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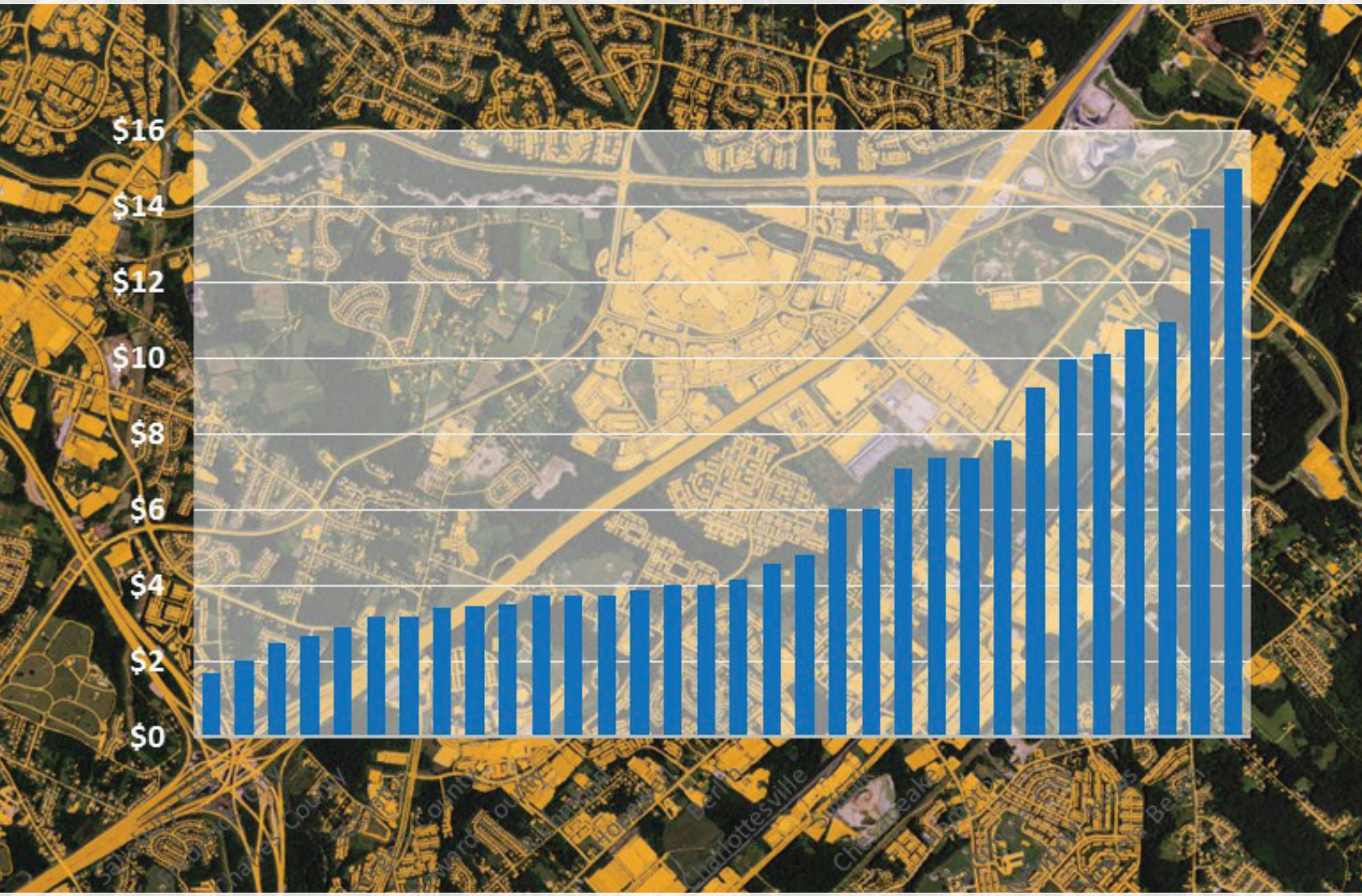

An Analysis of Stormwater Utility Incentive Programs in the Chesapeake Bay

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An Analysis of Stormwater Utility Incentive Programs in the Chesapeake Bay

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Abstract

Urban stormwater is the fastest growing source of nutrients entering the Chesapeake Bay. Municipal governments are implementing stormwater utilities to meet Bay requirements and to finance local stormwater infrastructure needs. Encouraging private landowners to retrofit existing developments with additional stormwater controls is critical to making progress toward reducing stormwater impacts because the large majority of land in most localities is controlled by private landowners. This analysis describes the financial incentive programs used by stormwater utilities in the Chesapeake Bay region to encourage private landowner adoption of stormwater controls. Incentives to adopt stormwater control practices are compared to the costs to install and maintain stormwater control practices. The analysis shows that fee credit programs provide limited financial incentives to property owners. The paper concludes with a discussion of other incentive programs that stormwater utilities have implemented to boost adoption rates.

