ASSESSING THE IMPACT
OF
CURRENT AND FUTURE TMDL DESIGNATIONS
ON
SMALL WASTEWATER SYSTEMS

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Executive Summary

Data on assessed/impaired waters and number of total maximum daily loads (TMDLs) maintained by the U.S. EPA in the ATTAINS database were evaluated to determine the impacts of TMDLs on small wastewater systems. Information within the ATTAINS database was mined in order to separate, to the extent possible, impacts to municipal systems in general and small systems in particular. The information generated was used in conjunction with information from a previous white paper entitled, *Small Wastewater System Profile*, to determine national, state and individual system upgrades resulting from the TMDL program. Further rate impacts from the upgrades were also determined where data allowed. Appendices to this report contain a summary of the relevant ATTAINS data for each state. Further information is available on the ATTAINS website by drilling down through the state data links.

The findings indicate wastewater systems in general represent a relatively small percentage of impairments (less than 10%) nationally for all water types with the exception of bays and estuaries where they represent 55% of the impairment causes. Conversely non-point sources and natural conditions as impairment sources far exceed that of municipal sources; up to 75% of impairments.

The category "municipal sources" as used by the EPA in the ATTAINS data base includes septic systems, decentralized systems, illegal hookups to storm sewers and other such potential pollutant sources for which a municipal sewer authority is likely not to have any control. In some states the proportion of the municipal impairment attributed to septic systems, decentralized systems, etc represents well over 50% of the impairment cause. The inclusion of pollutant sources not under the control of a municipal authority into the category of "municipal sources," likely contributes to a public perception that wastewater treatment plants and their collection systems are a greater source of water quality impairment than warranted.

While municipal systems represent a relatively small percentage of the impairment causes, a significant economic burden is potentially placed upon communities, particularly small communities, as a result of upgrades driven by TMDL permit changes. Monthly sewer rates for the states examined in this report are expected to rise by 114% to 625%. This represents an average monthly sewer bill of $98.18 with a range of $52.91 to $135.89. Common affordability indicators suggest monthly sewer rates over an average of $68.61 are not sustainable.

Readers should note that the data reported herein is accurate as of the date of the report but that the information contained within the EPA's ATTAINS dataset is constantly changing. As a consequence, comparison of the data in this report to the ATTAINS data set may show variation which is attributable to the dynamic nature of the ATTAINS data set.

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1.0 INTRODUCTION

Kramer Environmental Management, Inc. (KEM) was tasked by the National Rural Water Association (NRWA) to gather information from the U.S. Environmental Protection Agency's ATTAINS database to assess the potential impacts of the total maximum daily load (TMDL) regulations upon small wastewater systems. The ATTAINS database is an on-line national repository for information on assessed and impaired waters. The Clean Water Act (CWA) requires each state to report the quality status of their waterways on a biennial basis. Two reports are required, an assessment report which indicates whether waters are meeting the designated use(s) assigned to each water by the state and an impaired waters list which is the list of waters that are not meeting designated uses and for which a corrective plan is required. These corrective plans are most often in the form of a TMDL. The impact of a TMDL on a given water body can result in much more stringent permit limits for a wastewater treatment plant discharging to that water body. A significant financial impact can befall a community if the community's current wastewater treatment plant is unable to meet the new limits and a new plant or substantial upgrades are required. This paper is an attempt to quantify the impacts of the TMDL program on small communities.

2.0 BACKGROUND

As part of their member services, NRWA periodically develops white papers on a variety of topics important to its membership. An earlier white paper entitled *Small Wastewater System Profile,* gathered basic information on a representative number of NRWA's member wastewater systems. Included among the information collected were system characteristics in terms of flow, population served, type of treatment, community economic statistics, etc. System operations and management personnel were telephonically interviewed during which time the familiarity with the TMDL program was ascertained. Familiarity with the TMDL program varied from little to no knowledge to very familiar. Systems that had been or were in the process of undergoing upgrades to meet a TMDL based permit limit were generally more familiar than systems that had not seen their permits altered by a TMDL.

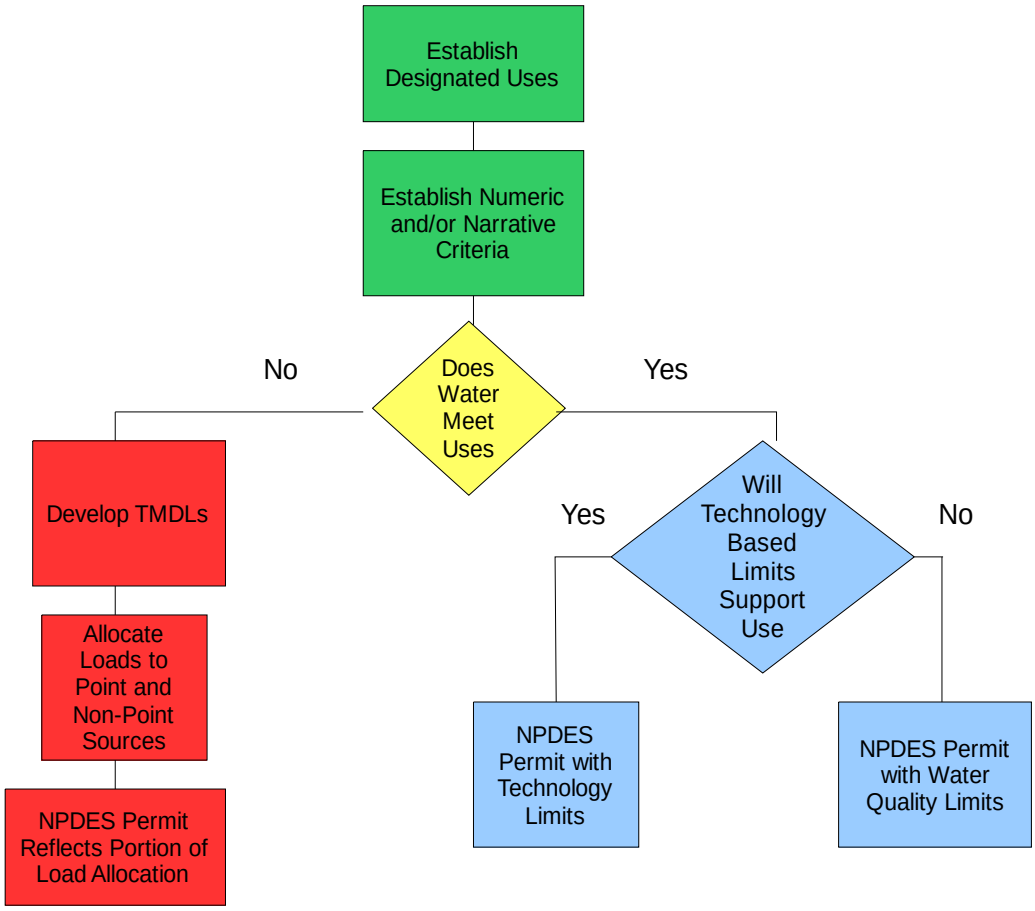
The United States Congress through the CWA, prescribed the water quality standards program in Section 3 of the Federal Water Pollution Control Act later known as and hereafter referred to as the CWA. The standards program consists of three components; designated uses, water quality criteria and antidegradation policies.

