

SEPTIC SYSTEM IMPACT ON SURFACE WATERS

A Review for the Inland Northwest



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Will McDowell
Chris Brick
Matt Clifford
Michelle Frode-Hutchins
Jon Harvala
Karen Knudsen

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INTRODUCTION

Montana, Idaho, Washington, and Oregon have experienced tremendous population growth in the past 15 years, and this growth is expected to continue. To many people's surprise, a great deal of this growth is occurring in rural areas without centralized infrastructure, such as sewage treatment plants. This rural growth tends to be concentrated near rivers and lakes, where increased wastewater loads can threaten water quality. One of the biggest challenges facing state and local governments is how to deal with the increase in wastewater while protecting the water quality that is crucial to the natural beauty of these areas.

Septic systems, also known as "on-site wastewater treatment systems," are widely used in rural and suburban settings to dispose of wastewater. When operating properly, septic systems remove many pollutants and provide some measure of protection for human health and for the environment. But as rural populations grow and aquifers exhaust their ability to dilute wastes from ever-increasing numbers of septic tanks, water quality steadily deteriorates. Most state and local governments have regulations designed to protect public health from the worst contaminants from septic systems: water-borne pathogens and nitrates. But very few governments have created effective measures to address the increasing threat that septic tanks pose to the ecosystems of rivers and lakes.

Why have communities not done more to prevent septic systems from harming our streams and lakes? Perhaps because in the past, when rural populations were lower, the impacts were minimal and there was little threat to our surface waters. Or it may be that the connection between groundwater and streams (or lakes) was simply not well understood. But scientists have demonstrated that septic wastes in groundwater do ultimately flow into rivers or lakes,

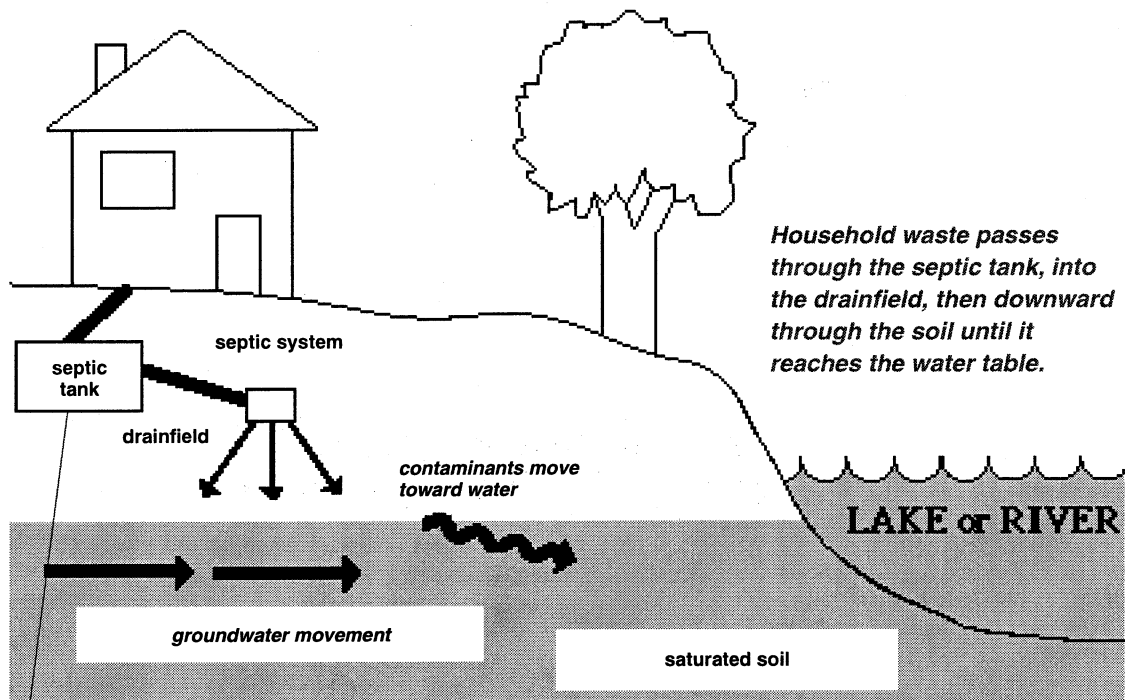
and that in many areas these wastes are already degrading the quality of nearby waters. The goal of this paper is to discuss this issue by examining the technical background of the problem, clarifying the risks, and reviewing options for mitigation.

