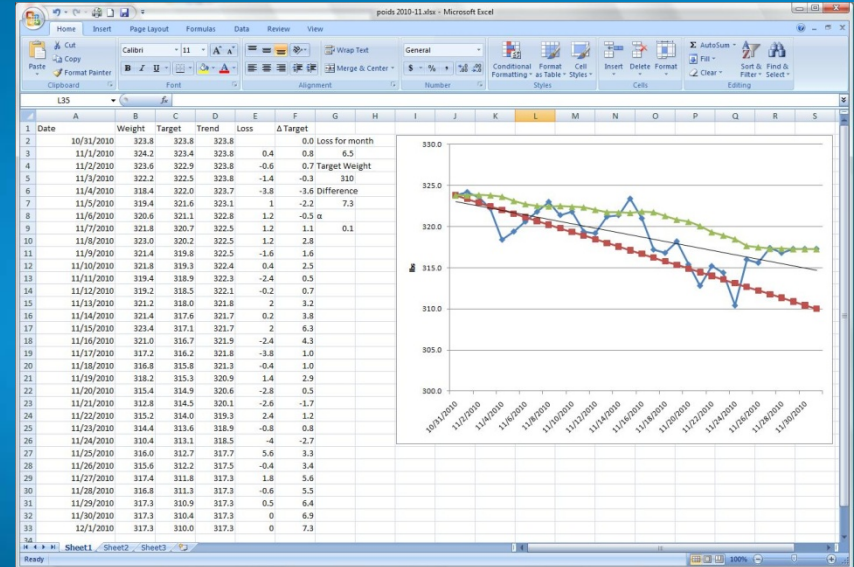


Operations and Spreadsheets

Wisconsin Wastewater Operators Association
46th Annual Conference
Wisconsin Dells, WI
October 11, 2012

Tom Crouse



Outline

- **What is a Spreadsheet?**
- **What should be recorded on a spreadsheet?**
- **How can spreadsheets help me?**
- **How can spreadsheets help others?**
- **Where can I get spreadsheets?**

Spreadsheet

- A spreadsheet is a computer application with tools that increase the user's productivity in capturing, analyzing, and sharing tabular data sets.



From This...



...To This

		Aeration Basin Lab Results					Influent Lab Results				Anoxic Selector	
		North/South	D.O. Reading	pH	Settleometer Results	MLSS	VSS	pH	Ammonia	COO	TKN	Alkalinity
140	Tue 01-May	South	8.1	7.61	360 / 250	2650	64%	6.96		1018	545	1267
142	Wed 02-May	South	7.6	7.48	280 / 250	2533	67%	6.99		1696		na
143	Thu 03-May	South	6.7	7.42	260 / 240	4000	60%			1519		na
144	Fri 04-May	South	5.9	7.31	300 / 260	3400	66%	7.00				na
145	Sat 05-May	South										
146	Sun 06-May	South										
147	Mon 07-May	South	7.9	7.43	220 / 200	2866	58%	6.97		1910		na
148	Tue 08-May	South	7.46	7.28	220 / 180	2750	75%	6.91				1034
149	Wed 09-May	South	7.1	7.23	200 / 180	2767		6.93		na		na
150	Thu 10-May	South										
151	Fri 11-May	South										
152	Sat 12-May	South	7.26	7.05	170 / 150	1900		6.87		na		na
153	Sun 13-May	South										
154	Mon 14-May	South		7.4	130	1811		7.07				
155	Tue 15-May	South	8.9	7.53	140 / 100	2333	64%		382			NA
156	Wed 16-May	South	8.4	7.46	110 / 100	2333	64%			2178		na
157	Thu 17-May	South	8.02	7.32	100 / 100	1967	69%	6.87	535	1563	432	1171
158	Fri 18-May	South	7.22	7.29	80	1840		6.8	538	2340		1180
159	Sat 19-May	South										
160	Sun 20-May	South										
161	Mon 21-May	South										
162	Tue 22-May	South	8.24	7.36	90 / 80	2100	70%	7.01		335		na
163	Wed 23-May	South	8.2	7.42	100 / 100	2160	71%	7.1				
164	Thu 24-May	South	7.6	7.31	80 / 80	1740	73%	7.01				
165	Fri 25-May	South	5.67		80/80	1908						
166	Sat 26-May	South										
167	Sun 27-May	South										
168	Mon 28-May	South										
169	Tue 29-May	South	9.23	7.57	80 / 80	1500	81%	7.04			414	768
170	Wed 30-May	South	8.39	7.39	80 / 80	1420	75%	7.05		1476		

Things to Record

▪ Influent

- Flow
- BOD mg/L
- Phosphorus mg/L
- TSS mg/L
- Ammonia mg/L
- pH
- Alkalinity
- Industrial & other loadings

▪ Effluent

- Flow
- BOD mg/L
- Phosphorus mg/L
- TSS mg/L
- Ammonia mg/L
- pH
- Alkalinity
- Dissolved oxygen

Things to Record

■ Activated Sludge Process

- Basins in operation
- MLSS mg/L
- Volatile portion
- Dissolved oxygen
- Settleometer
- pH
- Basin temperature
- Alkalinity

Things to Record

- **Laboratory QA/QC**
 - Blanks
 - Replicates
 - Spikes
 - GGA
 - Other

Things to Record

■ Chemicals

- Phosphorus Removal Chemicals
- Sludge Thickening Chemicals
- Other?

■ Utilities

- Electric
- Natural Gas
- Fuel for generator(s)
- Biogas production / use

Things to Record

■ Biosolids

- Gallons wasted
- Solids dewatered/thickened
- Gallons/pounds hauled onto approved fields
- Gallons/pounds hauled per day, per month
- Fuel for trucks
- \$\$\$ for contract haulers
- Digester temperatures & levels

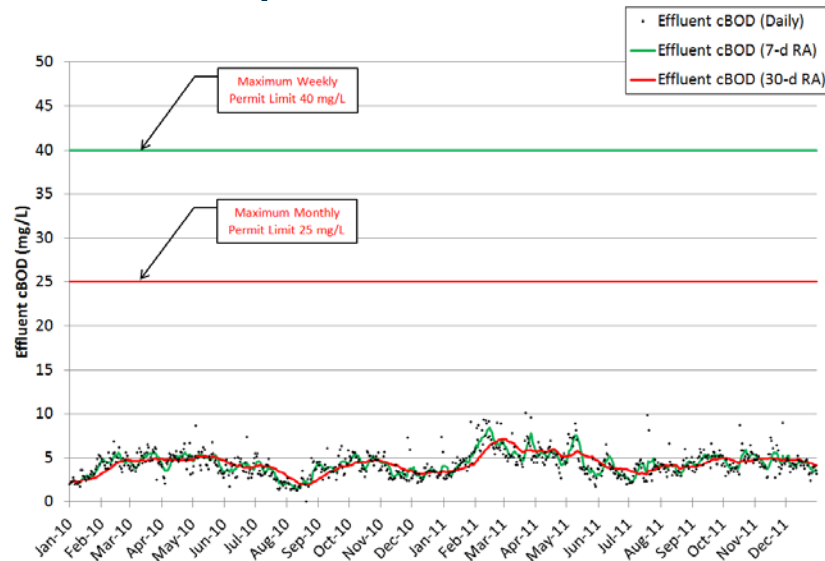
What can the spreadsheet can do for you?

- **Calculate pounds**
 - BOD
 - TSS
 - Ammonia
 - Phosphorus
- **Calculate process control stuff**
 - SRT
 - F:M
 - SVI

What can the spreadsheet can do for you?

