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Minnesota Department of Health
Minnesota Pollution Control Agency
Minnesota Department of Agriculture
Minnesota Department of Natural Resources
Minnesota Board of Water and Soil Resources
University of Minnesota
Natural Resources Conservation Service
Minnesota River Citizens Advisory Committee
Coalition for a Clean Minnesota River
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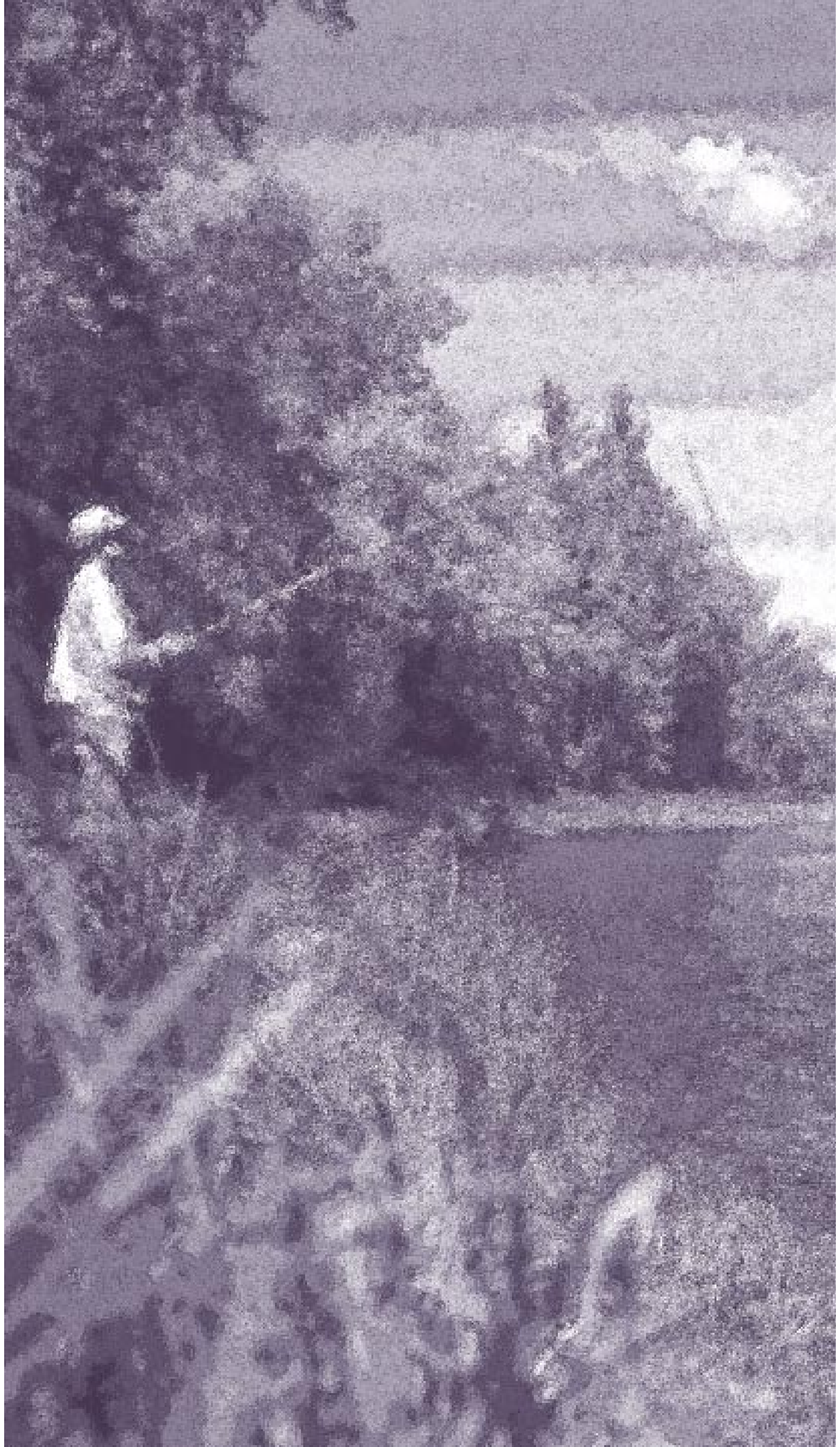
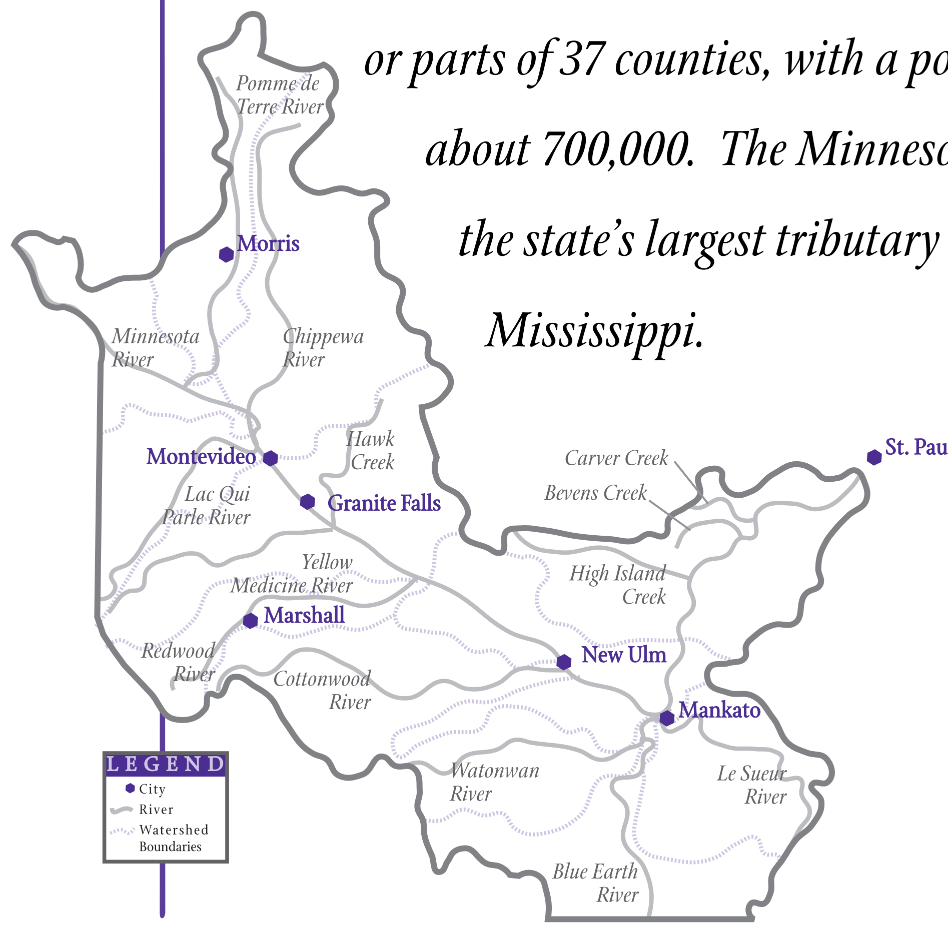
Bacteria in the Minnesota River



