CE 326 Principles of Environmental Engineering
Rapid Sand Filter Design
Due April 2, 2008

A new water treatment plant is planned for a community of 40,000 people along the Des Moines River. The new plant will consist of rapid mix for coagulation, flocculation, and sedimentation basins, followed by rapid sand filters. The water quality for the plant will be similar to the Des Moines River water sample tested in the lab during the past two weeks. Use the following as a basis of design of the rapid mix, slow mix (flocculators), sedimentation basin, and rapid sand filters:

| | |
|---|---|
| design population | 40,000 |
| average demand | 100 gallons per capita per day |
| maximum day demand | 2.4 times average |
| cold water temperature | 10°C |
| avg. floc particle size | 50 μ |
| sand | |
| specific gravity | 2.65 |
| effective size, mm | 0.47 |
| uniformity coefficient | 1.4 |
| shape factor | 0.84 |
| bed porosity | 0.42 |

Prepare a design for the rapid mix, slow mix (flocculators), sedimentation basin, and rapid sand filters and include a sketch of plan of the entire facility. For the rapid mix and slow mix basins, provide horsepower requirements for the mixers. For the rapid sand filter, include section views showing details for the underdrain, support media, media, and washwater troughs. In your layout provide space for expanding the facility for up to twice the capacity at some future time. Prepare a short report providing a summary of the basis of design, any assumptions that were made (G and Gt values, sedimentation loading rate, filtration loading rate, depth of sand, backwash rate, etc.), and design calculations. Use the example on the web as a guide for sizing the washwater troughs. Example problems 3-25 through 3-28 in the text provide examples of the hydraulic calculations.