- **Graph and Trend**

- A picture is worth 1,000 words



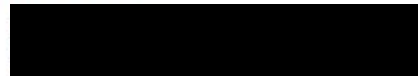
- **Send data to someone else**

- Someone else can make graphs

Wastewater Discharge Monitoring Long Report

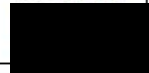
For DNR Use Only

Facility Name:
Contact Address:



Facility Contact: Thomas Crouse, Operator
Phone Number: (715)448-2612
Reporting Period: 09/01/2004 - 09/30/2004
Form Due Date: 10/15/04
Permit Number: 0036803

Date Received:
DOC: 129490
FIN: 6553
FID: 737128480
Region: West Central
Permit Drafter:
Reviewer:
Office:



Sample Point	701	701	701	701	001	001	
Description	INFLUENT	INFLUENT	INFLUENT	INFLUENT	EFFLUENT	EFFLUENT	
Parameter	211	66	457	335	211	66	
Description	Flow Rate	BOD5, Total	Suspended Solids, Total	Nitrogen, Total Kjeldahl	Flow Rate	BOD5, Total	
Units	MGD	mg/L	mg/L	mg/L	MGD	mg/L	
Sample Type	Continuous	24-Hour Comp	24-Hour Comp	24-Hour Comp	Continuous	24-Hour Comp	
Frequency	Daily	3/week	3/week	Monthly	Daily	3/week	
Foot Notes							
Sample Results	Day 1	0.033	158.9	98		0.0287	4.6
	2	0.0331				0.027	
	3	0.0353				0.0343	
	4	0.03				0.0253	
	5	0.0302				0.0268	
	6	0.0333	185	66	41.2	0.0281	4.89
	7	0.0373	98.5	66		0.0343	4.85
	8	0.0321	156	64		0.0304	5.09
	9	0.029				0.0254	
	10	0.0291				0.0226	
	11	0.0304				0.0262	
	12	0.0366				0.0304	
	13	0.0342	157.8	98		0.034	3.56
	14	0.0314	207	116		0.0344	3.81
	15	0.0308	160.8	80		0.023	3.2
	16	0.0297				0.0245	
	17	0.0265				0.0213	
	18	0.0271				0.0214	
	19	0.0284				0.0253	
	20	0.0353	199.2	86		0.0343	3.67
	21	0.0273	202.6	94		0.0244	3.92
	22	0.0265	185.7	80		0.0346	3.59
	23	0.0254				0.0196	
	24	0.0283				0.0239	
	25	0.0315				0.0268	
	26	0.0283				0.0259	
	27	0.0321	231.9	90		0.03	3.18
	28	0.0259	178.5	98		0.0216	4.08
	29	0.0248	173.83	48		0.0248	4.7
	30	0.0286				0.031	
	31						
Total	0.9115				0.8203		

Wastewater Discharge Monitoring Form

Facility Name:
Reporting Period: 09/01/2004 - 09/30/2004

Permit: 0036803
DOC: 129490

	Sample Point	701	701	701	701	001	001
	Description	INFLUENT	INFLUENT	INFLUENT	INFLUENT	EFFLUENT	EFFLUENT
	Parameter	211	66	457	335	211	66
	Description	Flow Rate	BOD5, Total	Suspended Solids, Total	Nitrogen, Total Kjeldahl	Flow Rate	BOD5, Total
	Units	MGD	mg/L	mg/L	mg/L	MGD	mg/L
Summary Values	Monthly Avg	0.0304	177	83	XXXXXXXX	0.0273	4.09
	Daily Max Amount	0.0373	231.9	116	41.2	0.0346	5.09
	Daily Min Amount	0.0248	98.5	48	XXXXXXXX	0.0196	3.18
Limit(s) in Effect	Monthly Avg						50 \ 0
	Daily Max Amount						
	Daily Min Amount						
QA/QC Information	LOD	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX
	LOQ	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX
	QC Exceedence						
	Lab Certification No.		734007450	734007450	750040280		734007450

Day	Flow Rate
1	1.25
2	1.23
3	1.22
4	1.26
5	1.3
6	0.85
7	0.8
8	1.26
9	1.23
10	1.25
11	1.27
12	1.25
13	0.8
14	0.8
15	1.26
16	1.24
17	1.25
18	1.23
19	1.27
20	2.36
21	0.95
22	1.24
23	1.27
24	1.24
25	1.22
26	1.25
27	0.88
28	0.75
29	1.26
30	1.24
31	1.25

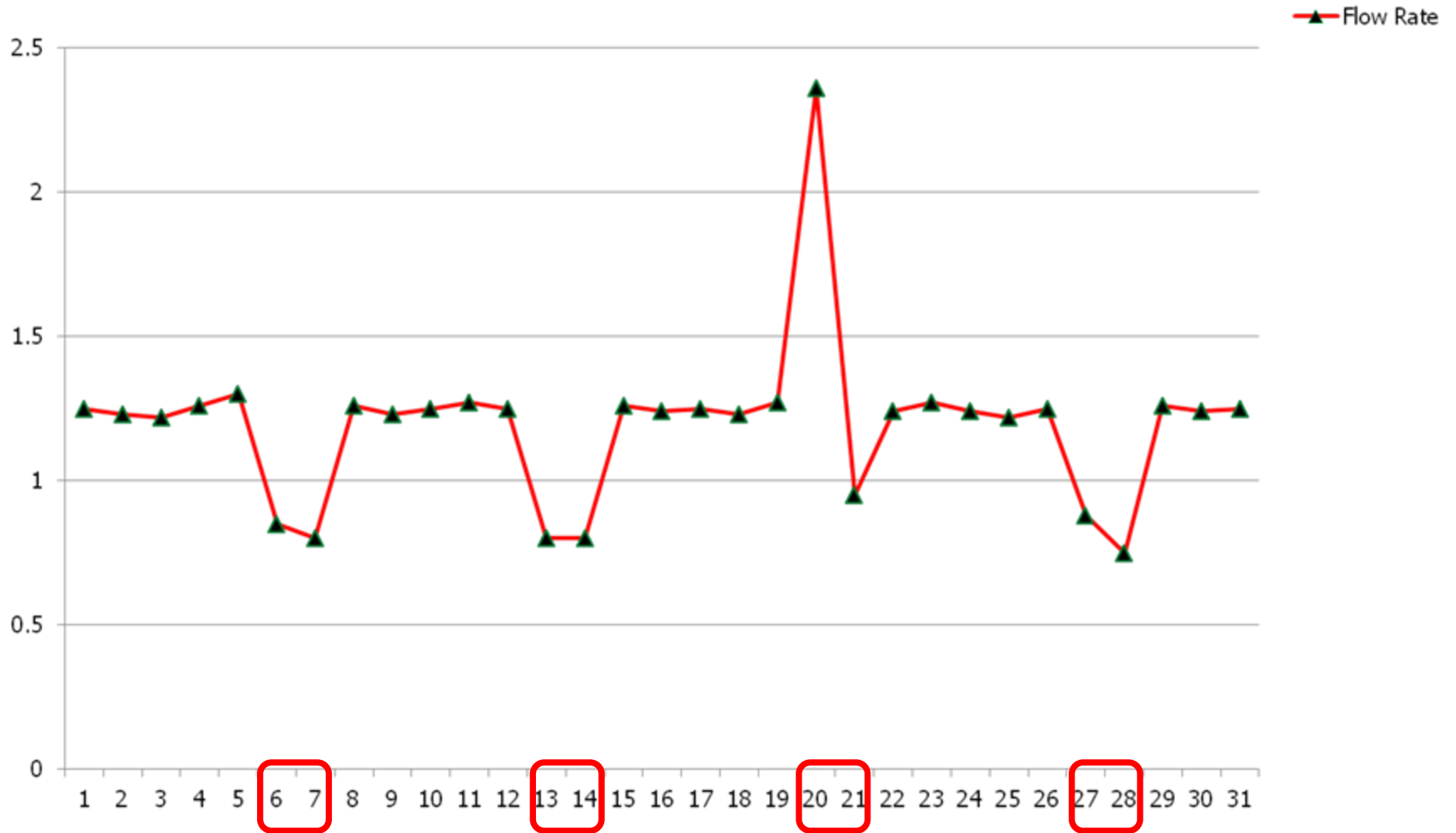
Explaining to council why there was a call-out and overtime on a weekend due to high flows.

2" of rain Friday evening.

The look on a council member's face after listening to you explain why there was a call-out and overtime on a weekend due to high flows.