Minnesota River Basin

The Minnesota River flows 335 miles through some of the state's richest agricultural land from its source in Big Stone Lake on the Minnesota/South Dakota border to its confluence with the Mississippi at Fort Snelling. The river's basin drains 16,700 square miles, including all or parts of 37 counties, with a population of about 700,000. The Minnesota River is the state's largest tributary to the Mississippi.



and the septage applied to land in a manner that minimizes the potential for surface runoff.

Feedlot location and land application of manure are of particular concern to livestock operators. If a feedlot is located close enough to a stream or drainage ditch to pose a pollution threat, a manure storage system such as an earthen storage basin or pit must be installed. Manure should be applied in such a manner as to prevent runoff (or discharge) to any water body. Both applying manure far enough away from surface water and incorporating it into the soil reduce the potential for surface-water contamination. In addition, properly utilizing manure as a crop nutrient reduces the potential for water pollution.

For more information

For more information on bacteria in the Minnesota River, please contact your local county environmental services office, University of Minnesota Extension Office, the Minnesota Pollution Control Agency (651/296-6300 or 800/657-3864), or the Minnesota River Basin Joint Powers Board (651/361-6590).

References	To order call:
Septic System Owners Guide	University of Minnesota Extension Service, (612) 624-4900 or (800) 876-8636
Guidelines for Land Application of Manure for WaterQuality Protection	Minnesota Pollution Control Agency, (651) 296-6300 or (800) 657-3864
Running Your Feedlot	Minnesota Pollution Control Agency, (651) 296-6300 or (800) 657-3864
Minnesota River Basin Water Quality Overview	University of Minnesota Extension Service, (612) 624-4900 or (800) 876-8636
Cryptosporidium	Minnesota Department of Health, (651) 215-0700
BEACH Program	Environmental Protection Agency, (312) 353-6704
Bacterial Contamination in Lakes, , Rivers and Streams	Minnesota Department of Health, (651) 215-0700

Check the MPCA's site on the worldwide web, at www.pca.state.mn.us.

