Applying knowledge to improve water quality

Pacific Northwest Regional Water Program

A Partnership of USDA NIFA & Land Grant Colleges and Universities

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Protecting Our Water:

Waste Water Treatment Plants

The average American uses over 100 gallons of fresh water each day in their home. After using this water in every day activities including showering, washing dishes, preparing food, using garbage disposals, flushing toilets, and washing laundry most used water goes down the drain. For those of us that live in cities and/or municipalities the water that goes down the drain enters sewers and ends up in a municipal waste water (waste water = sewage) treatment plant (also known as sewer treatment plant).

Municipal waste water treatment plants are modern marvels that clean up this dirty water by removing wastes and pathogens from this used water and then discharging the cleaned water back into rivers or streams. In most cases the cleaned water is purer and safer than the water in the recipient river.

The water cleaning process is done through a sequential series of steps known as preliminary treatment, primary treatment, secondary treatment, and tertiary treatment followed by water disinfection and then discharge into an appropriate water body.

The solid wastes in the sewage entering a treatment plant include fecal material and food waste. However, these wastes are very diluted by the water they travel with into the treatment plant. In fact there are about 1,000 parts water to each part of solid waste material. Modern treatment plants use physical, biological, and chemical processes to clean up this contaminated water. The first two steps in wastewater treatment (preliminary and primary) are physical steps. These steps rely on physical processes such as screening and gravity to remove the largest particles of waste from the water.

Preliminary Treatment. When wastewater arrives at the treatment plant via the sewer system it flows through a bar screen which removes any large-sized inert materials such as pieces of plastic and rags. The removal of this material is vital because it can damage pumps that are used to move the liquid waste through the various cleaning steps in the treatment plant. After

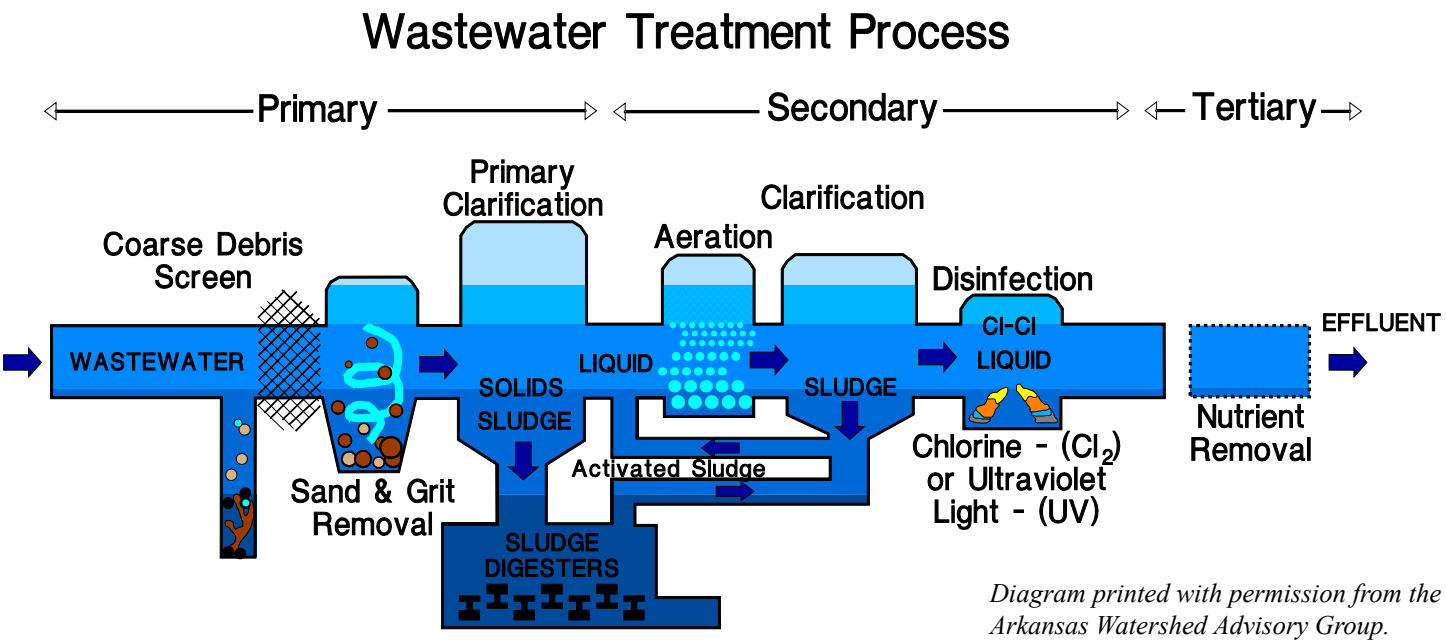

Diagram printed with permission from the Arkansas Watershed Advisory Group.