Through a review of scientific and policy studies, this paper will discuss the following questions:

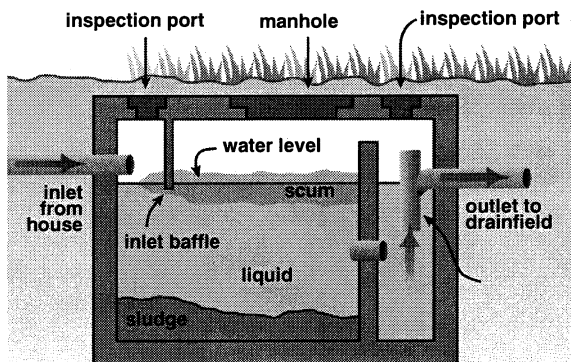
- What risk does septic effluent pose to streams and lakes?
- How do contaminants get from septic systems to groundwater?
- How do contaminants get from groundwater to streams and lakes?
- What are the wastewater treatment options when trying to achieve public health and resource protection goals?
- What are the existing policy and regulatory options for mitigating surface water impacts?

This paper is intended to give policymakers a broader appreciation of the risks that traditional septic systems pose to our surface waters, in the hope that this will lead them to develop strategies that maintain and improve the water quality of our lakes and rivers.

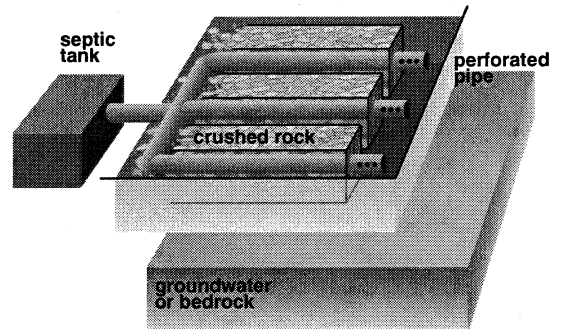
Waste's Journey from House to Water Table to Lakes and Streams



Up close: Septic Tank



Up close: Drainfield



SEPTIC EFFLUENT: What risk does it pose to streams and lakes?

Sepic systems discharge a variety of contaminants which can affect surface waters, including nutrients, pathogens, organic matter and solids. Conventional septic tank and drainfield systems treat wastewater by settling solids and partly digesting the organic matter, allowing liquid effluent, which still contains nutrients and pathogens (bacteria, protozoa and viruses) to be discharged into the soil beneath the drainfield.

In the soil, biological processes, filtration, and adsorption remove most pathogens and some nutrients. However, conventional septic systems are not adequate for removing nitrate, and only partly remove phosphorus, certain pathogens, and certain other compounds, especially where soils or ground water conditions are marginally suitable, or where septic system densities are too high (EPA, 2002). Anything that is not removed by the soil under the drainfield will end up in groundwater.

Nutrient enrichment and its effect on lakes and rivers:

Septic systems are among the many sources of nutrients in groundwater and surface water—other major sources include agricultural fertilizers, livestock manure, air pollution, forest fires, eroded sediments, municipal wastewater, and storm-water runoff. Nutrient enrichment, or eutrophication, is the over-fertilization of surface waters by nitrogen and phosphorus, and is one of the leading causes of pollution of lakes, rivers, and coastal bays in the United States (EPA, 2004***).