Bacteria in the Minnesota River

Bacteria is a pollutant of considerable concern in the Minnesota River. Fecal coliform, a bacteria found in the intestines of humans and animals, is widely found in excess of allowable levels in lakes and streams of the Minnesota River basin. The presence of fecal coliform is an indicator that too much pollution from sewage and manure is getting into the river.

Introduction

The water resources of the Minnesota River basin offer tremendous potential for fishing, swimming, drinking, and wildlife habitat. Unfortunately, as a result of many types of pollution, the draining of most wetlands, and the impacts of our uses of urban and agricultural land, much of that potential remains unfulfilled. In addition, pollution from the Minnesota degrades the potential uses of the Mississippi River to Lake Pepin and beyond, potentially as far as the Gulf of Mexico.

The basin's water resources encompass rivers and smaller streams and lakes, and ground-water aquifers. Its streams range from rippling trout streams to turbid tributaries and a muddy main-stem river that contributes most of the annual suspended sediment load in the Mississippi River upstream of Lake Pepin. Lakes tend to be deep and relatively clear in the wooded northern parts of the basin, and shallow or even marsh-like and clouded in the intensively farmed southern region.

One of the most serious pollutants affecting these waters is bacteria.[1] This booklet focuses on the problem of bacterial contamination of rivers and streams in the Minnesota basin — its extent, how it's measured, where it comes from, what it means, and how to reduce it. Although significant progress has been made in reducing many of the sources of bacterial contamination, water-quality monitoring indicates the problem remains widespread throughout the basin. This situation raises public concern over the safety of recreational activities in bacteria-contaminated streams and rivers.

Reasons for concern

Bacteria come from a variety of sources, including agricultural runoff, inadequately treated domestic sewage, even wildlife. Some of these bacteria may cause disease. Other potentially disease-causing agents from these sources include viruses, protozoa, and worms. But it's bacteria which cause the most problems; of greatest concern are bacteria from human fecal material.

Available monitoring tools make it difficult to determine whether bacterial contamination in a water body is from human or animal sources. It is, however, possible to determine whether the bacteria originated in the intestinal tract of a mammal. This kind of bacteria is called fecal coliform. If fecal coliform bacteria

[1] Another critical pollutant in the Minnesota is phosphorus. For more information, see the publication *Phosphorus in the Minnesota River* (MPCA/Minn. River Joint Powers Board, 1998).

Bacteria can get into the river from runoff entering ditches and tributaries

Wildlife also may contribute bacteria to the Minnesota River and its tributaries. However, in most locations the contribution from wildlife is relatively minor.

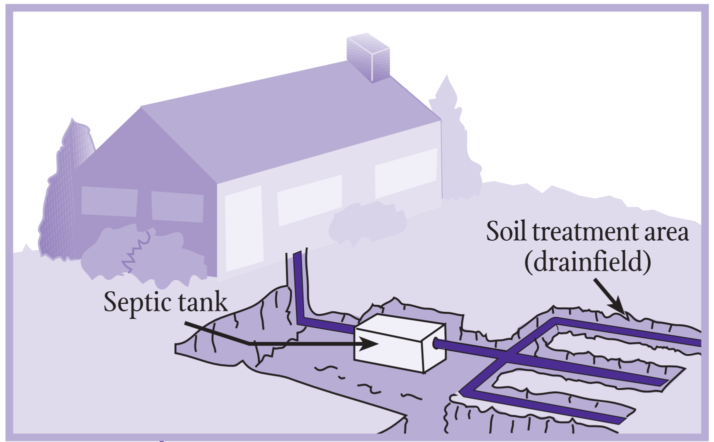
How can we keep bacteria out of the river?

There are a number of safeguards and management practices we can use to keep human and animal waste, and therefore bacteria, out of the river. Some are mandated by law, others are required in permits, still others are voluntary. Following are some of the regulations and voluntary practices used to meet the fecal coliform standards. Space limitations preclude a listing of all the regulations or best management practices for wastewater treatment plants, septic systems, or feedlots. For this information, please refer to the publications listed at the end of this document.

Wastewater treatment plants, feedlots, and septic systems have different requirements which are designed to minimize the environmental effects of the wastes they discharge.

Wastewater treatment facility permits (renewed every five years) specify effluent limitations for a wide range of pollutants. Permits for mechanical plants require disinfection of waste. Monthly reporting of monitoring data ensures that any exceedences of fecal coliform effluent limits are identified and appropriate enforcement action taken if necessary.

