Report for 2004DE42B: Undergraduate Internship: Evaluating Land Application of Wastewater as a Nutrient Reduction Control Strategy for the Chesapeake Bay

- Water Resources Research Institute Reports:
  - Ritter, William, and Erin Zimich, 2005, Evaluating Land Application of Wastewater as a Nutrient Reduction Control Strategy for the Chesapeake Bay, Delaware Water Resources Center, University of Delaware, Newark, Delaware, 23 Pages.

Report Follows

Undergraduate Internship Project #4 of 9 for FY04

Erin Zimich's project "Evaluating Land Application of Wastewater as a Nutrient Reduction Strategy for the Chesapeake Bay" is co-sponsored by the DWRC and the UD College of Engineering. Dr. Bill Ritter of UD's Department of Civil and Environmental Engineering is the project advisor. Erin will inventory current and prospective land application sites and will consider the costs of additional application facilities for potential further nutrient reduction.

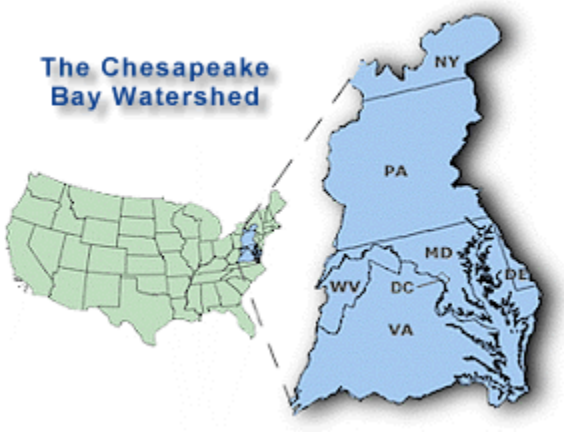
"My internship has given me perspective on the state of water quality in the Chesapeake Bay and made me realize that, in order to maintain this precious resource, drastic measures must be taken." --Erin Zimich

Abstract

The Chesapeake Bay, which is the largest estuary of its kind and provides habitat for vast numbers of species as well as a revenue source for human commercial interests, receives wastewater discharges from six states and the District of Columbia. Two billion gallons of treated effluent reach the Bay waters each day; this wastewater, though treated, is leading to a nitrogen loading of almost 60 million pounds yearly.

Nitrogen is one of the Bay's biggest current pollution problem. Excess nitrogen causes algae blooms that affect the Chesapeake in two major ways. First, large living populations of algae drift thickly through the water and decrease the amount of sunlight that reaches bottom-dwelling grasses, causing some grasses to die and those that survive to be less productive in absorbing CO2 and releasing oxygen. Second, as algae dies, the decaying process removes oxygen from the water. This one-two punch, reducing new oxygen production from plants and wasting oxygen already present in the system, has a serious adverse effect upon the Bay. Fish kills are probably the most visible result of this phenomenon, but nitrogen originated problems are also a large contributor to the current ¾ reduction in Bay productivity.

There are four main sources of nitrogen pollution in the Chesapeake: agriculture, sewage treatment plants, urban storm water, and air pollution. Sewage treatment plants are the second largest contributor of Bay pollution, and constitute for 22% of the nitrogen load. Though nationwide standards regulate the amount of nutrients that are discharged into the Bay, they have proven to be insufficient. Due to the Chesapeake Bay's extreme importance to industry, many states are working together to adopt stricter nutrient reduction standards.



Federal regulations encourage states to reduce effluent discharges into sensitive waters such as the Chesapeake Bay by using wastewater for some purpose other than mere discharge. Land application of wastewater, also called land treatment, is one of the successful methods of reducing nutrient loading into waterways. By applying partially treated wastewater at a

prescribed application rate to soils, instead of water, the nutrient loads can be more easily controlled. Land application offers benefits that are not achieved by simple discharge: nutrients are used in a controlled and beneficial manner, water is conserved, and the costs of saleable crops can be reduced. When effluent is discharged into water the nutrients that it contains may travel hundreds of miles to affect unexpected areas in unexpected ways. Applying wastewater to land in a controlled fashion eliminates this guessing game. Simply, land application uses as fertilizer nutrients that would otherwise act as pollutants.

Perhaps the biggest hurdle that spray irrigation must overcome is public perception that it is unsafe. This "fear of becoming Mexico" is simply unfounded; land application of waste is not at all a new technology and has in fact worked successfully in the US and elsewhere for hundreds of years. The practice was first documented in Germany in 1531, but it is believed to have been in existence long before. Land application was widely used in the United States until the 1960's and was once considered the safest and most reliable form of waste treatment. Several factors precipitated its fall from favor: germ theory of the transmission of disease, improper management of facilities that led to the overloading of application sites, and the development of farmland for other uses. None of these reasons, however, is insurmountable. Provided that there are proper engineering controls in place, land treatment of waste is still the most reliable and environmentally efficient method available. It is certainly feasible to use it more often in the United States.

The question thus becomes, "Is land application a good option for reducing the pollution load into the Chesapeake Bay?" To answer, this study is accessing the potential of each treatment plant that discharges into the Bay. This report summarizes an analysis of the present land application sites in the watershed and an analysis of the Pennsylvania wastewater treatment plants potential to convert to land application.