Measuring the Success of Stormwater Credit Programs through the Implementation of Credit Utilization Ratios

Conan Brooks

2010 Capstone Project

Table of Contents

Executive Summary

Credit programs can serve different purposes, including encouraging stormwater customers to pay for and maintain Best Management Practices (BMPs) on their property when doing so will provide a financial advantage. Assuming this reduced cost of the BMP will also lower costs for the utility while improving urban water quality, credit utilization can be used to show that a credit program is a successful at lowering the cost of pollution abatement. Evaluating different credit programs might be possible through the use of ratios, or a combination of ratios, in order to compare a credit program's utilization to other utilities. Policy makers, then, may be able to use this tool as a way to find which credit programs are successful and worth imitating.

This paper evaluates using stormwater credit programs using two ratios using information collected in a survey of 12 different stormwater utilities. The ratios are looked at for analyzing which credit programs are more successful following set assumptions. Next, the ratios are used in a regression analysis to examine their relationship with amount of fees.

The credit ratios have the advantage of measuring utilization compared to other utilities despite the fact that these programs are different in population size and geography. This

paper reports findings about the utilization and then provides recommendations for increasing utilization.

Introduction

In 2008, Lexington, Kentucky, entered into a consent decree with the Environmental Protection Agency (EPA) because of noncompliance with the National Pollutant Discharge Elimination System (NPDES). (Lexington Consent Decree 2008) The NPDES is a program that requires permits for municipal stormwater discharges. In addition the NPDES program also requires implementation of structural Best Management Practices (BMPs) for managing stormwater as well as program components such as education and other programs that also help mitigate water pollution. (EPA 2008) Currently Lexington is forming a comprehensive plan for dealing with stormwater, including how to pay for components of its stormwater program and how to improve its urban stormwater quality.

The subsequent fine the EPA imposed on Lexington has most likely given the city the political capacity for the creation of the Water Quality Management Fee, a stormwater fee to be paid by all property owners of developed land in the county in Fayette County. (Lexington-Fayette Urban County Government, or LFUCG, is a combined city-county government body) This fee will be used to finance stormwater projects, administration, engineering, and other aspects of stormwater management. Like many other stormwater utility fees, this fee is based on impervious area of property owners. (Black and Veatch)

A 2008 survey from Western Kentucky University found 448 stormwater utilities whose stormwater fee is based on Equivalent Residential Units (ERUs) or units of impervious surface area. (Campbell 2008) This setup is similar to Lexington's fee. These fees impose financial costs on residents, businesses, and institutions in the applied areas in order to pay for the burden they place on the storm sewer system. Some of the stormwater utilities also offer a credit program or a way for payers of the fee, or customers, to reduce their financial burden from the fee.

As part of the new Water Quality Management Fee, Lexington has decided to not to implement a credit program. Instead, it will offer a grant or incentive program in order to try to, according to city officials,more directly give money where it is needed. As part of this decision, the city officials said that that credit systems had low participation rates, and therefore, they were not ideal. (Gorton 2009) A relevant question is what credit programs have higher participation rates. This study will use credit utilization ratios to measure performance of stormwater credit programs and will attempt to identify characteristics that increase utilization.

Stormwater Runoff

Impaired urban surface runoff continually tests positive for suspended solids, bio-chemical oxygen demand, nitrogen, phosphorus, coliforms, chlorides, oil and grease, heavy metals, pesticides, and potentially other toxins. In fact urban surface runoff often contains more suspended solids, chlorides, heavy metals, and pesticides than raw

domestic sewage does. (EPA 1999) Sources of these pollutants include oil from cars, washing cars on streets, lawn fertilizers, and other chemical applications. This runoff is often referred to as stormwater runoff because it is rain or snowmelt that pushes pollutants into bodies of water (EPA 1999).

This paper will not go into the technical side of removing pollutants from stormwater or their environmental impacts. Instead, this paper will focus on the administrative management side of operating stormwater utilities and the use of credit programs. However, it is necessary to understand some basics when considering stormwater pollution in order to apply administrative programs.

The purpose of implementing stormwater pollution control or prevention is to stop degradation of stormwater runoff into receiving bodies of water. The most common tool to improve the quality of urban streams and meet the NPDES permit requirements is the implementation of BMPs. (EPA 1998) Common structural BMPs include detention and retention basins and ponds, filtration systems, wetlands, and swales. Common non-structural practices include hazard disposal, lawn debris and chemical management, education programs and low-impact development (LID). (Strassler 1999) all of these BMPs have been shown to reduce water pollution and improve urban water quality

Many of the structural BMPs address stormwater quantity, or peak flow that runs off property and into sewers or streams. By reducing runoff quantity, utilities can greatly reduce the need for sewer infrastructure and reduce water pollution. Many of the credit

programs involve on-site implementation of BMPs such as detention ponds. (Black and Veatch 2007) The other way of reducing water pollution is to improve stormwater quality. By not allowing water to wash pollutants off impervious surfaces and into streams pollution can be prevented. Managing quality may require removing pollutants before or after storm events. Examples of quality improvements may include street sweeping, reduction in fertilizers, and cleaning of pet waste. Cost-benefit and effectiveness analyses are available to different levels in many of these BMPs. (EPA 1999)

Stormwater Fees

As stated above, many municipalities finance their stormwater utilities by implementing a stormwater fee based on ERUs of impervious area. Impervious area is defined as developed land that does not allow water to percolate or absorb through, but instead, allows water to rush off the surface. Funding stormwater utilities based on ERUs of impervious surfaces has advantages over funding from a municipality's general funds, which are generally funded through property or income taxes. Firstly, because impervious surface is correlated to poor water quality, this fee structure appears to follow the popular "polluter pays" principal. Secondly, this method gives a dedicated revenue source to pay for the stormwater utility. However, this fee structure still needs to consider sufficiency, flexibility, balance of rates and level of service, legality, and equity. (Gilson 2008)