State rules also apply to the design and function of *septic systems*. One of the most important is the requirement for soil treatment, typically a mound or drainfield. A septic tank should be checked at least every 3 years. If full, it must be pumped,



Components of a typical septic system.

These "unsewered" communities and areas were identified as having problems such as partially treated or untreated discharges of sewage from a common tile line (or storm sewer) to a stream or ditch, small lots with multiple failing septic systems, and small lots with failing septic systems around lakes and streams. According to the survey, there were 38 unsewered incorporated communities and 102 unsewered areas in the Minnesota River basin. Most of them had populations of less than 500 people.

Septic systems, which consist of a septic tank and soil treatment area (typically drain fields or mounds), have been generally recognized over the years as an acceptable means of treating wastewater. The effluent from a septic tank contains solids, phosphorus, nitrogen, chloride, bacteria, viruses, and organic chemicals. Because of this, it is illegal to discharge a septic tank directly to a tile line or surface water. Instead, the septic tank should be connected to a soil treatment system. A properly sited, installed, and maintained individual sewage treatment system results in disease-causing bacteria dying off within the soil treatment area as effluent moves through it.

When soil treatment areas are lacking or wastewater from a residence or from a septic tank is allowed to flow directly into tile drains or drainage ditches, most of the nutrients, oxygen-demanding materials and pathogens enter surface or ground water relatively untreated. Surveys conducted in southern Minnesota show that many rural septic systems have no soil treatment areas.

Animal sources of bacteria include feedlots and manure. Livestock production is a significant industry in Minnesota. There are an estimated 35,000 to 45,000 feedlots in Minnesota; about 15,000 operate under state or county permits. Manure is a natural byproduct of livestock production; too often it is regarded as a waste to be disposed of cheaply instead of as a valuable fertilizer. Improperly handled, animal manure containing disease organisms can directly affect human health. Microorganisms in livestock manure may carry diseases that can be transmitted to humans through contact with or consuming contaminated water.

levels exceed state water-quality standards, it's an indication that too much fecal matter is entering the stream. This indicates a potential threat to public health.

There are many types of fecal coliform bacteria, and not all of them cause disease in humans. But where there are coliform bacteria there may be other pathogens (disease-causing organisms) of concern. Thus, widespread violation of the fecal coliform standard in the Minnesota River basin indicates serious pollution and a possible health *concern*, but it doesn't necessarily mean there is an immediate health *threat* in any particular area.

Fecal coliform bacteria are one of many types of organisms which may cause disease. To test for all of these possible organisms in a body of water would be impractical and expensive. It would be like asking the doctor to test you for every possible disease before you even knew if you were sick. A sensible doctor would first take the patient's temperature, blood pressure, and other vitals. These simple tests serve to indicate if disease is present and additional tests are needed. Similarly, a positive fecal coliform test indicates that a variety of potentially harmful contaminants — not just fecal coliform — may be finding their way into a water body.

Streams and rivers of the Minnesota River basin are routinely monitored for fecal coliform. According to data from the last 10 years of monitoring, high fecal coliform levels are the most common reason for water-quality violations in the Minnesota River. In fact, during the decade 1987-1996, 20 of 35 water quality violations in tributaries and the main channel were caused by exceedences of the fecal coliform standard.

The standard

Water-quality standards for fecal coliform vary depending on the intended use of a particular water body.

Drinking-water supplies

Since fecal coliform can be an acute health risk to humans, the U.S. Environmental Protection Agency has established an enforceable requirement that samples from public drinking-water supplies contain no fecal coliform. All public water utilities are subject to this zero-tolerance standard.

Fecal coliform bacteria may be a problem in private water supplies too, especially in uncased shallow wells. Private well owners should periodically test their wells for coliform bacteria. If present, the wells should be disinfected.

Bacteria can make surface waters unsafe for body-contact recreation.

Surface water

The state of Minnesota has established water-quality standards (based on federal criteria) which are designed to protect the state's water resources for their officially designated uses, such as drinking, recreation or aquatic life support. The water-quality standard for fecal coliform[2] is intended to protect surface-water quality for recreational purposes. Similar guidelines are used by the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers to help evaluate the safety of beaches for swimming (Minnesota and 10 other states are members of this group). Thus, surface waters which meet the standard are deemed to be safe for body-contact recreation. Those which fail to meet the standard may pose a health risk; however, additional tests will be needed to determine the source of contamination and whether pathogens are present among the fecal coliform bacteria.

