and incentivize green infrastructure implementation. Cleveland's Complete and Green Streets Program was introduced in 2011 to alter restrictive standards and make the process of installing green infrastructure less cumbersome. The ordinance prioritizes functionality beyond

The plan seeks to restore Cleveland's tree canopy as a means to reduce heat days and improve stormwater management. As mentioned previously, at its current rate, tree canopy cover will drop to 14 percent by 2040 (

75 percent of the total possible canopy (City of Cleveland, 2015).

automobiles, encourages alternative modes of transportation, and includes language recognizing "the need of the policy to assist in the management of stormwater runoff and provide environmental benefit" (Cleveland Municipal Ordinance 2012).

Figure B-2: Tree Cover in Cleveland



The Cleveland Complete and Green Streets Task Force has developed a comprehensive list of different street designs that include green infrastructure. Street reconstruction and repurposing allows for the use of sheet flow dispersion, bioretention, amended soils, and pervious paving/porous asphalt. Additionally, sidewalk construction allows for curb cuts and drainage areas, while chicanes, traffic circles, and bulbouts provide opportunities for green infrastructure implementation (City of Cleveland, 2013).

The inclusion of language supporting stormwater management practices in the ordinance is a major step toward city-wide green infrastructure implementation. Municipal codes are often structured in such a way that they make innovative stormwater control structures prohibitively expensive and/or prevent them from being installed at all.

Collaboration between NEORS and the City of Cleveland is also expected to reduce costs to implement green infrastructure. The collaboration can simultaneously revive neighborhoods and stimulate economy

while addressing stormwater management and water quality issues (NEORS, 2010b).

B.5 SOCIO-ECONOMIC BENEFITS OF GREEN INFRASTRUCTURE

Using a five-year period (2020-2024), the City of Cleveland anticipates economic benefits from the installation and maintenance of green infrastructure (Land Studio 2013):

- **Job Creation:** The creation of 219 direct, indirect, and induced jobs through maintenance spending and \$11 million



in income. Of these, 146 (66 percent) will be directly related to the maintenance of green infrastructure and stormwater pipes.

- **Value Added:** A total value added economic impact of \$13.8 million (\$8.2 million in the direct effect, \$1.1 million in the indirect effect, and \$4.6 million in the induced effect) will be observed.
- **Tax Generation:** Over the five-year period, it is anticipated that over \$2.8 million (\$1.6 million in the direct effect, \$1.1 million in the indirect effect, and \$4.6 million in the induced effect) in taxes will be generated.
- **Output:** Green infrastructure stormwater pipe maintenance will produce \$23.9 million in output, \$14.7 of which is in the direct effect.

Furthermore, the city's current trees provide significant economic benefits:

- **Energy Savings:** Current tree canopy saves residents and business owners a total of \$3.5 million in energy costs (32 million kilowatt-hours of energy) each year.

- **Business District Improvement:** Recent studies indicate that tree cover in business districts and shopping areas attracts more customers and increases the amount of time spent shopping and total spent.

In addition to the environmental benefits provided, numerous social benefits are derived from Cleveland's tree canopy:

- **Property Value:** Current tree canopy increases property values, providing a cumulative benefit of \$4.5 million.
- **Public Health:** Through prevention of approximately 1,200 incidents including asthma, obesity, diabetes, and mental health, trees improve public health across a range of issues.
- **Safety:** Tree canopy creates a safer community by slowing traffic speeds, lowering stress, and providing buffers for pedestrians.
- **Noise Pollution:** Green space and landscaping blocks noise and pollution by almost 50 percent for residents living near highways.



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