Flow Rate

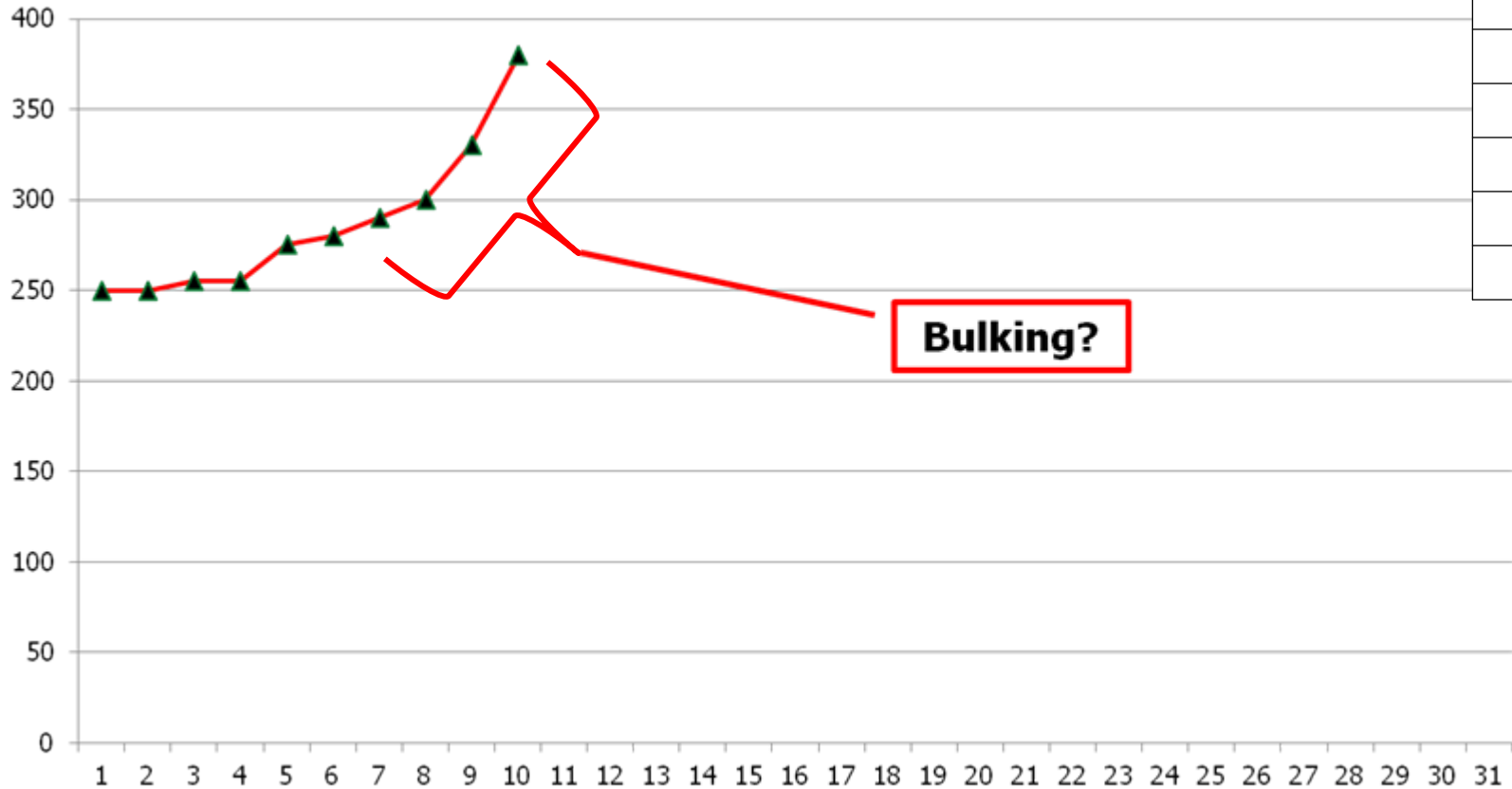




The look on a council member's face after seeing your graph used to explain why there was a call-out and overtime on a weekend due to high flows.

Troubleshooting:

Settle



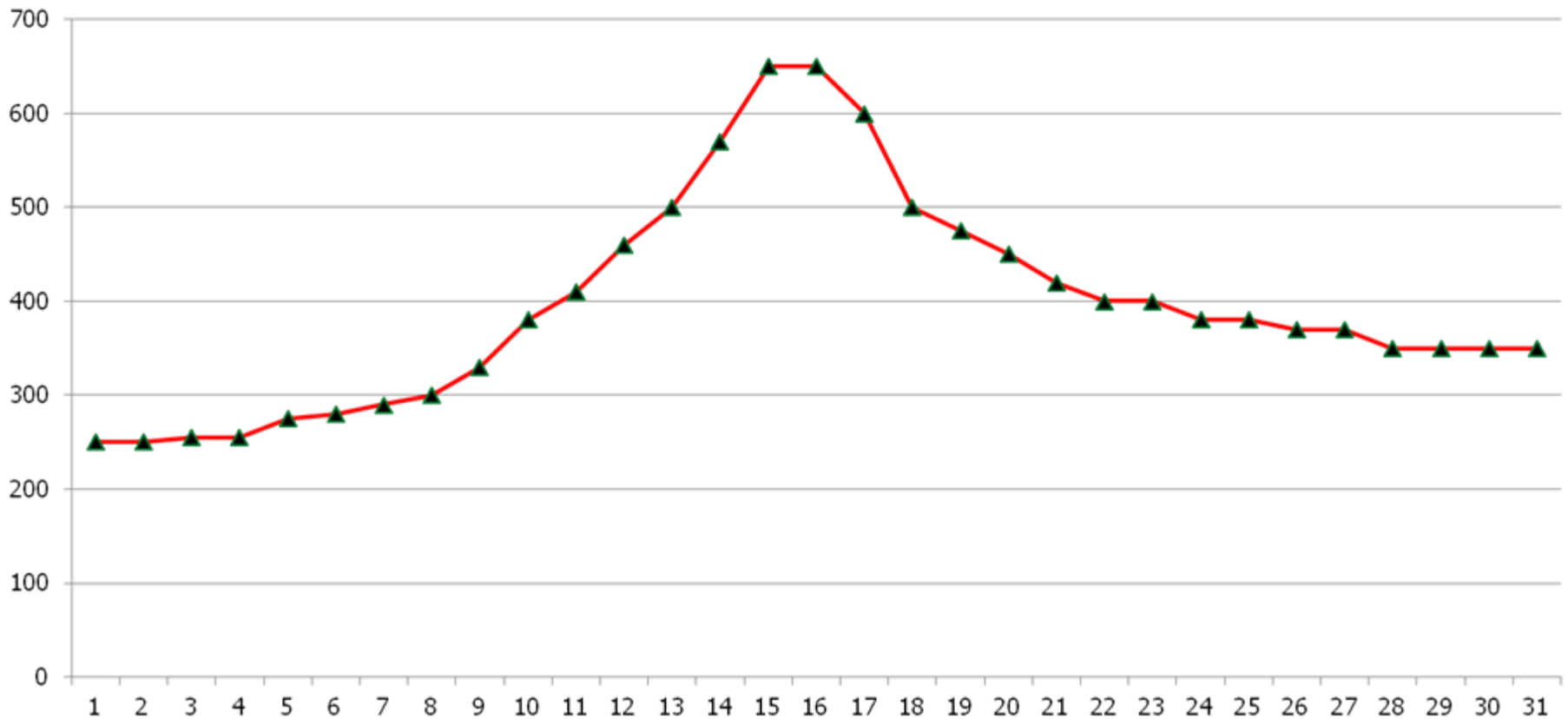
Day	Settle
1	250
2	250
3	255
4	255
5	275
6	280
7	290
8	300
9	330
10	380

Bulking?