Bacteria trends in the Minnesota River

In 1975, the MPCA prepared a detailed assessment of water-quality conditions in the Minnesota River basin. Most monitoring stations reported violations of the fecal coliform standard in at least 25 percent of samples; many reported violations of 50 percent or more; and several, such as the Maple and Le Sueur rivers, reported violations in 100 percent of the samples taken. Much of the river and its tributaries thus were unsafe for body-contact recreation. Sources of fecal coliform pollution were identified as: 1) communities supplying inadequate disinfection of treated wastewater; 2) animal feedlots and pastured animals; and 3) failing septic systems. The Minnesota River Assessment Project, from 1989-1994, showed continuing frequent violation of the fecal coliform standard under all flow conditions.

[2] The standard for fecal coliform bacteria (Minnesota Rules Chapter 7050.0222) for most waters of the state applies between March 1 and October 31 and is divided into two parts:

- 200 organisms per 100 milliliters (not to exceed a geometric mean of not less than 5 samples per calendar month) OR
- 2000 organisms per 100 milliliters (no more than 10 percent of the samples per calendar month can individually exceed)

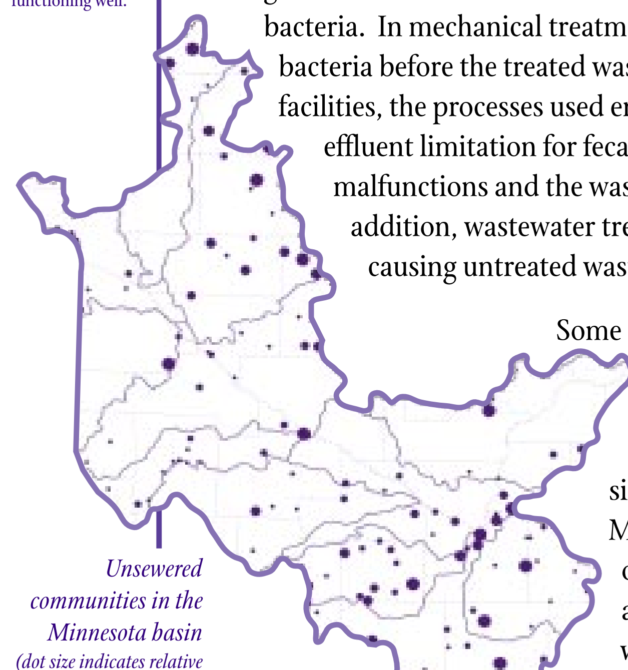
What are the sources of bacteria in the Minnesota?

There are a number of sources of human and animal waste which enter the Minnesota River. Improperly treated human waste may come from densely populated areas such as cities, unsewered areas with inadequate community or individual wastewater treatment, or a single home with a failing septic system. Sources of animal waste include feedlots and manure runoff as well as wildlife.

Since the early 1970s, most municipal sources have dramatically reduced fecal coliform in their wastewater effluent. More feedlots are obtaining permits, which should lead to improved water quality. And we now have a statewide system in place for licensing of septic-system contractors (installers, designers, pumpers and inspectors) and for providing county oversight, which is expected to greatly reduce this source of pollution in the future. Despite these types of improvements, recent monitoring data show that many portions of the Minnesota River and its tributaries still exceed the fecal coliform standard.

Most municipalities rely on wastewater treatment plants to remove pollutants from their wastewater. The two main types of treatment systems used are waste stabilization ponds and mechanical plants. In a pond system, the water is held for at least 180 days, during which it undergoes treatment by natural processes. This long detention time ensures that the discharged water will be very low in bacteria. In mechanical treatment plants, a disinfection process kills most bacteria before the treated wastewater is discharged. In both types of facilities, the processes used ensure that the discharge meets the state effluent limitation for fecal coliform.[3] However, occasionally equipment malfunctions and the waste does not receive adequate treatment. In addition, wastewater treatment facilities sometimes become flooded, causing untreated waste to flow directly into a river.

Some small cities and settled areas in the Minnesota River basin do not have centralized wastewater treatment and instead rely on septic systems. The problem with this situation is that many septic systems in Minnesota do not provide adequate treatment of wastewater.[4] In 1997, the MPCA conducted a state-wide county survey of known areas where wastewater problems were occurring.



Unsewered communities in the Minnesota basin (dot size indicates relative population)

[3] The effluent limitation for fecal coliform is 200 organisms per 100 milliliters, and applies from March to October for discharges to most state waters. If the wastewater outfall is within 25 miles upstream of a drinking-water supply, the limitation applies year-around.

[4] A 1992 survey by the MPCA found that about 70 percent of septic systems statewide are not treating wastewater adequately to protect the environment and human health. Proper design, siting, and maintenance are necessary to keep septic systems functioning well.