The CWA requires each state, or the U.S. Environmental Protection Agency if the state does not act, to establish a designated use(s) for each regulated water body that supports the fishable and swimmable objectives of the CWA. Section 101 (a)(2) of the CWA states, "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983." A designated use is that use or uses that the public wishes a water body to be able to support. These take the form of descriptive terms such as warm water fishery, cold water fishery, drinking water supply, contact recreation (variations including wading, partial immersion, full immersion), irrigation, industrial water supply, etc. The process to establish these uses is a public process that takes place every three years. Designating uses is the starting point in the process and the point at which NRWA or its membership could have the most influence in the process. The TMDL process is a downstream event that is only triggered upon failure to meet the designated use as shown in Figure 1.

In the context of the CWA a use is not necessarily what the water body currently supports. The CWA uses the term "existing use" which could mean the use the water is capable of supporting or any use that has been attained since November 28, 1975, even if the water is currently not meeting that use (Introduction to the Clean Water Act, EPA Watershed Academy). For example if a portion of a river supported a cold water fishery designation in 1980 but in 2009 no longer supports that use due to land use factors that have altered the characteristics of the water, by law that portion of the river is required to meet the cold water fishery use. This of course can have substantial implications as controls must be put into place to meet the existing use. In some cases this simply may not be attainable.

Attainable uses are defined in EPA's Water Quality Handbook as the uses that can be achieved when all point sources are meeting technology based effluent limits and when cost effective and reasonable BMPs are imposed on all non-point sources. Technology based controls are well defined in the regulations for point sources. However the exact definition of "effective and reasonable BMPs" and even the identification of all non-point sources are much harder factors to come by. The CWA grants authority to go beyond technology based limits in fact it requires that more stringent limits known as water quality based limits be imposed upon point sources when the water body to which they discharge is at risk of not meeting its designated use (40 CFR 122.44(d)).

Figure 1: The Water Quality Standard Process, Point Source Oriented



Water quality based effluent limits (WQBELs) are permit limits that are designed to insure that a water body meets the water quality criteria established to support the designated use. Water quality criteria are simply the chemical, microbiological, biological and physical limits that are needed to support a designated use. For example a cold water fishery designated use will have lower temperature and higher dissolved oxygen needs than a warm water fishery designated use. This is because cold water fish species require these conditions to survive. If public sentiment shows that trout (a cold water fish) are desirable in a given water body and that use is attainable, then temperature and dissolved oxygen levels supportive of trout will be used as the controlling criteria. In this example if technology based limits could only produce an effluent with 4 mg/L dissolved oxygen but the criteria to support cold water fishery requires 5mg/L dissolved oxygen, a water quality based limit of 5 mg/L may be written into a given permit.

The U.S. EPA publishes recommended water quality criteria. The criteria have come to be known for the color of the cover of the report hence the names Green Book, Red Book, Blue

Book and the current version the Gold Book. The criteria are based upon laboratory studies of the acute and chronic affects of contaminants upon aquatic species and on risk analyses from the consumption of aquatic species by humans. Generally there are fresh and salt water criteria as well as human consumption criteria of water and aquatic species. States may adopt the EPA criteria or develop their own. Within the fresh and salt water criteria are values for acute and chronic exposure levels.

Acute criteria are developed by exposing eight representative species of aquatic organisms to serial dilutions of a given contaminate. Organisms will include several species of fish, invertebrate, planktonic crustaceans, benthic crustaceans, insect larva, algae, plants and up to two additional species. The tests are run for 48 to 96 hours depending upon the test species and methodology with test endpoints coinciding with the concentration of contaminate that is lethal to 50% of the test organisms, otherwise known as the LC_{50}. The final criteria for the contaminate is the geometric mean of the four most sensitive test species.

The chronic value is based upon a 28 day test on three species including a species of fish, an invertebrate species and one of the acutely sensitive species. The final criteria value is a mathematical derivation of the chronic and acute test results.

With respect to human health criteria values, the values are risk based for exposure to a particular contaminate over some temporal period. In the case of carcinogens it will be exposure over a period of 70 years. In the case of non-carcinogens the exposure period is chemical and endpoint specific. Human health criteria include criteria for the consumption of water and aquatic species or just aquatic species. Consumption values are usually based upon eating 6.5 grams of fish or shellfish per day and drinking 2 liters of water although some stares reportedly use as high as 37 grams of fish/shellfish per day as the average daily consumption.

The criteria developed from these tests are used as the basis to determine if a water body is meeting its designated use(s). A state is required to review its designated uses every three years. During that review if discharges of contaminants or the presence of contaminates are interfering or are likely to interfere with the attainment of a designated use, the state must adopt water quality criteria for that contaminate. A variety of criteria are often applied to the same water body. For example a water body that has a designated use for shellfish harvesting will have to meet not only fresh or salt water acute and chronic criteria but also human health criteria which could potentially be a list of 20 or more pollutants. In practicality there will generally be a short list of criteria that are the drivers for determining if a water body is not meeting its designated use; i.e. concentrations of a relative few pollutants will actually be over the limit.

The U.S. EPA guidance for determining if criteria are being exceeded is very conservative. In-stream concentrations of many contaminants fluctuate over time as a result of a variety of factors including assimilation rates of the contaminate in the water, levels of contaminate discharge, flow conditions, sediment uptake and release, and air deposition among other factors. Hence aquatic organisms are exposed to varying concentrations over time. EPA guidance indicates that an aquatic organism's average exposure over a one hour period should not exceed the acute criteria. Recall the endpoint of the acute test is lethality after 48 or 96 hours. Likewise the average 4 day concentration should not exceed the chronic criteria, a 28 day test. Recognizing that aquatic organisms are exposed to many stressors, EPA's Water Quality Handbook indicates exposure beyond these levels should not occur more than once in a three year period. The logic is the organisms need time to recover from the stressor. EPA admits that this is a very high degree of protection.

