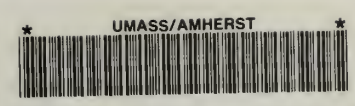

Cost Benefit Analysis

A REPORT ON THE COSTS AND BENEFITS OF DIFFERENT ASSSESSMENT/RATE SETTING APPROACHES TO STORMWATER MANAGEMENT IN CHICOPEE, MASSACHUSETTS

I. Purpose of Cost / Benefit Analysis

There is a wide range of methods that a stormwater utility can use to assess a fee on property owners for use of the stormwater system. In order to better understand why one method might work well for a given community it is important to compare the relative costs and benefits of a number of methods. The type of assessment method employed will affect the following aspects of the stormwater utility:

- cost to implement
- amount of money that can be raised
- ease (or lack thereof) to establish and administer the utility
- public perception of the fees
- ability of the stormwater utility to create incentives for the public to change behavior to help reduce runoff
- ability of the stormwater utility to weather political roadblocks

For the purposes of this project, 197 parcels in the city of Chicopee were analyzed to determine the different costs and benefits associated with four different assessment methods. The various costs and benefits of each assessment method are described based on the following four criteria:

Administrative Time / Resources—How much staff time, expertise and resources (specifically computer software and hardware) does the method require—for both start-up and the ongoing administration of the stormwater utility?

Equity—Do the stormwater fees reflect the actual impact each parcel has on stormwater runoff based on the area of impervious surface? If the bills reflect the actual area of impervious surface then a financial incentive is built into the utility structure for property owners to reduce their contribution to the stormwater management problem by either: a) reducing impervious surface or, b) creating on-site stormwater management systems.

Sustainability/Effectiveness—How well does each method meet the goals of the Stormwater Utility (management program), and what is the likelihood that the fee will be sustained over time by the community? In Chicopee the goals of the program are to provide: 1) capital for projects to correct Combined Sewer Overflows (CSOs), 2) revenue for the maintenance of the stormwater system, and 3) incentives for individual property owners to reduce stormwater runoff.

Political Expediency—What are the chances that the assessment method will be accepted by elected officials and residents?

II. Cost / Benefit Analysis of FourAssessment Methods

INTRODUCTION AND DESCRIPTION OF ASSESSMENT METHODS

A stormwater utility is based on the idea that property owners pay a "user fee" for using the municipal stormwater system. There are various assessment methods that can be used to measure how much each property contributes to the system and thus how much each property should be charged. For the purposes of this project, four assessment methods were chosen to be tested using a sample of properties in Chicopee, Massachusetts. Here is a brief description of each assessment method:

1) Modified Flat Fee

A flat fee is a stormwater utility charge that is the same for all property owners within a particular land use classification regardless of size or any other factor. Chicopee adopted a flat fee method in August of 1998. A flat fee of $40 per year is charged for all single family residences. All other properties pay a fee no less than $40 and no more than $400 based on the overall size of the property. This fee was established based on the fourth criteria mentioned above, political expediency. The fee will only generate an estimated $500,000 annually. The proposed stormwater management program for the city has an annual operating budget of either one or three million dollars, depending on how ambitious a program one chooses to adopt.

2) ERU

The "Equivalent Residential Unit" or ERU method uses a billing unit based on the average impervious surface for a residential parcel. The ERU is estimated by taking a random sampling of properties and finding the average impervious surface area for each property classification. For the sample tested in Chicopee the properties were divided into 4 types:

- Small Residential (1,2 & 3 Family houses, mobile home)
- Large Residential (condominiums, apartments, multiple housing on single parcel, group quarters, multi-use, child care)
- Industrial, Commercial, and Public Service
- Vacant and Limited Development (agricultural, forestry, recreational, vacant, open space)

3) Impervious Surface (Based on Assessor's Records)

This method uses assessor's records to estimate the impervious surface area on parcels based on building size and pavement areas. Chicopee's Assessor's records contain the square footage of all buildings but do not contain the square footage of all paved areas as pavement is not taxed on residential properties. The impervious surface area for each parcel is multiplied directly by a given rate to calculate the fee.

4) Impervious Surface (Based on Aerial Photos and GIS)

This method uses GIS (Geographic Information System) to combine parcel information from the assessor's records with actual measurements of impervious surface areas as identified through the use of aerial photography. The impervious surface area for each parcel is then multiplied directly by a rate to calculate the fee.

