

## DO Sag Calculations using the Streeter Phelps Equation Program

### INSTRUCTIONS

Using the data for DO Sag Curve of untreated wastewater, primary treated wastewater and secondary treated wastewater. inset the data into the Streeter Phelps Program. Input Data is entered in the **Yellow Cells**.

For each of the three scenarios enter the data from the columns m and mg/l in the table from OXYGEN-SAG CURVE COMPUTATIONS spread sheet. (see example below). Plot the DO and BOD levels versus the distance downstream of a point source of pollution.

Highlight the two columns m and mg/l copy them into a blank Excel spread sheet.

From the menu bar select insert, then select charts, and Scatter Smooth Lines.

The DO Sag curve will appear.

Under chart elements select and label the following Axis

Axis titles

Chart Title

Gride Lines

Major Horizontal

Major Vertical Minor

Horizontal Minor Vertical

[https://people.wou.edu/~taylors/es476\\_hydro/DOSAG.xls](https://people.wou.edu/~taylors/es476_hydro/DOSAG.xls)

. Data for Thompson Run Thompson Run STP Untreated Wastewater

Stream Discharge 2.0 m<sup>3</sup>/se

Width 10 m

Depth 2 m

DO stream 9.4 mg/l

BOD stream 2 mg/l

Temperature Stream 16oC

STP Discharge 0.5 m<sup>3</sup>/sec

STP Discharge Temp 25oC

STP Discharge BOD 1800 mg/l

Data for Thompson Run Thompson Run STP Primary Treated Effluent

Stream Discharge	2.0 m <sup>3</sup> /sec
Width	10 m
Depth	2 m
DO stream	9.4
BOD stream	2 mg/l
Temperature Stream	16oC
STP Discharge	0.5 m <sup>3</sup> /sec
STP Discharge Temp	25oC
STP Discharge BOD	60 mg/l

Data for Thompson Run Thompson Run STP Secondary Treated Effluent

Stream Discharge	2.0 m <sup>3</sup> /sec
Width	10 m
Depth	2 m
DO stream	9.4
BOD stream	2 mg/l
Temperature Stream	16oC
STP Discharge	0.5 m <sup>3</sup> /sec
STP Discharge Temp	25oC
STP Discharge BOD	25 mg/l

Questions:

1. What is the dissolve Oxygen at the critical point for each of the scenarios?

At what downstream distances does it occur.

BOD 180 mg/l

BOD 60 mg/l

BOD 25 mg/l

2. Using the data from the Sag Curve for Thompson Run discharge of 60 mg/l BOD

complete the following table.

Distance from Point Source m	Distance mi	DO mg/l
0	0	
1000	0.6	
3000	1	
5000	2	
7000	4	
9000	5	
10000	6	
13000	8	
15000	9	
19000	12	
42000	26	

## Problems

### 1. The Streeter-Phelps Equation Un Treated Effluent BOD 180 mg/l

25 million gallons per day (mgd) (1m<sup>3</sup>/sec) of domestic sewage is discharged into a stream. The flow rate of the stream is 250 cubic feet per second (cfs) ( 3.5m<sup>3</sup>/s). The velocity of the stream is approximately 3 miles per hour. (0.02 m/s). The temperature of the sewage is 21 °C. The Temperature of the Stream is 15o C. The Wastewater temperature is 20 °C. The BOD<sub>5</sub> of the wastewater is 180 mg/l. The BOD of the stream is 1 mg/l, The DO of the sewage is 0 mg/l The DO of the stream is 9.2 mg/l.

### 2. The Streeter-Phelps Equation Primary Treated Effluent BOD 60 mg/l

25 million gallons per day (mgd) (1m<sup>3</sup>/sec) of domestic sewage is discharged into a stream. The flow rate of the stream is 250 cubic feet per second (cfs) ( 3.5m<sup>3</sup>/s). The velocity of the stream is approximately 3 miles per hour. (0.02 m/s). The temperature of the sewage is 21 °C. The Temperature of the Stream is 15o C. The Wastewater temperature is 20 °C. The BOD<sub>5</sub> of the wastewater is 60 mg/l. The BOD of the stream is 1 mg/l, The DO of the sewage is 0 mg/l The DO of the stream is 9.2 mg/l.

3. The Streeter-Phelps Equation Primary Treated Effluent BOD 60 mg/l 25 million gallons per day (mgd) (1m<sup>3</sup>/sec) of domestic sewage is discharged into a stream. The flow rate of the stream is 250 cubic feet per second (cfs) ( 3.5m<sup>3</sup>/s). The velocity of the stream is approximately 3 miles per hour. (0.02 m/s). The temperature of the sewage is 21 °C. The Temperature of the Stream is 15o C. The Wastewater temperature is 20 °C The BOD<sub>5</sub> of the wastewater is 25 mg/l. The BOD of the stream is 1 mg/l, The DO of the sewage is 0 mg/l The DO of the stream is 9.2 mg/l.

4. Using the data from the tables for BOD Reduction Raw Waste Water 180 mg/l BOD and Reduction Secondary Effluent 25 mg/l BOD, construct excel graphs of each comparing BOD Reduction vs distance and time of travel downstream. Compare the two graphs and relate them to improvements in stream water quality discuss how sewage treatment impacts stream water quality.

BOD Reduction Raw Waste Water 180 mg/l BOD

Time Day	Distance mi	BOD
0	0	180
0.25	6	140
0.5	12	120
1	24	78
1.5	36	50
2	48	20
2.5	60	15

BOD Reduction Secondary Effluent 25 mg/l BOD

Time Day	Distance mi	BOD
0	0	25
0.5	12	16
1	24	12
1.5	36	8
2	48	6
2.5	60	5