Because many stormwater utilities' funding are classified as fees and not taxes, the fees must meet state laws that define what constitutes a fee. Most notably, fees must be voluntary and exchanged for a service (stormwater management). (Doll and Scodari 1998) That is important when considering including a credit program because it may have an advantage legally, equitably, or even politically. (Clarkson 2003) Further, credit programs have the opportunity to provide a mechanism to incorporate incentives for onsite stormwater management and thus negate the fee. (Doll and Scodari 1998)

Credit Programs

Credit programs may exist for several reasons. The main objectives of credit programs are to incentivize property owners to engage in practices that improve environmental quality. However, they can also possibly be legal or political. Since fees but must be voluntary, customers must be able to avoid the fee by either not using the service or participating in a credit program. Also, new fees must often be voted on by government, so credit programs are a way of decreasing political opposition. However, when property owners install or implement and maintain BMPs on their own property, they are potentially lowering the cost normally paid by the utility. Therefore, a well utilized credit program can have a potentially large impact on a stormwater utility. Despite this, credit programs have rarely impeded revenues, often accounting for only two to five percent of revenue (Reese 2007).

These impact based credits elicit a number of questions including how to define a standard against which the system is judged, how to define the impacts a property has on stormwater systems, how to measure reduction in these impacts and associated reduction in costs of services, how to assign costs of service to the impacts, and how much of the fee to make subject to crediting. (Reese 2007) How stormwater programs answer these questions is what makes every stormwater credit program unique. Indeed, not many administrators have followed a cookie-cutter approach. Because every stormwater program is unique, this often makes comparing them difficult.

From the stormwater utility viewpoint, having privately financed, constructed, and maintained on-site detention or retention theoretically reduces costs of a stormwater utility. However, actual cost savings are difficult to determine, and therefore, rules of thumb can used. (Reese 2007) In order to estimate cost savings, costs of running stormwater programs both per acre for capital and program administration (fixed) costs must be calculated. Once this is done, the stormwater utility can decide what level of credit should be available.

From the perspective of the customer, having the credit option should create flexibility to choose the least costly alternative between providing an on-site BMP or paying the city for its stormwater service, and thus improve efficiency. (Doll and Scodari 1998) Equally important is the desire for the community to avoid as much deadweight loss as possible from the imposed fee. Because prices for living and operating businesses most certainly go up in the area with a stormwater utility fee, it can be theorized that people will

consume less and create a loss of investment. Therefore, stormwater utilities must keep the fees as low as possible while still meeting the requirements of the NPDES program.

Still, many utilities have decided not to include a credit program. A survey of stormwater utilities with fees found only 46% of 71 respondents offered credits for private detention/retention facilities (Black and Veatch). One reason might be because of apparent lack of utilization and difficulties in incentivizing behavior. Minneapolis and Portland offer credits for green roofs to help reduce this barrier to entry and encourage more home owners to invest in these structures. However, these programs have had limited success in green roof construction in those cites due to low net present value of the structures. (Carter and Fowler 2008)

Previous Credit Survey

Below is a table from a previous survey of credit programs conducted by Amy Doll and Paul Scodari in 1998. As you can see from the chart, three of the nine credit programs have received few or no applications for the credits. This is one way of showing credit program's utilization. Also in the survey results, we see that all the programs are solely or partially based off of water runoff quantity. Credit programs do vary by total credit possible and credit eligibility (i.e. non-residents vs residents). In comparing these programs, Amy Doll and Paul Scodari use a case study methodology to examine the programs in their paper.

Figure 1: 1998 Doll and Scodari Survey

Utility	Eligible Users	Basis for Credit	Design Storm	Maximum Credit	Typical Credit
Gainesville, FL	Nonresidential	Volume of onsite	25-year, 24-hour storm	100% of base fee	15-35%
Orlando, FL	Commercial and multi-family residential	Onsite retention or detention	NA	42%	42%
Wichita, KS	Properties ≥ 50 ERUs	Two credits: volume of detention or retention	1) 100-year storm 2) Complete retention	1) 40% 2) 80%	Currently no applications
Louisville-Jefferson County, KY	Commercial properties	Onsite detention of peak flows	2-year, 10-year, 100-year storms; pre-development runoff	82%	Varies with degree of control
St. Paul, MN	Nonresidential properties	Onsite detention of peak flows; acreage, peak flows	5-year, 100-year storms; release limited to 1.64 cfs/acre	10% (5-year storm) 25% (100-year storm)	Varies with degree of control
Charlotte, NC	Commercial, industrial, institutional, multi-family residential; homeowner association	1) peak discharge 2) total runoff volume 3)annual pollutant loading reduction	1) 10-year, 6-hour 2) 2-year, 6-hour 3) reduction in loading	1) 50% 2) 25% 3) 25% Up to 100%	Varies with degree of control
Durham, NC	Nonresidential properties	Pollution credits for Water quality and quantity controls	State standards for facility design; esti-mated pollutant removal efficiency	25%	Few applications
Cincinnati, OH	Commercial properties	Onsite retention	Limit discharge to pre-development runoff	50%	Credit never used
Tulsa, OK	Privately maintained facilities	50% greater detention; maintenance costs of onsite facilities		60%	Varies
Austin, TX	Commercial properties	Onsite detention, inspection		50%	50%
Bellevue, WA	All properties	Onsite detention; intensity of development		Reduction of one rate (intensity of development) class	Varies
King County, WA	Commercial properties	Private maintenance		Reduction of one rate class	Varies
Indianapolis, IN	Nonresidential properties	Discharge to specified streams; onsite retention or detention watershed size	Tier Two:2-, 10-, 25-, 50-, 100-year events	Tier One: 25%; ≤$50 Tier Two: 35%; <$250	(proposed)

Data Collection Methodology

For the purpose of examining credit utilization, data was gathered on stormwater utilities through a survey given to program administrators. Supporting data was gathered through examination of credit applications. Since these credit applications are typically found online, a Google search was used to find credit programs. All programs were given the

survey via email and contacted by phone as a follow up. Surveys were sent out by email in mid February 2010, and calls were made to non-responding utilities in early March.