DATA CONSTRAINTS

It is important to note that for any assessment method employed, the results will only be as good as the quality of data used. As a community completes a cost/benefit analysis, one must be aware that data constraints might skew the results of the analysis. In the course of Chicopee's project the following data constraints were identified:

- purpose for which original data was collected may be different from purpose of stormwater utility—for example, in the case of assessor's data, information on properties is collected for tax purposes. The assessor's office may not have any use for information on size of driveways on properties, because property owners are probably not taxed based on the size of their driveway. Therefore, if one uses assessor's data to generate an idea of impervious surface on a property, one will likely miss driveways and parking lots—areas which contribute to stormwater management concerns;
- data from one source may be out of date—one might compare assessor's records of impervious surface with aerial photography and conclude that one source of data is inaccurate, but it may be that the data simply has not been updated;
- using a sample v. using the whole community—while it may seem easier to analyze a representative sample of properties to determine costs and benefits of different assessment methods, the use of a sample can introduce new problems. Creating a representative sample of the non-residential properties may be difficult, especially if one has a large number of non-residential classifications;
- data identifying whom to bill may be complicated as some properties appear to be owned by one person or entity when in fact individuals are responsible for the use of the land, as in the case of mobile home parks. In contrast, condominium owners may be billed for the square footage of their unit, but the common space (parking lots and driveways), probably much larger and more likely to contribute to runoff problems, may not be counted.

COST / BENEFIT ANALYSIS OF ASSESSMENT METHODS BASED ON THE FOUR CRITERIA IDENTIFIED

Criteria #1. Administrative Time / Resources

This criteria is defined as the amount of time (and other resources) spent administering a stormwater utility including: creation of a database of property owners, addresses, and property information; implementation of a billing system; outreach to the public and response to customer comments and complaints, and future updates to the database.

Method 1—Modified Flat Fee

(total property size)

The flat fee method requires that a database be created of all the parcels with information on the types of parcels (i.e. residential or commercial), the name and mailing address of the owner, and overall parcel size for the non-residential properties. The costs for this data (assuming that the assessor's office can provide an ASCII file and that the stormwater utility (management program) has the necessary computer equipment and software) is relatively low. Updating the data will be a minimal expense for single-family households, however for all non-single family parcels, because the fee is based on parcel size, administrators will

have to decide how often to update parcel information depending on the community's knowledge of variability in parcel size.

Method 2—Equivalent Residential Unit (ERU)

(sample of Assessor's Data by parcel type)

The ERU method requires the same database that was created for Method 1. Assessor's data is used to divide the database into 4 parcel type groupings as noted above. A sample is also taken using assessor's data that is large enough to be representative of each parcel type to calculate an average ERU for each class. For Chicopee the sample required approximately 200 parcels. The impervious surface area is calculated for each parcel in the sample. Assessor's records can be used to calculate the impervious surface area for commercial properties, but the records do not contain the square footage of all pavement areas for residential properties because driveways are not counted. The ERU method requires the most complex billing calculations of all the methods. This method requires approximately twice as much time for start-up and implementation as Method 1. Initially there is more time and resources required for this method to create the calculations for billing, but once the calculations are set up the time spent running the billing is the same as for the other methods. In subsequent years the sample data will need to be updated to recalculate the ERU for each parcel type.

Method 3—Impervious Surface Measurement from Assessor's Data

(all properties—building footprint)

This method requires a database of all parcels based on Assessor's data with complete information on all parcels regarding the square footage of impervious surface. Impervious surface area is calculated by adding the areas of all the buildings and paved areas on each parcel. This requires a large expenditure of time to collect the correct information from the assessor's data and to obtain the square footage of pavement areas in the city that are presently not taxed. A rate per square foot of impervious surface area is relatively easy to calculate. Start-up and implementation time for this method is not much more demanding than for Method 2 and the benefits of this method are much greater. The assessor's data used to calculate impervious surface will need to be updated periodically to ensure its accuracy. Using a method that assigns an exact value of impervious surface for each parcel may cause property owners to appeal the value that has been assigned to their property. The stormwater utility may need to respond legally to these challenges, thus creating the potential for substantial future expenses.

Method 4—Impervious Surface Measurement from Aerial Photography—GIS

This method requires gathering and creating costly data in order to measure the actual impervious surface area of each parcel. The steps required as part of this method include: aerial photography, measuring the impervious surface areas using the aerial photographs, entering assessor's data into GIS to define parcel boundaries, digitally inputting the impervious surface areas into GIS, and finally downloading the GIS information into a database that also includes additional assessor's data on parcel types. The cost for this method, time and other expenses, is estimated to be higher than the other methods. This method also requires hiring employees with GIS expertise or contracting an outside firm for this task. Future costs would be higher because updating would require additional aerial photographs and GIS work.

