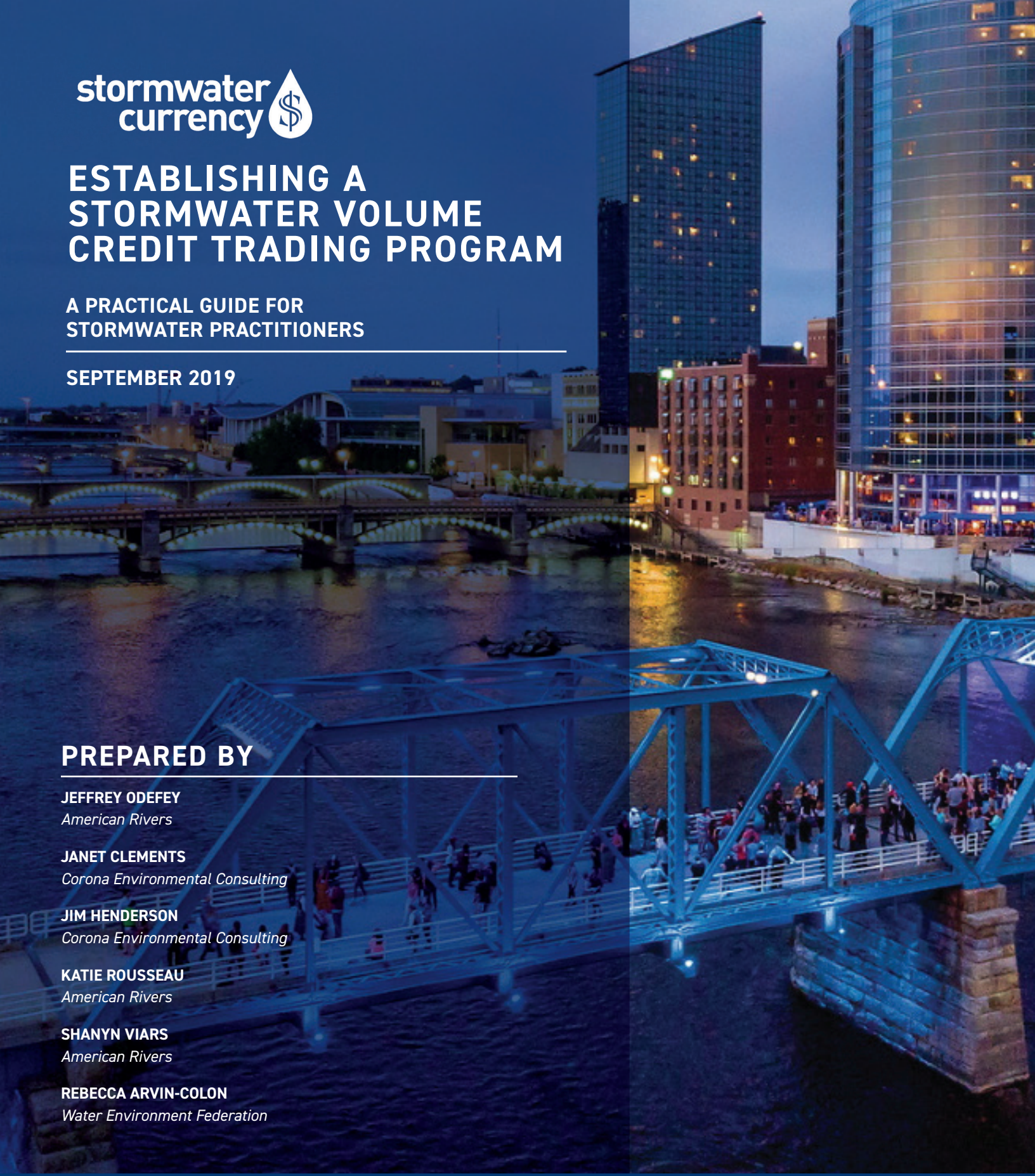

stormwater currency

ESTABLISHING A STORMWATER VOLUME CREDIT TRADING PROGRAM

A PRACTICAL GUIDE FOR STORMWATER PRACTITIONERS

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PHOTO: ANDREW WAMBOLDT

INTRODUCTION

This document describes the history and fundamentals of stormwater volume credit trading, primarily through the lens of the design for a proposed trading program in Grand Rapids, Michigan. It is the product of a collaboration between staff from American Rivers, Corona Environmental Consulting, and the Water Environment Federation, working together under the tradename *Stormwater Currency*.

The purpose of this document is to outline the considerations that informed our research, analyses, and program design decisions for the proposed credit trading market in Grand Rapids. Our goal is to provide an understanding of key issues that other municipalities and stormwater agencies may consider when evaluating a stormwater credit trading approach, and to provide a rough 'road map' for determining whether such an approach is well suited to meet local needs. The document covers the following topics:

- Background information about stormwater credit trading
- Essential preconditions for considering a trading program
- Threshold technical and economic feasibility for a stormwater credit trading
- Fundamental aspects of a stormwater credit trading program
- Trading program administration and implementation

BACKGROUND

What is stormwater volume credit trading?

Several types of credit trading could involve stormwater, including trading based on stormwater volume, trading based on the amount of pollutant reduced, and mitigation banking based on measures such as greened acres or acres of wetland.

This document focuses on stormwater volume credit trading for meeting post-construction stormwater management requirements at new development and redevelopment sites.

Within this context, stormwater volume credit trading provides an off-site compliance option for developers and property owners who are subject to stormwater management regulations. Typically, such regulations include onsite retention or detention requirements for new development and redevelopment projects above a certain size. A credit-trading program enables property owners or developers subject to these stormwater management requirements to meet a portion of their requirements offsite by buying volume-based stormwater "*credits*." The credits are generated by the installation and maintenance of green infrastructure (GI) projects, or other distributed stormwater best management practices (BMPs), located off-site. Credits can be generated by:

1. Property owners or third parties who voluntarily implement GI retrofit projects on properties that are not subject to post construction stormwater management requirements;
2. Developers and property owners who are subject to post-construction stormwater management requirements and who build GI projects that exceed minimum stormwater requirements.

A trading program requires that a responsible local entity oversee and manage the trading marketplace and ensure that the GI projects behind the credits are properly maintained over time. This function is most likely to be provided by a stormwater agency, but an independent entity could be created or retained as a program administrator. While establishing and running a credit trading market is not without risk, cost, or complexity, a properly designed stormwater credit trading program can benefit property developers, improve urban water quality, foster community resilience, and better distribute the co-benefits of GI projects throughout a community.

PHOTO: NNECAPA 2006 CC FLICKT

Property owners and developers will buy credits from an offsite provider when it is cheaper or easier than managing all stormwater onsite.

Key benefits of a stormwater volume credit trading program

Post-construction stormwater trading provides flexibility for property owners and developers subject to post-construction stormwater management requirements. Property owners and developers will buy credits from an offsite provider when it is cheaper or easier than managing all stormwater onsite. In some cases, buying credits can allow property owners or developers to take advantage of additional buildable area onsite, including rooftop or underground area. In other cases, onsite controls may not be feasible or may be very expensive. Purchasing credits can also provide a less expensive option for meeting stormwater management obligations compared to other alternative compliance options, such as paying an in-lieu fee (as defined below). Importantly for many communities, a stormwater credit trading program does not involve adopting a new fee or tax. Instead, trading can be an optional pathway by which real estate developers can achieve regulatory compliance.