The purpose of the survey was to gather information about credit programs typical organization, implementation, and utilization. Questions asked included how many credits were typically submitted annually, how many credit applications have been received, how many have been accepted over the life of the program, and who was most likely to apply for credits. Because city populations may not be a good way of comparing the scope of credit applications, utilities were asked to give the total number of customers billed, or how many different entities received the stormwater fee. Populations may not reflect the true size of the utility because customers are billed by property accounts and not based on people occupying property. The survey was sent to 28 stormwater utilities that had credit programs across the United States. Of the 28 utilities surveyed, 12 utilities fully responded (42%), another utility responded but used a different rate structure and so was omitted, and another partially responded.

Surveys were completed by: Flagstaff (AZ), Normal (IL), Charlotte (NC), Greensboro (NC), Rockdale Co (GA), Raleigh (NC), Jefferson (WI), High Point (NC), Sugar Hill (GA), and Memphis (TN), Jefferson Sanitation District (Louisville, KY), and Radcliff (KY).

Next, credit manuals were read for comparison. Credit manuals are guides published by the utilities to help credit applicants understand and implement projects that qualify for

credits. Understanding the application process may better explain barriers for customers to complete the credit requirements. Credit applications also often explain rational behind why certain programs or BMPs are credit worthy (as opposed to others that may not be deemed credit worthy). The credit applications vary in technical depth, length, and supporting materials required. A list of HTML addresses where the credit applications can be located can also be found in the appendix.

Table 1: Responding Utilities

Utility	State	Year Implemented	Population	ERU	Monthly Fee	Yearly Fee/1000SQFT
Charlotte	NC	1993	1,745,524	2,613	$5.51	$25.30
Flagstaff	AZ	2003	129,849	1,500	$1.22	$9.76
Normal	IL	2006	167,699	3,200	$4.60	$17.25
Greensboro	NC	1994	714,765	2,543	$2.70	$12.74
High Point	NC	1993	714,765	2,588	$2.00	$9.27
Memphis	TN	2006	1,304,926	3,147	$4.00	$15.25
Sugar Hill	GA	2009	17,204	1,000	$1.50	$18.00
Rockdale Co.	GA	2006	84,569	3,420	$3.39	$11.89
Jefferson	WI	2008	7,822	3,220	$3.33	$12.41
Raleigh	NC	2004	1,125,827	2,260	$4.00	$21.24
Radcliff	KY	2003	21,961	2800	$4.50	$19.29
Louisville	KY	1987	713,877	2,500	$3.31	$15.89

*http://www.census.gov/popest/metro/CBSA-est2009-annual.html, http://www.census.gov/popest/counties/CO-EST2009-01.html, *Bloomington and Normal ,IL were listed together, http://www.city-data.com/city/Sugar-Hill-Georgia.html, http://www.city-data.com/city/Jefferson-Wisconsin.html*

The table above shows background information on utilities that responded to the survey. *ERU* stands for amount of square footage in the utility's equivalent residential unit. For example, if a municipality had a 2,500sqft ERU, then for every 2,500sqft, the property owner should pay the amount of fee (if a property had 37,500sqft of impervious area, then they would have to pay 15 times the fee since 37,500/2,500 equals 15). Since each utility's ERU is different, the last column is the annual fee paid on every 1,000sqft of

impervious area. Also notice that two of the three largest utilities by population pay the highest fees.

Some of the administrators who returned the surveys reported estimates of rather than technically correct figures. These cases were identified as best as possible in the responses in the appendix. Not having precise data makes actual rankings or comparisons difficult. The information in this report is intended for conveying the idea of ratios only, not for judging credit programs.

Analyzing Credit Utilization through Ratios

Assuming that credit programs have a positive effect for both utilities and customers by decreasing costs and that implemented BMPs will have a positive environmental impact; credit utilization can be measured to determine the effectiveness of the program. Knowing which credit programs are well-utilized can give program administrators a head start in knowing which credit programs might be worth modeling. This measure does have the limitation of revenue lost by awarding credits.

To help answer the question which programs are more utilized than others, a ratio may be used to give each utility a score. These scores can be used to help rank and compare utilities. One possible ratio would be to compare the amount of credit applications received to possible applicants, or total number of stormwater customers. Credit applications can be indicative of utilization since more applications give more possibilities for the utility to accept projects that meet its goals. For simplicity in this

ratio, an assumption will be made that all billed parcels (customers) could be eligible for credits. This will show how effective the program is at potentially reducing costs for residents and or businesses. Another potential ratio that can be used is the number of credits accepted over the lifetime of the credit program divided by the number of billed parcels. This will show how utilized the credit program has been over the duration of the program, rather than on a year to year basis. These ratios could be used to "score" the success of a credit program's use when comparing different and diverse programs. On both ratios a higher score indicates a higher utilization of the utility's credit program. Therefore, utilities should strive for a higher ratio (assuming no detrimental effects on needed revenue).

Equation 1: Credits Applied Ratio

$$\frac{\text{Average Annual Number of Applications}}{\text{Stormwater Customers}} = \text{Credits Applied Ratio}$$

Equation 2: Lifetime Credit Usage Ratio

$$\frac{\text{Total Credits Approved}}{\text{Stormwater Customers}} = \text{Credits Applied Ratio}$$

Table 2: Utility Ratios

Charlotte	NC	$25.30	240,000	17	200	0.0708	0.08333
Flagstaff	AZ	$9.76	19000	1	436	0.0526	2.29474
Normal	IL	$17.25	14,000	4	4*	0.2857	0.02857
Greensboro	SC	$12.74	76,398	<5	54	0.0654	0.07068
Memphis	TN	$15.25	280,000	2.5	10	0.0089	0.00357
Sugar Hill	GA	$18.00	5,900	12	9	2.0339	0.15254
Jefferson	WI	$12.41	2,884	0	0	0.0000	0.00000
Raleigh	NC	$21.24	123,011	1	3	0.0081	0.00244
Radcliff	KY	$19.29	6,600	1	1	0.1515	0.01515
Louisville	KY	$15.89	214,000	10	130	0.0467	0.06075
High Point	NC	$9.27	27000	1	3	0.0370	0.01111
Rockdale Co.	GA	$11.89	27,000	150	~800	5.5556	2.96296
					*assumes all credits awarded		