▲ Settle

Troubleshooting cont'd:

Settle



Laboratory QA/QC

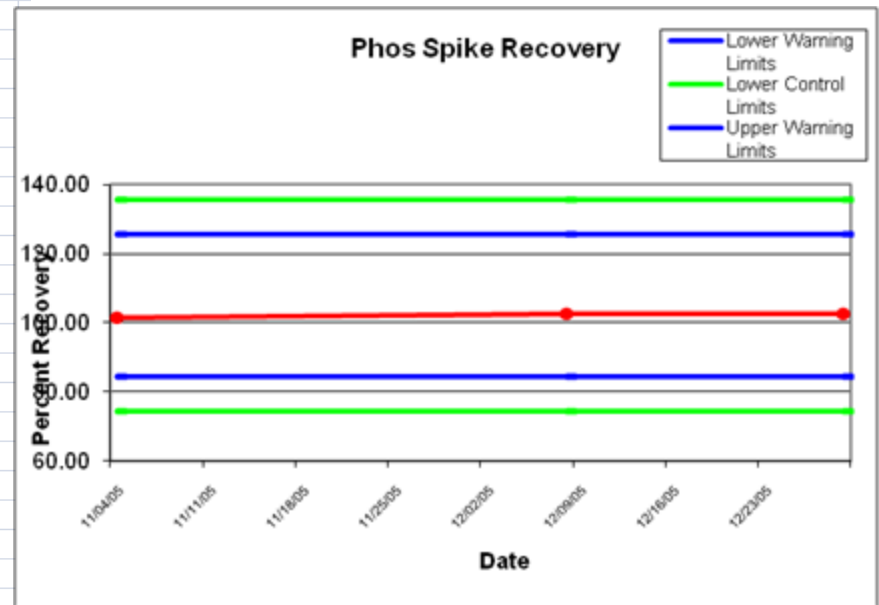
Phosphorous LOD & LOQ				
			$m = 1.5788$	Date
Spike Level =	0.03 mg/L		$y = 0.0168$	By
				01/20/06 TAC
	mg/L =	Spike: 3mL 0.5ppm diluted to 50 mL w/ distilled water.		
	Absorbance (abs-b)/m			
Rep. 1	0.069	0.033	# replicate	t - value
Rep. 2	0.058	0.026	7	3.143
Rep. 3	0.054	0.024	8	2.998
Rep. 4	0.054	0.024	9	2.896
Rep. 5	0.057	0.025	10	2.821
Rep. 6	0.057	0.025		
Rep. 7	0.058	0.026		
Mean	0.0262			
St Dev.	0.0032			
t - value	3.143			
LOD =	$(t - value) * (standard deviation) =$		0.01011	LOD
LOQ =	$(3.33) * (LOD) =$		0.03368	LOQ
5 point checks:	Green cell =	Yes	Red cell =	No
1)	Is LOD greater than 10% of the spike level?	Spike(10%)	LOD	
	spike = 0.03	$(spike\ mg/L) * (10\%) :$	0.003	0.0101
2)	Is the spike level greater than the LOD?	Spike	LOD	
	Common sense: if LOD > spike level, one could not detect it.	0.03	0.01011	
3)	Is the LOD below any relevant permit level?	LOD	Phos limit	
	Phosphorous permit limit: 1.0 mg/L	0.0101	1.0	
4)	Is the signal-to-noise ratio (S/N) between 2.5 and 10?	Mean		
	$S/N = Mean / std\ dev.$	std dev.		
		8.1365		
5)	Is mean recovery within reasonably expected limits?	Mean recovery %		
	Mean recovery = $(mean / spike\ level) * 100$	87.271 %		

Laboratory QA/QC

1 Ammonia LOD & LOQ						
2			m =	-59.3	Date	By
3	Spike Level =	0.1 mg/L	Blank =	0.00	01/10/05	DB
4						
5					Spike: 1mL 10ppm diluted to 100mL w/ NH3 free water.	
6	mg/L=					
7	Rep. 1	0.094	# replicates	t - value		
8	Rep. 2	0.093	7	3.143		
9	Rep. 3	0.091	8	2.998		
10	Rep. 4	0.099	9	2.896		
11	Rep. 5	0.097	10	2.821		
12	Rep. 6	0.101				
13	Rep. 7	0.100				
14						
15	Mean	0.0964				
16	St Dev.	0.0038				
17	t - value	3.143				
18						
19	LOD = (t - value) * (standard deviation)=	0.01202	LOD			
20	LOQ = (3.33) * (LOD) =	0.04002	LOQ			
21						
22	5 point checks:	Green cell =	Yes	Red cell =	No	
23						
24	1)	Is LOD greater than 10% of the spike level?	Spike(10%)	LOD		
25		spike = 0.1 (spike mg/L) * (10%):	0.01	0.012		
26						
27	2)	Is the spike level greater than the LOD?	Spike	LOD		
28		Common sense: if LOD > spike level, one could not detect it.	0.1	0.01202		
29						
30	3)	Is the LOD below any relevant permit level?	LOD	Phos limit		
31		Phosphorous permit limits: 4.0 & 8.0 mg/L	0.012	4.0		
32						
33	4)	Is the signal-to-noise ratio (S/N) between 2.5 and 10?	Mean			
34		S/N = Mean / std dev.	std dev.			
35			25.22			
36						
37	5)	Is mean recovery within reasonably expected limits?	Mean recovery %			
38		Mean recovery = (mean / spike level) * 100	96.429 %			

Laboratory QA/QC

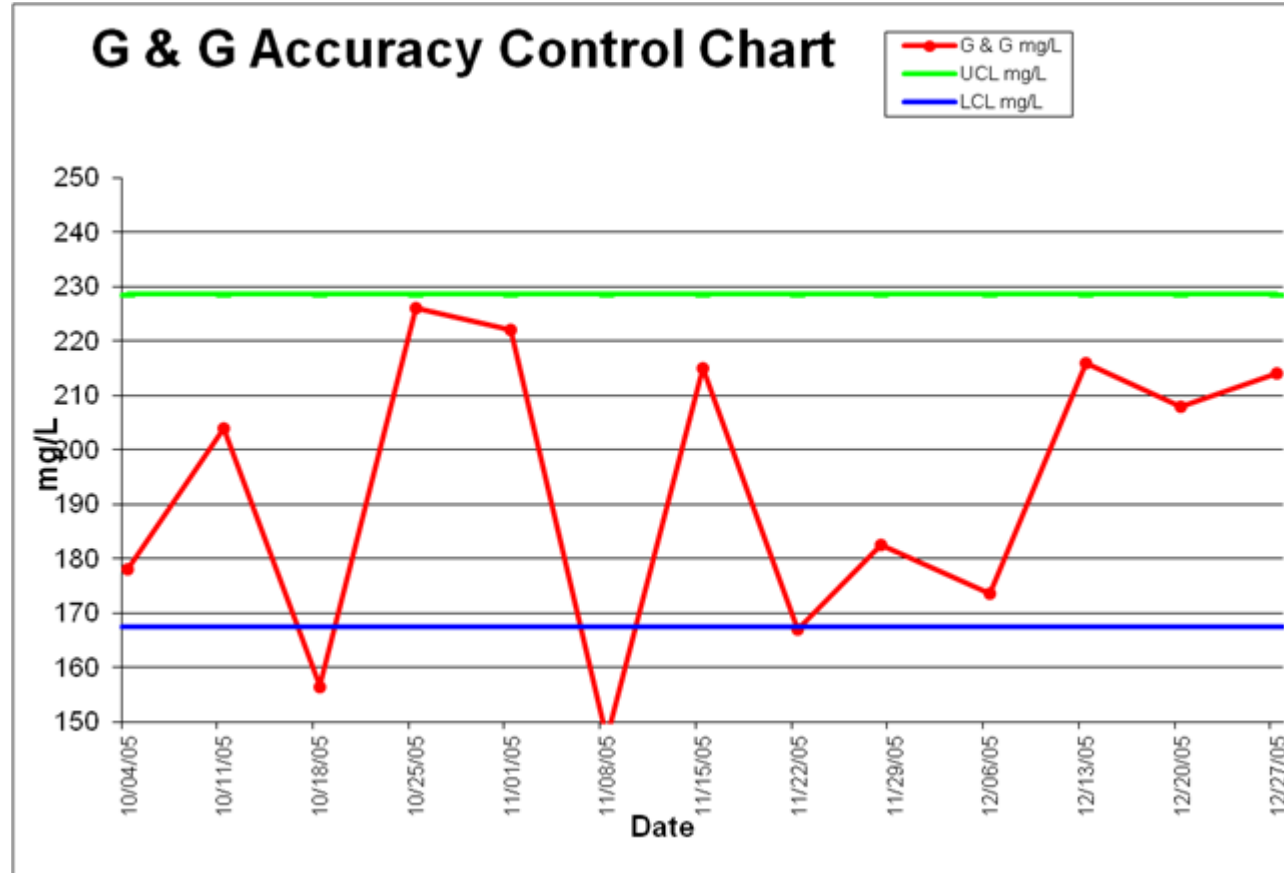
20 Data points Total Phos Spike									
To determine warning, control limits & z-score.									
	Date	Recovery percent	Outlier Low %	Recovery %	Outlier High %	Lower Warning Limits	Lower Control Limits	Upper Warning Limits	Upper Control Limits
6	23-Sep-05	97.20		97.20		84.56	74.33	125.48	135.71
7	15-Sep-05	115.50		115.50		84.56	74.33	125.48	135.71
8	02-Aug-05	106.23		106.23		84.56	74.33	125.48	135.71
9	29-Jun-05	120.23		120.23		84.56	74.33	125.48	135.71
10	19-May-05	124.40		124.40		84.56	74.33	125.48	135.71
11	07-Apr-05	89.70	89.70	89.70		84.56	74.33	125.48	135.71
12	11-Mar-05	95.57		95.57		84.56	74.33	125.48	135.71
13	21-Feb-05	100.47		100.47		84.56	74.33	125.48	135.71
14	01-Feb-05	95.10		95.10		84.56	74.33	125.48	135.71
15	15-Dec-04	115.63		115.63		84.56	74.33	125.48	135.71
16	05-Nov-04	104.43		104.43		84.56	74.33	125.48	135.71
17	20-Oct-04	92.43		92.43		84.56	74.33	125.48	135.71
18	03-Sep-04	113.47		113.47		84.56	74.33	125.48	135.71
19	18-Aug-04	112.43		112.43		84.56	74.33	125.48	135.71
20	21-Jul-04	107.37		107.37		84.56	74.33	125.48	135.71
21	21-Jun-04	113.53		113.53		84.56	74.33	125.48	135.71
22	14-May-04	109.73		109.73		84.56	74.33	125.48	135.71
23	13-Apr-04	96.90		96.90		84.56	74.33	125.48	135.71
24	23-Mar-04	94.20		94.20		84.56	74.33	125.48	135.71
25	20-Feb-04	95.80		95.80		84.56	74.33	125.48	135.71
26									
27	N	Critical Z	N =	N =	Low value	High value	Average of differences	Sum of differences	Number of samples
28	18	2.65	20.0	20.0	89.70	124.4	105.0	2100.3	20.0
29	19	2.68	Z Score =	Z Score =	89.70	124.4			
30	20	2.71	1.497179	1.894836					