In addition to benefits for developers, a trading program can result in greater overall water quality/stormwater control benefits compared to standards that require developers to manage stormwater on-site. For example, allowing some portion of retention to be met offsite can result in a greater number of smaller GI installations which, in comparison to a smaller number of larger stormwater management practices (e.g., all onsite), capture more stormwater annually and help distribute the environmental, social, and human health co-benefits of GI throughout a city or watershed (Dougherty et al. 2016). Municipalities can also design programs in a way that encourages or incentivizes credit generation in areas where it will result in the greatest overall benefit, rather than simply gaining additional stormwater control where new development and redevelopment happens to be occurring.

Applications of stormwater credit trading

Stormwater credit trading was pioneered by the District of Columbia's Department of Energy and Environment (DOEE). The core attributes of the DC program have continued to inform subsequent program designs and evaluations, and so are worth considering in some detail here. Developed to complement the District's MS4 permit, and associated restrictions on stormwater discharges from development projects, DOEE's Stormwater Retention Credit Trading Program was designed to achieve multiple stormwater goals for District developers and residents. Some of the fundamental features of DOEE's Stormwater Retention Credit Trading Program are:

PHOTO: HAWORTH, INC.

- Major property development projects within the District (defined as projects with land-disturbing activity of 5,000 ft2 or more) must retain the volume of stormwater runoff created by a 1.2" rain event. For less extensive "substantial improvements" to a property, property owners must retain the first 0.8 in. of a storm event. Property owners must retain the first 50% of the required stormwater retention volume onsite, if it is feasible to do so. They can then look to meet the remaining 50% by either paying DOEE an in lieu fee (which is tied to the agency's cost of installing equivalent GI) or by purchasing an equivalent amount of GI BMP capacity (in the form of credits) from an offsite provider.
- Developers or property owners have an obligation to demonstrate that they have purchased their required retention volume each year, for the lifetime of the development. For this reason, Stormwater Retention Credits (SRCs) are calculated in terms of gallons of BMP capacity per year. Developers may purchase multi-year blocks of credits from willing sellers, helping to provide efficiency and certainty in the market.
- Developers or property owners can purchase credits from projects located anywhere within the District (i.e., there are no trading boundaries).
- Sellers of credits may provide them by either voluntarily installing GI on unregulated sites, or by exceeding their regulatory retention requirements on regulated projects. Credit-generating projects cannot exceed the volume capacity associated with a 1.6" rainfall event. DOEE established this rule because BMPs designed to manage larger storm events result in excess capacity that is rarely utilized and therefore should not be used to meet regulatory requirements.
- DOEE will certify SRCs for up to three years; sellers are responsible for maintaining GI projects and are subject to DOEE inspections. This shifts the compliance obligation from the regulated development site to the generator of credits.
- DOEE's market includes an SRC Price Lock Program that provides the option for credit generators to sell their credits to DOEE as a buyer of last resort. Under the program, DOEE will agree to purchase credits from sellers at a price that is lower than the going market price. This encourages credit-generators to sell their SRCs on the market, but also provides them with some certainty that they will be able to make a reasonable return on their investment. The program is limited to SRC generators who voluntarily create credits in the District's MS4 area because these projects create greater water quality benefits compared to projects located in the combined sewer area.

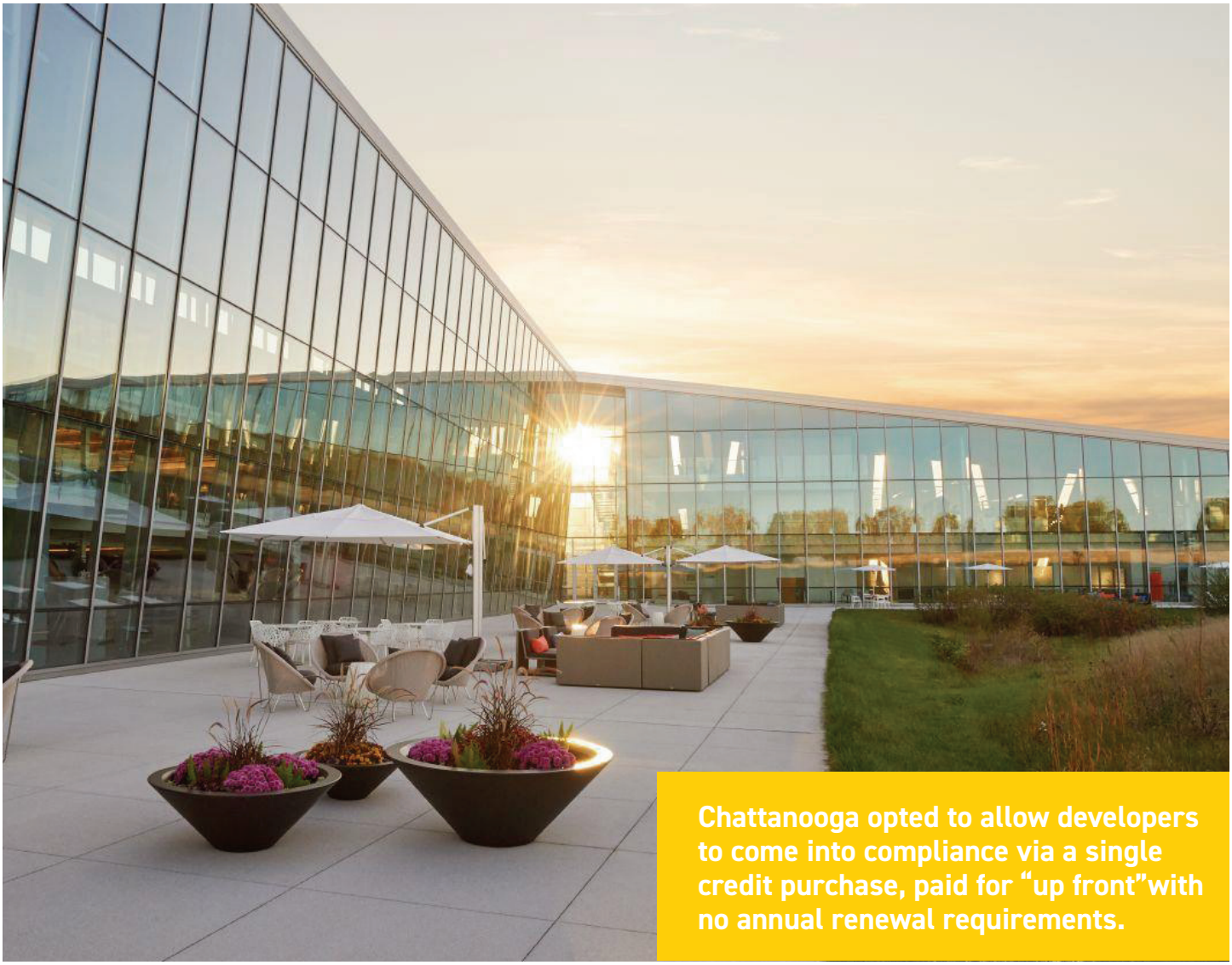


PHOTO: HAWORTH, INC.

Chattanooga opted to allow developers to come into compliance via a single credit purchase, paid for "up front"with no annual renewal requirements.