Note: Ratios were multiplied by 100 and 1,000 respectively in order to improve readability of the number
Total Credits awarded is over the lifetime of the credit program

Credits Applied Ratio

As can be seen in Table 2, Rockdale County stands as an outlier in their ratio, scoring significantly higher than other utilities surveyed. It is interesting to note that second to Rockdale County is Sugar Hill, another Georgia utility. It may be worth looking into if they both have something in common that increases utilization. Normal's credit program also scored well compared to the remaining utilities. Aside from Rockdale County. and Sugar Hill, the rest of the utilities scored somewhat closer together. We can see which utilities achieved greater utilization then others as interpreted by the ratio

The ratio does not account for Rockdale County's credit system allows residents to apply for multiple credits. Some households or property owners are reported to apply for two credits apiece. This would naturally skew the ratio higher. Like Rockdale County, Flagstaff (AZ) allows residents to apply for credits, and this is most likely reflected in the

other ratio. However, Rockdale County achieved a much higher ratio due to sustained higher reported credit applications. This would be another topic to look into.

Because some utilities such as Rockdale County will receive a large amount of credit applications the utility should also designate a "saturation point" of where there a too few customers eligible for the credit to make the ratio valid. This may mean that utilities should set a long term "saturation" target for credit applications. When enough people have applied for or have been approved for credits, then the utility should re-evaluate and set new goals. For understanding where the saturation point is with credits, the Lifetime Credit Usage Ratio might be used for knowing when that point is reached.

Lifetime Credit Usage Ratio

The second ratio, Lifetime Credit Usage Ratio, would be more indicative of long-term success of the program, but would disregard fluctuations of utilization or non-utilization. Even though this ratio does not account how many years the programs have been in existence, it can be assumed that the number of billable parcels will grow at a rate that is both slow and measurable.

From the second ratio results, Rockdale County and Flagstaff serve as outliers, with the other utilities not changing ranks by much. A likely explanation for this is that both Flagstaff and Rockdale County have indicated that residents are likely to apply for credits. Since these utilities have found a way to successfully have residents utilize a

credit program, their ratios are much higher. This also shows that allowing more customers to qualify for credits can visibly increase the utilization of the credit program

The utility program in Flagstaff works on a tier-system, in which residents' fees are based on property size broken into tiers. This credit program allows residents to reduce the tier that their property is classified by one. Rockdale County operates a credit for low impact parcels, allowing residents with less-developed properties to easily qualify for credit. Both of these systems reduce, but do not eliminate, the fee the property owners pay, and both of these programs reward good design practices or BMPs. These credit systems allow for more access to stormwater credits to customers.

Regression Analysis

Assuming credit programs are operating similarly, a regression analysis can be done for utilization. Using the yearly fee per 1,000sqft as a dependent variable, and testing for utilization using the credit applied ratio we would expect to find that as the fees increase, utilization also increases.

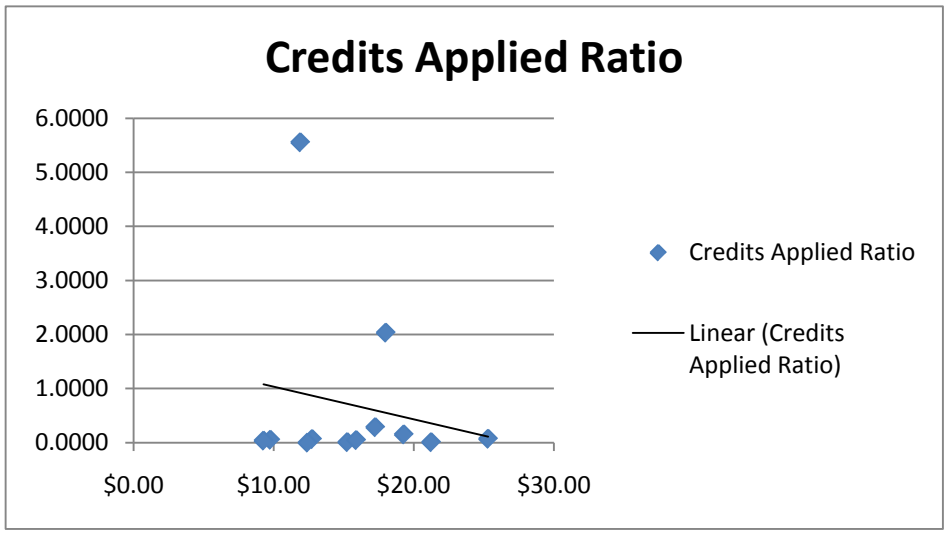
SUMMARY OUTPUT- Credits Applied Ratio

Regression Statistics	
Multiple R	0.178
R Square	0.032
Adjusted R Square	-0.065
Standard Error	1.686
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.9349	0.9349	0.3289	0.5790
Residual	10	28.4229	2.8423		
Total	11	29.3577			

	Coeff.	*S.E.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.6443	1.7287	0.9512	0.3639	-2.2074	5.4961
X Variable 1	-0.0606	0.1057	-0.5735	0.5790	-0.2962	0.1749



There is a negative coefficient regarding fee amount and credit applications submitted. The negative coefficient is accounted for because of Rockdale County's reported success with credit applications and their relatively low fee. Without Rockdale County, the coefficient is positive and the expected correlation can be seen (higher fees mean higher credit utilization). Neither of the analyses proved to be statistically significant.