Laboratory QA/QC

Accuracy Control Chart Glucose - Glatamic Acid

Date	G & G mg/L	UCL mg/L	LCL mg/L
04-Oct-05	178	228.5	167.5
11-Oct-05	204	228.5	167.5
18-Oct-05	156.5	228.5	167.5
25-Oct-05	226	228.5	167.5
01-Nov-05	222	228.5	167.5
08-Nov-05	147	228.5	167.5
15-Nov-05	215	228.5	167.5
22-Nov-05	167	228.5	167.5
28-Nov-05	182.5	228.5	167.5
06-Dec-05	173.5	228.5	167.5
13-Dec-05	216	228.5	167.5
20-Dec-05	208	228.5	167.5
27-Dec-05	214	228.5	167.5



Laboratory

Stock Solution	
C1	V1
1,000	

=

Standard	
C2	V2
5	1,000

Where:

C1 = concentration of stock solution mg/L

V1 = volume of stock solution mL

C2 = concentration of standard to be made mg/L

V2 = volume of standard to be made mL

C1 = #DIV/0!

V1 = 5

C2 = 0

V2 = 0

$$C_1 V_1 = C_2 V_2$$



Chemical Use

Phosphorus Characterization		Units	Value
Phosphorus Atomic Weight		g/mole	30.98

Ferric Chloride (FeCl ₃) Characterization		Units	Raw Solution	Jar Test Solution
Iron Atomic Weight		g/mole	55.85	55.85
Chlorine Atomic Weight		g/mole	35.45	35.45
Ferric Chloride Solution Specific Gravity		--	1.352	1.090
Ferric Chloride Solution Strength		%	33.86%	10.00%
Ferric Chloride Percent Ferric by Weight		%	11.66%	3.44%
Iron Concentration in Solution		mg/mL	157.6	37.5

Alum (Al ₂ (SO ₄) ₃ *14H ₂ O) Characterization		Units	Raw Solution	Jar Test Solution
Aluminum Atomic Weight		g/mole	26.98	26.98
Sulfur Atomic Weight		g/mole	32.06	32.06
Oxygen Atomic Weight		g/mole	16.00	16.00
Hydrogen Atomic Weight		g/mole	1.00	1.00
Alum Solution Specific Gravity		--	1.335	1.100
Alum Solution Strength		%	48.50%	10.00%
Alum Percent Aluminum by Weight		%	4.40%	0.91%
Aluminum Concentration in Solution		mg/mL	58.8	10.0

Chemical Use

Jar Testing Spreadsheet - Ferric Chloride (FeCl₃) for Phosphorus Precipitation

Date: _____

Plant: _____

Sample Location: _____

FeCl₃ Stock Solution: SG = 1.352
 FeCl₃ Content = 33.9% By Weight of Solution
 Fe Content = 11.7% By Weight of Solution

Jar	Jar Testing Calculations							Jar Testing Analytical Results			
	Sample Volume (L)	Estimated Soluble Phosphorus Conc. (mg/L PO ₄ -P)	Milli-Moles SP (mM)	Target Fe:P Molar Ratio (M/M)	Milli-Moles Fe Added (mM)	Mass Fe Added (mg Fe)	Vol FeCl ₃ to Add (mL)	Measured SP Concentration (mg/L PO ₄ -P)	Actual Fe:P Molar Ratio (M/M)	Sample pH	Comments
	1.0	2.0	0.065	0.0	0.000	0.0	0.000				
	1.0	2.0	0.065	1.0	0.065	3.6	0.096				
	1.0	2.0	0.065	2.0	0.129	7.2	0.192				
	1.0	2.0	0.065	3.0	0.194	10.8	0.288				
	1.0	4.0	0.129	1.0	0.129	7.2	0.192				
	1.0	4.0	0.129	2.0	0.258	14.4	0.384				
	1.0	4.0	0.129	3.0	0.387	21.6	0.576				
	1.0	6.0	0.194	1.0	0.194	10.8	0.288				
	1.0	6.0	0.194	2.0	0.387	21.6	0.576				
	1.0	6.0	0.194	3.0	0.581	32.4	0.865				
	1.0	8.0	0.258	1.0	0.258	14.4	0.384				
	1.0	8.0	0.258	2.0	0.516	28.8	0.769				
	1.0	8.0	0.258	3.0	0.775	43.3	1.153				