Pacific Northwest Regional Water Quality Coordination Project Partners

Land Grant Universities

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Contact Fred Sorensen:
907-786-6311
http://www.uaf.edu/ces/water/
University Publications:
http://www.alaska.edu/uaf/ces/publications/

Idaho
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Contact Bob Mahler: 208-885-7025
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University Publications:
http://info.ag.uidaho.edu/Catalog/catalog.htm

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Extension Service
Contact Mike Gamroth: 541-737-3316
http://extension.oregonstate.edu/
University Publications:
http://extension.oregonstate.edu/catalog/

Washington
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Contact Bob Simmons:
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University Publications:
http://pubs.wsu.edu/

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Water Resource Research Institutes

Water and Environmental Research Center (Alaska)
http://www.uaf.edu/water/

Idaho Water Resources Research Institute
http://www.boise.uidaho.edu/

Institute for Water and Watersheds (Oregon)
http://water.oregonstate.edu/

State of Washington Water Research Center
http://www.swwrc.wsu.edu/

Environmental Protection Agency

EPA, Region 10
The Pacific Northwest
http://www.epa.gov/r10earth/

Office of Research and Development, Corvallis Laboratory
http://www.epa.gov/wed/

The Project

Land Grant Universities, Water Research Institutes, and EPA Region 10 have formed a partnership to provide research and education to communities about protecting or restoring the quality of water resources. This partnership is being supported in part by the USDA's National Institute of Food and Agriculture (NIFA).

Our Goal and Approach

The goal of this Project is to provide leadership for water resources research, education, and outreach to help people, industry, and governments to prevent and solve current and emerging water quality and quantity problems. The approach to achieving this goal is for the Partners to develop a coordinated water quality effort based on, and strengthening, individual state programs.

Our Strengths

The Project promotes regional collaboration by acknowledging existing programs and successful efforts; assisting program gaps; identifying potential issues for cross-agency and private sector collaboration; and developing a clearinghouse of expertise and programs. In addition, the Project establishes or enhances partnerships with federal, state, and local environmental and water resource management agencies, such as by placing a University Liaison within the offices of EPA Region 10.

flowing through the bar screen the sewage velocity is reduced which allows inert sands to settle out of the water. The removed sands, rags, and plastic are either incinerated or sent to a landfill.

Primary Treatment. This treatment stage removes visible pieces of organic materials such as fecal wastes and food materials using gravity. Here the sewage flows into a large tank called a primary clarifier. Here the water in the tank remains motionless for several hours allowing the larger sized organic materials to settle out to the bottom. Also, waxes, oils, and fats float to the surface of the tank. The settled organic materials and the skimmed off waxes, fats and oils are collectively removed and called raw sludge. This removed raw sludge can be composted or anaerobically digested then pastured and sold on the market as a humus rich material for lawns and gardens.

Secondary Treatment. Small sized organic materials (colloidal sized-particles) that do not settle out from water in a reasonable amount of time are removed in this step. These materials include fecal wastes and food particles that are very small in size. This is a biological treatment process because this treatment depends on biological microorganisms to break down this waste.

Tertiary Treatment. Only the most modern wastewater treatment plants employ this step. Here chemical processes are used to remove inorganic nitrogen and inorganic phosphorus from the wastewater. This is an expensive step and currently only about 20 percent of the waste water treatment plants in the USA are capable of doing this. However, removal of N and P is important to prevent eutrophication (rapid aging) of the nation's waters.

Disinfection and Discharge. After the above treatments are completed any pathogens remaining in the water are killed. This disinfection process is usually accomplished by using chlorination. However, ozone and ultraviolet radiation can also be used to kill pathogens. After disinfection the water is now clean and can be safely discharged into streams, rivers, or lakes.

National Water Quality Program Areas

The four land grant universities in the Pacific Northwest have aligned our water resource Extension and research efforts with eight themes of the USDA's National Institute of Food and Agriculture.

1. Animal Waste Management
2. Drinking Water and Human Health
3. Environmental Restoration
4. Nutrient and Pesticide Management
5. Pollution Assessment and Prevention
6. Watershed Management
7. Water Conservation and Management
8. Water Policy and Economics

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