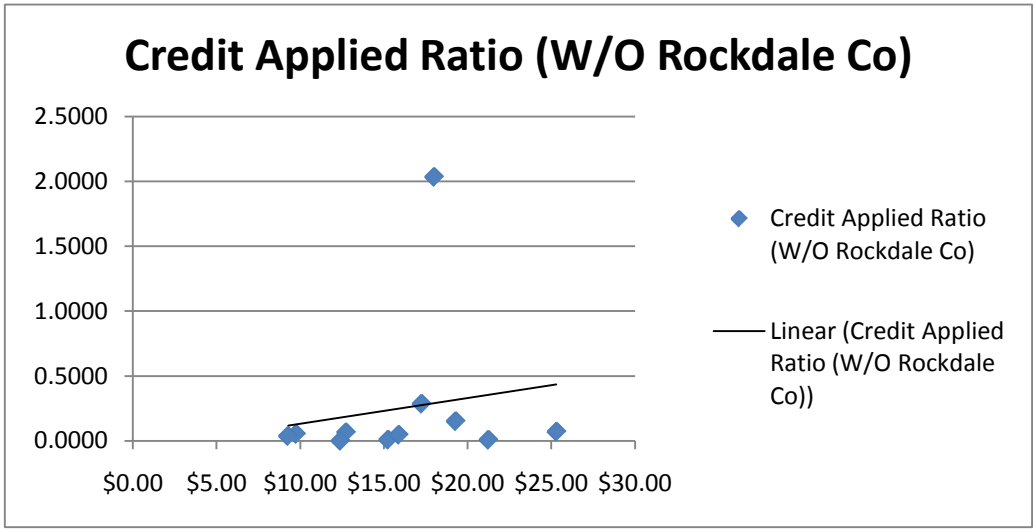
SUMMARY OUTPUT- Credits Applied Ratio Without Rockdale County

Regression Statistics	
Multiple R	0.1619
R Square	0.0262
Adj. R Square	-0.0820
Standard Error	0.6210
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Sign. F*
Regression	1	0.0934	0.0934	0.2421	0.6345
Residual	9	3.4708	0.3856		
Total	10	3.5642			

	Coefficients	*S.E.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.0662	0.6713	-0.0987	0.9236	-1.5849	1.4524
X Variable 1	0.0198	0.0402	0.4921	0.6345	-0.0712	0.1107



With the use of the ratio scores, other variables may be used to test for credit utilization. These may include, city programs implemented, geographical features, population characteristics, and others.

Conclusion

Ratios are not only helpful in showing the utilization of individual stormwater credit programs but are useful in comparing that utilization with similar utilities for purposes of statistical analysis. Also, credit ratios are important in measuring the success of credit programs in that the credit ratios provide a tool to determine whether or not a stormwater credit program actually incentivizes the behavior of customers and results in a reduction of costs on a stormwater management. The Credits Applied Ratio shows how much interest lies in a stormwater credit program from year to year while the Lifetime Credit Ratio shows utilization over the duration of the program. New and better ratios can be developed and better systems of tracking information can be used to ensure the integrity of the data supporting the ratios.

The advantage of utilizing credit ratios as a way to measure the success of a stormwater credit program is that the credit ratios normalize usage of credit programs across different utilities by providing a uniform standard. Using credit ratios to score utilities provides an effective way to determine which stormwater credit programs possess higher utilization and by what relative amount over other utilities.

The use of one ratio or only ratios without first understanding what is being compared is probably not recommended. Particularly important will be the understanding of what the ratio actually means when taking other figures into account such as revenue generated, population served, desired BMPs implemented, and goals of the credit program.

Lastly, credit utilization can be used to measure the amount of behavior changed or incentivized in quantifiable BMPs. However, when a customer reduces impervious area (i.e. replaces a parking lot with porous asphalt) they will have made a positive contribution to stormwater management in a way that is not quantified by measuring credit usage. Utilities should consider tracking these actions as well for purposes of measuring success in incentivizing behavior.

Other interesting Findings

- Credit programs can be wide ranging and tailored to help with certain problems. For instance, the city of Sugar Hill (GA) has identified septic tanks as a problem to address, and thus have offered residents a 40% credit for having their septic tank pumped every five years (defined as normal maintenance). This is also interesting because septic tanks are not specifically mentioned in NPDES guidelines. (EPA 2008)

- Eight of twelve utilities reported having five or less applications for credits each year.

- Although municipalities have tailored their credit systems for their jurisdictions, there are cases of similarities. Peachtree city, GA, Snellville, GA Sugar Hill, GA, have credit manuals that is extremely similar in wording, structure, and even share formatting style. However, they do differ with credit options are requisites.

- All credit programs come with barriers of entry. Some programs come with more than others. All credit programs found except Indianapolis' proposed program require engineers to certify that BMPs exist and will function accordingly. The cost of contracting with an engineer, and possibly yearly, serves as a barrier to entry that increases pay-back time.

- Another cost is to have an application fee that customers must pay in order to apply for credit. Jefferson (WI), Indianapolis (IN), Normal (IL), and Bloomington (IN) all have application fees that accompany their applications.

- None of the credit programs surveyed said they contracted out any part of their service to reduce costs.

- Raleigh (NC) had the highest estimate of credit program costs with under $10,000. Flagstaff (AZ) reported a one-time cost ($2,500). The rest of the utilities reported minimal or significantly less

- Five of twelve utilities reported having done a cost-benefit analysis for running their credit programs. This may signify that many utilities believe that the cost of running a program is low or that the credit programs were likely a result of political or legal forces.

Recommendations for maximizing Credit Program Utilization

1) Stormwater utilities should keep barriers and costs of entry into credit programs low. Costs of entry include application fees and costs associated with engineering approval for BMPs.

2) Nominal costs of on-site BMPs (and maintenance) may increase over time for customers where nominal rates of most stormwater fees will decrease. (assuming fees do not increase in yearly increments) Considerations for present value of BMPs required for credit projects should be included. Achieving this may be done by raising the maximum credit possible.

