Problem of the Day
2015.Aug.20

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A 102-acre pond system serves a population of 15,200 people. The influent BOD concentration is 225 mg/L and the influent flow is 1.9 MGD. Calculate the organic loading to this pond system.

Introduction

Organic loading to a pond is a very straightforward pounds-per-day calculation divided by the surface area of the pond system in acres. Piece of cake!

Solution

The following information is given in the problem statement or assumed. Note the manner in which I have modified the way I express mg/L and others.

1. Raw wastewater (RW) flow = 1.9 Mgal RW/d

2. Influent BOD concentration = 225 mg/L = 225 ppM = 225 lb BOD/M lb RW

3. Density of RW = 8.34 lb RW/gal RW (assumed since not given)

4. Pond surface area = 102 ac

5. Population served = 15,200 people (not used in problem)

Today's problem asks to calculate the organic loading to the pond system. Organic loading to ponds is always in units of lb BOD/d·ac. These units, then, are put between heavy vertical lines, as always, followed by an equals sign and the blank solution bridge.

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$$\left| \frac{\text{lb BOD}}{\text{d·ac}} \right| = \underline{\hspace{10cm}}$$

The only place the units lb BOD appear in the list is in the numerator of No. 2. This, then, is entered to start the solution bridge to get the units needed in the numerator of the answer as shown in bold.

$$\left| \frac{\textbf{lb BOD}}{\text{d·ac}} \right| = \left| \frac{225 \textbf{ lb BOD}}{\text{M lb RW}} \right|$$

The only place the units d appear in the list is in the denominator of No. 1. This, then, is entered to get the units needed in the denominator of the answer as shown in bold. Note the Ms cancel in the denominator and numerator.

$$\left| \frac{\textbf{lb BOD}}{\textbf{d·ac}} \right| = \left| \frac{225 \textbf{ lb BOD}}{\cancel{\text{M}} \text{ lb RW}} \right| \frac{1.9 \cancel{\text{M}}\text{gal RW}}{\textbf{d}}$$

The only place the units ac appear in the list is in the numerator of No. 4. This, then, is entered to get the units needed in the denominator of the answer as shown in bold.

$$\left| \frac{\textbf{lb BOD}}{\textbf{d·ac}} \right| = \left| \frac{225 \textbf{ lb BOD}}{\cancel{\text{M}} \text{ lb RW}} \right| \frac{1.9 \cancel{\text{M}}\text{gal RW}}{\textbf{d}} \left| \frac{}{102 \textbf{ ac}} \right|$$

The solution bridge now contains all the units needed in the answer. Unwanted units now need to be canceled. The density of the raw wastewater (No. 3) is entered to cancel the units lb RW and gal RW.

lb BOD		225 lb BOD	1.9 ~~Mgal RW~~		8.34 ~~lb RW~~
d·ac	=	~~M lb RW~~	d	102 ac	~~gal RW~~

Since all the units have now canceled except those needed in the answer, **lb BOD/d·ac**, we know the solution bridge is complete. The arithmetic gives the answer.

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lb BOD		225 lb BOD	1.9 ~~Mgal RW~~		8.34 ~~lb RW~~
d·ac	=	~~M lb RW~~	d	102 ac	~~gal RW~~

225 x 1.9 x 8.34 ÷ 102 = **35.0 lb BOD/d·ac**.

Discussion
I'm liking the lb/M lb. You?

Happy calculating! Let us know, by leaving a comment, if you want us to do a specific problem, if you see a mistake, or if you have a question on any of the Problems of the Day you are looking at.