Between 2014 and 2019 there have been 660 transactions through the Program, at an average market price of $1.82 per SRC. Since 2014, the average market price for a credit has dropped from $2.27 to S1.77. This cost compares favorably with DOEE's established payment in lieu cost ($3.61 as of 2017) and on-site management costs for real estate re/development projects. DOEE's program has provided economically valuable flexibility to developers, particularly in the dense downtown urban core where available land area to build stormwater retention projects is in short supply and comes with a high opportunity cost. The downtown area also falls within the District's combined sewer area, where combined sewer overflows (CSOs) are mostly being addressed through large-scale gray infrastructure projects. Because of high land costs, the program has the effect of incentivizing GI retrofits to manage stormwater runoff from existing impervious areas outside of the downtown/combined sewer area and within the MS4 area of the District, where GI projects result in greater water quality improvements. The distribution of credit generating GI projects with the MS4 area also results in improvements, and associated co-benefits, in neighborhoods that are not otherwise seeing direct investments in real estate projects.

The City of Chattanooga, Tennessee has also developed a credit trading program, although it has not been utilized (i.e., no trades have been made). The approach preferred by Chattanooga differed in many ways from the DC model, including fundamental alterations to credit structure, duration, and transaction details. Perhaps most distinctly, Chattanooga opted to allow developers to come into compliance via a single credit purchase, paid for "up front" with no annual renewal requirements. This approach factored significantly into Stormwater Currency's recommended program design for the City of Grand Rapids, as discussed in more detail in a subsequent section.

Stormwater credit trading requires a sufficiently strong regulatory driver to create the demand for credits.

ESSENTIAL PRECONDITIONS FOR CONSIDERING A TRADING PROGRAM

Stormwater credit trading programs will not fit every community's needs. At the outset, at least three necessary prerequisites must be in place, including those related to regulatory, economic, and leadership conditions.

Regulatory conditions

Stormwater credit trading requires a sufficiently strong regulatory driver to create the demand for credits. This includes regulations related to the threshold for when regulations apply, as well as the strength of the standards themselves. For example, in Washington D.C., development projects are subject to higher retention-based stormwater management standards than renovation projects; in Grand Rapids, the City will apply new retention-based channel protection requirements associated with the City's forthcoming MS4 permit to new development and redevelopment sites that add 1,000 square feet of impervious area or more. In both cities, a relatively large percentage of development sites are above these thresholds.

In addition, both cities have relatively strong retention requirements that developers must meet. For example, in Grand Rapids, new channel protection standards will require developers to retain the difference in runoff associated with the 2-year, 24-hour storm (or approximately the 2.56" rain event) compared to pre-development conditions. Further, developers must try to meet these standards using GI-based BMPs. For many developments, the retention standard will be difficult to achieve onsite because of poorly draining soils or other technical considerations; it may also be undesirable from an economic standpoint to dedicate available land area to GI projects, rather than to use it for other purposes. These factors further help to create the demand for credits.

It is important to note that while retention standards drive the credit trading markets in D.C. and Grand Rapids, there may be the potential for establishing credit trading to meet detention-based standards. However, careful consideration must be given to how requirements must be met onsite to ensure feasibility of the market. For example, if a developer subject to detention standards must meet a certain portion of these requirements onsite, in many cases, it likely will not make economic sense to look offsite to meet the remaining requirements. This is because the marginal cost associated with constructing additional detention capacity will likely be less than looking offsite for credits. However, this will vary based on site constraints and other factors.

Finally, with respect to regulatory conditions, stormwater volume credit trading provides a flexible approach to compliance with post construction stormwater requirements included in MS4 permits and/or other water quality-related permits/ordinances. A fundamental prerequisite is that the language in the relevant permit or ordinance specifically authorize off-site compliance. Beyond this, the permit or ordinance may include specific requirements related to offsite compliance and/or key trading program elements. These requirements are typically related to protecting from potential adverse environmental impacts of credit trading – such as eligibility rules - or use of credit ratios to provide a safety factor to ensure that water quality gains will be achieved. In some cases, this language may create disincentives for developing a trading program and/or affect program feasibility. For example, previous permits have adopted narrow exceptions that allow off-site compliance; this approach, however, is contrary to what would be optimal for building a trading program. A successful program depends on relatively easy access to off-site alternatives. A fair balance seems to have been struck by the DC program, which allows developers to meet up to 50% of their retention requirement off-site. In Grand Rapids, the city's MS4 permit outlines several onsite infeasibility conditions that trigger the allowance for offsite compliance; however, these conditions are flexible enough that they create significant off-site compliance opportunity. Conversely, in Chattanooga, the State of Tennessee added language to the city's MS4 permit that severely limits the conditions under which a developer is allowed take advantage of offsite compliance; this has effectively reduced market demand to zero.

PHOTO: EPA

Economic conditions

Stormwater credit trading generally will not function well in locations without a vibrant development economy. Without sufficient demand, there will be inadequate incentive to create a supply of credits, as well as an insufficient amount of trading to justify the "overhead" of managing a trading program. There is no hard and fast rule about how much real estate development needs to be occurring, however, both DC and Grand Rapids can capitalize on a pattern of strong investment in commercial, multi-family, and institutional construction spanning multiple years.

Within this economy, there also needs to be a distribution of disparate real estate values and/or conditions that enable GI to be installed more cost-effectively in some parts of watershed than in others. Developers who have the option to participate in the market will only do so if it results in a monetary benefit in the form of cost savings and/or real estate value associated with land that would otherwise be used for stormwater management. For example, in DC, the market is robust with a focus on high value redevelopment in the central downtown neighborhoods and marked variability in real estate costs across the District. High dollar per square foot values and demand result in high opportunity costs for 'downtown' projects faced with dedicating available area to stormwater management. This cost can be a significant driver in favor of an off-site compliance alternative. Grand Rapids has a less intense but still vibrant development sector in which opportunity cost is less of a factor. Instead, compliance costs for mixed use and commercial developments outside the central core are likely to increase dramatically with the adoption of new regulations. The result will likely be a more geographically dispersed trading market.

Leadership creativity and authority

Finally, pursuing a market-based solution like a credit trading program is not for the faint of heart. Working through the design process, community outreach and political buy-in necessary to succeed takes commitment, vision and creativity. Without innovative, open-minded agency staff and leadership, and civic and community leader who share those attributes, it's unlikely that a credit trading program will flourish. Additionally, strong inter-departmental communication is essential for integrating stormwater, development, transportation, parks, and other GI policies and projects.

ASSESSING PROGRAM FEASIBILITY: IS THERE ENOUGH SUPPLY AND DEMAND?

Technical feasibility As described above, a key factor in determining the viability of a stormwater credit trading market is whether there will be enough supply and demand for credits. Thus, one of the initial analyses to undertake is an assessment of the distribution of physical (geologic, hydrologic, etc.) conditions that determine the suitability of GI projects. The distribution of physical constraints helps to inform the geographic presence and extent of demand (where meeting stormwater requirements onsite may be infeasible), as well as supply (where infiltration-based GI is feasible). This type of analysis can also help to determine whether a market can support multiple trading areas (e.g., by watershed).
As a starting point, it can be helpful to conduct a GIS-based representation of various GI-suitability factors. In designing the proposed Grand Rapids program, the Stormwater Currency team created a map depicting the distribution of USDA soil types and other feasibility factors (see Table 1) across the city's watersheds and by parcel type (e.g., residential, commercial, institutional). The goal of this exercise was to identify areas where retention would likely be deemed infeasible based on criteria identified in the City's draft stormwater design manual.

