

Nitrifying Activated Sludge Wastewater Treatment Plant  
Workshop Problem No. 7  
Calculate the F/M Ratio, Sludge Age, and SVI for Basin No. 2  
Two basins are in service (Basins No. 1 and No. 2)

Final Workshop Problem for 2 or 3 students:

Use the following data and attached worksheets to calculate F/M Ratio, Sludge Age (SA), SRT, and SVI<sub>(30 min)</sub> for a single aeration basin (Basin #2). The aeration basins were sized and designed for nitrification. The plant consists of two (in service) basins. Primary Clarifiers are operating ahead of the basins.

Flows and Loadings

Total Primary Effluent flow to both basins 3.0 MGD or **1.5 MGD** per basin.  
Primary Effluent BOD concentration is **150 mg/L**.  
Primary Effluent TSS concentration is **125 mg/L**.  
Assume flow, BOD, and TSS loadings are split evenly between basins  
Effluent Flow from Basin #2 is also **1.5 MGD**.  
Effluent TSS is **4.7 mg/L**

Basin #2 Data

Basin #2 capacity is **0.700 MG**  
MLSS **3,500 mg/L**  
MLVSS **3,018 mg/L**  
RSSS/WSSS concentration is **6,370 mg/L**  
Wasting Rate **38 gpm for 24 hours per day**  
(estimated/calculated from Basin #2)  
30 minutes settling test **300 ml/L**  
Desired F/M Ratio **0.11**  
Desired SA **14.0 Days**  
Desired SVI < **100**  
Desired SRT **9.0 Days**  
Additional Information:  
Return Sludge Flow Rate is 99%  
Detention Time at 1.5 MGD is 11.2 hours

Required Worksheets:

- (Task 1) Worksheet #6 "Flow-Thru Activated Sludge Processes, Organic Loading and F/M Ratio"
- (Task 2) Worksheet #7 "Flow-Thru Activated Sludge Processes, Sludge Age and SVI"
- (Task 3) Worksheet #7 "Flow-Thru Activated Sludge Processes, Solids Retention Time"

For Extra Credit , you may complete the following:

Based on the information provided, would you recommend any testing and/or operational changes?

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Student Name: \_\_\_\_\_

**Worksheet #6**

Demo for Workgroup Problem No. 7

  Input Required  
 Calculate Value

**Flow-thru Activated Sludge Processes  
 Organic Loading and F/M Ratio**

Use this Worksheet for a single in service basin. Calculate / estimate flow entering basin.

**Comments:**

  
  

Student Name: \_\_\_\_\_

Basin No. 2 Information

**Operating data (Organic Loading and FM Ratio)**

<span style="border: 1px solid black; padding: 2px;">1.500</span> Flow to basin, MGD	<span style="border: 1px solid black; padding: 2px;">0.700</span> Basin Capacity, MG
<span style="border: 1px solid black; padding: 2px;">3,500</span> MLSS, mg/L <u>86%</u> % MLVSS	<span style="border: 1px solid black; padding: 2px;">3,018</span> MLVSS, mg/L
<span style="border: 1px solid black; padding: 2px;">150</span> Influent or P.E. BOD, mg/L	<u>93.6</u> Aeration Cap. In 1000 cu. Ft. (Basin Capacity, gals / 7.48)

**Pounds of BOD entering basin**

BOD in mg/L	# per gal water	Flow in MGD	pounds of BOD/day
_____ x	8.34 x	_____ =	_____ -

**Calculated Organic Loading (ppd of BOD/1000 cu. Ft.)**

\_\_\_\_\_ pounds per day BOD / \_\_\_\_\_ 1000 cu.ft. capacity = \_\_\_\_\_

**Pounds of (MLVSS) Mixed Liquor Suspended Solids**

MLVSS in mg/L	# per gal water	Capacity in MG	pounds of MLVSS
_____ x	8.34 x	_____ =	_____

**Food to Microorganisms**

pounds of BOD/day	pounds of MLVSS	FM Ratio	<b>DESIRED FM Ratio</b>
_____ /	_____ =	_____	<b>0.11</b>

to **increase** F/M increase wasting      to **decrease** F/M decrease wasting

**Worksheet #7**

Demo for Workgroup Problem No. 7

Input Required  
 \_\_\_\_\_ Calculate Value

**Flow-thru Activated Sludge Processes  
 Sludge Age (SA) and Sludge Volume Index (SVI)**

Use this Worksheet for a single in service basin. Calculate/ estimate flow entering basin.

**Comments:**

Student Name: \_\_\_\_\_

Basin  Information

**SA and SVI Information**

Flow to Basin, MGD       Basin Capacity, MG  
 MLSS, mg/L      86% % MLVSS       MLVSS, mg/L  
 Influent or P.E. TSS, mg/L       30 min settling test, ml/L

**Pounds of TSS entering basin**

TSS in mg/L	x	# per gal water	x	Flow in MGD	=	pounds of TSS/Day
_____		8.34		_____		_____

**Pounds of (MLSS) Mixed Liquor Suspended Solids**

MLSS in mg/L	x	# per gal water	x	Capacity in MG	=	pounds MLSS
_____		8.34		_____		_____

**Sludge Ave (SA) Days (using MLSS)**

pounds MLSS	/	pounds of TSS/Day	=	SA Days	<b>DESIRED SA</b>
_____		_____		_____	Days <input type="text" value="14.0"/>

decrease wasting to raise SA

**Sludge Volume Index (SVI)**

30 min settling, ml/L	/	MLSS, mg/L	x	=	SVI
_____		_____			<b>DESIRED SVI</b>
					<input type="text" value="&lt; 100"/>



**Worksheet #8**

Demo for Workgroup Problem No. 7

  Input Required  
 Calculate Value

**Flow-thru Activated Sludge Processes  
 Solids Retention Time (SRT)**

Use this Worksheet for a single in service basin. Calculate/ estimate flow entering basin.

**Comments:**

Student Name: \_\_\_\_\_

Basin No. 2 Information

**SRT Information**

1.500 Effluent Flow, MGD

0.700 Basin Capacity, MG

3,500 MLSS, mg/L

6,370 WSSS, mg/L

38 Wasted Sludge, gpm

Wasted Sludge, MGD

4.7 Effluent TSS, mg/L

**Pounds of (MLSS) Mixed Liquor Suspended Solids**

MLSS in mg/L	# per gal water	Capacity in MG	pounds MLSS
_____ x	8.34	_____ x	= _____

**Solids Wasted, ppd**

WSSS in mg/L	# per gal water	Waste Sludge in MGD	WSSS in ppd
_____ x		_____ x	= _____

**Effluent TSS Wasted, ppd**

TSS in mg/L	# per gal water	Effluent Flow in MGD	TSS Over Weir, ppd
_____ x	8.34	_____ x	= _____

**Total ppd Wasted (Waste Sludge and TSS Over Weir):**

WSSS in ppd	+	TSS Over Weir in ppd	=	Total Solids Wasted, ppd
_____		_____		_____

pounds MLSS		Total Solids Wasted, ppd	days
_____	/	_____	= _____
<b>SRT</b>			

**DESIRED SRT**  
 Days 9.0