Criteria #2 Equity

Depending on the assessment method used, the fees assessed for each property may or may not reflect the actual impact each parcel has on stormwater runoff. The goal in creating an equitable system is to charge a fee that represents the product a customer receives just as an electric bill reflects the actual amount of electricity used. Unless a method is used that measures all impervious surface on a parcel, an estimate must be made to represent each parcel's usage of the stormwater system.

In this analysis, equity for each assessment method is measured by how close the stormwater charge is to the relative impervious surface area for each parcel based on the data gathered from Method 4. Without having a meter to measure how much water runs off each parcel into the stormwater system, impervious surface area is the best available indicator of the runoff each parcel contributes to the stormwater management system. Using Method 4 as the baseline, a comparison was made for the sample parcels in Chicopee to test how close each method comes to the baseline.

In order to analyze the equity of each assessment method a few parcels were chosen to highlight the different fees that are assessed by the different methods:

The table above shows variability in fees generated by the different methods. If one agrees that Method 4 is the most accurate representation of a property's actual impervious surface, it is most telling to look at the variability in fees produced by Methods 1 and 2 compared with fees from Method 4. The assessor's data does not include all paved areas and therefore the impervious surface area factored into a fee using assessor's data is smaller than the impervious surface area measured in the GIS Method. This discrepancy is offset to some extent by the different rates that were determined for Methods 3 and 4.

There is a large variation in size of impervious surface for properties in Class 3 including: commercial, industrial, public service, vacant, and other open space. This variation makes it impossible to use Method 1 or 2 with any accuracy for these types of parcels. PVPC analyzed the variation of impervious surface of these parcels and found a 95% Confidence Interval for a range of property size from 8,000 to 28,000

TABLE 1 - SAMPLE OF PARCEL STORMWATER FEES USING DIFFERENT METHODS

		Fees Assessed for Each Method				Impervious Area (ft2)		
Class*	Parcel Description	Method 1	Method 2	Method 3	Method 4	Assessor Data	GIS Data	Parcel Size (Acres)
1	Single Family	$40	$36	$14	$11	672	933	.239
1	Single Family	$40	$36	$36	$36	1668	3090	.184
1	Single Family	$40	$36	$61	$37	2856	3206	.358
1	Single Family	$40	$36	$40	$42	1881	3690	.274
2	Two-Family	$40	$56	$39	$34	1797	2970	.184
2	Three-Family	$40	$56	$37	$49	1705	4287	.172
2	Apartments 4-8	$40	$74	$144	$33	6800	2877	.178
2	8+ Apartments	$400	$74	$2,392	$4,526	112651	397142	30
2	Mobile Homes	$40	$36	$2,159	$1,870	101636	164079	11.8
2	Condominiums	$40	$36	$10	$878	467	76394	n/a
3	Small Retail & Service	$40	$128	$19	$31	870	2688	.085
3	Fuel Service	$40	$128	$302	$151	14078	13160	.324
3	Manufacturing	$40	$128	$227	$165	10590	14315	.371
3	Manufacturing	$373	$128	$2,401	$2,860	113071	250981	7
3	Warehouse & Distribution	$91	$128	$157	$182	7300	15787	1.75

** Class 1-Single Family Residential; Class 2-Larger Residential; Class 3-Non-Residential*

square feet. The 95% Confidence Interval measures the variation of size in the sample. This range of variation is too large to allow identification of trends in the data.

EQUITY OF ASSESSMENT METHODS:

Method 1—Modified Flat Fee

(total property size)

This method appears to be relatively equitable with regard to smaller residential properties because the variation of the impervious surface area is small for these types of properties. The 95% Confidence Interval of impervious surface area for 1, 2, and 3 family residences has a range of 1,580 to 1,757 square feet. This is a relatively small variation. For all other types of parcels a flat fee method is not very equitable.

The current Chicopee assessment method uses the overall parcel size as an indicator of the fee for all parcels except single family residences. An analysis of the correlation between overall property size and impervious surface area found no consistent correlation. While the Chicopee method makes an attempt at varying the fee to better represent different parcels' different impact on the stormwater system, it would be significantly more equitable to calculate impervious surface area for all non-residential parcels.

Method 2—Equivalent Residential Unit (ERU)

(sample of assessor's data—by parcel type)

As discussed above, this method, when applied to residential properties, is relatively equitable, but for non-residential properties the equity level is low due to the dramatic variability in impervious surface area of these property types. If equity is a significant community concern, the time spent calculating the ERU for these property types would be better spent calculating the actual impervious surface area using assessor's, or some other reliable data.