Once a state has determined that in stream concentrations of pollution are preventing or are likely to prevent a water from attaining or maintaining its designated use, the water body is designated as impaired or threatened; respectively. Impaired indicates the state believes there is sufficient data to demonstrate the water is unable to meet its designated use. Threatened indicates the water is likely not going to be able to support its designated use due to contaminate levels but the data set is insufficient to draw definitive conclusions. Every two years each state is required to make an assessment of their waters or a portion of their waters and determine if the waters are meeting their designated uses. The data is submitted to the U.S. EPA in the form of two reports; the Assessed Waters Report often referred to as the 305 b report from the section of the CWA requiring the assessment and reporting; and the Impaired Waters Report often referred to as the 303 d report.

The 305 b report will report the status of waters by category. The categories are:

Category 1 – Meeting uses
Category 2 – Meeting some uses, insufficient data to determine if all uses are being met
Category 3 – Insufficient data to determine if any uses are being met
Category 4 – Not meeting uses but no TMDL required
- 4a TMDL exists
- 4b Pollution controls in place, water expected to meet uses in near future
- 4c Non pollutant source of non-impairment

Category 5 – Water is impaired, listed on 303 d report

The Category 5 waters will make up the 303 d report. Those waters are considered impaired; i.e. one or more pollutants are present at concentrations that are preventing the water from meeting its designated use – the concentrations exceed relevant criteria levels. A water body can be impaired for one or more pollutants. The content of these 305 b and 303 d reports are made

available by each state and are available nationally in a data repository maintained by the U.S. EPA known as ATTAINS – http://www.epa.gov/waters/ir/.

The Category 5 waters on the 303 d report make up the waters likely to receive a TMDL. There are alternatives to TMDLs in cases where some implementation step will or is believed to be sufficient to return the water to its designated use. These may be the elimination of discharges, reductions in pollutant discharge from a particular permitting strategy or similar plan that the state feels will be sufficient to allow the water to meet the designated use. But in most cases if a water is impaired a TMDL will be required. In short the TMDL is a mass balance which sets an acceptable level of pollutant that will allow the water body to meet its designated use. In theory all sources contributing a particular pollutant are assessed and through a computer or mathematical model, all avenues for pollutant removal are considered. Pollutant removal includes the ability of the water to assimilate the pollutant and reductions that will be achieved as a result of new permit limits and best management practices (BMPs) that will be put into place as a result of the TMDL. The goal is to not overload the water body to the point where the pollutant cannot be removed sufficiently to allow the water to meet its designated use.

Upon determining the amount of pollutant a water can receive and still meet its designated use, an allocation of that amount is divided between point sources and non-point sources. That which is allocated to the point sources is known as the waste load allocation (WLA) and that which is allocated to the non-point sources is the load allocation (LA). A margin of safety is introduced to accommodate growth or to allow for uncertainties in the process. The WLA and LA are then further divided up among the various point and non-point sources. Point sources such as wastewater treatment plants see the allocation reflected in their discharge permit while non-point sources are assigned BMPs that if implemented are believed to be sufficient to reduce the discharge of non-point source pollution. Point sources are at risk for the greatest impacts from this process since only point sources have enforceable permits. The CWA does not have a permitting mechanism for non-point sources. There are various provisions in the CWA that address non-point source pollution but none include an enforcement mechanism such as the National Pollutant Discharge Elimination System (NPDES) permitting system which is only applicable to point sources. Hence the burden for pollutant reductions can fall more heavily upon the point sources in the absence of a regulatory mechanism to force non-point sources to reduce pollutant loads. Reductions from non-point sources depend upon the willingness of individuals to implement and maintain the prescribed BMPs.

3.0 METHODOLOGY

KEM used the ATTAINS database to obtain state specific and national summary data for assessed and impaired waters. Much of the information presented throughout the remainder of

the report and in the appendices was derived from the ATTAINS dataset. The presentation of the information herein is data intensive yet represents only a portion of the data available. Summary data is presented in the body of the report while state specific data may be found in the appendices. ATTAINS allows the user to drill down to additional information for any given state. Links within the data tables allows the user to drill down to additional data by simply clicking on the blue underlined link. Two report formats may be found; an integrated report format wherein the information from the 305 (b) and 303 (d) reports are combined and separate 305 (b) and 303 (d) report formats. While not a regulatory requirement, the U.S. EPA is requesting states use the integrated format to standardize data reporting. To date 23 states use the integrated format. Tables 1 and 2 provide examples of the types of data available from the integrated report.

TABLE 1: INTEGRATED REPORT SUMMARY EXAMPLE, ALABAMA

	Rivers and Streams (Miles)	Lakes, Reservoirs, and Ponds (Acres)	Bays and Estuaries (Square Miles)	Ocean and Near Coastal (Square Miles)
Good Waters	**7,658.1**	**337,689.9**	**78.7**	
Previously impaired waters now attaining all uses				
Threatened Waters				
TMDL completed				
TMDL alternative				
Non-pollutant impairment				
TMDL needed				
Impaired Waters	**2,567.9**	**91,911.9**	**426.8**	**201.0**
TMDL completed	746.0	28,886.7		
TMDL alternative	4.3			
Non-pollutant impairment	22.8			
TMDL needed	1,794.8	63,025.2	426.8	201.0
New TMDLs completed	5.7	.0	.0	.0
Remaining TMDLs needed	1,789.1	63,025.2	426.8	201.0
Total Assessed Waters	**10,226.0**	**429,601.8**	**505.5**	**201.0**
Total Waters	77,242.0	490,472.0	610.0	Unavailable
Percent of Waters Assessed	13.2	87.6	82.9	Unavailable

TABLE 2: INTEGRATED REPORT - PROBABLE SOURCES EXAMPLE, ALABAMA

Probable Source Group	Rivers and Streams (Miles)	Lakes, Reservoirs, and Ponds (Acres)	Bays and Estuaries (Square Miles)	Ocean and Near Coastal (Square Miles)
Agriculture	1,123.1	4,728.2		
Atmospheric Deposition	100.8	6,592.5		
Construction	297.0			
Habitat Alterations (Not Directly Related To Hydromodification)	56.4			
Hydromodification	31.2	58,712.6		
Industrial	194.2	12,276.8		
Land Application/Waste Sites/Tanks	44.8			
Legacy/Historical Pollutants	69.0	32,281.9		
Municipal Discharges/Sewage	448.8	12,276.8	157.6	
Natural/Wildlife	17.0			
Other		50,019.3		
Resource Extraction	425.7	412.5		
Spills/Dumping		412.5		
Unknown	528.0	3,551.2	1.0	201.0
Urban-Related Runoff/Storm water	575.6	22,499.2	376.3	