3) Expanding credit eligible projects and customers will likely see and increase in credit utilization.

Works Cited

Black and Veatch. “2007 Stormwater Utility Survey.” 2007. Feb. 10, 2010. <http://www.bv.com/Downloads/Resources/Brochures/rsrc_EMS_2007 StormwaterUtilitySurvey.pdf>.

Campbell, C. Warren. “Western Kentucky University Stormwater Utility Survey 2008.” May 2008. Western Kentucky University. Feb. 10, 2010. <http://www.wku.edu/ swusurvey/SWU%20Survey%202008.pdf>.

Carter, Timothy and Laurie Fowler. “Establishing Green Roof Infrastructure through Environmental Policy Instruments.” *Environmental Management* 42.1 (2008): 151-164. Feb. 10, 2010. <http://www.springerlink.com/content/y675j67632070632/fulltext.pdf>.

Clarkson, Harold E. “Creating a Stormwater Utility with Near-Zero Opposition.” *Stormwater* 4 (2003): 62-69.

Doll, Amy and Pual Scodari. “Credits as Economic Incentives for On-Site Stormwater Management: Issues and Examples.” EPA National Conference on Retrofit Opportunities for Water Resource Protection in Urban Environments. Chicago, Illinois. February 9-12, 1998. Feb. 10, 2010. <http://stormwaterfinance.urbancenter.iupui.edu/PDFs/ DollScodari.pdf>.

“Evaluating the Effectiveness of Municipal Stormwater Programs.” Environmental Protection Agency. January 2008. February 10, 2010 <http://www.epa.gov/npdes/pubs/ region3_factsheet_swmp.pdf>.

Gilson, Susan. “Guidance for Municipal Stormwater Funding.” National Association of Flood and Stormwater Management Agencies. Jan. 2008: ES-1-ES-3. <http://www. nafsma.org/Guidance%20Manual%20Version%202X.pdf>.

Gorton, Linda. Lexington-Fayette Urban County Government Task Force Report to Council. April 16, 2009: FAQ-2. Feb 10, 2010. <http://www.lexingtonky.gov/index. aspx?page=1963>.

Keller, Brant. “What's Stormwater Funding?” *Stormwater* 2 (2002): 38-42.

Pelley, J. 1997. “The Economics of Urban Sprawl.” *Watershed Protection Techniques* 2(4):461-467.

Reese, Andrew. “Stormwater Utility User Fee Credits.” *Stormwater* 7 (2007). Feb. 10, 2010. <http://www.psparchives.com/publications/our_work/stormwater/lid/

2009_Local_Assitance/005_Appendices/Stormwater%20Utility%20User%20Fee%20Credits%20article.pdf>.

Science Applications International Corporation. "Economic Analysis of the Final Phase II Storm Water Rule." Environmental Protection Agency. 2009: ES 1. February, 10, 2010. <.http://cfpub.epa.gov/npdes/docs.cfm?program_id=4&view=allnpdes &sort=name&amount=all>.

Strassler, Eric, J.Pitts, and K.Strellec. "Preliminary Data Summary of Urban Stormwater Management Practices." Environmental Protection Agency. 2007. February 10, 2010. <http://www.epa.gov/guide/stormwater/files/usw_a.pdf >.

United States of America and the Commonwealth of Kentucky v. Lexington-Fayette Urban County Government, No. 06-386-KSF, 2007 WL 2020246 (E.D. K.Y. July 6, 2007).

Responses to Stormwater Credit Survey

Utility	State	Population	ERU	Monthly Fee	Annual Fee/1000SQFT	Parcels Billed (Customers)	Avg. Credits Applied for Annually	Total Credits awarded	Credits Applied Ratio (x 1000)	Lifetime Credit Usage Ratio (x100)
Charlotte	NC	1,745,524	2,613	$5.51	$25.30	240,000	17	200	0.0708	0.08333
Flagstaff	AZ	129,849	1,500	$1.22	$9.76	19000	1	436	0.0526	2.29474
Normal	IL	167,699	3,200	$4.60	$17.25	14,000	4	4*	0.2857	0.02857
Greensboro	NC	714,765	2,543	$2.70	$12.74	76,398	<5	54	0.0654	0.07068
Memphis	TN	1,304,926	3,147	$4.00	$15.25	280,000	2.5	10	0.0089	0.00357
Sugar Hill	GA	17,204	1,000	$1.50	$18.00	5,900	12	9	2.0339	0.15254
Jefferson	WI	7,822	3,220	$3.33	$12.41	2,884	0	0	0.0000	0.00000
Raleigh	NC	1,125,827	2,260	$4.00	$21.24	123,011	1	3	0.0081	0.00244
Radcliff	KY	21,961	2800	$4.50	$19.29	6,600	1	1	0.1515	0.01515
Louisville	KY	713,877	2,500	$3.31	$15.89	214,000	10	130	0.0467	0.06075
High Point	NC	714,765	2,588	$2.00	$9.27	27000	1	3	0.0370	0.01111
Rockdale Co.	GA	84,569	3,420	$3.39	$11.89	27,000	150	~800	5.5556	2.96296

Annual fee/1000sqft calculated by monthly fee/1000 x 12
*Total credits awarded assumed to equal total credits applied for

population from CBSA EST-2009; US CENSUS BUREAU
http://www.census.gov/popest/metro/CBSA-est2009-annual.html
http://www.census.gov/popest/counties/CO-EST2009-01.html
*Bloomington, IN and Normal, IL were listed together
http://www.city-data.com/city/Sugar-Hill-Georgia.html
http://www.city-data.com/city/Jefferson-Wisconsin.html