This assessment not only helped the team to understand the potential distribution of demand for credits, but also informed an evaluation of potential opportunities for generation of stormwater retention credits, including available land area by parcel type and by sewershed.

PHOTO: MARIA CAHILL

PHOTO: WARD WILSON TETRA TECH

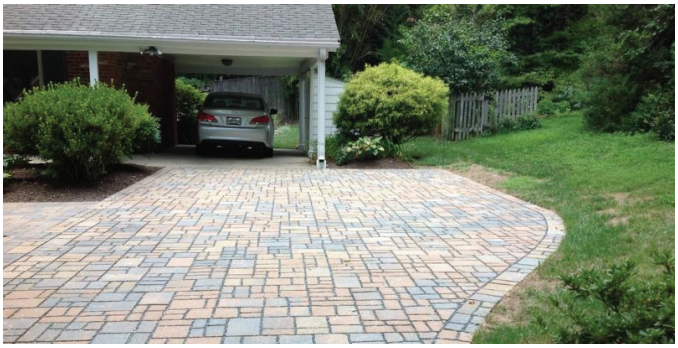


PHOTO: MD PERM PAERS

FEASIBILITY ANALYSIS CRITERIA FOR ON-SITE INFILTRATION

CATEGORY*	CRITERION (MAKES THE CATEGORY INFEASIBLE)
Poorly Draining Soils	Hydrologic Soil Group C Or D
Shallow Depth To Groundwater	Depth To Groundwater Less Than 3 Feet
Contaminated Sites (Part 201 Or 213 Sites)	On A Contaminated Site
Wellhead Protection Areas	Within 100 Feet Of A Wellhead Protection Area
Steep Slopes	Slopes Greater Than 15%

* Depth to bedrock and stormwater hot spots also were listed in the draft stormwater design manual. However, information on depth to bedrock was not readily available. Data on stormwater hot spots was also not available. Slope steepness was not mentioned in the manual but is commonly included in feasibility analyses for GI location, and therefore included in this analysis.

To further assess demand, we applied findings from the physical feasibility assessment to past development projects (from 2014 – 2018), using data from City planning documents and permits. We identified the percentage of projects that would have been subject to the City's forthcoming stormwater management requirements for channel protection if they had been in place, as well as those that would have faced onsite feasibility constraints. This analysis also allowed us to identify trends in real estate development locations, types, and costs that, in turn, provided information about the distribution of credit demand and an approximate volume of off-site retention needed for regulatory compliance.

In general, the project team found there was a roughly equal distribution of potential demand and potentially available credit supply sites across the City's seven sewersheds. However, the technical feasibility analysis was instructive about the importance of City efforts to promote GI projects to generate credits. As described in more detail below, efforts to create an initial supply of credits and publicize the stormwater credit trading program with business groups, affordable housing developers, and non-profit groups including faith-based institutions will likely be important to providing supply commensurate with expected demand. Financial incentives for credit sellers and/or project aggregators could also help to ensure a continuous supply of SRCs.

Economic feasibility

Beyond physical infeasibility constraints, in many communities (e.g., D.C.) economic factors will play a larger role in driving the demand for credits. Thus, it is important to consider whether enough development sites will have an economic incentive to purchase credits to comply with stormwater management standards (i.e., creating demand), as well as whether less expensive areas or options exist for credit-generating projects (i.e., creating opportunities for supply).

When considering the purchase of credits, an important factor for developers is the opportunity cost associated with the land that would be required to implement GI BMPs onsite (i.e., could it be put to a more profitable use?). Thus, rather than simply comparing the costs of onsite v. offsite retention, we calculated this opportunity cost for our sample development sites based on local real estate values and footprints for different BMP types. To estimate the cost of credits, we assumed a range of return on investment scenarios for the seller. We also assumed that credits would be generated in areas with slightly lower land values compared to the downtown area of the City. Our analysis found that it would be economically beneficial in many cases for developers to purchase credits.

FUNDAMENTAL ASPECTS OF A STORMWATER CREDIT TRADING PROGRAM

The optimal design of stormwater credit trading programs will vary based on local physical conditions, existing stormwater management requirements for new and redevelopment sites, economic drivers, the local development market, and water quality needs. The key to having an effective market is to balance supply and demand for credits. The following sections outline several key program design elements and considerations for utilities and municipalities interested in establishing a stormwater volume credit-trading program.

Trading boundaries

A key tenet of any stormwater credit trading program is that it should not result in any adverse water quality impacts relative to a baseline condition under which credit trading is not allowed. However, credit trades can result in dislocation of the site where runoff is controlled from the location where the credits are generated. Trading boundaries that cover a large geographic area can increase the risk of localized flooding, erosion, or water quality impacts, especially when allowing trades that are out of the local sewershed and are not connected hydrologically. Watershed boundaries used in credit trading should be defined to match local conditions. Local water quality goals such as TMDLs may influence the choice of boundary.

To guard against unwanted water quality "hot spots" or leave some watershed areas at risk, it may be best to limit trading to exchanges that occur within the same watershed. The scale of this watershed may differ from place to place, depending on local water quality needs and objectives. For example, in Grand Rapids, the City's MS4 permit specifies that off-site compliance must occur within the same watershed. To comply with this requirement, the City has identified three primary trading areas that represent aggregations of the City's seven sewersheds. The goal in establishing these areas was to optimize the balance between having a large enough market (i.e., enough supply and demand within a trading area) and improving water quality within the municipality's watersheds.

The goal in establishing these areas was to optimize the balance between having a large enough market (i.e., enough supply and demand within a trading area) and improving water quality within the municipality's watersheds.

In some cases, the best situation may be for the credit generating project to be upstream in the same watershed from the credit-using site. In this case, the credit-generating site still physically benefits from the stormwater control upstream, and stormwater impacts are controlled in the same watershed. However, there may be conditions where dislocation of the stormwater control from the site of credit use may be mitigated by other factors, such as existing stormwater controls and baseline conditions. There may also be instances when stormwater credit trading across sewersheds or watersheds serves desirable public policy goals. For example, as described earlier, in Washington, DC, developers and property owners can purchase credits associated with projects located anywhere within the District. Much of the demand for credits in DC comes from redevelopment occurring in the downtown urban core, most of which falls within the District's combined sewer area. However, the majority of credits are being generated outside of downtown, in areas served by the MS4. DOEE believes that DC Water's investments in the combined sewer area to reduce CSOs will ameliorate any potentially adverse effects on stormwater control from credit usage downtown and that GI investment in the District's MS4 area helps control water quality in smaller tributaries, where the positive water quality effects can be more significant.

In addition, there is an important distinction between greenfield development and redevelopment of ultra-urban areas. In an ultra-urban context, the type of development occurring is typically redevelopment of existing impervious land. Thus, the development is not generally causing new harm to waterbodies through increased runoff. In this case, the purpose of regulations is to undo the harm that has already been done and allowing credit trading across sewersheds may not result in adverse water quality impacts. Alternative program design or trading restrictions may be more applicable for greenfield/new development where the goal is to prevent new harm.