Introduction

Stormwater runoff contributes to impairments of many water bodies nationwide. In the Chesapeake Bay watershed, stormwater runoff is the fastest growing source of nutrients to the Bay (Chesapeake Bay Program n.d.). Partly in response to federal, state and regional efforts to achieve Chesapeake Bay water quality goals, local governments face increasing pressure and regulatory requirements to limit the water quality impact of urban stormwater runoff.

To meet these requirements, counties and cities in the Chesapeake Bay watershed are increasingly adopting stormwater utilities. Stormwater utilities charge property owners fees to maintain and improve stormwater infrastructure. Typically, utilities establish fees based on the amount of stormwater runoff a property contributes, most frequently measured as the impervious surface area on a property. Most stormwater utilities also establish incentive programs to encourage private landowners to adopt stormwater controls on their own properties. The most common incentive program involves stormwater fee credit programs. Encouraging private landowners to retrofit existing developments with additional stormwater controls is critical to making progress toward reducing stormwater impacts because the large majority of land in most localities is controlled by private landowners.

The purpose of this analysis is to describe and analyze financial incentive programs used by stormwater utilities in the Chesapeake Bay region to encourage private property owners to voluntarily adopt stormwater controls. We first describe the stormwater utility fee structures and credit programs. We then compare the magnitude of credit incentives to the costs to install and maintain stormwater control practices. The analysis shows that fee credit programs provide limited financial incentives to property owners. The paper concludes with a discussion of other incentive programs that stormwater utilities have implemented to boost adoption rates.

[1] *Data for this analysis were gathered by the students in the Spring 2016 Environmental Economics Analysis and Management (AAEC 4314) course at Virginia Tech. The authors would also like to thank David Hirschman at the Center for Watershed Protection for his insights and technical support.*

Project Methods

The study used existing databases to identify stormwater utilities located within the Chesapeake Bay watershed (Choose Clean Water Coalition 2016; Campbell et al. 2014). The original list of stormwater utilities was then verified to ensure that the utilities were still operational. Several municipalities recently repealed their stormwater utilities and in other cases draft plans were never implemented. Additionally, one stormwater utility was removed from the analysis because it was not designed to collect sufficient funds to operate a functional utility. Several other municipalities were removed from the list because their stormwater utility was effectively operated by a larger municipality. Through this process, the researchers identified 32 operational stormwater utilities in the Chesapeake Bay watershed in 2015: 12 in Maryland, 17 in Virginia, 2 in Pennsylvania, and 1 in Washington, D.C.. Approximately 70% of these utilities have been implemented in the past 10 years.

Preliminary data on fee structure, rates, incentive programs, and eligible stormwater control practices were collected via online research, mainly through local government websites. The second phase of data collection involved personal phone interviews with department employees of the stormwater utilities. The purpose of these interviews was to verify and clarify the preliminary data and to solicit additional information on participation rates and incentive program implementation.

Overview of Stormwater Utility Fee Structures

Stormwater utilities most commonly structure fees based on the equivalent residential unit (ERU) or a similar method. ERUs are standardized units of impervious surface, typically calculated as the average impervious surface area (in square feet) for a single-family property in a locality. The ERUs present in this analysis range from as low as 200 ft^2 to more than 3,000 ft^2. A property owner is charged a fee based on the amount of ERUs covered by his or her property. For example, if a monthly fee is $5 per ERU and the ERU is 1,000 ft^2, a 3,000 ft^2 property would be charged at 3 ERUs, with a total fee of $15 per month. To avoid calculating impervious surface for all residential properties, many utilities will charge residential properties within a particular classification (e.g., single-family detached) a single fee to simplify administration.

The majority of utilities in the region charge a single fee rate per ERU rather than using a tiered pricing system. Most utilities charge commercial and residential properties the same rate, based on the ERUs. In addition to the ERU fee structure, two utilities use a flat-fee structure in which each property is charged the same fee regardless of size. About one-fifth of all stormwater utilities in the Bay region set a cap on the maximum stormwater fee a property owner must pay. This cap is typically assigned as a percentage of the property tax value.