Responses to Stormwater Credit Survey

City	State	Average Annual Number of Credits Applied For	Who is most likely to apply for credits	Total number of credits applied For	Total Credits awarded	Cost/Benefits of Credit Program Considered	Monetary Amount of Credits Awarded	Expenditures towards credit programs
Charlotte	NC	17	commercial	200	200	no	not given	not sure
Flagstaff	AZ	1	Residential	442	436	yes	$8,424.00	$2,500 (one time)
Normal	IL	4	Commercial/Industrial	12	not given	not given	not given	not given
Greensboro	NC	<5	commercial/multi-family/3rd parties	unknown	54	yes	$143,993.66	employee time
High Point	NC	<1	commercial	5	3	no	$3,048.96	minimal
Memphis	TN	2.5	non-residential	10	10	yes	not given	not given
Sugar Hill	GA	12	Residential/schools	about 15	9	yes	$6,761.20	<$500
Rockdale Co.	GA	250	Residential/Commercial	~1000	~800	no	not given	$350.00
Jefferson	WI	0	nobody has applied	0	0	no	$0.00	$0.00
Raleigh	NC	1	government	6	3	yes	$350,000.00	<$10,000
Radcliff	KY	1	schools	2	1	no	$545	0
Louisville	KY	10	commercial	200	130	not given	not given	not given

Responses to Stormwater Credit Survey

Utility	State	Year Program Implemented	Has the Program Been Altered	Impervious Surface Percentage Non-Residential	Percent of Fee Paid by NSFRP*	Maximum Credit Possible	Maximum Possible w/o Education Credit	Total Non-Educational Credits Awarded	Service Contracted Out
Charlotte	NC	1993	Yes	64%	70%	100%	100%	all	no
Flagstaff	AZ	2003	2005	65%	65%	68%	68%	$7,833.00	no
Normal	IL	2006	No	responded incorrectly	62%	50%	50%	not given	no
Greensboro	NC	1994	2004	79%	77%	55%	50%	$770.12	no
High Point	NC	1993	2004	not measured	12%	40%	40%	$3,048.96	no
Memphis	TN	2006	No	not measured	24%	50%	45%	not given	no
Sugar Hill	GA	2009	No	not measured	est. <40%	40%	40%	$151.20	no
Rockdale Co.	GA	2006	No	not measured	3%	50%	50%	not given	no
Jefferson	WI	2008	No	70%	70%	100%	100%	$0.00	no
Raleigh	NC	2004	Yes	66%	67%	up to 85% (otherwise 50%)	up to 85% (otherwise 50%)	$125,000.00	no
Radcliff	KY	2003	Yes	70%	30%	40%	25%	0	no
Louiseville	KY	1987	No	not given	not given	82%	82%	$0.00	no

*NSFRP- Non Single Family Residential Property

Service contracted out- was any part of the credit program contracted out

Characteristics of different Credit Programs

City	State	Year Started	Open To:	max credit Possible	storm event used	processing time	Application Fee	Annual Reapplication	Education Credit	Quantity Credit	Quality Credit
Bloomington	IN	2004		100%	100-year	60 days	100			100%	
Charlotte	NC	1994	non-residential	100%	2/10 year	not given	none	no	none	100%	0%
Connersville	IN	2007	only nonresidential	50%	none	30 days		no	none	45%	5%
Flagstaff	AZ	2003	both	68%	100-year	not given	none	no	20%	10%	50%
High Point	NC	1993	anyone, but designed for non-residential	40%	10-year	not given	none	no	none	20%	20%
Holly Springs	GA		residential and non residential	40%	25-year	30 days	none	1-3years	30%	10%	10%
Indianapolis	IN		nonresidential	90%	up to 100-year	60 days	50/250	no	none	85%	5%
Jefferson	WI	2008	both	multiple	10 and 100 year	30 days	100	no	none	50%	50%
Maryville	TN	2003	residential and non residential	50%	none	not given	none	no	20%		10%
Memphis/Shelby Co.	TN	2003	both	50%	none	60 days	none	yes	5%	25%	15%
Minneapolis	MN			100%	100year	not given	none	no		100%	50%
Nashville	TN	2009	non-residential	50%	none	not given	none	no	20%	20%	20%
Normal	IL	2006	both	50%	none	not given	50/200	no	separate	35%	10%
Raleigh	NC	2004	non-single family lots		up to 25 year	not given	none	yes	none	50%	none
Richmond	VA	2009	nonresidential	50%	no	60 days	none	yes	0%	20%	20%
Rockdale County	GA	2006	both	varies- has both year to year and reduction credits	up to 100-year	not given	none	1-3 years	50%	30%	10%
Snelleville	GA		residential and non residential	40%	none	not given	none	no	20%	30%	10%
Suffolk	VA	2005	non-residential	40%	none	30 days	none	yes	0%	20%	20%
Sugar Hill	GA	2009	everyone	40%	up to 100-year	30 days	none	1/3/5/10/permenent	40%		10%
Greensboro	SC	1994	non-residential	55%	none	45 days	none	no	5%	20%	30%
Columbia	SC				none						
Radcliff	KY		non-residential/non-agg	40%	up to 100-year			no	25%	25%	25%
Louisville	KY	1987	Commercial	82%					0		