Conditions for going offsite

Conditions that allow property owners to meet a portion of their stormwater management requirements offsite should not be overly restrictive. For example, in Washington, DC, developers can meet 50% of their stormwater management requirements offsite (e.g., by purchasing credits), which helps to ensure a sufficient demand for credits. In some areas, such as Grand Rapids, permit language limits the ability to meet regulations offsite to sites where stormwater management is infeasible because of poorly draining soils or other conditions. This can limit the size of the stormwater credit trading market, depending on how infeasibility conditions are defined. As described earlier, it is also important that the cost of onsite retention is sufficiently higher than the cost of offsite retention for a relatively significant percentage of development properties. The cost of retention can be higher in locations where the land area is constrained, or its cost is at a premium. In popular downtown areas where development is desirable, the cost of onsite retention is often higher than the cost of developing credits elsewhere in the trading area. Opportunity costs associated with the land required to implement stormwater BMPs onsite can also be an important economic driver for offsite compliance.

PHOTO: EPA

In lieu fee program

A credit-trading market functions better when buyers and sellers have some level of certainty. For buyers, this means being able to purchase credits at reasonably low prices (e.g., at a cost that is lower than installing onsite stormwater controls) and to be ensured that there will be an adequate supply of credits available for purchase. This can be accomplished through the establishment of an in lieu fee program.

An in-lieu fee program typically allows developers to pay a fee to the local municipality or stormwater agency when it is not feasible to implement stormwater controls onsite. The municipality uses the revenues it collects from the in lieu fee to build stormwater control projects that offset landowners' requirements. The in-lieu fee program allows government agencies to aggregate projects to install GI in the public right-of-way or other public property. This means that the municipality must install and maintain the GI projects.

The in lieu fee is important because it can be used to set the ceiling for a credit-trading market—if it is cheaper for developers to purchase credits from the market than to pay the in-lieu fee, then the in-lieu fee will serve as the ceiling. The in-lieu fee approach works because it is typically much more expensive for a municipality to implement GI on public property than it is for private property owners (i.e., credit generators) to install stormwater management BMPs on their properties. At the same time, the establishment of an in lieu fee program also helps to ensure developers that an offsite compliance option will always be available. This is particularly important when developers must purchase credits each year, as in the DC market. This is discussed in more detail below.

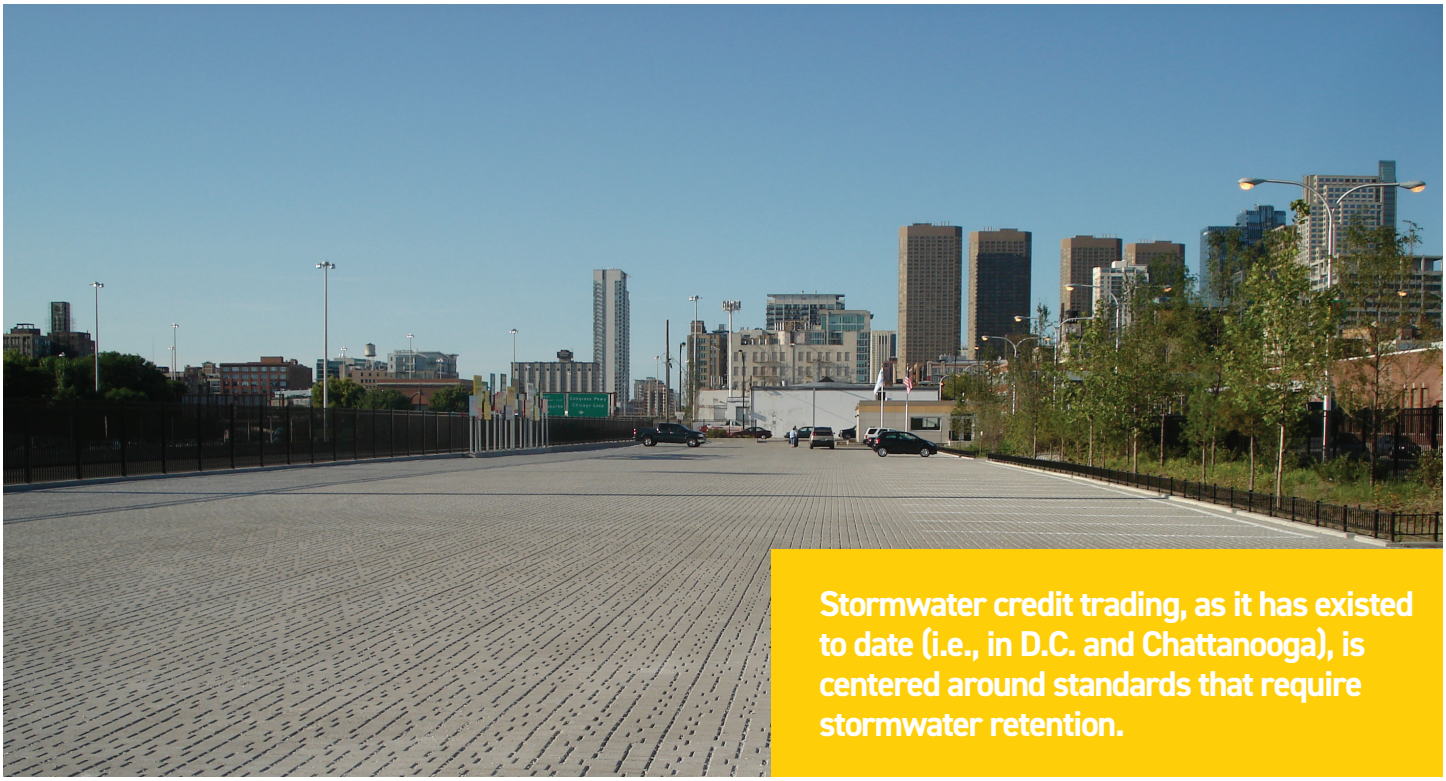


PHOTO: KATIE ROUSSEAU

Stormwater credit trading, as it has existed to date (i.e., in D.C. and Chattanooga), is centered around standards that require stormwater retention.

Credit currency and duration

A stormwater credit trading program is essentially a market where property owners buy and sell volume-based stormwater credits. Each credit is based on a unit of BMP capacity or volume managed, with no attempt to translate that volume into equivalent pollutant removal. As such, each credit reflects a volume based on the design capacity of the credit-generating BMP. Credits should be measured in gallons, or cubic feet, whichever is consistent with local technical standards. For example, a bio-infiltration cell designed to capture 1,000 gallons of stormwater could be worth 1,000 credits, if one credit is set to be worth one gallon of stormwater retention capacity.

In addition, stormwater credit trading, as it has existed to date (i.e., in D.C. and Chattanooga), is centered around standards that require stormwater retention. However, some areas are currently exploring the potential for credit trading programs as a form of offsite compliance for meeting detention standards. While detention standards do not require stormwater to be captured and retained onsite, detention-based credits can be translated into a "volume managed" currency. Importantly, the economics associated with purchasing credits for meeting detention standards may vary significantly from retention-based markets and should be studied as part of an initial program feasibility assessment.