Method 3—Impervious Surface Measurement from Assessor's Data

(all properties—building footprint)

This method has a high level of equity, as it relies on actual impervious surface of buildings located on each parcel. To obtain an accurate count of total impervious surface by property, the pavement area of most parcels in Chicopee would need to be added to the Assessor's data. While the equity level for this method is much higher than Methods 1 and 2, especially for commercial and industrial properties there are still limitations based on human error and the challenge of maintaining up-to-date records.

Method 4—Impervious Surface Measurement from Aerial Photography—GIS

This method is the most equitable of the four methods analyzed. The measurements of impervious surface area are the closest they can be without going out and actually measuring the properties.

Criteria #3. Sustainability/Effectiveness

This criteria was measured by answering the following questions about each method: How well does the method meet the goals of the Stormwater Utility? In Chicopee the goals of the utility generally are to provide: 1) capital for projects to correct Combined Sewer Overflows (CSOs), 2) revenue for the maintenance of the stormwater system, and 3) incentives for individual property owners to reduce stormwater runoff.

It can safely be stated that all four methods will meet the goals of raising capital for CSOs and for stormwater system maintenance. The question is, how do they distribute the burden among utility fee payers, and how easy is it to get the different methods implemented? The simplicity of Method 1 seems to have been a major factor in Chicopee's success at implementing a stormwater management fee as smoothly as they did. However, its simplicity may be a liability as the public understanding of how the fees are assessed grows.

The following is an analysis of how well each method reaches the third goal of creating incentives for individual property owners to reduce stormwater runoff.

Method 1—Modified Flat Fee

(total property size)

This method creates the least incentive to reduce size of impervious surface for individual parcels. The individual property owners will not be aware of any relationship between the size of their bills and the amount of impervious surface on their property. For residential properties, the issue of incentive may not be as important because residential property owners cannot do much to limit impervious surface on their property.

Method 2—Equivalent Residential Unit (ERU)

(sample of Assessor's data by parcel type)

This method creates no incentives to reduce the size of impervious surface on parcels because it is based on the average size of a group of properties. Incentives could be built into this method to give credit to parcels that reduce impervious surface by adjusting the ERU for parcels. Any attempt at doing this would create significant administrative costs for the Stormwater Utility staff to assess and approve these adjustments.

Method 3—Impervious Surface Measurement from Assessor's Data

(all properties—building footprint)

This method includes incentives for property owners to reduce the size of the impervious surface because the fees are based directly on size of impervious surface. Again, as with Method 2, the administrative costs for the Stormwater Utility or the Assessor's Office would increase due to the need to certify that changes have been made to a parcel. If the bill reflects the actual area of impervious surface then a financial incentive is included in the utility structure for property owners to reduce their use of the stormwater system.

Method 4—Impervious Surface Measurement from Aerial Photography—GIS

This method includes incentives just as Method 3 does, but these incentives come at a higher cost as updating aerial photographs to identify changes in impervious surface area is more expensive than updating Assessor's records.

Criteria #4. Political Expediency

How likely is it that your community will accept the various methods? This is a difficult question to answer because each community has its own unique political situation, but each assessment method does raise unique political concerns.

The stormwater management fee in Chicopee was implemented with a flat fee for single family residential properties and a sliding scale for non-single family residential and all other properties based on

total size of the parcel. This fee system was both easy to implement and relatively simple to explain to the public. In Chicopee the simplicity of the method allowed for relatively smooth implementation. Chicopee chose to prioritize establishment of the fee, recognizing that over time, the City would need to make changes to the structure and the fee calculation to improve both the equity of the fee and the ability of the fee to generate sufficient funds for the city's stormwater management program. Research on other communities around the country shows that many municipalities have taken this approach when launching a stormwater utility. However, as the popularity of stormwater utilities grows, and the public is better educated about the need to correlate rates with actual contribution to the stormwater management problem, future publics may demand a more equitable fee system from the start.

Method 1—Flat Fee

(total property size)

This method has a relatively low administrative cost and is easily explained to the public. It is politically expedient to use this method as a starting point in order to establish a stormwater utility. For residential properties in Chicopee the flat fee may remain the most politically expedient because of the relatively small variation in parcel size of this property type.

Method 2—Equivalent Residential Unit (ERU)

(sample of assessor's data by parcel type)

This method is cumbersome and moderately expensive to implement and administer. It is more equitable than the Flat Fee Method, but the complexity of the billing calculations makes it quite difficult for the public to understand. This method is probably the least politically expedient as simplicity is often favored over fairness.