Information Gathered from stormwater credit manuals found online

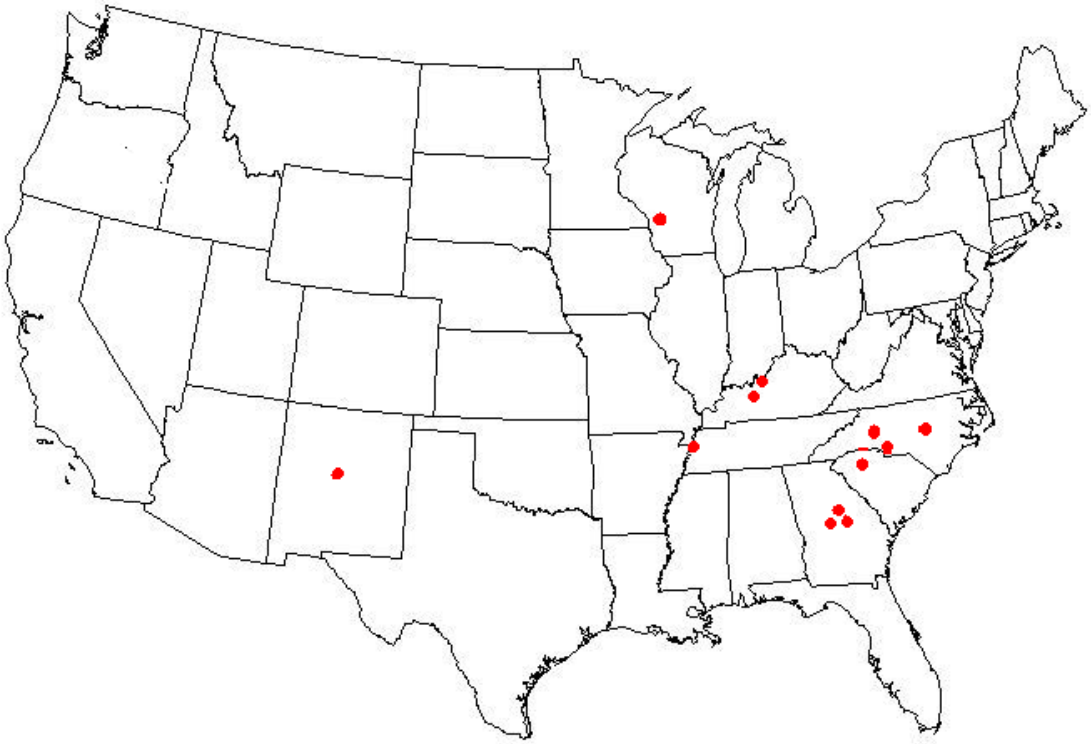
Max Credit Possible: Maximum allowable credit available under the program
Open To: Who is eligible to apply for credits
Storm Event Used: Storm events that retention BMPs should be designed for
Application on Fee: Amount customer must pay to apply for the credit
Education Credit: maximum credit available based on education
Quantity Credit: Credit based on structural BMP regarding quantity of runoff
Quality Credit: Credit regarding BMP for improving water quality

Copy of Stormwater Credit Program Survey

Location of Credit Manual Websites

City	State	Credit manual website
Bloomington	IN	http://www.cityblm.org/upload/images/eng/pdfs/Storm%20Water%20Credit%20Manual.pdf
Burlington	VT	http://www.dpw.ci.burlington.vt.us/docs/stormwater_credit_manual_051309.pdf
Charlotte	NC	http://www.charmeck.nc.us/Departments/StormWater/Contractors/Storm+Water+Design+Manual.htm
Connersville	IN	http://www.connersvilleutilities.com/cvilleSWU.pdf
Flagstaff	AZ	http://209.67.135.19/pdf/v1/credit_manual.pdf
High Point	NC	http://www.high-point.net/pubsrv/SWStormwaterFeeCreditManual.pdf
Holly Springs	GA	http://www.hollyspringsga.us/index.php?option=com_docman&task=doc_details&gid=144&Itemid=50
Indianapolis	IN	http://www.indygov.org/eGov/City/DPW/Environment/CleanStream/Solutions/Flooding/Documents/CreditManualRe
Jefferson	WI	http://www.jeffersonwis.com/Recreation%20&%20Parks/Public%20Works%20&%20Engineering/Stormwater%20C
Kinston	NC	http://www.ci.kinston.nc.us/publicservices/Kinston_StormwaterUtilityCreditApplication.pdf
Maryville	TN	http://www.ci.maryville.tn.us/Laurie/SW%20Credit%20Manual%20June%202005.pdf
Memphis/Shelby Co.	TN	http://www.cityofmemphis.org/pdf_forms/creditManualJan2006.pdf
Minneapolis	MN	http://www.ci.minneapolis.mn.us/stormwater/fee/stormwater_faq.asp
Nashville	TN	http://www.nashville.gov/water/cwip/docs/SWUserFeeCreditManual.pdf
Normal	IL	http://www.normal.org/Files/StormwaterCreditManual.pdf
Raleigh	NC	http://raleighnc.gov/portal/server.pt/gateway/PTARGS_0_2_125755_0_0_18/Stormwater_Credit_Manual.pdf
Richmond	VA	http://www.ci.richmond.va.us/dpu/documents/Stormwater_Credit_Manual_NonResidentialProperties.pdf
Rockdale County	GA	http://www.rockdalecounty.org/docs/SWManual2.pdf
Snelleville	GA	http://www.snellville.org/vertical/Sites/%7B2457B773-F66B-45E3-9E9F-57703865A8B2%7D/uploads/%7BE6FC11
Suffolk	VA	http://www.suffolk.va.us/pub_wks/docs/SW%20Utility%20NR-Credit%20Manual.pdf
Sugar Hill	GA	http://www.cityofsugarhill.com/filestorage/62/6025/SW_Credit_Manual_Updated_011410.pdf
Greensboro	SC	http://www.greensboro-nc.gov/NR/rdonlyres/E0AC56EE-0843-4D1B-8689-EA3752EBA3D9/0/CreditPolicy2005.pdf
Columbia	SC	http://www.columbiasc.net/downloads/engineering/Columbia_2003_Revised_Final_Credit_Manual.doc
Radcliff	KY	http://cityof.radcliff.org/pdf/stormwater/Final%20Storm%20Water%20Surcharge%20Credits%20Application.pdf
Peachtree	GA	http://www.peachtree-city.org/documents/Engineering/Stormwater/swcreditmanual.pdf
Louisville	KY	http://www.msdlouky.org/

Location of Credit Program Survey Responses



12 Utilities responded from seven states
28 surveys were surveyed. Non-responding utilities include:

Austin, TX
Bellevue, WA
Bloomington, IN
Burlington, VT
Columbia, SC
Connersville, IN
Gainesville, FL
Kinston, NC
Maryville, TN
Minneapolis, MN
Nashville, TN
Northern Kentucky (SD1), KY
Orlando, FL
Richmond, VA
Snellville, GA
Suffolk, VA