

ISSUE BRIEF



KENTUCKY WASTEWATER

2011 Kentucky Grade: C-

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Effective wastewater treatment removes harmful pollutants from water and returns the water to the community's rivers and streams so that downstream users have a safe source of drinking water, a place for recreation and a healthy aquatic environment for plants and animals.

CURRENT CONDITIONS

One of the most common forms of pollution control in the United States is wastewater treatment. The infrastructure used for wastewater treatment is a system of collection sewers, pumping stations and treatment plants. Sewers collect wastewater from homes, businesses and industries, and the wastewater is then delivered to treatment plants. Most treatment plants were built to clean wastewater for reuse or discharge into streams or other receiving waters.

There are primary and secondary basic stages in the treatment of wastes. In the primary stage, solids settle and are removed from wastewater. The secondary stage of treatment removes approximately 85 percent of organic matter. Sometimes, the primary and secondary stages are combined into one operation. To complete treatment, the discharge from a wastewater treatment plant is usually disinfected before being discharged into receiving water. Disinfection is the process of treating the water to kill pathogenic bacteria. Done properly, disinfection will kill more than 99 percent of harmful bacteria in effluent.

Today's pollutants, such as heavy metals, chemical compounds, toxic substances and nutrients, such as nitrogen and phosphorus, are more difficult to remove from water. Increasing demands on the water supply aggravate the problem. In addition, the increasing need to reuse water calls for better wastewater treatment. These challenges are being met with improved methods of removing pollutants or pollution prevention at the source.

Pretreatment of industrial waste, for example, removes many troublesome pollutants at the beginning of the pipeline. In addition, treatment processes called tertiary or advanced waste treatment techniques have been developed. These techniques range from biological treatment that removes nitrogen and phosphorus to physical-chemical separation techniques, such as filtration, carbon absorption, distillation and reverse osmosis. These wastewater treatment processes, alone or in combination, can achieve almost any degree of pollution control desired. Waste effluents purified by these treatments can be used for industrial, agricultural and recreational purposes and even drinking water supplies.

Wastewater infrastructure can be placed in two categories – collection and treatment systems. Both systems must work in conjunction with each other to adequately protect the overall water quality of Kentucky's receiving streams. In communities throughout the state, these systems are

outdated, under capacity or in need of rehabilitation. The following table shows the treatment levels of wastewater treatment plants in the past and estimates 2028 treatment levels.

Table 1 – Commonwealth of Kentucky

Municipal Wastewater Treatment Plants					
Treatment Level		1972	2004	2008	Future 2028
Less Than Secondary	Number of Facilities	17	0	0	0
	Population Served	280,000	0	0	0
	Percentage Served	8%			
Secondary	Number of Facilities	43	149	117	115
	Population Served	463,000	1,566,266	1,184,448	1,572,426
	Percentage Served	14%	37.8%	28%	N/A
Advanced	Number of Facilities	16	91	120	126
	Population Served	164,000	912,458	1,206,985	1,840,860
	Percentage Served	5%	22%	28%	N/A
No Discharge	Number of Facilities	0	1	1	1
	Population Served		435	435	435
	Percentage				

In 2009, there were 259 municipally owned plants, 197 school plants, 121 subdivision plants and 836 package plants in Kentucky. Approximately 860,000 households, or 55 percent of households in Kentucky, have public sewers, while 690,000 households, or 45 percent, do not have public sewers. The statistics illustrate that the majority of homes with public sewers are in urban areas. Households without public sewers are served by septic tanks, other on-site systems or, in some rural areas, straight pipes to a receiving stream. As public water lines have been extended into unsewered areas, there has been an increase in on-site system failures, which has

been attributed to increased water use. In some cases, there are no on-site systems and raw sewage is discharged directly onto the ground or into a receiving stream.

Water Resources

Sedimentation/siltation and pathogens are the two major causes of pollution to water bodies. This type of pollution comes from runoff from agricultural activities and construction. Only 52 percent of the major streams in Kentucky support aquatic life. Meanwhile, 31 percent support swimming and 68 percent support boating.