Data for this report was gathered from each state on the miles, acres, or square miles of impaired waters; size of water impaired by municipal sources, non-point sources, and natural sources; number of TMDLs developed for the state; and how many miles, acres or square miles of water are under a TMDL. In support of this project, the U.S. EPA ran a query on the ATTAINS data to show the number of TMDLs that have a WLA to a municipal source for those states reporting that metric. Twenty-five states reported such information. All information is captured in Excel spreadsheets and presented in the appendices to this report.

Cost impacts are derived from the data gathered during the development of the *Small Wastewater System Profile* white paper coupled with the current and potential future TMDLs that will impact municipal sources outlined in this report.

4.0 RESULTS

4.1 National Data

4.1.1 Impaired and Assessed Waters

The data in the ATTAINS database shows a substantial amount of U.S. waters are impaired yet to date fewer than half of the waters have been assessed with the exception of Great Lakes Open waters. Of the assessed waters nearly all water types are reported to have over 50% impairment. Table 3 shows the breakout of waters, amounts assessed, impaired, total, and percentages assessed and impaired.

TABLE 3: U.S. ASSESSED AND IMPAIRED WATERS

	Rivers and Streams	Lakes, Reservoirs and Ponds	Bays and Estuaries	Wetlands	Great Lakes Shoreline	Great Lakes Open Water	Coastal Shoreline	Ocean and Near Coastal
	miles	acres	sq miles	acres	miles	sq miles	miles	sq miles
Assessed	929,432	17,497,279	17,857	2,051,861	1184	210,644	2,078	5,506
Impaired	458,209	11,545,337	11,222	746,163	1,110	210,582	791	4,465
Not assessed	2,603,773	24,168,770	69,934	105,648,139	4,018	0	56,540	48,614
Total	3,533,205	41,666,049	87,791	107,700,000	5,202	60,546	58,618	54,120
% of Total Assessed	26.3%	42.0%	20.3%	1.9%	22.8%	347.9%	3.5%	10.2%
% of Assessed Impaired	49.3%	66.0%	62.8%	36.4%	93.8%	100.0%	38.1%	81.1%

As presented in the ATTAINS database, the predominate cause for impairment of waters in the U.S. are non-point sources. With the exception of impairments to bays and estuaries, municipal sources consisting of wastewater only sources, are the cause of a small percentage of the impairments. Municipal source impairments are less than 10% of all impairments except for bays and estuaries where they account for 55% of the impairments. Table 4 and Figure 2 shows the impairment percentage for municipal, natural and non-point sources as a percentage of the

total impaired waters. Note impairments from municipal sources are well below those for natural and non-point sources in all water types except bays and estuaries.

Within the municipal source type, KEM extracted only those sources that are municipal wastewater in nature. Specifically municipal wastewater point sources both large and small, sewer overflows, combined sewer overflows/discharges, package plants, and total detention domestic lagoons. Excluded from municipal were wastewater sources not likely to be under the control of a municipality such as domestic sewer, septic systems, decentralized systems, sewer discharges in non-sewered areas and unpermitted domestic sewer discharges. Including these sources into the municipal category changes the national data by as much as 25% in some cases while it has virtually no change in others.

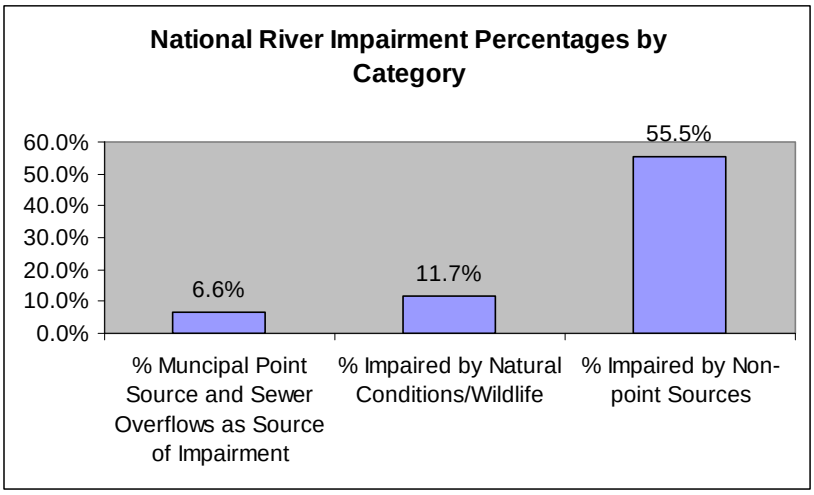
TABLE 4: PERCENT IMPAIRMENTS OF FROM MUNICIPAL, NATURAL AND NON-POINT SOURCES

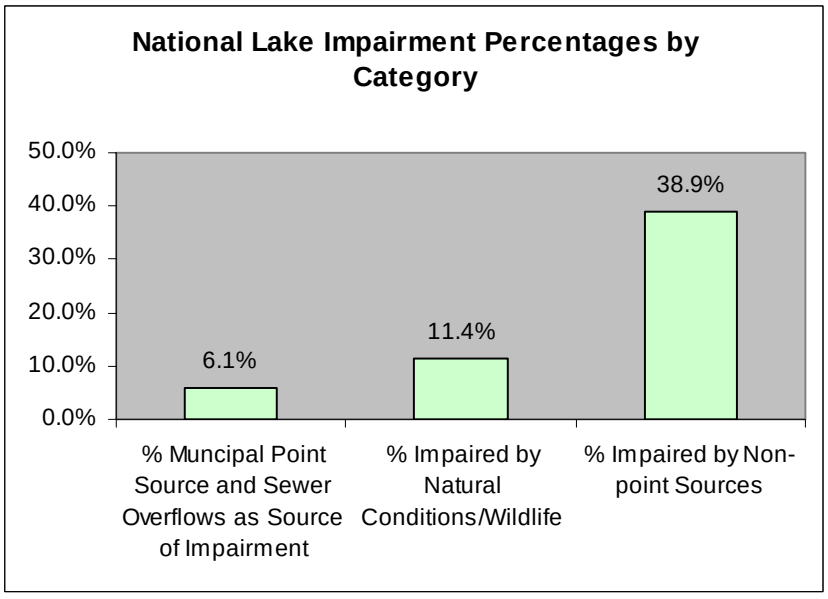
Source Type	Rivers and Streams	Lakes, Reservoirs and Ponds	Bays and Estuaries	Wetlands	Great Lakes Shoreline	Great Lakes Open Water	Coastal Shoreline	Ocean and Near Coastal
% Municipal Point Source and Sewer Overflows as Source of Impairment	6.61%	6.06%	55.22%	0.06%	0.72%	0.00%	2.65%	0.13%
% Impaired by Natural Conditions/Wildlife	11.67%	11.44%	33.76%	17.90%	0.04%	0.00%	12.64%	0.00%
% Impaired by Non-point Sources	55.55%	38.89%	69.93%	74.18%	0.99%	8.66%	25.41%	0.54%