Bench Sheets

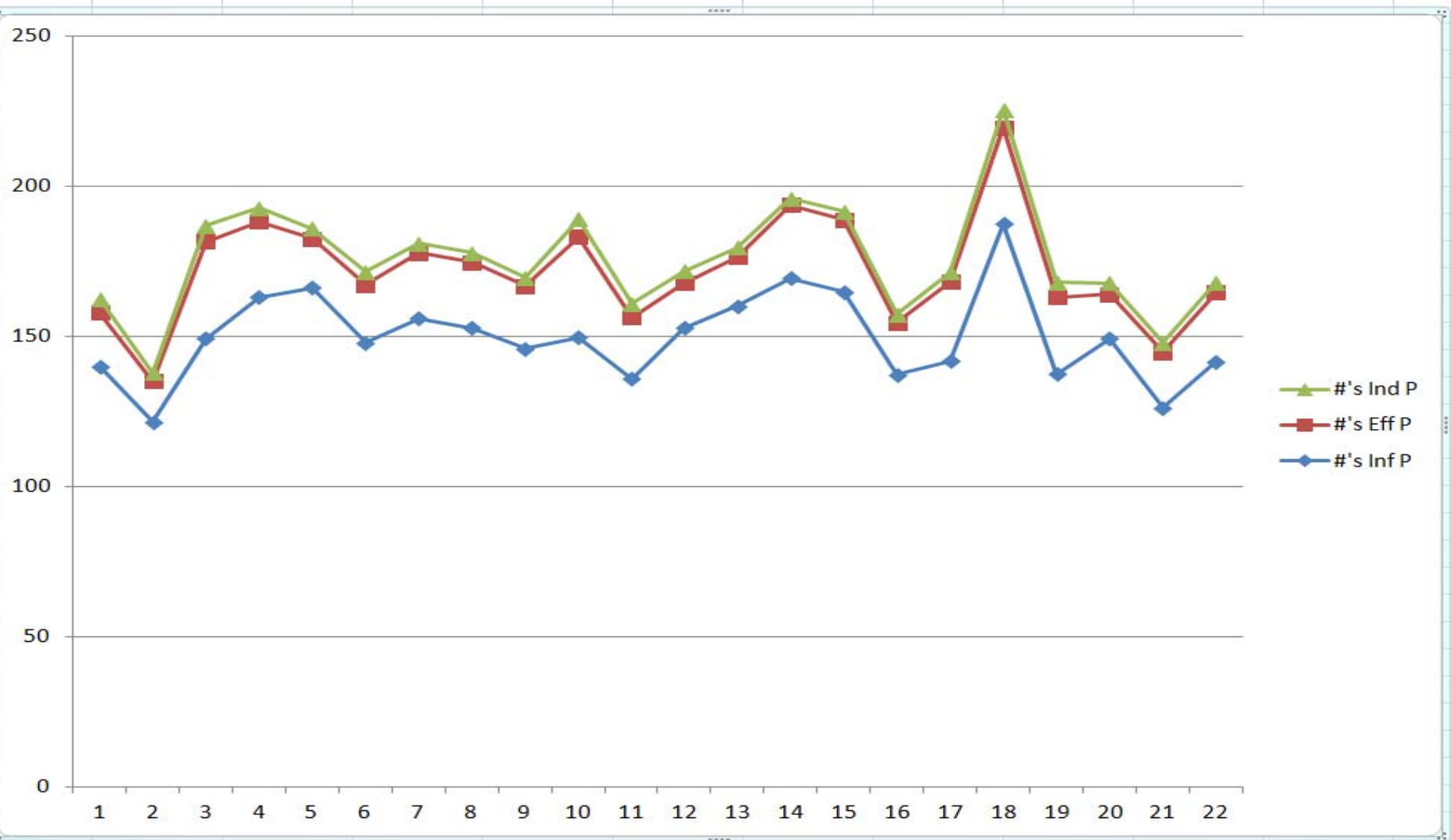
WWTP
Documentation of Operation
Month of _____, 20__

Daily Data Collection											Daily check List Check <input type="checkbox"/> Indicates Normal Operation														
Day of Month	Rain fall, inches	Temperature at noon, deg. F	Clarifier Sludge DOB, ft	ML Temperature	RAS Flow Rate, gpm	ML Recycle Flow rate, gpm	WAS Flow, minutes x gpm	Decant Volume	Inner DO Conc., mg/L	Outer DO Conc., mg/L	Effl. Ammonia Conc., mg/L	Eff. Nitrate Conc., mg/L	Water Meter Reading, gallons	Aerators	Mixer	Clarifier Drive	RAS Pump	ML Pump	Mixer	Scum Pump	WAS Pump	Inner DO Probes/Meters	Outer DO Probes/Meters		
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									

Industrial Contributions

Inf Flow MGD	mg/L Inf P	mg/L Eff P	Ind Flow MGD	mg/L Ind P	#'s Inf P	#'s Eff P	#'s Ind P
2.649	6.341	0.81	0.036	15	140	17.90	4.50
2.53	5.763	0.64	0.028	12	122	13.50	2.80
2.627	6.816	1.47	0.03	21	149	32.21	5.25
2.849	6.862	1.06	0.031	18	163	25.19	4.65
2.655	7.503	0.74	0.033	12	166	16.39	3.30
2.649	6.69	0.88	0.036	14	148	19.44	4.20
2.859	6.541	0.92	0.029	13	156	21.94	3.14
2.919	6.278	0.9	0.027	14	153	21.91	3.15
2.922	5.992	0.85	0.031	11	146	20.71	2.84
3.325	5.397	1.21	0.032	22	150	33.55	5.87
2.883	5.649	0.85	0.035	16	136	20.44	4.67
2.947	6.215	0.61	0.034	14	153	14.99	3.97
3.323	5.779	0.59	0.031	12	160	16.35	3.10
2.924	6.946	1	0.027	10	169	24.39	2.25
3.015	6.557	0.95	0.027	13	165	23.89	2.93
2.763	5.956	0.75	0.029	12	137	17.28	2.90
2.961	5.743	1.07	0.028	13	142	26.42	3.04
3.368	6.675	1.14	0.033	22	187	32.02	6.05
2.857	5.767	1.08	0.034	17	137	25.73	4.82
2.631	6.805	0.67	0.03	15	149	14.70	3.75
2.773	5.46	0.8	0.033	11	126	18.50	3.03
2.879	5.897	0.96	0.031	13	142	23.05	3.36

Industrial Contributions



Activated Sludge

$$\text{Pounds (Lbs.)} = (\text{flow MGD}) (\text{mg/l}) (8.34 \text{ Lbs/Gal})$$

$$\text{Sludge Volume Index (ml/g)} = (30 \text{ min. sett. solids in ml/l}) (1000) \text{ MLSS (mg/l)}$$

$$\text{MCRT (days)} = \frac{(\text{Vol. of Aera. Tank}) (\text{MLVSS})}{(\text{Flow in MGD}) (\text{Effluent VSS}) + \{(\text{WAS Flow}) (\text{Was VSS})\}}$$

$$\text{F:M} = \frac{(\text{Flow MGD}) (\text{Aera. Tank Influent BOD in mg/l})(8.34\text{lb/gal})}{(\text{MLVSS}) (\text{Aera. Tank Volume in MG}) (8.34 \text{ lb.gal})}$$

Activated Sludge

Activated Sludge

Wasting Calculator

Data Needed	Value
Process Volume (MG)	0.520
MLSS (mg/L)	1,660
WAS MLSS (mg/L)	3,380
% Volatile	73
30 minute settle (ml/L)	370
Influent Flow (MGD)	0.154
COD/BOD %	40
Inf. COD (mg/L)	1,714
Inf. BOD (mg/L)	686
Desired MCRT (Days)	8
Days/Week to Waste	7
Effluent Flow, (MGD)	0.000
Effluent SS (mg/L)	0.00

Process Volume MG	Aeration Operation
0.520	Aeration Basin No. 1
0.520	Aeration Basin No. 2
1.040	Total Aeration Basin