Nutrient enrichment can cause a host of negative ecological effects on streams and lakes, including loss of water clarity, proliferation of aquatic weeds, algae blooms, and drop-offs in dissolved oxygen (a critical factor for fish and other aquatic life). Algae blooms can also make drinking water taste

and smell bad, can release toxins (in the case of blue-green algae), and can contribute to the problem of carcinogenic tri-halomethanes formed by chlorination of drinking waters high in organic detritus (Carpenter, et.al., 1998, “Nonpoint Pollution of Surface Waters with N&P”, Ecological Society of America, <http://esa.sdsc.edu/>).

Nitrogen, in its nitrate form, is also a direct risk to human and livestock health if it reaches high concentrations in drinking water (10 milligrams/Liter is the EPA maximum contaminant level for drinking water). However, the levels of nitrogen and phosphorus that cause ecological damage in lakes and rivers are far lower—usually more than 10 times lower—than the levels which are toxic to humans and livestock. Therefore, the precautions taken by communities to protect groundwater used for drinking are not sufficient to protect rivers and lakes from ecological impacts.

The issue of “limiting nutrients” in lakes and rivers:

Some state and local governments assume that phosphorus is the only nutrient of concern for surface water pollution, but this is not the case. In lakes and rivers a certain ratio of nitrogen to phosphorus is required to trigger an algal bloom or excessive growth of aquatic plants, and the nutrient which is in shortest supply is known as the “limiting nutrient.” In freshwater systems, the limiting



Septic systems can contribute nutrients to surface waters, especially nitrogen; while associated development activities—e.g., construction, roads, lawns—increase phosphorus. The combination threatens sensitive waters.

nutrient is often, but not always, phosphorus. In parts of the Clark Fork River, for example, nitrogen is the limiting nutrient.

Nitrogen from septic systems can cause nutrient enrichment in fresh water if:

- 1) complementary sources of phosphorus are available, or could become available, such as phosphorus associated with soil erosion, phosphorus associated with wildfires, phosphorus from municipal/industrial wastewaters; or phosphorus in urban and suburban storm runoff; and/or
- 2) septic-derived phosphorus can reach surface water, which is more likely when the septic system is very close to a stream or lake, as in a lake-front home. Note that many of these sources of phosphorus increase with development.

Rural and suburban regions experiencing growth near lakes and rivers:

Much of the northwestern United States has experienced accelerated growth rates in the last 15 years, including many formerly rural counties in Idaho, western Montana, Oregon and Washington. The growth in these areas was far higher than the national average from 1990 to 2000, as was growth in western Montana. Much of this growth is concentrated near well-known rivers and lakes or coastal waters. The counties listed in Table 1 below experienced growth rates that are more than **double the national average** of 13% between 1990 and 2000.

Table 1: Fast-Growing Counties in the Northwest USA

State/County	Growth Rate, 1990 - 2000	Key Surface Waters & Tributaries:
MT- Gallatin Co.	34%	Gallatin River and tributaries
MT- Ravalli Co.	44%	Bitterroot River and tributaries
MT- Lake Co.	26%	Flathead Lake and river
MT- Flathead Co.	26%	Flathead Lake, Swan Lake, Whitefish Lake, many others
ID- Kootenai Co.	56%	Spokane River, Coeur d'Alene & other lakes
ID- Bonner Co.	38%	Pend Oreille Lake
ID- Ada, Canyon, Elmore & Boise Cos.	37 - 90%	Boise River, Payette River, Snake River and reservoirs
ID- Teton Co	74%	Upper Snake River
OR- Crook, Deschutes, Jefferson Cos.	36% - 54%	Deschutes River and tributaries
OR- Yamhill & Washington Cos.	30% - 43%	Willamette and tributaries
WA- Whatcom, Skagit, Snohomish & Thurston	29% - 30%	Nooksak, Skagit, Skykomish, Stillaguamish rivers, lakes, Puget Sound
WA- Benton, Franklin, & Grant Cos.	27% - 36%	Yakima River, Columbia River, various lakes
WA- Stevens & Pend Oreille Cos.	27% - 32%	Spokane and Pend Oreille Rivers, Roosevelt Lake
WA- Chelan Co.	27%	Columbia tributaries & lakes

Source: U.S. Census Quickfacts