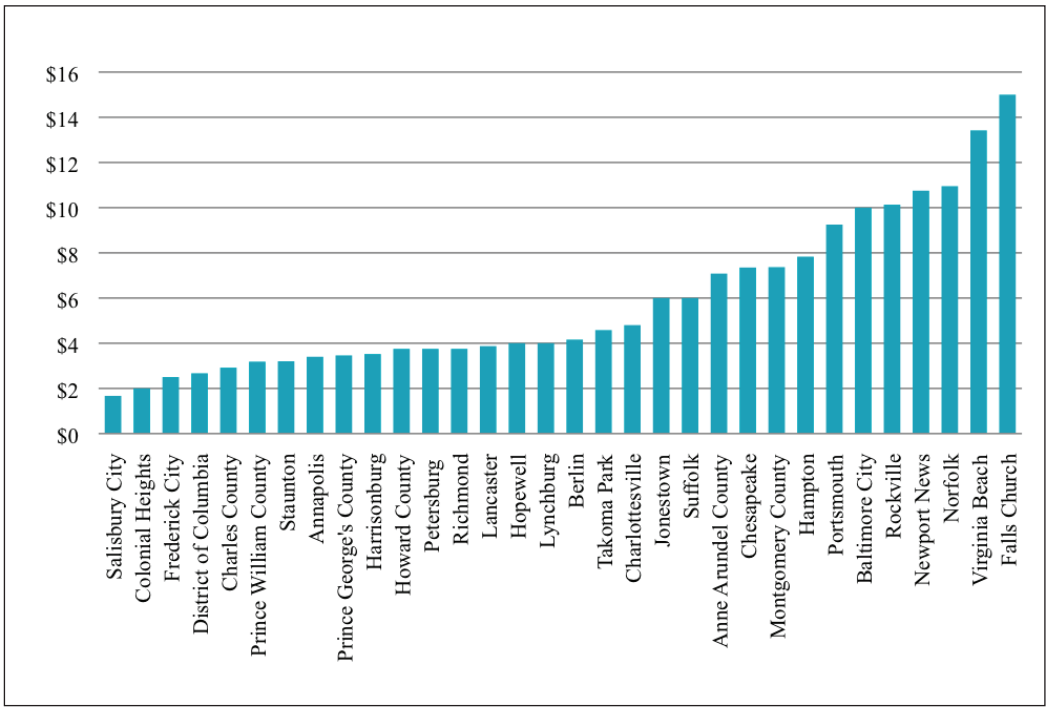

Figure 1. Monthly stormwater fee for one-quarter-acre residential property with 2,000 ft^2 impervious surface (2015).

For example, in Howard County, Maryland, the commercial property stormwater fee cannot be higher than 20% of the property tax.

Figure 1 presents the monthly stormwater utility fees that would be charged by each utility for a standardized residential property. To compare fee levels across utilities, each fee is reported for a hypothetical single-family residential property located on a one-quarter-acre lot with 2,000 ft^2 of impervious surface. Overall, stormwater fees are relatively modest, averaging a little less than $6 per month for this residential property. Stormwater fees range from as low as $1.67 per month (Salisbury City, Maryland) to as high as $15 per month (Falls Church, Virginia). The large majority of all stormwater utilities (81%) would charge less than $10 per month for a typical one-quarter-acre residential property.

Average residential and commercial stormwater fees do not vary significantly by state. Table 1 reports the annual stormwater fees that would be paid by a hypothetical residential (2,000 ft^2 impervious) and commercial (1 acre impervious) property by state. On average, a Virginia residential and commercial property owner would pay $80 per year and $1,615 per year, respectively, while the same property owner in Maryland pays, on average, $61 per year and $1,073 per year, respectively. The higher average stormwater fees in Virginia are driven largely by stormwater utilities serving older, low-lying areas in the tidewater region of the state.

Incentive Programs for Property Owners: Fee Credit Program

Every stormwater utility in the Chesapeake Bay watershed offers, or is developing, some type of incentive program for private landowners to adopt stormwater control practices (frequently called best management practices [BMPs]). Nationally, only about half of stormwater utilities offer incentive programs (Black & Veatch 2014). By far the most common type of incentive program is the stormwater fee reduction, typically called a fee credit program. Fee credit programs offer landowners a percent reduction on their stormwater fees in exchange for voluntary implementation of pre-approved stormwater BMPs on their properties. To receive the stormwater fee credit, property owners need to reduce or treat the stormwater runoff from their properties.

Currently, 30 of the 32 stormwater utilities within the Chesapeake Bay watershed have a stormwater fee credit system in place (the others are developing a credit program). Each stormwater utility sets different requirements that the private landowner must meet to receive the fee reduction. The application process for the fee credit programs differ depending on the locality of the property. For example, only 19 of the 32 localities post their fee credit applications online, and in 13 localities the applications are the same for all property types regardless of land use (residential, commercial, etc.). The credit renewal frequency ranges from one to five years for all localities, and the median frequency is three years. Two

Table 1. Annual stormwater fees paid by residential and commercial property owners in the Chesapeake Bay watershed (2015).

