Homework #4

All problems are from the course textbook (Chapra) unless otherwise indicated.

1. Problem 3.2 (only a through e, reprinted below) Give results in mg/L for parts b & d

   A lake with a single inflow stream has the following characteristics:
   - Mean Depth = 5 m
   - Surface Area = 11×10^6 m^2
   - Residence time = 4.6 yr

   An industrial plant presently discharges malathion ($W = 2000 \times 10^6$ g/yr) to the lake. In addition, the inflowing stream also contains malathion (c_{in} = 15 mg/L). Note that the volumetric rate of inflow and outflow are equal. Assuming that a first-order decay reaction can be used to characterize malathion decay ($k = 0.1\ yr^{-1}$),
   (a) Write a mass balance equation for malathion for this system
   (b) If the lake is at SS, compute the malathion concentration
   (c) If the lake is at SS, what percent reduction in industrial loading is needed to drop the lake concentration to 30 ppm?
   (d)Evaluate each of the following options
      (i) build a WWTP that reduces the industrial discharge of Malathion by 50%
      (ii) double the lake's depth by dredging
      (iii) double the lake's outflow by diverting an unpolluted nearby stream
   (e) What other factors would need to be considered when making a decision in "d"?

2. Problem 4.5 show a graph of total P (in µg/L) vs year from 1990 to 2010
3. Problem 4.6 show a graph of total P (in µg/L) vs year from 1990 to 2010
4. Problem 4.7 show a graph of total P (in µg/L) vs year from 1990 to 2010
5. Problem 1.3 a&b from Thomann & Mueller (reprinted below):

A particular river had a significant effect on a reservoir through the discharge of suspended solids from the river to the reservoir. It is important to estimate the mass loading of solids to the reservoir to determine the extent of long-term sedimentation of solids in the reservoir, reducing its available volume. A brief survey over a 10-day period is shown below.

a. plot the flow versus time in days.
b. Estimate the mean mass loading of solids (in kg/d) into the reservoir, using a log-log plot of flow vs. solids.

Day	Flow (m^3/s)	Suspended Solids Concentration (mg/L)
1	1.0	10
2	1.5	
3	15.0	
4	100.0	
5	20.0	40
6	10.0	18
7	5.0	
8	2.5	20
9	1.5	
10	1.0	8

Assigned: 11 Oct 17
Due: 18 Oct 17