Problem of the Day

2014.Nov.20

Introduction

The Water Environment Federation is the trade organization for water professionals, including wastewater treatment operations professionals (http://wefcom.wef.org/home). Individual states, or groups of states, sponsor local chapters. On October 29, 2014, I gave a 6-hour Math for Operators Workshop at the annual conference of the Pacific Northwest Clean Water Association (PNCWA). PNCWA represents Idaho, Oregon and Washington (http://www.pncwa.org/). All operators should seriously consider joining their local association. In California it is the California Water Environment Association (http://www.cwea.org/).

Long story short: I randomly covered a series of math problems in the PNCWA workshop, and I have been requested by several attendees to send them the problems. Instead, I am going to post them here (starting with the 2014.Nov.04 Problem of the Day). They are good practice for all visitors to WWTT's Problem of the Day.

For those of you who may be new to WWTT's Problem of the Day, we insert a page break before and after the problem statement so you can print it without looking at the solution. **See what you can do to solve the problem before looking at the solution**.

For the last several days, the Problem of the Day has focused on velocity. It turns out that clarifier surface overflow rate (SOR) and trickling filter hydraulic loading are both "velocities in disguise." There is another hydraulic loading calculation that gives many operators angst: hydraulic loading to wastewater treatment ponds.

Hydraulic loading to ponds is always in units of **inches/day**. Compared to all the other units used in water and wastewater math, inches/day are very unique. But let's think about these units: "inch" is a unit of length and "day" is a unit of time. When I'm driving down the road, I'm going so many miles/hour, length/time. Indeed, just like miles/hour are units of velocity, so are inches/day. So again, hydraulic loading to ponds is a "velocity" calculation and is done just like all the others:

$$v = \frac{Q}{A}$$

Today's Problem of the Day calculates the hydraulic loading to a wastewater treatment pond.

Problem of the Day

Given the following information, calculate the hydraulic loading to this wastewater treatment pond.

- Influent flow = 1.25 MGD
- Area of pond = 45 acres
- **Calculate: hydraulic loading**.

Solution
The hydraulic loading is calculated using the velocity equation given above labeled a little differently here:

$$H_L = \frac{Q}{A}$$

where H_L is the hydraulic loading, Q is the plant flow and A is the pond surface area. Remember, there is a very useful conversion factor we use with a lot of pond problems:

$$\frac{3.069\ ac\text{-}ft}{Mgal} \quad \text{or} \quad \frac{Mgal}{3.069\ ac\text{-}ft}$$

Problem of the Day: Given the following information, calculate the hydraulic loading to this wastewater treatment pond.

- Influent flow = 1.25 Mgal/d
- Area of pond = 45 ac
- **Calculate: hydraulic loading, units are always in/d for ponds**.

$$\frac{H_L\ \textbf{in}}{\textbf{d}} = \frac{Q}{A} = \frac{1.25\ \cancel{Mgal}}{\textbf{d}} \left| \frac{}{45\ \cancel{ac}} \right. \frac{3.069\ \cancel{ac}\cancel{ft}}{\cancel{Mgal}} \left| \frac{12\ \textbf{in}}{\cancel{ft}} \right.$$

All the units have canceled except those needed in the answer, **in/d**, so the math is complete. The arithmetic gives the answer:

1.25 x 3.069 x 12 ÷ 45 = **1.023 in/d**.

That conversion factor sure makes pond problems easy!

Good calculating and **leave a comment** so we know how we're doing!