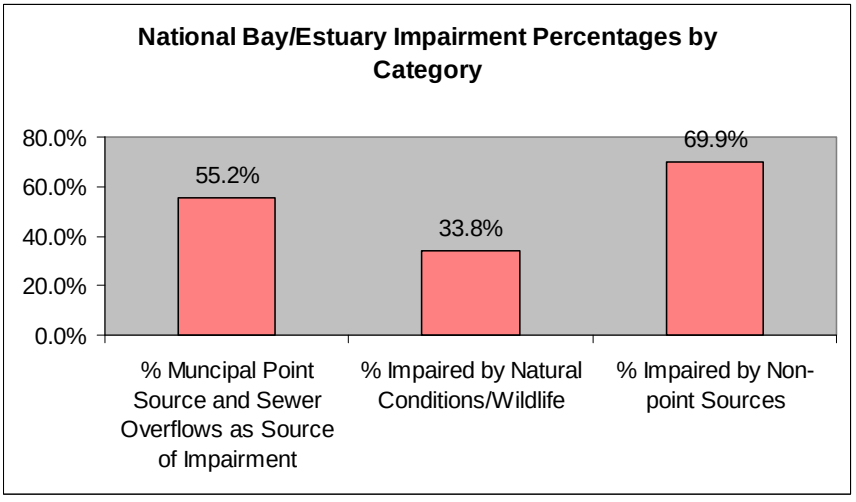
Note total percentages over 100 indicate multiple impairment sources.

Non-point sources are inclusive of agriculture, aquaculture, construction, land application/waste sites/tanks, recreation/tourism non-boating, recreational boating/marinas, resource extraction, silviculture, unspecified non-point, and urban runoff sources. Although not the subject of this report, the data indicates air deposition to be a significant contributor to impairments particularly for lakes, ponds and reservoirs. This is primarily due to mercury deposition.

Figure 2: Percentage Data for Several Water Types







An estimate of the total impairments that could potentially be caused by municipal sources was obtained by multiplying the current municipal % impairment by the total waters yet to be assessed and adding to those already determined impaired by municipal sources. However this is a dynamic condition as waters are assessed biennially and conditions may change from one assessment period to the next making the percentages subject to variation. In theory as the TMDLs are applied and pollutant reductions are realized, waters will be removed from the list of impaired waters. Regardless an estimation of total river miles, total lake acres, etc can be made and is shown in Table 5.

TABLE 5: POTENTIAL WATER IMPAIRMENT FROM MUNICIPAL SOURCES

	Rivers and Streams	Lakes, Reservoirs and Ponds	Bays and Estuaries	Wetlands	Great Lakes Shoreline	Great Lakes Open Water	Coastal Shoreline	Ocean and Near Coastal
	miles	acres	sq miles	acres	miles	sq miles	miles	sq miles
Current Municipal Point Source and Sewer Overflows as Impairment Source	30,277	699,915	6,197	458	8	3	21	6
Total Potential Waters Impaired by Municipal Sources	202,326	2,165,103	44,816	65,306	37	3	1,522	71

4.1.2 TMDLs

ATTAINS date indicates there are currently 38,222 TMDLs developed nationally. A querry of the ATTAINS data set was run by the U.S. EPA, Office of Wetlands, Oceans, and Watersheds to support this project. The querry was designed to show the number of current TMDLS as of March 31, 2009, and showed that 1,713 TMDLs (4.5%) contained a WLA to a municipal source(s). The dataset contained information on the District of Columbia, Puerto Rico, and 23 of the 50 states reflecting the variation in how states report data. However, the data set is large enough that it is likely to be representative of all 50 states. Therefore within all 50 states it can be estimated that there are 3,440 TMDLs with a municipal source(s) WLA representing 9% of the total number of TMDLs. Note that any individual TMDL can have a WLA that is spread among multiple municipal sources. Table 6 shows the ten most frequent pollutant groups for which a TMDL has been developed.

TABLE 6: TOP 10 TMDL BY POLLUTANT

Pollutant Group	Number of TMDLs
Pathogens	6,986
Mercury	6,671
Metals other than Mercury	6,538
Nutrients	4,281
Sediment	3,086
Organic Enrichment/Oxygen Depletion	1,775
pH/Acidity/Caustic Conditions	1,562
Temperature	1,527
Salinity/Total Dissolved Solids/Chlorides/Sulfates	1,507
Ammonia	1,029

4.2 State Data

The ATTAINS database provided similar data on a state by state basis; see appendices. Not all states have adopted the integrated report format. In these cases the ATTAINS data set will not always show the number of TMDLs per mile of river (river mile), acre of lake (lake acre), etc nor sources of impairment. When information was not available, "Not Reported" or "Value!" indicates the information is not available. State websites were reviewed in an attempt to augment the ATTAINS data when possible. It is noted there is no regulatory requirement to use the integrated report format.

Impairments from municipal sources by state range from no municipal source impairments in Colorado to a high of 74% of the river miles impaired in Oklahoma. Table 7 summarizes the municipal impacts by state.