	Residential (2,000 ft^2 impervious)			Commercial (1 acre impervious)		
	Virginia	Maryland	Pennsylvania	Virginia	Maryland	Pennsylvania
Count	17	12	2	17	12	2
Mean	$80	$61	$59	$1,615	$1,073	$1,180
Median	$58	$47	$59	$1,255	$771	$1,180
Std Dev	$46	$33	$13	$990	$795	$168
Range	$24–$180	$30–$122	$46–$72	$393–$3,936	$35–$2,489	$1,011–$1,349

utilities charge an application fee, but other localities within the Chesapeake Bay watershed do not charge an administrative fee for applying. The most widely accepted stormwater BMPs for credit are bioretention areas, permeable pavement, infiltration trenches, and rain barrels. Most utilities require the installation of structural BMPs to obtain a fee reduction, but a few stormwater utilities offer credits for other practices (see discussion below).

The amount of potential fee reduction the landowner may receive varies among the localities. The most common credit utilities offer is a 50% fee reduction. Utilities that offer a 100% fee reduction often do so under restrictive conditions. To achieve a high percentage of fee credit, stormwater utilities often require the application of multiple BMPs. Five utilities only offer the credit to commercial properties, which often face the highest annual fees. Some localities offer different credit percentages for commercial and residential properties. In Howard County, Maryland, for example, residential properties can obtain a 20% fee reduction, whereas commercial properties can obtain a 50% reduction.

Table 2 illustrates the value of fee credit that a residential or commercial property owner can receive from installing stormwater BMPs. For each utility offering a credit program, the total maximum percent fee credit offered was multiplied by the estimated annual fee for that utility. The fee reduction was calculated for a residential property with 2,000 ft^2 of impervious surface and for two commercial properties, one with 1 acre of impervious surface and another assuming 10 acres of impervious surface. The calculated fee reduction is reported as an annual value and as a total over 20 years. Since many structural BMPs have a useful life of up to 20 years, the total sum of fee savings over 20 years is also reported as the present value sum of fee reductions discounted at 5%.

The annual stormwater fee reductions available for residential property owners are modest; the median value of reductions is $24 per year for stormwater utilities offering fee reductions for residential property owners ($294 over 20 years). Falls Church, Virginia, offers the highest annual maximum fee credit ($126 per year), but requires the application of multiple BMPs to achieve that level. The maximum possible stormwater fee

Table 2. Maximum value of stormwater fee credits offered by stormwater utilities in the Chesapeake Bay watershed (2015).

Annual Fee Reduction Value	Residential (2,000 ft^2 impervious)	Commercial (1 acre impervious)	Commercial (10 acres impervious)
25th Quartile	$19	$391	$3,920
Median	*$24*	*$502*	*$5,059*
75th Quartile	$42	$791	$9,275
Present Value over 20yrs @ 5%			
25th Quartile	$236	$4,876	$48,857
Median	*$294*	*$6,254*	*$63,041*
75th Quartile	$528	$9,852	$115,586

reductions for commercial properties with 1 acre of impervious surface ranges from $17 to $3,725 per year, with a median value of $502 per year. The median present value of these fee reductions over 20 years is $6,254 (see Table 2).

To evaluate the magnitude of the financial incentives created by stormwater credits, the fee savings are compared to the costs to install commonly accepted stormwater control practices. Costs to design, construct, and maintain urban stormwater practices are obtained from King and Hagen (2011), who estimate costs to treat 1 acre of impervious surface with a BMP, including the opportunity costs of land set aside for the stormwater control practice. We adjust cost estimates for inflation (converted into 2015 dollars) and express all costs as an annual cost. The upfront costs to install a stormwater BMP—design/permitting, construction, and land costs—are spread out uniformly over either 5 or 20 years (analogous to a loan payment and assuming an interest rate of 5%). Annualized upfront costs are added to annual operation and maintenance costs to produce a total annual cost estimate.

Figures 2 and 3 show the estimated annual costs for typical stormwater control practices accepted for credit. Annualizing costs over five years, the cost faced by a landowner treating 1 acre of impervious surface ranges from $7,000 to almost $62,000 per year. For a 20-year planning horizon, the annual costs range from $3,000 to $23,000 per year for 20 years with a median value of $6,500. For most stormwater control practices, construction costs comprise the largest portion of costs, although planning and design costs can be significant in retrofit situations (most relevant here).