F:M
0.168

SVI
109

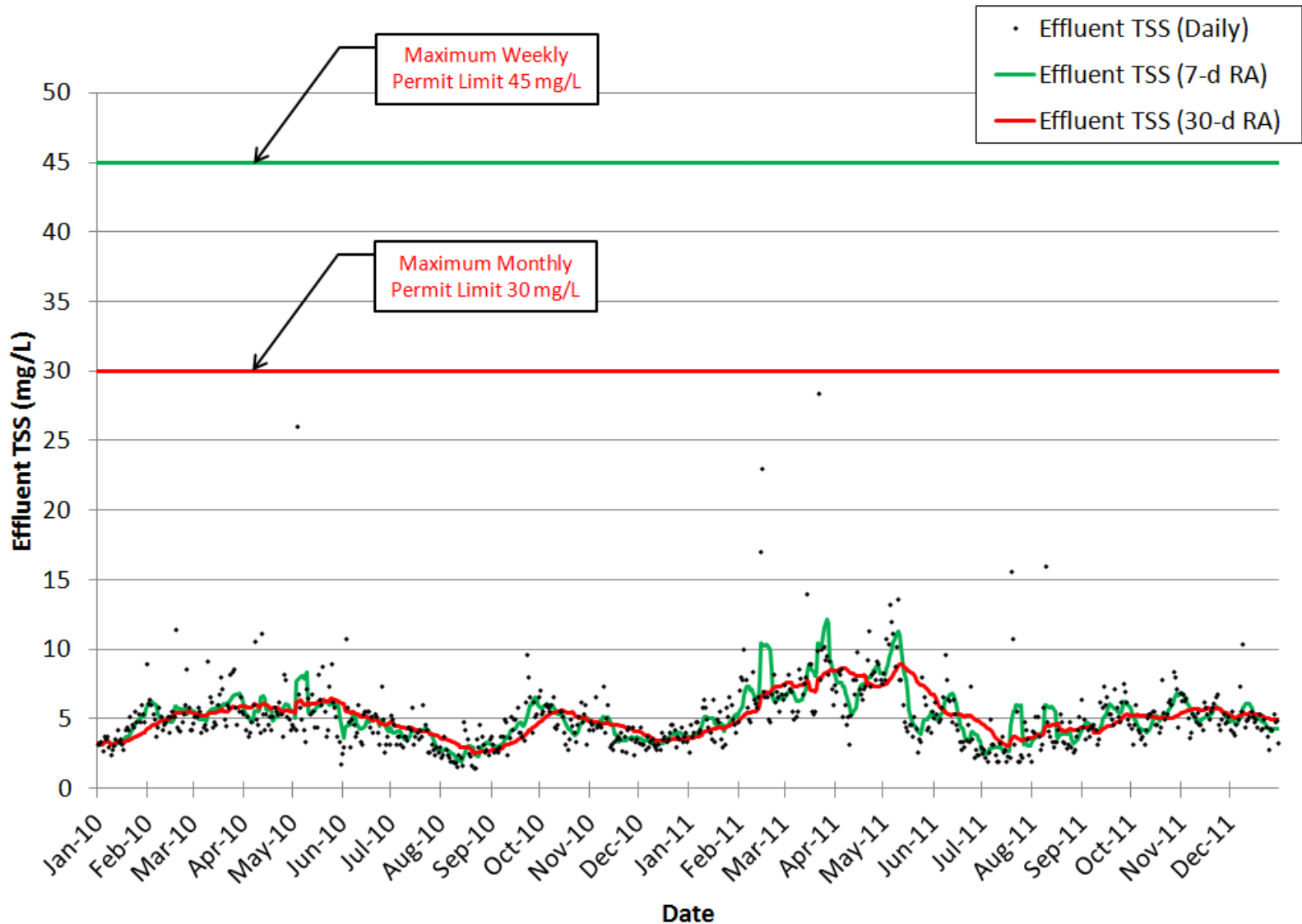
Enter effluent data if effluent TSS exceeds 15 mg/L