Combined Sewers

Combined sewers collect and convey both storm water and domestic sewage. During dry periods, the collection system only conveys sewage to wastewater treatment facilities. However, during storm events, sewage and storm water are combined in the sewer pipe. The capacity of the collection and treatment systems are frequently exceeded in wet weather so that excess, untreated flows are diverted to receiving waters through various overflow points along the collection system. Combined sewer overflow (CSO) discharges have been identified as a significant threat to the water quality of much of the country's receiving waters. These systems are receiving a great deal of attention due to changing U.S. Environmental Protection Agency (EPA) regulations. For example, the EPA has approved a new CSO strategy for curbing water pollution from combined sanitary-storm sewers that overflow in wet weather. The Kentucky Division of Water (DOW) has 12 long-term control plans that are either approved, pending or under review. In addition, there are two communities opting to separate their sewers entirely and long-term control plans will not be required.

There are 17 communities that operate and maintain combined sewers in Kentucky. Combined, these 17 communities have more than 346 overflow points. The EPA's 2008 Clean Water Needs Survey indicated that \$312 million would be required to correct CSO-related problems in Kentucky, which is a 45 percent increase in funding needs since 2003. Since 2003, Kentucky has eliminated 72 CSOs and reduced overflow volume from 5.84 billion gallons to 3.101 billion gallons.

Sanitary Sewer Overflows

Properly designed, operated and maintained sanitary sewer systems are meant to collect and transport all sewage that flows into them to a publicly owned treatment works (POTW). However, occasional unintentional discharges of raw sewage from municipal sanitary sewers occur in almost every system, which are called sanitary sewer overflows (SSOs). SSOs have a variety of causes, including severe weather, improper system operation and maintenance, and vandalism. The untreated sewage from these overflows can contaminate drinking water supplies, causing serious water quality problems. In addition, untreated sewage can potentially create back-ups into basements, causing property damage and threatening public health.

Many Kentucky municipalities have not fully investigated SSO problems or determined the measures necessary to correct them. Some municipalities have not submitted needs for SSO correction measures because those measures may be considered maintenance with a low priority

because they do not expand the customer base and generate new revenue for the utility. Currently, 22 communities have an active sanitary sewer overflow plan to correct problems.

Kentucky's initiative to eliminate sanitary sewer overflows and dry weather overflows includes sanitary sewer overflow plans, sewer overflow response protocols and self-assessments in keeping with the EPA Capacity, Management, Operations and Maintenance Program.

The extent of the SSO problem is unknown, but Kentucky has initiated a new wet weather team to inspect complaints. Two percent of these inspections are referred to enforcement. Prior to 2003, 71 communities were under sanction with 34 sanctions lifted. Since then, 17 communities were added to the sanctions list and 15 communities have been removed from the sanctions list. However, 39 Kentucky communities remain under sanction.

Non-Point Source and Watershed Basin Plans

Non-Point Source (NPS) pollution comes from many diffuse sources such as rainfall or runoff moving over and through the ground surface. As the runoff moves, it picks up and carries away natural and human pollutants. Kentucky's approach to controlling NPS pollution includes both focused watershed projects and statewide initiatives. A watershed is the area that drains to a common waterway, such as a stream, lake, estuary, wetland, aquifer or ocean. A watershed-based plan is one that includes an evaluation of all of the activities occurring within a watershed that could affect its common waterway. Watershed projects address diverse NPS concerns through aggressive best management practices (BMPs) implementation and include water quality monitoring as a measure of success. Statewide programs help raise public awareness about runoff pollution, provide technical information on BMPs and develop and implement regulatory programs. Since 2002, eight watershed-based plans have been approved and 18 are under development.

On-Site Sewage Treatment Systems

Kentucky has a population of approximately 4.3 million. Wastewater service is provided to 2.4 million residents from municipal systems and an additional 836 small, private treatment plants, an increase from 633 plants in 2002. The remaining 40 percent of Kentucky's residents are served by on-site sewage systems, such as septic tanks and individual house treatments.

On-site wastewater treatment programs are administered by county health departments. The health departments regulate on-site evaluations to determine if the site and soil conditions are suitable for on-site wastewater systems. Certified inspectors are required to perform site evaluations and certified installers are required to construct the systems. In addition, health departments must address any complaints raised by malfunctioning systems. On-site septic tank systems require periodic emptying, which can be challenging given the limited number of septage receiving sites in the state. In fact, several counties do not have any septage receiving facilities.