Table 7: Percent of Impairment Attributable to Municipal Sources

State	% River Impairment	% Lake Impairment	State	% River Impairment	% Lake Impairment
Alabama	15.7	15	Montana	5.4	33
Alaska	33	0	Nebraska	3.6	0
Arizona	5.5	45.1	Nevada	0	0
Arkansas	7.3	0	New Hampshire	1.1	0.7
California	4.1	0	New Jersey	Not rpt	Not rpt
Colorado	0	0	New Mexico	11.7	0
Connecticut	31.4	29.9	New York	40.6	18.8
Delaware	4.7	Not rpt	N. Carolina	Not rpt	Not rpt
Florida	Not rpt	Not rpt	N. Dakota	17.2	47.9
Georgia	3.9	0	Ohio	1.9	Not rpt
Hawaii	Not rpt	Not rpt	Oklahoma	74	2.2
Idaho	0.2	0	Oregon	Not rpt	Not rpt
Illinois	21.6	4.5	Pennsylvania	3.2	Not rpt
Indiana	11.1	0	Rhode Island	19.3	4.3
Iowa	2.8	0	S. Carolina	Not rpt	Not rpt
Kansas	Not rpt	Not rpt	S. Dakota	4.3	0
Kentucky	20.2	7	Tennessee	11	1.7
Louisiana	21.6	0.4	Texas	9.1	Not rpt
Maine	7.8	5.6	Utah	4.9	66.8
Maryland	Not rpt	Not rpt	Vermont	0.6	37.4
Massachusetts	Not rpt	Not rpt	Virginia	18.6	1.4
Michigan	1.6	2.4	Washington	Not rpt	Not rpt
Minnesota	12.5	0	West Virginia	20.1	0.4
Mississippi	Not rpt	Not rpt	Wisconsin	6	0.4
Missouri	4.2	0	Wyoming	0.5	0.2

Like the national data, municipal sources as reported in the ATTAINS database are inclusive of septic systems, decentralized systems, and other sources of domestic waste that are not likely to be under the control of a municipal wastewater authority. Inclusion of these non-controllable sewer sources can have a significant effect on the number of waters that appear to be impaired from a municipal source. The term municipal source as reported by each state is not consistent. For example Alabama includes in their report the following under the category municipal discharges/sewage: municipal point source discharges, on-site treatment systems (septic systems and similar decentralized systems), sanitary sewer overflows (collection system failures). Connecticut municipal category includes: combined sewer overflows, illicit connections/hookups to storm sewers, municipal point source discharges, on-site treatment systems (septic systems and similar decentralized systems), sanitary sewer overflows (collection system failures), and wet weather discharges (point source and combination of storm water, CSO and SSO). Other states include these and other non-municipal discharges such as "septage

disposal." To the wider audience of the general public, the concept of impaired waters from municipal sources is likely to be understood as municipal wastewater treatment plants and possibly collection system failures/overflows. Inclusion of septage, illicit hookups to storm sewers, septic systems, and decentralized systems potentially skews the perception of the impact of municipal wastewater systems on water quality. The actual impact of including septic systems, illicit hookups, et al is not significant in some states but makes up greater than 50% of the impairments in others. For example data for Alabama shows that 6% of the 448 impaired river miles are impaired due to septic systems while in North Dakota 72% of the 728 impaired river miles are impaired from septic systems.

If the data from states in which municipal sources account for 20%+ of the impairments in Table 7 are examined, the inclusion of septic systems, decentralized systems, etc clearly shows how the municipal category is skewed. This is an acute problem with the integrated report format. States separately reporting their impaired and assessed waters breakout the various wastewater components so the values do not get skewed. Table 8 shows the impacts of including septic, decentralized systems, etc in the municipal data for those states in which municipal systems are reportedly responsible for 20%+ of the impairments.

TABLE 8: IMPACT OF NON-MUNICIPAL SOURCES INCLUDED IN THE MUNICIPAL CATEGORY

State	Total River Miles Impaired by Municipal (Miles)	Portion Attributable to Septic, Decentralized Systems, etc (Miles & %)	Total Lake Acres Impaired by Municipal	Portion Attributable to Septic, Decentralized Systems, etc (Acres & %)
Alaska	73	33.3 (46%)	0	0
Connecticut	223	59 (27%)	2,136	279 (13%)
Illinois	1,924	0 (0%)	6,255	0 (0%)
Kentucky	1,383	485 (35%)	6,847	3,658 (53%)
Louisiana	1,435	0 (0%)	2,220	0 (0%)
Montana	887	106 (12%)	164,687	35,180 (21%)
New York	2,091	0 (0%)	61,906	0 (0%)
N. Dakota	728	524 (72%)	127,423	9,662 (8%)
Oklahoma	7,677	6,740 (88%)	12,915	12,915 (100%)
Utah	142	0 (0%)	101,362	0 (0%)
Vermont	2.5	0 (0%)	73,869	0 (0%)
West Virginia	1,885	1,542 (82%)	61	61 (100%)

4.3 Potential Cost Impacts of TMDLs

The NRWA white paper entitled, *Small Wastewater System Profile*, (September 2008), indicated the average or mean cost to comply with more restrictive permit limits as a result of a TMDL was $6,900,000. The white paper documented that small systems reported the actual or projected costs for their completed or planned upgrades ranged from $50,000 to $15,000,000. The cost data developed under that paper are believed to be representative of national cost figures as data was obtained from systems in the northeast, southeast, southwest, west and northwest regions of the U.S.

A report entitled the *Clean Watersheds Needs Survey 2004 Report to Congress* (U.S. EPA, January 2008) indicates there are a total of 38,187 wastewater treatment and collection systems in the U.S. This includes all systems both small (serving less than 10,000 people) and large (serving greater than 10,000 people). The report further indicates there are 18,558 small systems in the U.S.

Converting the national assessed and impaired waters data from the ATTAINS data base into water units allows for the calculation of projected costs associated with the TMDL program. A water unit is a normalized unit which is the summation of all river miles, lake acres, shoreline miles, estuary square miles, etc. The national data contained in the ATTAINS database and as shown in this report, indicate there are a total of 153,165,531 water units in the U.S. of which 20,715,841 have been assessed and 132,599,788 have not been assessed. Using the total number of TMDLs (38,222) a ratio of TMDL to assessed water units can be calculated. Multiplying that ratio by the number of unassessed water units and adding to the current total number of TMDLs provides an estimate of the total number of TMDLs to be developed for all water units. Section 4.1.3 estimated that 9% of all current TMDLs contain a WLA to municipal sources. Therefore, multiplying the total number of projected TMDLs by 9% provides a projected total number of TMDLs that will have WLAs to municipal sources; 24,921. The watershed needs survey indicates that 48.6% of all wastewater systems serve populations of less than 10,000; the typical definition of a small system. The 24,921 TMDLs represent TMDLs that will impact all municipal sources, small and large. Based on the 48.6% figure, the projected number TMDLs that will affect small systems is 12,111. In determining costs as a result of a TMDL, it is assumed that each of the 12,111 TMDLs will require an equal number of plant upgrades. There will be many scenarios as TMDLs are developed including a single plant being exposed to multiple TMDLs, multiple plants being exposed to a single TMDL, and sources which are not truly municipal sources counted in the municipal category as shown in Table 8. These factors will ultimately change the final number of small system upgrades making the 1:1 ratio used for this report as a worse case scenario for predicting cost impacts.