The annual costs to treat 1 acre of impervious surface are compared to the average annual credit offered by Bay stormwater utilities to a commercial property with 1 acre of impervious surface. The portion of stormwater BMP costs covered by the fee reduction is shown in Figure 4 for 5- and 20-year planning horizons. Over a 20-year period,

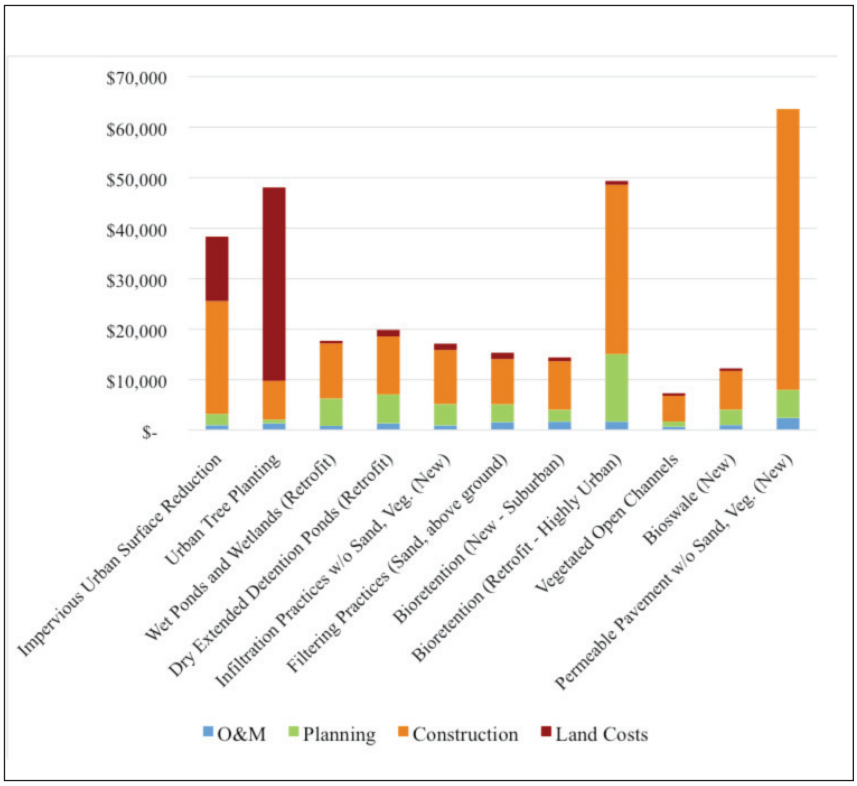

Figure 2. Annual costs (2015$) to treat 1 acre of impervious surface (5-year planning horizon). Source: Data derived from King and Hagen (2011).

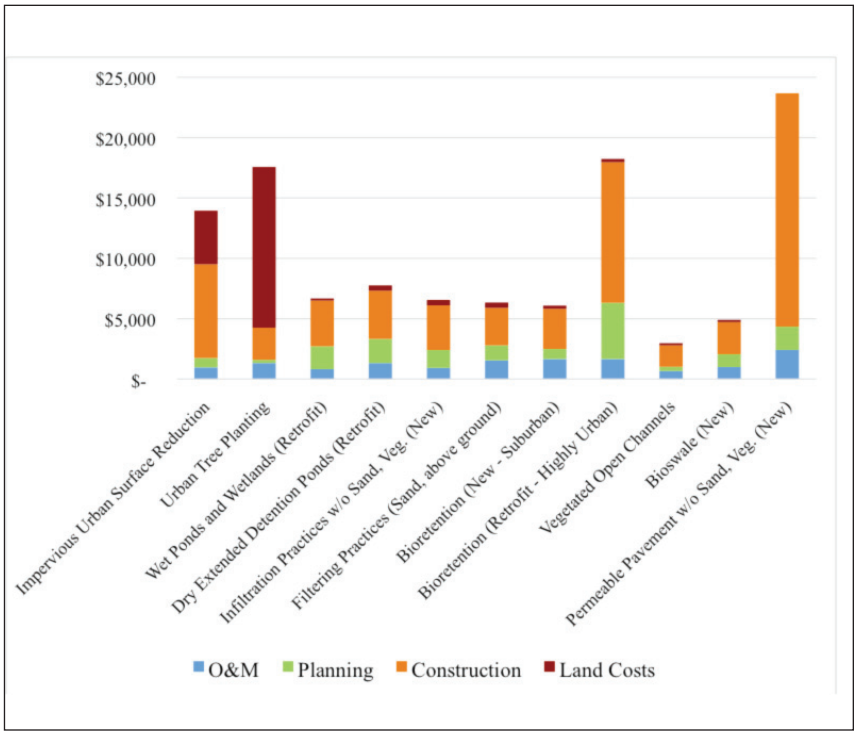

Figure 3. Annual costs (2015$) to treat 1 acre of impervious surface (20-year planning horizon). Source: Data derived from King and Hagen (2011).

stormwater credits cover less than 15% of the total costs to install and maintain most urban stormwater control practices. In no instance does the median credit value cover more than 30% of any stormwater control practice. The portion of costs recovered over a 5-year planning horizon is less than 5% for most stormwater control practices. It should also be noted that this analysis assumes that the application of the stormwater control practices listed in Figure 3 would be able to achieve the maximum credit available in the localities. In many instances, achievement of the maximum credit possible would require the application of multiple BMPs.