Method 3—Impervious Surface Measurement from Assessor's Data

(all properties—building footprint)

This method is expensive to establish and administer but it is much more equitable than Methods 1 and 2. As the public becomes more aware and informed about why and how stormwater fees are charged then more questions may arise about the equity of the fees. This method provides the municipality with a clear justification that the City is charging an individual property based on actual stormwater runoff that impacts the stormwater management system. This method would be politically expedient in a community with an educated and litigious public where the local government wants to create clear incentives for the public to change practices that contribute to stormwater and water quality problems.

Method 4—Impervious Surface Measurement from Aerial Photography—GIS

This method is the most costly to implement and administer, but it also produces the most equitable and legally defensible results. The use of aerial photography and GIS results in the most accurate measurement of impervious surface area, but the costs involved may make this method politically impractical. However, as many communities are creating GIS maps of their municipalities, it may cost considerably less to measure impervious surface as part of an already planned and paid for GIS program.

III. CONCLUSIONS OF COST/BENEFIT ANALYSIS

The Cost / Benefit analysis highlights a number of issues that are noteworthy for a community considering creating a stormwater utility. A city or town must decide its priorities and then determine which method best meets its needs. Below is a list of a few of the important findings from the cost / benefit analysis.

- There is a large amount of variability of impervious surface area for commercial and industrial properties. It would make sense for a stormwater utility to allocate extra funds and time to improve the accuracy and equity of the assessment method for the commercial and industrial parcels because this is where the most variation in impervious surface will occur.
- There is only slight variation in the impervious surface area of residential properties, making it practical and expedient to use a flat fee assessment method for single-family residences.
- Assessor's data is relatively easy to access, but many paved surface areas will need to be measured and added to the building data.
- Simplicity of assessment method is extremely important to facilitate both public understanding and acceptance and political support for the new utility.
- Use of a sample of properties to analyze rates can be extremely problematic. Sampling makes sense with groups of properties that do not vary dramatically, such as single family residential, but with property types that vary within their classification, it is very difficult to create a representative sample. It is only slightly more expensive and much more effective to use a technique to measure impervious surface area for all properties in these cases.
- While the use of GIS data seems cumbersome, it offers reliability and equity not offered by the other methods and, the popularity of GIS suggests that this assessment method will become increasingly affordable as municipalities create GIS maps and data layers for multiple uses.

Costs of the Different Methods/Minimum Requirements to Implement:

TABLEM 2–MAJOR FINDINGS AND ISSUES FOR THE DIFFERENT ASSESSMENT METHODS

	Admin. / Res.	Inter-class Equity	Effectiveness	Political Expediency	Ease of Implementation
1) Modified Flat Fee	Lowest Cost	Low except residential properties	Raises funds but creates no incentives for changing practices	High	High
2) Equivalent Runoff Unit (ERU)	Mid-Range Cost	Low except residential properties	Raises funds but creates no incentives for changing practices	Low	Medium
3) mpervious Surface (Based on Assessor's Data)	Higher Cost	OK but needs quality check	Achieves all goals	Medium	Low
4) Impervious Surface (Based on GIS Data)	Highest Cost—unless muni. has GIS	Best	Achieves all goals	Medium to High	Low

While it is tempting to look for a proscribed list of the items and resources a municipality must have in place in order to begin to undertake the development of a stormwater utility, the research conducted as part of this project shows that this is a wrong-headed approach toward developing a stormwater utility. An exciting characteristic of existing stormwater utilities in the United State is that they do not all look alike. While research for this project confirms the existence of basic components of a stormwater utility (legal foundation, community outreach and education, a management program, an assessment method and a rate setting procedure) the details of program development and implementation are very flexible.

For example, If a community has GIS capabilities already in place, then it certainly seems to make sense for them to use data derived from aerial photography to drive their assessment process. If they do not, then it may or may not be cost-effective for the community to develop GIS capabilities. Because each community is different, municipal staff will have to take the information presented in this report and evaluate the different approaches against their community's reality.

The City of Chicopee passed a stormwater management fee before the research for this project was complete. After discussing the proposed Stormwater Management program and fee with key business leaders and city council members, the Board of Sewer Commissioners recommended a $10/quarter fee for single-family residential properties and a $0.30/1000 square feet fee for non-single family residential, commercial, and industrial properties (with a cap of $400/year), as a stormwater management fee payment which the public could bear. This amount compares favorably with start-up fees in communities across the United States (see chart in Assessment Briefing Paper for detail). Such overt political planning can be an effective way to implement a stormwater management program. For a more systematic approach to rate setting, see Briefing Sheet #5 on Rates.

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