Further, in some communities, both retention and detention-based standards apply. For example, in Grand Rapids, developers must retain the post-development difference in stormwater volume runoff associated with the 2-year, 24-hour storm for channel protection purposes. However, developers must also meet detention -based standards for flood control and water quality. The channel protection requirements serve as the driver for the program; however, retention credits purchased by developers for meeting these requirements will also apply to onsite water quality and flood control volumes (effectively reducing the volume that must be managed onsite for water quality/flood control). Another design consideration is related to the time period over which credits are valid. First, and following the DC model, is to set a short "lifespan" for credits. DC DOEE will certify credit-generating projects for a period of up to three years. For example, if a site is eligible for 1,000 SRCs, DOEE would certify 3,000 credits upfront. After the three-year period, credit-generators can re-certify their credits by passing a DOEE inspection and applying for recertification. In this example, they would be eligible to certify another 3,000 credits, and another 3,000 three years later (total 9,000 SRCs over the nine-year period). After each certification period, credit-generators may also choose to opt out of the market (i.e., choose not to re-certify and sell credits). In this case, the developer who had previously purchased their credits would need to find another provider. A second approach is to require that credit generators sell credits for a much longer period (e.g., 30 to 50 years) or for the life of the development to which they are selling the credits. These approaches are discussed in more detail below.

PHOTO: BRIAN KELLY | EXPERIENCE GRAND RAPIDS

Generating stormwater volume credits

Stormwater retention credits can be generated by the installation of GI practices or other distributed stormwater BMPs that are not otherwise needed to meet regulatory requirements. There are two categories of projects that can foreseeably supply retention credits:

1. Development and redevelopment projects that treat more stormwater than the regulations require
2. Voluntary projects installed as retrofits on properties where no other construction is ongoing or where construction activities do not trigger stormwater management standards.

DOEE's program in DC allows regulated projects to generate credits by installing surplus retention capacity above the local design standard. The District's stormwater regulations are centered around meeting water quality objectives by retaining the volume associated with the 1.2" storm, which equates to the 90th percentile storm. Regulatory projects are allowed to retain surplus volume up to the 1.7" storm (95th percentile) to generate credits. This upper bound, or cap, is important to ensure that the treatment volumes installed to generate credits will be used during most foreseeable rain events. Along those lines, while DOEE allows this approach, they view credits generated in this way as less desirable. This is because having more distributed BMPs that meet the 90th percentile storm (i.e., rather than adding additional capacity to existing BMPs) will result in more stormwater runoff being captured during less intense, more frequent rain events. This results in greater overall water quality benefits.

In Grand Rapids, the retention standards differ significantly in that they require new development and redevelopment sites to retain the difference in stormwater runoff associated with the 2-year/24-hour storm. This equates to the 99th percentile storm; thus, it would make little sense to express a local cap in terms of a larger storm or design standard. Instead, the proposed Grand Rapids program will allow regulatory projects to generate credits by treating additional impervious area on-site, for example, from a pre-existing or modified parking area.

The second category of credits arises when land owners voluntarily retrofit existing impervious areas with a GI installation, as long as the installation is not intended to provide compliance with any stormwater regulatory requirement. For example, a parking lot owner may voluntarily convert some area to bio-infiltration cells or pervious pavement and generate credits from the amount of stormwater retained by these practices. These retrofits may be created with the motivation of profiting from the sale of retention credits or may also be intended to provide additional property or neighborhood benefits. Credits may also be generated by retrofit projects funded by philanthropic or other grants, subject to grant and legal restrictions.

Of course, the BMP capacity installed to create credits is only valuable if it is maintained and continues to function over time. When applying for credit certification, a credit generator is essentially agreeing to maintain, and ensure continued performance, of the associated stormwater BMP over a set time period. They also agree to take on all liability associated with regulatory compliance. As such, offsite providers are regulated in the same way as a developer or property owner who implemented all stormwater controls onsite. The same enforcement authority applies.

Purchasing /using credits

A primary purpose of a well-defined credit market is to provide a flexible option for meeting regulatory compliance in a cost-effective manner. As briefly discussed above, there are two differing approaches for structuring the purchase of retention credits. The first is to adopt a "up front, one-time purchase" approach that allows developers to enter a single transaction with a provider of permanent credits, while the second requires credit purchasers to make regular purchases of short-term credits over a real estate project's lifetime. Each approach has its benefits and drawbacks.

PHOTO: PETER MCDANIEL

PHOTO: MARIA CAHILL DAYBREAK COHOUSING

Up front, one-time purchase

Under a one-time purchase structure, a site developer contracts for the purchase of retention credits from a provider who then bears the responsibility of assuring sufficient credit-generating GI to provide functional retention capacity 'in perpetuity' or over the life of the development. Realistically, the term of an agreement would likely run for 20 to 30 years (to cover the presumed effective lifespan of a green infrastructure BMP), with possibility of renewal. Once the agreement is reached, the site developer submits proof of purchase to the stormwater agency and from that time on is considered to be in compliance with the local stormwater requirements. Under the terms of the purchase agreement, the credit provider becomes solely responsible for ensuring that the credit-generating project is maintained and functional over the term of the agreement. The provider may opt to maintain the original GI practices for the entire time, or to substitute equivalent new practices (in the same trading area) during the contract period. Under this approach, the credit price would reflect the long-term maintenance cost, and therefore would have a higher upfront cost than the "pay as you go" approach. In the long-run, however, there may be advantages to this approach: long term costs for the duration of the development's lifetime will be lower, compliance for the site developer is simpler and more certain, and site developer may be able to bundle the upfront cost into the initial capital financing for the project.

The terms of a credit purchase are expected to be negotiated by the parties to the agreement. One possible approach is for the parties to agree that the "one time" purchase for capital/construction costs will actually be paid for over time, and to develop a payment plan. This approach provides consistent revenue to the seller and relieves the purchaser of an obligation to secure full funding for the purchase at the onset, if desired.

This approach provides the most certainty for the property developer and the local stormwater agency. All off-site compliance obligations are met before the final development sign-off or certificate of occupancy issues, and there is only a single transaction for the stormwater agency to track. The downsides fall mostly on the retention credit provider, who bears all costs and risks going forward. With a one-time payment, ongoing maintenance costs may be difficult to fund and a change in land use at the site where green infrastructure has been installed would require the provider to find replacement credits without additional payment. This inability to freely "opt out" of the market may discourage some would-be credit providers from entering the market.

Continuous purchase obligation

The DC credit market revolves around credits that have a lifespan of one year and a certification period for three-year's worth of credits at a time. In this model, a real estate project developer must purchase a sufficient amount of credits to cover its annual retention obligations. This annual approach means that the credit market in DC is relatively fluid as developers and credit suppliers negotiate relatively frequently for credit purchases. While seemingly complicated, this approach maximizes flexibility for all parties. Developers are free to shop the market, and purchase future credits at the best price; credit providers are free to adjust their prices throughout the lifetime of their green infrastructure project, and to enter and leave the marketplace as their land use plans or other circumstances demand. DOEE is able to ensure that all credits 'consumed' are adequately maintained and do not fall into prolonged periods of neglect.

DOEE has taken steps to reduce the administrative and transactional costs associated with this annual purchase obligation. First, DOEE will certify green infrastructure retention credits for up to three years, a period which can be extended upon proof that the retention capacity has been maintained. This allows for longer term planning by both credit providers and credit purchasers. Second, DOEE encourages purchasers and suppliers to enter into longer term contracts, so that the number of required transactions is reduced but payments for maintenance are assured.