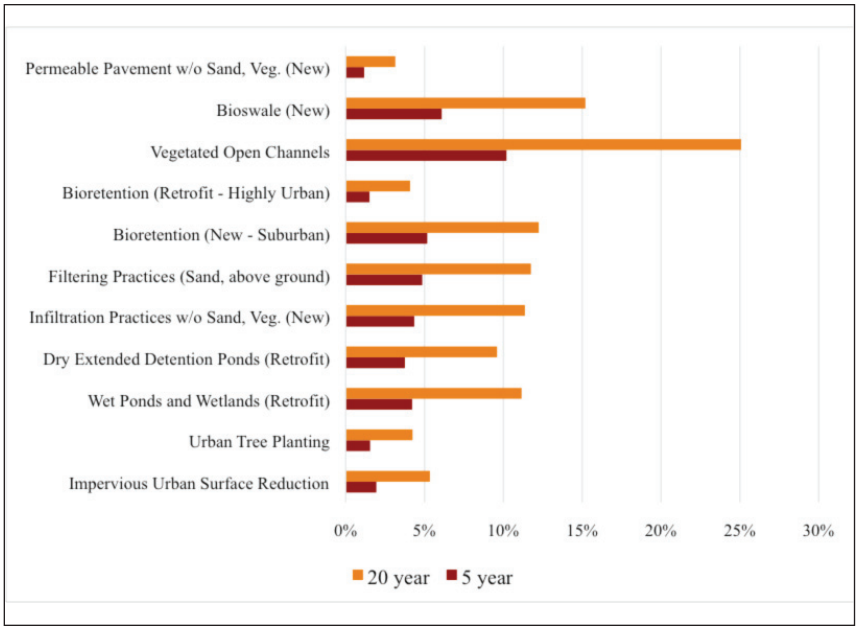

Figure 4. Portion of stormwater control costs covered by average fee rebate to treat 1 acre of impervious surface for commercial properties.

When examining the breakdown of urban stormwater control costs, the vast majority of costs are upfront design, land, and construction costs. Stormwater fee credits on average cover approximately only two-thirds of the remaining operation and maintenance costs. Fee credits are sufficiently large to cover the operation and maintenance costs of only one stormwater control practice evaluated in this analysis (vegetated open channels).

Stormwater fee credit programs appear to offer minor financial incentives for private landowners to retrofit existing lands with conventional stormwater control practices. Although the researchers were unable to obtain comprehensive data on landowner participation rates for fee credit programs, the collected evidence confirms these findings. Of the 15 stormwater utilities providing some quantitative data on participation rates, approximately 80% of the utilities report fewer than 50 fee credit applications per year. Typically, the number of accounts receiving a credit are less than a very small fraction (<2%) of all properties.

Other Incentive Programs and Adoption of Stormwater BMPs

Additional incentives appear to be needed to stimulate more widespread voluntary adoption of stormwater control practices. To encourage voluntary adoption of stormwater BMPs, eight utilities offer other financial incentive programs beyond fee credits. These incentive programs compliment credit programs by offering additional financial assistance for the installation of BMPs (in addition to fee credit programs). These utilities offer some type of cash subsidy to cover a portion of stormwater BMP installation costs.

A common financial assistance program is a traditional cost-share to cover installation costs. Cost-share is expressed as a percentage of installation costs or as a flat fee per unit of effort (see Table 3). The cities of Charlottesville and Harrisonburg participate actively in the Virginia Conservation Assistance Program (VCAP). VCAP is a state-funded program that provides cost-sharing for BMP construction costs for select BMPs in the Chesapeake Bay region. Charlottesville Conservation Assistance Program (CCAP) follows VCAP structure, but funding is provided by the city of Charlottesville (Thomas Jefferson Soil and Water Conservation District n.d.). Lancaster County, Pennsylvania, offers the most generous cost-sharing program, offering up to 100% of design costs and 90% of implementation costs. Several utilities in Maryland offer rebate programs that reimburse property owners for a fixed payment schedule (Rockler and Varsa 2013). For instance, these rebate programs reimburse property owners per square foot of rain garden, permeable pavement, or green roof installed and a per gallon payment for cisterns, rain barrels, and dry wells. Many Maryland programs

also offer payments for tree planting. Most cost share and reimbursement programs place maximum caps on the total amount of reimbursement received by each project (which in many instances prevent the applicant from recovering the full 50% of the installation costs).