Using the breakdown of system sizes contained in the *Clean Watersheds Needs Survey 2004 Report to Congress,* and the mean small system upgrade cost developed in the *Small Wastewater System Profile*, allows the derivation of national and state projected costs as a result of the TMDL program to small systems; Tables 9 and 10.

TABLE 9: DERIVATION OF NATIONAL SMALL SYSTEM TMDL COSTS

Total Assessed Water Units	20,715,841
Total Unassessed Water Units	132,599,788
Current # of TMDLs (Sept 2009)	38,222
#TMDLs/Total Assessed Water Unit	0.0018
Projected #TMDLs Once all Unassessed Water Units are Assessed	238,680
Total TMDLs = Current + Projected *	276,902
TMDLs Impacting Municipal Systems (9% of total)	24,921
Total # Systems all Sizes	38,187
Total # Small Systems	18,558
% Small Systems	48.6%
Potential Number of Small System Upgrades	12,111
National Small System TMDL Driven Projected Costs	**$83,566,598,200**

* U.S. EPA has begun a shift toward watershed TMDLs rather than a water segment approach so the final number of TMDLs will be less than projected. However the same number of municipal systems are expected to be impacted.

The *Clean Watersheds Needs Survey 2004 Report to Congress* estimated the total small system need at $19 billion, less than one fourth of this paper's estimate. During the data collection effort for the *Small Wastewater System Profile* respondents were asked about their familiarity with the TMDL program. Most had limited to no knowledge of the program. Only those respondents that had completed an upgrade or were planning on upgrades as a result of the TMDL program were significantly familiar. This level of familiarity was relatively equal among plant operators/managers and city/town managers.

The data contained in the *Clean Watersheds Needs Survey 2004 Report to Congress* builds upon data contained in many documents including capital improvement plans that could be as old as 1994. With respect to small systems needs, the watersheds survey allowed small systems to submit data on their expected needs. Given a potential lack of understanding of the TMDL

program, its resultant implications for system upgrades, and aged data, the watershed survey results may be under estimating the true cost of the TMDL program on small systems. The estimates developed in this report use actual or estimated small system costs required to implement upgrades as a result of the TMDL program so are believed to closer represent the true costs. In addition the methodology used applies the proportion of TMDLs effecting municipal sources (TMDLs with a waste load allocation to a municipal source) and takes into consideration the yet unassessed total waters in the U.S. to arrive at cost projections. For these reasons it is believed the costs presented in this report more accurately reflect the potential cost impacts to small systems over the next 5 to 20 years as a result of the TMDL program. Court orders have set the completion date for all TMDLs at 2013 but given that many of the waters have not even been assessed, it is unlikely a 2013 date can be achieved. The watershed survey assumes a 20 year horizon which appears to be a more realistic time frame. Hence the costs projected in this report could be expected to be incurred over the next 20 years. Costs were derived as follows:

$$\text{Per state cost } \$ = [(a \div b) \times c] \times d$$

where,

a = total number of small systems per state

b = total of small systems nationally

c = potential national number of small system upgrades from Table 9

d = $6,900,000 representing the per system TMDL upgrade cost

TABLE 10: PROJECTED PER STATE UPGRADE COSTS

State	No. of Small Systems*	Potential No. of Small System Upgrades	Projected Per State Small System Upgrade Cost	State	No. of Small Systems *	Potential No. of Small System Upgrades	Projected Per State Small System Upgrade Costs
		(# of systems/18558) x 12111	(Potential upgrades x $6.9 million)			(# of systems/18558) x 12111	(Potential upgrades x $6.9 million)
Alabama	151	99	$679,952,383	Montana	208	136	$936,623,150
Alaska	Not rpt	Not rpt	NA	Nebraska	522	341	$2,350,563,868
Arizona	169	110	$761,006,310	Nevada	57	37	$256,670,767
Arkansas	443	289	$1,994,827,191	New Hampshire	87	57	$391,760,645
California	301	196	$1,355,401,771	New Jersey	503	328	$2,265,006,946
Colorado	325	212	$1,463,473,673	New Mexico	40	26	$180,119,837
Connecticut	115	75	$517,844,530	New York	1,100	718	$4,953,295,507
Delaware	37	24	$166,610,849	N. Carolina	440	287	$1,981,318,203
Florida	116	76	$522,347,526	N. Dakota	Not rpt	Not rpt	NA
Georgia	61	40	$274,682,751	Ohio	1,050	685	$4,728,145,711
Hawaii	18	12	$81,053,926	Oklahoma	437	285	$1,967,809,215
Idaho	229	149	$1,031,186,065	Oregon	209	136	$941,126,146
Illinois	714	466	$3,215,139,084	Pennsylvania	1,626	1061	$7,321,871,359
Indiana	433	283	$1,949,797,231	Rhode Island	14	9	$63,041,943
Iowa	920	600	$4,142,756,242	S. Carolina	92	60	$414,275,624
Kansas	799	521	$3,597,893,737	S. Dakota	11	7	$49,532,955
Kentucky	300	196	$1,350,898,775	Tennessee	223	146	$1,004,168,089
Louisiana	311	203	$1,400,431,730	Texas	1,629	1063	$7,335,380,346
Maine	165	108	$742,994,326	Utah	193	126	$869,078,212
Maryland	274	179	$1,233,820,881	Vermont	84	55	$378,251,657
Massachusetts	141	92	$634,922,424	Virginia	286	187	$1,287,856,832
Michigan	24	16	$108,071,902	Washington	222	145	$999,665,093
Minnesota	298	194	$1,341,892,783	West Virginia	625	408	$2,814,372,447
Mississippi	660	431	$2,971,977,304	Wisconsin	907	592	$4,084,217,295
Missouri	866	565	$3,899,594,463	Wyoming	120	78	$540,359,510

*Clean Watersheds Needs Survey 2004 Report to Congress; U.S. EPA.