Package Treatment Plants

Typically, package treatment plants are suitable for isolated or remote areas where it is not economically or geographically possible to extend centralized sewer services and wastewater flows are small. Because DOW's priority to regionalize package treatment plants for more cost effective treatment of wastewater and improved performance, Kentucky's regulations allow DOW to mandate connections of private package plants that are within one mile of an existing collection system. Even though the number of municipal treatment plants increased and service areas were extended, the number of package treatment plants increased from an estimated 633 in 2002, to 836 in 2010. The increase in plants highlights that areas difficult to serve using centralized systems are using package treatment plants. Since these areas initially used straight pipes, the introduction of package treatment plants has had a positive impact on water quality, because it treats and disinfects raw wastewater before discharging into a local stream. Even though package treatment plants are easy to install and operate, many are poorly operated and are in non-compliance due to the lack of full-time, certified operators.

Numeric Nutrient Criteria

The next triennial review by the U.S. Environmental Protection Agency in 2011 will focus on water quality criteria. This plan targets the promulgation of numeric criteria for wadeable streams, lakes and reservoirs. Larger boatable waters are also undergoing similar processes. Phosphorus is an essential plant nutrient, but excess concentrations can result in nuisance growth of aquatic plants and algae. Excessive plant growth may result in depletion of dissolved oxygen which negatively affects fish. Excessive nitrogen has a similar result.

Recently, the state initiated the development of a statewide nutrient reduction plan for phosphorus and nitrogen consistent with the Mississippi River Gulf Hypoxia task force recommendations.

Animal Feed Operations

In 2008, a new rule for controlling pollutant discharge concentrations from animal feeding operations was established. As this program is implemented, improvements to water quality should become more visible since animal feed operations contribute a significantly to non-point source pollution.

Storm water – Municipal Separate Storm Sewer System (MS-4)

The control of storm water is important because storm water runoff directly affects watershed functions and the water quality of receiving waters.

Kentucky has 40 municipal separate storm water sewer system communities with permits, plus 20 additional communities that share these types of permits. Of these, 38 have been added since 2003. This program includes public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site runoff control, post-construction storm water management, and pollution prevention.

Permitted communities must maintain a storm water management program with the goal of reducing pollution discharged from the separate storm water sewer systems. This means that these separate sewer system programs must be assessed and modified continuously. This new focus creates a quality-based standard for storm water discharges.

Investment Needs

Adequate investment from a variety of sources is required in order to maintain the water quality improvements made to date, address new threats to water quality and prevent deterioration of Kentucky’s infrastructure. Based on DOW’s 2008 Needs Survey, Kentucky will need a minimum of \$2.1 billion to meet wastewater collection and treatment needs over the next 20 years. The Kentucky Infrastructure Authority (KIA) reports that more than \$142.6 million is available in Clean Water State Revolving Fund low-interest loan program.

Table 2 – 2008 Kentucky Wastewater Needs for Municipalities

Kentucky Clean Water Needs Survey						
	2000*	2004*	Percent Change	2004**	2008**	Percent Change
Wastewater Treatment Plant	\$841,000,000	\$656,000,000	-22%	\$777,000,000	\$454,000,000	-42%
Wastewater Collection Combined	\$2,2027,000,000	\$1,978,000,000	-2%	\$2,344,000,000	\$1,351,000,000	-42%
Sewer Overflow	\$241,000,000	\$181,000,000	-25%	\$215,000,000	\$312,000,000	+45%
Stormwater Management Controls	\$2,000,000	\$27,000,000	+800%	32	Not Listed	-100%
Totals				\$3,336,000,000	\$2,110,000,000	

Approximately \$454 million is needed for improvements and expansions to treatment plants. The wastewater collection system has needs totaling \$1.35 billion, including collector and trunk sewers and sewer rehabilitation to remove known extraneous water infiltration/inflow that enters the sewer system. This extraneous flow sometimes causes sanitary sewer overflows due to limited pipe capacity. Most municipalities have been challenged to solve this problem in a cost effective manner. As these municipalities investigate sources of infiltration/inflow, costs may increase.

Likewise, 17 Kentucky municipalities are developing long-term control plans to reduce overflows in combined sewer systems. Current costs to reduce the overflows are estimated to be \$312 million over the next 20 years. As long-term control plans are developed, this number is expected to increase until overflows have been eliminated.