Despite the additional financial incentives, application rates and participation rates (as nearly all applications are accepted) are low relative to the number of eligible properties. Even with significant cost-share grants, the cost analysis above indicates that commercial property owners must still voluntarily incur significant out-of-pocket expenses to treat an acre of impervious surface. Take, for example, a commercial property owner receiving a typical fee credit and a 75% construction grant to install a bioretention area to treat 1 acre of impervious surface. From King and Hagen (2011), installation costs (construction plus design costs) would be approximately $50,000 and annual maintenance costs would be approximately $1,600 (expressed in 2015 dollars). Assuming installation costs share (75% cost share with a $10,000 cap) and an annual credit fee rebate of $500 annually (median value, see Table 2), the property owner would still face out-of-pocket costs of $10,340 per year over five years.[2]

During interviews, several utilities expressed that it is a challenge to encourage commercial property owners to voluntarily adopt stormwater BMPs. For example, the interview with representatives from Howard County, Maryland, revealed that the county has had zero participation by commercial properties in its fee credit and cost-share programs. Despite outreach

Table 3. Summary of cost share (reimbursement) rates for selected stormwater utilities.

	CCAP, VCAP	Howard County	Montgomery County	Prince George's	Rockville
Conservation Landscaping	$250/1,000 ft^2 Max $3,500	50% of costs	Up to $3/ft^2		Up to $2/ft^2
Imperv cover Removal	$2.50/ft^2		Up to $4/ft^2	$6/ft^2	Up to $4/ft^2
Rainwater Harvesting	$2/gallon		$1/gallon	$2/gallon	$1/gallon Max $500
Bioretention	75% of costs				
Permable Pavement	$3/ft^2	50% of costs	Up to $4/ft^2	$12/ft^2	
Green Roofs	$10/ft^2	50% of costs	$10/ft^2	$10/ft^2	
Rain Garden	75% of costs Max $2,000	50% of costs	Up to $9/ft^2	$10/ft^2	
Wetlands	75% of costs Max $5,000				
Vegetative Swales	75% of costs Max $5,000				
Tree Canopy		50% of costs	$200/tree	$150/tree	$150/tree Max $600
Maximum Award	$10,000 unless noted		$2,500 residential; $10,000 commercial	$4,000 residential; $20,000 commercial	$1,200 unless noted

[2] *$40,000 in out-of-pocket installation costs repaid annually over 5 years would be $9,240. These installation costs would then be added to the $1,100 maintenance costs not covered by the fee credit ($1,600-$500).*

efforts and sending contractors out to these properties to perform cost estimates, property owners have been unwilling to participate and prefer to pay the total stormwater fee. These large commercial properties, however, are those that many cities and counties desire to target the most, as they produce a significant amount of the stormwater runoff currently affecting the Chesapeake Bay watershed.

Residential property owners also face out-of-pocket expenses even with rebates and credits. Out-of-pocket costs, however, may be modest for small-scale residential BMPs, such as rain gardens and rain barrels. Some residents could even receive a net benefit if they were undertaking a landscaping change anyway (tree planting, conservation landscaping, etc.). Furthermore, some residents may be willing to incur some costs out of civic responsibility or environmental stewardship. Newburn and Alberini (2016) report that more than half of residents responding to a survey in the Washington, D.C./ Baltimore area claimed they would be willing to pay to install a rain garden on their property (average willing to pay equal to $\$6.72/ft^2$). A few utilities appear to have active marketing and social awareness campaigns, especially for residential property owners. Assessing the effectiveness of various marketing strategies is worthy of further attention. Stormwater utilities, however, must balance adoption of numerous small-scale residential projects against the administrative cost to process, oversee, and monitor these practices.

Another financial issue involves administrative costs. The cost to obtain information and apply for stormwater incentive programs can also affect adoption. About 70% of stormwater utilities in the Chesapeake Bay region publish credit or rebate application forms online. Of those utilities publishing application forms online, significant variation was observed in the complexity of the application. Because the design of many larger scale stormwater BMPs can be complex, application processes may need to reflect that complexity. If a stormwater utility wishes to encourage the implementation of residential adoption, however, such complexity may present a significant barrier to adoption, as application forms can appear daunting to the average resident. A few stormwater utilities have simplified application procedures for residential properties. Baltimore City, for example, offers simple processes for residents (single-family dwelling) to follow to receive stormwater fee credits. Residents fill out a simple two-page form and can earn fixed dollar reductions on their stormwater fee for installing rain gardens, rain barrels, or tree planting; no complex designs are required. Residents can even receive credit for donating time (a minimum of eight hours) for community stream cleanups or tree plantings.