4.4 Potential Rate Impacts

Using the data contained in the *Small Wastewater System Profile,* rate impacts have been developed based on the projected TMDL statewide costs shown in Table 10. The *Small Wastewater System Profile* contains monthly sewer rate and number of connections data for 17 states. TMDL driven rate impacts are derived by amortizing the amounts shown in Table 10 over a 20 year loan term at the latest published U.S. Department of Agriculture, Rural Utility Service interest rate of 4.35% as of July 1, 2009. Using the average monthly sewer rate per connection and average number of connections, the monthly rate impact is determined for the 16 states for which the *Small Wastewater System Profile* and Table 10 have corresponding data. Table 11 contains the derivation of monthly sewer rates. The data in Table 11 indicate an average rate increase of 263% ranging from a low of 114% to 624% for the 16 states examined. States with low current rates experience the greatest percentage increase. The annual debt service amount per system is relatively consistent from state to state reflecting the use of an average TMDL driven upgrade cost of $6,900,000 as noted above. The loan amortization reflects a principal amount of 100% of project costs, an unlikely loan term. Communities would be required to contribute some proportion of the project costs likely to be 20%. Regardless the projected increases driven by the need to meet stricter standards as a result of the legal requirements imposed by the Clean Water Act, clearly are significant and likely much higher than have been projected heretofore. While projected cost data could only be derived for 16 states, there is no reason to believe the remaining states would not be subject to similar increases.

TABLE 11: PROJECTED SYSTEM RATE INCREASES

State	Current Ave Monthly Sewer Rate	Current Ave # of Connections	Current Per System Ave Annual Revenue	Projected Number of System Upgrades	Statewide Upgrade Costs (system upgrades × $6.9 million)	20 Yr Amortization	Per Affected System Annual Debt Service	Per Affected System Projected Annual Revenue Needs (current + debt service	Projected Ave System Rate Increase	Projected Ave Monthly Rate
CT	$27.33	1,269	$416,181	75	$517,844,530	$774,914,753	$516,610	$932,791	224%	$88.58
GA	$26.79	1,189	$382,240	40	$274,682,751	$411,041,739	$513,802	$896,042	234%	$89.59
KY	$30.82	1,828	$676,068	196	$1,350,898,775	$2,021,516,748	$515,693	$1,191,761	176%	$85.15
MS	$10.95	750	$98,550	431	$2,971,977,304	$4,447,336,844	$515,932	$614,482	624%	$79.23
MO	$23.56	1,596	$451,221	565	$3,899,594,463	$5,835,445,011	$516,411	$967,632	214%	$74.08
MT	$41.32	1,565	$775,990	136	$936,623,150	$1,401,584,944	$515,289	$1,291,278	166%	$110.08
NE	$19.63	446	$105,060	341	$2,350,563,868	$3,517,439,141	$515,754	$620,813	591%	$135.63
NV	$27.14	1,278	$416,219	37	$256,670,767	$384,088,182	$519,038	$935,257	225%	$88.12
NH	$37.81	1,032	$468,239	57	$391,760,645	$586,239,857	$514,245	$982,485	210%	$117.14
NC	$25.86	1,114	$345,696	287	$1,981,318,203	$2,964,891,230	$516,532	$862,228	249%	$90.36
NM	$22.15	921	$244,802	26	$180,119,837	$269,535,567	$518,338	$763,139	312%	$91.20
PA	$48.60	1,218	$710,338	1061	$7,321,871,359	$10,956,620,772	$516,335	$1,226,672	173%	$132.53
TX	$30.79	1,025	$378,717	1063	$7,335,380,346	$10,976,835,938	$516,314	$895,031	236%	$103.56
UT	$24.74	12,541	$3,723,172	126	$869,078,212	$1,300,509,108	$516,075	$4,239,247	114%	$52.91
WA	$40.61	1,240	$604,277	145	$999,665,093	$1,495,922,393	$515,835	$1,120,112	185%	$115.89
WI	$31.72	809	$307,938	592	$4,084,217,295	$6,111,718,966	$516,192	$824,130	268%	$116.61

5.0 CONCLUSION

This report demonstrates the costs to be born by small wastewater systems is much higher than previously reported. This will have a substantial economic impact on the affected communities particularly the smallest as the economies of scale mean fewer people will be required to bear the cost of the upgrades. U.S. Census data for the year 2000 were used as the basis for the *Small System Profile Report.* The census data indicated the median household income for the 166 communities in 17 states researched, was $33,225 vs. the national average of $41,994. The 2008 American Community Survey, a year by year update to the latest census data, shows the national median income has risen to $52,029, a 23.9% increase. Assuming rural incomes have risen proportionally to national incomes, the current median rural income is estimated at $41,166. A common industry rule of thumb used to determine water or wastewater utility affordability is 2% of household income. This would correspond to a monthly sewer rate of $68.61 based upon the $41,166 estimated rural median household income. This report estimates monthly sewer rates can be expected to rise by as much as 624%. Monthly rates are estimated to range from $52.91 to $135.63 with an average of $98.17. All of the rates exceed industry affordability levels with the exception of the projected rate for Utah at $52.91 per month. It is unclear how communities will be able to meet potential economic needs driven by the TMDL upgrades.

The category "municipal source" used in the biennial 305b reports should be amended to include only those sources that are truly under the control of a municipality. A more refined breakout showing municipal wastewater point sources and their corresponding collection systems should be included to differentiate the true impacts from municipal wastewater point sources and decentralized wastewater sources; i.e. septic systems and others not under the control of the municipal wastewater authority. As shown in this report, municipal and non-municipal controlled wastewater data is often combined and gives the public the impression that municipal wastewater systems are a greater source of water quality impairment then is true. The media, environmental groups, and others likely use the date as presented in the ATTAINS system or in state reports at face value without understanding the elements that make up the data. The result may be that the general public assumes wastewater plants are a larger source of impairment than warranted.

The data presented in this report shows that municipal wastewater point sources and their collection systems are a relatively small percentage of the impairments with the exception of impaired bays and estuaries. Despite this there continues to be a focus on wastewater plant upgrades and correspondingly significant economic resources being directed toward a source that is not the most significant problem. EPA continually shows non-point sources and air deposition as the largest sources of water quality impairments nationally. Within a given state impairments from municipal sources may be a leading or significant cause of impairment but nationally they are not. However costs that will be required of communities to upgrade their wastewater treatment systems are expected to be high and potentially not sustainable for many communities.

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