Hybrid approach

The hybrid model may be somewhat implicit within the "one time" purchase model. Under this approach, the site developer would pay up front (one-time or over multiple years) for the capital cost portion of those credits, including design, permitting, construction, and a return on investment for the credit seller. They would then enter into a contract with the credit seller under which they pay a small amount each year to cover maintenance costs (the developer could also pay for multiple years of maintenance at one time, depending on the buyer-seller agreement). With a maintenance agreement between the credit seller and local agency guaranteeing ongoing performance, and a maintenance contract between seller and purchaser providing sufficient revenue to cover maintenance costs, this flexible arrangement can provide sufficient security for all three parties. This approach is being recommend by the project team for adoption in Grand Rapids.

PHOTO: PETER RAABE OR AR

Green infrastructure projects can be priced much lower than the going market value for new credits.

Ensuring an adequate supply of credits initial supply of credits

One concern with the launch of a credit trading program is having enough credits "banked" to meet initial demand, before the function of the market creates sufficient incentive for developers and retrofit projects to create newly constructed green infrastructure. Both DC and Grand Rapids anticipated that GI projects constructed after a designated date (but before the program roll out) would be an initial source of credits. In Grand Rapids, only GI installed by the City's departments will be "grandfathered" into the program; in DC, privately funded and implemented projects were also included. These projects were able to provide a supply of credits before the private sector was fully engaged in credit generation. One lesson learned from this experience is that previously installed green infrastructure projects do not need to recoup installation costs as those have long ago been absorbed. As a result, they can be priced much lower than the going market value for new credits. This creates unfair competition and can effectively discourage participation in the marketplace by generators of new retention credits. One solution to this problem can be to set an expiration date for all credits that were created before the launch of the trading program.

Continuous supply of credits

The market administrator or stormwater agency will most likely need to take an active role in ensuring that an adequate supply of credits exists to meet the demand from new development and redevelopment over the lifetime of the trading program. One of the strengths of a credit trading program is that it creates an incentive for private property owners and developers to fund and construct GI projects. The agency can make participation in the market more attractive by offering incentives in the form of funding or through non-financial steps that ease real estate development projects (i.e., to incentivize developers to go beyond their regulatory requirements). These incentives may be especially useful in creating future supply in watersheds where insufficient credits currently exist.

The most prominent incentive concept, which DOEE has adopted, is to establish a "purchase guarantee" program that would assure credit generators that the stormwater agency would be a buyer of last resort for unsold credits. The commitment by the District to purchase (at a below market rate) unsold retention credits has created some degree of certainty in the market by creating a floor for credit price. It has also reduced risk for credit sellers. DOEE has also established an aggregator start up grant through which it provides up to $75,000 to potential project aggregators to cover initial costs associated with project identification, coordination with property owners, and other associated activities. A potential barrier to agencies considering these approaches is the ability to adequately fund them.

Some additional options for creating incentives for credit generators include:

* Ensuring compatibility between stormwater retention requirements and other provisions of the local development and planning code. For example, properly designed street tree installations (and trees installed as part of a retention facility) should be able to count toward both the stormwater requirements and urban forest or other landscaping requirements. Local government may want to consider measures to harmonize these closely related policy goals in a way that creates an incentive for additional trees in shade deprived portions of the city;
* Coordinating with local watershed and community organizations who are able to obtain grant funding (from private philanthropic and other sources) to create green infrastructure projects. Coordination may make it easier for these projects to qualify as credit-generating projects, and may enable the agency to guide projects to priority locations within the urban landscape;
* Working closely with the local affordable housing community to assist in the design and implementation of green infrastructure that reduces costs or provides economic returns for these projects;
* Hosting workshops or otherwise connecting property owners and green infrastructure developers to private 'impact' investors who may be interested in providing funding for credit generating green infrastructure projects.
* Providing limited funding to third-party project aggregators (i.e., third-parties or property owners who develop multiple credit-generating projects across multiple properties) to help cover costs associated with project identification, property owner recruitment, and design.
* Providing upfront financing (in the form of a low-interest or no-cost loan) to credit sellers for design and construction of GI projects, with payment due upon sale of credits.

PHOTO: BRIAN KELLY | EXPERIENCE GRAND RAPIDS

PHOTO: SEAN FOLTZ WI.

Credit trading ratios and market directives

Credit trading ratios may be applied to ensure that water quality objectives are met or to meet other public policy goals. Credit ratios require developers to arrange more off-site retention than they would be required to install on-site. Currently, Grand Rapids' MS4 permit requires developers to purchase 1.5 times the amount of BMP capacity that they would need to install onsite if they are able to capture a minimum on-site retention volume of 0.4 inches; a more protective 2:1 ratio applies when a minimum on-site retention volume cannot be met. The downside to credit trading ratios is that they increase the cost of purchasing off-site retention credits; however, in many cases this cost may not exceed options for meeting retention requirements on-site. On a beneficial note, positive credit ratios result in the installation of more green infrastructure projects and more retention volume than would otherwise be achieved, increasing the amount and distribution of green infrastructure benefits across a community. The economic implications of credit ratios should be studied as part of the initial program feasibility assessment.

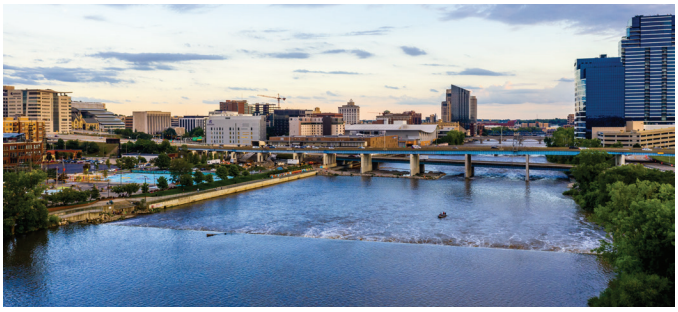
Other program rules can also be established to help drive environmental and social outcomes. For example, in D.C., DOEE is considering the establishment of "priority" credits. In this case, all credits generated by voluntary projects in the District's MS4 area would be designated as high priority. All other credits, including credits from new development and redevelopment sites that exceed requirements and/or projects within the CSO area of the District, are lower priority. Developers looking to purchase credits on the market would be required to purchase the high priority credits first, if they were available. Other potential rules may include the establishment of one-way trading areas. For example, where buyers within trading area A would be allowed to purchase credits from high priority trading area B but not vice versa. This would have the effect of directing credit generators to build more supply in trading area B, where in this example, stormwater projects may result in greater water quality benefits.

TRADING PROGRAM ADMINISTRATION AND IMPLEMENTATION

Given the resource and staffing limitations at many stormwater departments, it is important that the implementation of a credit trading program not create overly burdensome demands on budgets and personnel. We believe that in some cases, existing municipal stormwater programs and processes can be adapted to serve as the foundations for a functional trading program. Some investment in additional capacity will be required, however these should be manageable.