Gal WAS/day
31,923

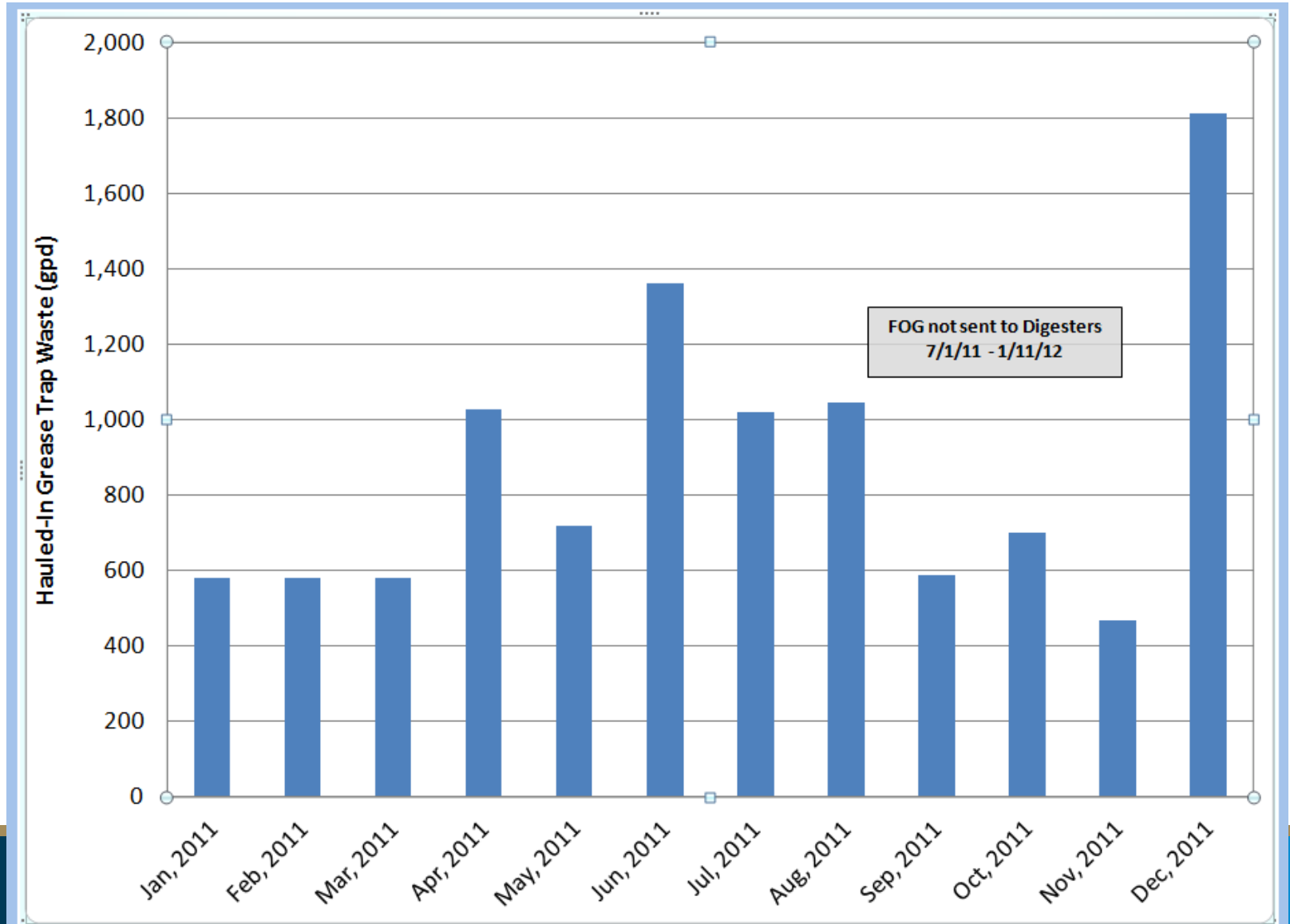
Data Entry

5			General	General	General	Influent	Influent	Influent	Influent	Influent	Influent	Influent	Influent	Influent	Influent	Influent	Influent	Influent	
6			Precip.	Air	Air			7 d RA	30 d RA		7 d RA	30 d RA		7 d RA	30 d RA	MONTHLY	100%	90%	
7				Max	Min					Raw	Raw	Raw	Raw	Raw	Raw	Raw			
8				Temp	Temp	Temp	Flow	Flow	Flow	BOD	BOD	BOD	BOD	BOD	BOD	BOD	BOD	BOD	BOD:TSS
9	Date	Day	Inches	Deg F	Deg F	deg F	MG	MG	MG	mg/l	mg/l	mg/l	mg/l	ppd	ppd	ppd	ppd	ppd	ratio
11	08-11 Average		0.11	54.33	35.93	48.21	3.145	3.145	3.141	289	289	288	7523	7515	7481	7528			1.03
12	08-11 Max		3.88	93.00	74.00	77.00	7.213	5.486	4.167	574	420	365	15863	10909	9131	8667			2.08
13	95%		0.65	84.00	65.00	73.00	4.00	3.99	3.95	407.20	363.77	345.12	10457.39	9142.31	8700.43	8579.53			1.31
14	08-11 Min		0.00	3.00	-18.00	4.00	2.300	2.489	2.489	71	173	227	1709	5674	5933	6290			0.30
15	5%		0.00	20.00	1.00	17.65	2.66	2.68	2.73	194.17	225.24	235.45	5001.70	6075.26	6364.06	6708.26			0.75
25	01/01/10	Friday	0.00	16	6		2.529	2.529	2.529	320	320	320	6749	6749	6749	6290.15	8196.00	7376.40	0.82
26	01/02/10	Saturday	0.00	20	-9		2.448	2.489	2.489	303	312	312	6186	6468	6468	6290.15	8196.00	7376.40	0.80
27	01/03/10	Sunday	0.00	9	-9		2.520	2.499	2.499	267	297	297	5611	6182	6182	6290.15	8196.00	7376.40	1.34
28	01/04/10	Monday	0.00	15	1		2.664	2.540	2.540	292	296	296	6488	6259	6259	6290.15	8196.00	7376.40	1.09
29	01/05/10	Tuesday	0.00	22	7		2.720	2.576	2.576	276	292	292	6261	6259	6259	6290.15	8196.00	7376.40	0.95
30	01/06/10	Wednesday	0.00	23	2		2.697	2.596	2.596	272	288	288	6115	6235	6235	6290.15	8196.00	7376.40	1.13
31	01/07/10	Thursday	0.09	26	4		2.664	2.606	2.606	277	287	287	6152	6223	6223	6290.15	8196.00	7376.40	1.08
32	01/08/10	Friday	0.10	25	9		2.878	2.656	2.640	284	282	286	6820	6233	6298	6290.15	8196.00	7376.40	1.00
33	01/09/10	Saturday	0.00	22	-2		2.587	2.676	2.634	226	271	280	4876	6046	6140	6290.15	8196.00	7376.40	0.87
34	01/10/10	Sunday	0.00	19	-1		2.521	2.676	2.623	231	265	275	4865	5939	6012	6290.15	8196.00	7376.40	1.03
35	01/11/10	Monday	0.01	21	0		2.649	2.674	2.625	271	262	274	5984	5868	6010	6290.15	8196.00	7376.40	1.15
36	01/12/10	Tuesday	0.00	29	16		2.679	2.668	2.630	300	266	277	6706	5931	6068	6290.15	8196.00	7376.40	1.32
37	01/13/10	Wednesday	0.00	28	13		2.721	2.671	2.637	263	265	276	5968	5910	6060	6290.15	8196.00	7376.40	1.04
38	01/14/10	Thursday	0.00	32	18		2.709	2.678	2.642	302	268	277	6823	6006	6115	6290.15	8196.00	7376.40	0.94
39	01/15/10	Friday	0.00	29	23		2.735	2.657	2.648	220	259	274	5018	5749	6042	6290.15	8196.00	7376.40	0.73
40	01/16/10	Saturday	0.00	29	22		2.522	2.648	2.640	243	261	272	5111	5782	5983	6290.15	8196.00	7376.40	0.86
41	01/17/10	Sunday	0.00	33	16		2.530	2.649	2.634	243	263	270	5127	5820	5933	6290.15	8196.00	7376.40	1.13
42	01/18/10	Monday	0.00	32	11		2.642	2.648	2.634	321	270	273	7073	5975	5996	6290.15	8196.00	7376.40	1.10
43	01/19/10	Tuesday	0.00	32	10		2.706	2.652	2.638	289	269	274	6522	5949	6024	6290.15	8196.00	7376.40	1.20
44	01/20/10	Wednesday	0.00	28	13		2.628	2.639	2.637	285	272	274	6246	5989	6035	6290.15	8196.00	7376.40	1.21
45	01/21/10	Thursday	0.00	26	17		2.713	2.639	2.641	313	273	276	7082	6026	6085	6290.15	8196.00	7376.40	1.17
46	01/22/10	Friday	0.00	31	23		2.627	2.624	2.640	291	284	277	6376	6220	6098	6290.15	8196.00	7376.40	1.05
47	01/23/10	Saturday	T	31	25		2.541	2.627	2.636	272	288	277	5764	6313	6084	6290.15	8196.00	7376.40	1.13
48	01/24/10	Sunday	0.35	37	31		2.704	2.652	2.639	240	287	275	5412	6354	6056	6290.15	8196.00	7376.40	0.98

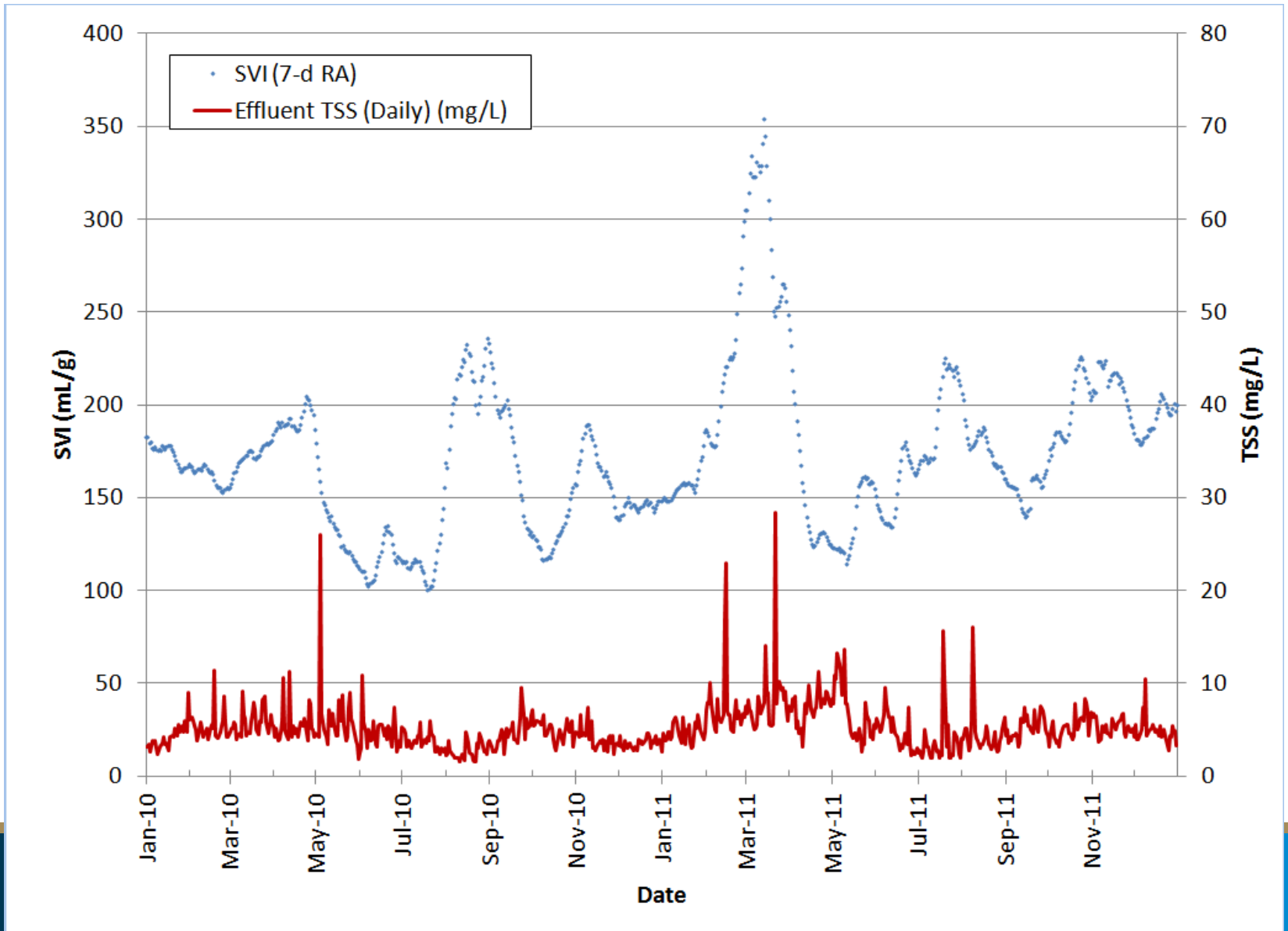
Displaying Data



Displaying Data



Displaying Data



Where to get Spreadsheets?

- **Chemical suppliers**
- **Sludge thickening equipment suppliers**
- **Engineer/consultant**
- **Neighboring wastewater plant**
- **Computer savvy operator**
- **Internet**



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