

1. The BOD_L in a stream is 3 mg/and the DO is 9 mg/. Stream flow is 15 MLD. A treated sewage effluent with BODL 50 mg/is discharged into the stream at a rate of 5 MLD. The DO of the sewage effluent is 2 mg/. Assume the deoxygenation and reaeration constants as 0.2/day and 0.5/day respectively and the saturated DO level is 11 mg/, determine the minimum DO level in the stream. If stream velocity is 1.5 m/s, where the minimum DO occurs.
2. Suppose the only source of BOD in a river is untreated wastes that are being discharged from a food processing plant. The resulting oxygen sag curve has a minimum value of DO, somewhere downstream, equal to 3.0 mg/L. Just below the discharge point, the DO of the steam is equal to the saturation value of 10.0 mg/L.
 - a. By what percent should the BOD of the wastes be reduced to assure a healthy stream with at least 5.0 mg/L of DO everywhere?
 - b. If the stream flows 1.1 m/s and it has a reaeration coefficient k_r equal to 0.80/day and a deoxygenation coefficient k_d of 0.20/day, how far downstream (km) would the lowest DO occur?
 - c. What ultimate BOD (L_0 mg/L) of the mixture of river and wastes just downstream from the discharge would cause the minimum DO to be 5.0 mg/L?
3. The following conditions are observed at a stream in a city. The stream flow is $25\text{m}^3/\text{sec}$. DO and L_a for river water is 6.55 and 5.86 mg/L, respectively. K_d & k_r are 0.19d^{-1} & 0.24d^{-1} respectively. The state requirement for minimum DO is 5.0 mg/L. How much additional BOD ($Q=3.11\text{m}^3/\text{sec}$, $DO=2.22$ mg/L) can be discharged into the stream and still maintain 5.0 mg/L DO at the flow stated. The saturated DO of the stream is 8.29mg/l
4. Consider a lake with surface area of $100 \times 10^6 \text{ m}^2$ for which the only source of phosphorus is the effluent from a wastewater treatment plant. The effluent flow rate is 0.4 m³/s and its phosphorus concentration is 10.0 mg/L. The lake is also fed by a stream having 20 m³/s flow with no phosphorus. If the phosphorus settling rate is estimated to be 10 m/yr, estimate the average total phosphorus concentration in the lake. What level of phosphorus removal at the wastewater treatment plant would be required to keep the average lake concentration below 0.010 mg/L?