Innovative Stormwater Incentive Programs

Given the cost and incentives described above, encouraging widespread voluntary adoption of stormwater control practices will continue to be challenging. Voluntary adoption of practices by commercial/industrial property owners may be particularly difficult. Yet, participation by property owners managing large parcels may be critical to making significant water quality improvements and reducing per-unit treatment costs. In many localities, the distribution of ownership of impervious surface may be spread unevenly among property owners. For instance, in one Virginia locality, nearly 30% of the impervious surface is located on just 0.2% of the parcels.[3] Although evidence is limited, designing and implementing retrofits on larger properties may also be less costly on a per-acre basis (economies of scale).

Cost-effective targeting and market-based incentives could be used to reach more privately managed impervious acres. Targeting involves the identification, either by planning or incentive design, of high-impact or low-cost opportunities. Lancaster County, Pennsylvania recently created the "Early Adopter's Program," a targeted cost-share funded by a local-government grant. The stormwater department targets private properties with high impervious surface as the best candidates for BMP installation. The grant funding covers 100% of the design costs and 90% of the installation fees for BMPs, leaving the property owners responsible for merely 10% of the construction costs after joining the cost-share program. Since its creation one year ago, Lancaster's Early Adopter's Program has successfully installed 50 stormwater BMPs on private properties and aims to expand the targeting process in the coming years.

[3] *Marcus Aguilar, Department of Civil and Environmental Engineering, Virginia Tech, personal communication with author. September 12, 2016.*

Market-like incentive programs offer other opportunities and differ from conventional cost-share in several fundamental ways. Market-like incentive programs generally compensate participants on the quantity of service provided (in the case of stormwater, volume of water retained, or quantity of pollutants reduced) through a competitive process. Such designs create profit opportunities for participants to search for and identify effective, low-cost stormwater control opportunities. A competitive process helps to lower the price of obtaining that service.

In principle, such programs can take a number of forms. For instance, market-like principles could be used as an alternative or complement for allocating funds to encourage adoption (Cutter et al. 2008). Rather than paying cost-share for specific practices, a stormwater utility could develop a competitive bid process for stormwater services. The utility could pay low-cost bidders a per-unit payment on the amount of service provided. Private owners and stormwater design and construction firms can submit bids that fully reimburse for the costs to install the control measures. Recently Durham, North Carolina, experimented with a bidding procedure to solicit residential property owners' participation to install rain garden, cisterns, and downspout disconnects (City of Durham, North Carolina 2015).

Stormwater credit trading programs may also introduce voluntary adoption incentives. Washington, D.C., initiated a stormwater retention credit trading program in 2014 for commercial properties. New development requirements increased the on-site stormwater retention requirements. The trading program provides developers with the option to comply with a portion of these requirements by purchasing stormwater retention credits provided off-site by a third party. Stormwater retention credits can be bought and sold. Credit providers can generate credits through retrofits of existing development. Although demand for credits is currently evolving, early results suggest that developers are actively generating surplus retention on-site, effectively stimulating the generation of additional stormwater retention (District of Columbia Department of Energy and Environment n.d.).

Prince George's County, Maryland, has a unique public-private partnership to encourage adoption of stormwater controls. The county has formed a partnership with Corvias Solutions with the goal of retrofitting 15,000 acres of pavement and buildings. A private partner managing all installation and maintenance of stormwater controls helps to reduce costs by expediting the design and approval process. Incentives exist to meet retrofit goals at low costs. Currently, this effort focuses primarily on retrofitting public land (and nonprofits in the future) (Day 2016). Future partnerships, however, may be modified to include the retrofit of private properties.

Conclusions

Private landowners will likely voluntarily install stormwater control measures on their properties if (1) they are intrinsically motivated to reduce the volume of stormwater runoff polluting the Chesapeake Bay and/or (2) ample incentives exist to offset the costs of BMP installation. Under the current fee credit systems, the costs of installing new BMPs on private properties generally outweigh the benefit of a reduced stormwater utility fee. Additional cost-share for BMP installation does not cover the difference. Unfortunately, this analysis cannot provide a clear, single solution to encourage commercial properties to participate in these programs and install new stormwater BMPs; however, new innovative programs described in the previous section may be part of the solution. More localities should follow in the innovative footsteps of Lancaster County, Prince George's County, and Washington, D.C. to create additional incentive programs within their localities. If the reward is higher than the cost, private landowners are more likely to choose to adopt these stormwater controls. For residential property owners, more research is needed to investigate how marketing campaigns, neighborhood activities/associations, and modest financial assistance can stimulate adoption behaviors.

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