The overarching responsibility of stormwater agencies is to ensure that the credit trading program confers compliance with the requirements of the MS4 permit and city stormwater ordinance that govern the program. To do so, staff must ensure that site developments purchasing credits have secured the amount of credits necessary to fully meet their compliance obligations, that credit generators have installed and are operating GI capable of providing adequate retention of stormwater, that credit-generating projects are tracked and inspected to demonstrate compliance over time, and to ensure that off-site compliance does not create localized flooding or water quality concerns Beyond these fundamental competencies, the agency can (and should) facilitate connections between would-be purchasers and sellers of credits; incentivize projects that create credits on Voluntary or Regulatory sites; and be prepared to analyze the successes and shortcomings of the program, and respond with policy revisions. This section makes some initial suggestions about how municipal stormwater departments can fulfill these roles.

We believe that in some cases, existing municipal stormwater programs and processes can be adapted to serve as the foundations for a functional trading program.



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Off-site/credit purchase determination

The credit purchase process should ideally begin upon submission of development permit applications to the appropriate municipal departments. At an appropriate junction in this process, the developer will need to obtain review and approval of its stormwater management plan. Information sharing between the planning review and stormwater agencies can enable the stormwater staff to have the information it needs to evaluate the developer's on and off-site stormwater management proposals. With sufficient and timely coordination, stormwater department staff should be able to review an application for use of off-site credits for any undesired watercourse or storm sewer impacts.

The stormwater agency will need to develop a process for ensuring that a developer has purchased credits prior to signing off on the stormwater management plan. This may involve having the developer submit proof of purchase or a certification to the stormwater agency that verifies the credit purchase. The certified credits (and their associated tracking identification) should already be in the agency's database and can be marked as sold.

Credit certification

Stormwater agency staff have a role in the assurance that credits offered for supply will provide the desired level of stormwater retention. The department should require that entities seeking to install GI to generate credits submit engineering designs of the project, along with retention calculations consistent with a locally approved template or method, for review. Once approved by agency staff, the credit generator would be required to provide proof of completion. Staff will then certify that the credits are valid for a period up to three years. The agency may choose to inspect all, or randomly inspect some, credit generating projects to ensure compliance with local design standards, etc.

Once installed, credit generating GI will need to be recertified every three years. Recertification can be accomplished via an application to the stormwater agency or market administrator, attesting to the continuing effectiveness of the GI practices. This application should include some documentation of the maintenance plan associated with the GI. Offsite green infrastructure projects created to generate credits should be folded into an inspection program and visited every three years.

Inspection and enforcement

A volume credit trading program creates a network of mutually supporting obligations to enable compliance with stormwater permits and standards. Ensuring that this network functions requires that the local stormwater agency exercise a strong inspection and enforcement capability. The agency needs to regularly inspect stormwater management BMPs installed on-site, both upon completion and during their functional lifespan. Failures to maintain BMPs properly will generally result in an order for corrective action, escalating to right of entry for the agency to repair, and potentially a lien on the property. The same pathway can be followed to ensure that BMPs constructed to provide off-site compliance credit are functioning over their design lifespan. Because the credit generator assumes the risk and responsibility of maintaining the credit-generating BMPs, one appropriate approach is to memorialize this responsibility in a legally binding agreement between the credit generator and the local agency. This agreement spells out the BMP owner's obligations and provides remedies (including fines, right of entry, lien) for non-compliance with these obligations.

Ideally, a volume credit trading program will result in more green infrastructure BMPs installed across the urban landscape to provide credits. Inspecting every one of these BMPs annually may present a significant administrative burden and cost. This burden can be reduced by instituting a 2 or 3 year inspection cycle. An alternative approach would be to require that the credit-generator retain an independent contractor to inspect its BMPs on a 2 or 3 year cycle, and submit a certified statement of performance to the agency. The agency can follow up with random or targeted inspections as it desires.

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Ensuring that this network functions requires that the local stormwater agency exercise a strong inspection and enforcement capability.

Credit purchase tracking

A credit tracking registry is a fundamental component of the trading program. Internally, the registry's database serves as the stormwater agency's primary means for tracking the purchase and 'consumption' of credits for off-site compliance with the new stormwater regulations. It also will enable the agency to track whether credits purchased by site developers are subject to on-going maintenance agreements, and issue notices of deficiency when coverage (either credit or maintenance) lapses are experienced. A public-facing component of the registry, ideally Web accessible, allows site developers to identify and contact credit generators in order to negotiate credit purchase agreements. Providing such a resource enables staff to have a relatively 'hands off' role in connecting credit buyers and sellers, reducing the need for staff to be involved in this process.

The database should also be used to track compliance with the ongoing maintenance requirements, including in the registry information about the maintenance provider and term of the maintenance agreement between the credit purchaser and maintenance provider (if different.)

On-line marketplace

The stormwater agency or market administrator will need to develop a web-based resource that serves as the credit trading "marketplace." This marketplace will serve as a publicly available roster of all credits that have been certified, their location within one of the trading areas, a calculation of the capacity (or number of credits) on offer by each provider, and a point of contact for each credit generator. Additional useful information may be the date of certification, presence of a current maintenance agreement, and any notations relevant to other requirements that the credits may be able to offset (e.g., tree canopy).

The marketplace should also provide information to the public, and interested 'customers' about completed transactions, including the identity of the parties, the purchase price, and location of both the site developer and the GI that provided credits. The District of Columbia Department of Energy and Environment's registry is a useful example of design, content and functionality.

Public and stakeholder outreach

While most municipal stormwater programs conduct regular public outreach, a credit trading program will be well served by robust engagement with the real estate development sector and others who are likely to purchase credits as well as NGOs, faith-communities and other property owners capable of installing retrofits to generate credits. Beyond typical outreach activities, the program may need staff to be capable of developing and managing specific incentive programs designed to encourage market participation.

Other considerations

Many cities are increasingly concerned about ensuring that investments in green infrastructure equitably benefit all of the city's neighborhoods and residents. City staff also should be alert to potential that green infrastructure investments that may contribute to increased property values, and associated gentrification and displacement of established, lower-income residents.

If functioning as intended, the credit trading program should have the effect of distributing funds from property investment dollars across the city's neighborhoods. In this way, a portion of the private sector investment in high-development neighborhoods are available to redress stormwater problems in neighborhoods that would otherwise not benefit from such investments. By engaging early with potential credit generators, public agencies may be able to help identify project locations that would redress historic investment inequities or address localized concerns or needs.

It is difficult to fully understand and quantify the role that new investments in green infrastructure have in gentrification. However, there is considerable evidence that GI can add to property values. If a neighborhood is already gentrifying, the addition that GI makes to property value could be undesirable. Local government should actively prepare for this eventuality. Given the attention that this issue is receiving in the public and NGO sectors, there are repositories of resources emerging to assist municipal governments with developing responsive programs and policies.

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CONCLUSION

A stormwater credit trading program can be viable approach to providing both regulatory flexibility for land development activities and a steady incentive-driven expansion of green infrastructure across an urban landscape. A well-functioning program should produce considerably more, and faster, retrofits of existing impervious area, reducing localized flooding and heat island effects while providing additional public benefits. A key attribute of a trading program is achieving these accomplishments largely with private investments, which in turn, can complement public expenditures on green infrastructure projects. Although commitments of public agency resources are necessary to ensure a successful program, these commitments can be considered a worthwhile investment in expansive public benefits and water quality regulatory compliance. In addition, the economic values inherent in a credit trading market may open opportunities to leverage additional financial and community resources.

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