

CVEN 5534, Wastewater Treatment

Assignment 2, due Tuesday, Sept. 14.

Wastewater Characterization and Regulation

1. Wastewater Data (Influent and Effluent) for the City of Longmont, CO Wastewater Treatment Plant (WWTP) is on the web page as a spreadsheet:
<http://ceae.colorado.edu/~silverst/cven5534/notes>. Use the spreadsheet data to:
 - a. **Compare values for average daily flow, maximum month, average day (MMAD), and maximum daily flow for the sampling period (Jan-Jun 2009).**
 - b. **Calculate ratios: Influent COD:TBOD, Effluent COD:TBOD, where TBOD includes both soluble and particulate components.**
 - i. The influent ratio is somewhat higher than typical values (see Composition table in class notes for Characteristics on the web page). **What might be an explanation for that?**
 - ii. The effluent ratio is much higher than the influent. **Why do you think that is?**
 - c. The WWTP discharges to the St. Vrain Creek, which is an ammonia-limited stream has new water quality standards (WQS) for ammonia in 2011. (see WQS for St. Vrain Creek in <http://ceae.colorado.edu/~silverst/cven5534/notes>)
 - i. Acute toxicity = 8.4 mg/L total ammonia nitrogen (NH₃-N + NH₄-N)
 - ii. Chronic toxicity = 0.06 mg/L NH₃-N

The relationship $\text{NH}_3\text{-N} = 0.06 \text{ NH}_4\text{-N}$ can be used to estimate the allowable in-stream concentration of NH₄-N for chronic or acute WQS under the critical pH condition for St. Vrain Creek (pH = 8.0).

Under low flow conditions the ratio of the base flow in St. Vrain Creek to the WWTP flow is 0.54:1.

Given the Longmont WWTP performance in 2009, which standard, chronic or acute, could impose the greatest changes to the discharge permit standard for total ammonia-nitrogen? Considering dilution in St. Vrain Creek what might that new standard be if the State tries to maintain WQS?

- d. Currently the discharge permit for Longmont WWTP contains no limit on nitrate nitrogen since the WQS for nitrate in the St. Vrain Creek is only limited by the agricultural standard, 100 mg/L NO₃-N. However, significant land development is occurring to the east of Longmont, and there is a possibility that the drinking water standard for nitrate: 10 mg/L NO₃-N may be added to WQS. **If that should happen, estimate the potential discharge standard for nitrate-nitrogen for the WWTP, considering the current dilution factor for the plant.**

- e. The state is changing the in-stream WQS for recreational use from the old indicator, fecal coliform bacteria (200 cells/100 ml) to a new indicator, E. coli, with a WQS of 126 cells/100 ml. **Given the 2009 data, and a conversion factor of 0.63 E. coli/fecal coliform cells, and the current dilution factor, will the plant meet the new WQS? USGS has reported that a more reliable ratio is 0.77 E. coli/fecal coliform cells. Will the WWTP be able to meet that standard?**
2. Compare the merits of wastewater discharge permits based **on technology-based limits versus water quality based effluent limits**. Consider factors such as: environmental impacts, cost, social and political factors, ability to incorporate new science and new contaminants, and any other aspects you think are important.