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EFFECTS OF BIOSOLIDS ON GROUNDWATER QUALITY

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Problem and Research Objectives:

Beneficial re-use of residuals, such as biosolids and short paper fiber, has become an increasingly important topic in both environmental policy and science over the past decade. These materials, which are a natural by-product of waste management, are becoming a significant disposal problem. Reclamation activities, such as those at abandoned gravel pits, provide a way for these secondary products to be recycled back into the environment. However, the same attributes that make this material valuable as an organic material, also may cause deleterious effects to groundwater without proper management and monitoring. Excessively high nitrogen content in biosolids may lead to nitrate concentrations in groundwater that exceed EPA allowable limits and lead to harmful environmental and human health effects.

The State of New Hampshire along with the entire New England region have been actively trying to enact policies dealing with the use of residuals specifically for reclamation activities. However, environmental policy and effective management practices are extremely difficult to develop without the aid of comprehensive scientific studies that examine the impacts of these activities on the ecosystem.

The purpose of this project is to continue a groundwater monitoring demonstration project at a reclamation site utilizing residuals regulated by Env-Ws 800. Specifically, the project assesses the impact of residual application on nitrogen concentrations (nitrate, ammonium, and dissolved organic N) and dissolved organic carbon in groundwater at a topsoil manufacturing site in New Hampshire. This site uses biosolids and/or short paper fiber (SPF) to reclaim (revegetate) a former gravel pit and manufacture topsoil. The primary goal of the project is to demonstrate whether current management and application practices are sufficient to protect groundwater from contamination with NO 3 -N and other forms of dissolved nitrogen. A secondary goal of the project is to assess levels of trace metals in groundwater at this reclamation site. In assessing these goals we aim to identify ways to improve best management practices (BMPs) and protect groundwater while continuing to provide a beneficial use for this nutrient-rich material.

Principal Findings and Significance:

The monitoring demonstration at this biosolids application site in Hooksett, NH has produced several key findings. First, there are significant increases in average NO 3 -N concentrations in groundwater when wells beneath biosolids treatment areas are compared to control and upgradient wells at the site. However, the concentrations of NO 3 -N in groundwater both within and downgradient from the biosolids treatment area show high spatial variability. This suggests that NO 3 -N contamination has not resulted from the relatively uniform biosolids applications, but rather has resulted from non-uniform stockpiling at the site. Based on the management history of the site and the location of areas of high NO 3 -N concentrations in groundwater we are fairly certain that this stockpiling activity has led to deleterious effects on groundwater.

We believe that gravel pit management practices can lead to nitrogen saturation of soils (Aber et al. 1989), a condition in which soil microbes and plants can no longer utilize available N in a predictable or effective way, resulting in contamination of groundwater with nitrogen. This was most likely the case at the Hooksett site where past stockpiling and application activity may have led to an inability of the soil to utilize the available N provided by the biomix application in October of 1999. Although available nitrogen appears to be high, the available carbon at the site appears to be quite low. This lack of available carbon as an energy source for microbial processing has led to increased levels of nitrification causing an increase in NO_3-N production and a subsequent leaching of NO_3-N to the groundwater.