Determining the Proper Wasting Rate of Activated Sludge

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Northeast Ohio
Regional Sewer District

Introduction: I am Matt Gaugler, I'm a Superintendent at the District and this presentation will discuss what MCRT is, the benefits of using it, how the District has implemented an MCRT strategy, an overview of the Process Dashboards, enhancements made along the way, and results.

Abbreviations

- MLSS: Mixed Liquor Suspended Solids
- MCRT: Mean Cell Residence Time
- F/M: Food to Microorganism Ratio
- TSS: Total Suspended Solids
- WAS: Waste Activate Sludge (also EAS)

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Definitions, explain each. Mention that the District uses EAS and that it may be interchangeable throughout the presentation.

Mean Cell Residence Time (MCRT)

- Average time biosolids are held within process tanks
- MCRT and F/M are inversely related. As MCRT increases, F/M decreases.

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MCRT is how long biosolids are held within the aeration process. This is similar to Sludge Age and SRT. MCRT is an industry standard formula. MCRT and F/M are inversely related.

Sludge wasting, is the single most important parameter affecting the performance of activated sludge systems. Each organization determines it differently. (Some it is supt only, some it is senses, some extremely mathematical).

**Note: Sludge age = solids in aeration basin/solids

entering aeration basin

SRT is same as MCRT but does not include clarifier solids inventory.

MCRT equations

OEPA	ABC
$\frac{\text{Solids inventory}}{\text{Effluent solids} + \text{WAS solids}}$	$\frac{\text{Aeration Tank TSS (lbs)} + \text{Clarifier TSS (lbs)}}{\text{TSS Wasted (lbs/day)} + \text{Effluent TSS (lbs/day)}}$

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MCRT is an industry standard formula. The Ohio EPA uses solids inventory divided by the sum of the effluent solids plus the WAS solids. ABC testing is similar, but specifics that clarifier solids are included within the equation. This method was originally used but was found to be overly tedious and had little to no effect on the results when ran in comparison. This is a negligible factor when sludge blankets are kept to a foot or less in the clarifiers.

MCRT and F/M are inversely related.

Sludge wasting, is the single most important parameter affecting the performance of activated sludge systems. Each organization determines it differently. (Some it is supt only, some it is senses, some extremely mathematical).

**Note: Sludge age = solids in aeration basin/solids entering aeration basin

SRT is same as MCRT but does not include clarifier solids inventory.

MCRT: Factors to Consider

- Effluent permit parameters
- Climate
- Process equipment

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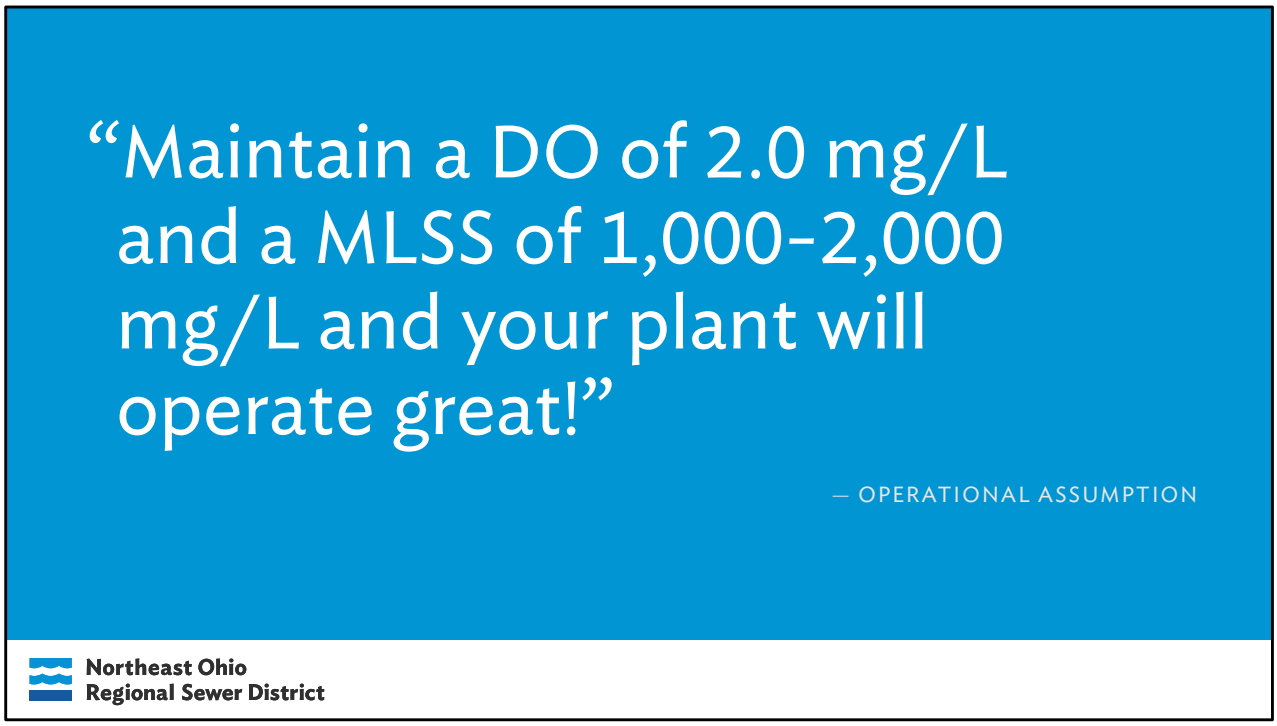
What needs to be accounted for when determining the correct MCRT. Permit parameters (nitrification needed?), are you operating in a cold environment or a warm one. Colder weather will require a longer MCRT due to slower biological activity. What process equipment does your plant have, aeration, extended aeration, Biological Nutrient Removal, contact stabilization, step feed, plug flow, etc.)

Process modeling is a valuable tool to assist in determining the ideal MCRT but may still need practical operation and adjustment as it is not foolproof.

MCRT is unique to each different treatment plant, and is not a one size fits all.



What are we all taught? Maintain DO of 2.0 mg/L and MLSS of 1000-2000 mg/L and your plant will run great, but…

(but not all the time.)

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I would bet we have all experienced a plant that had issues at some point while holding these values. One reason for this is that the MLSS is a resulting parameter and not a control parameter and it only signifies quantity of solids, not quality. This could be equated to a mechanic buying a 26-piece socket set that has 26 5/8" sockets. While the set it complete with 26 pieces, it would lack the diversity of sizes to be a valuable set.

Why use MCRT

- Stable MCRT results in a stable F:M ratio
- Stable MCRT creates selective environment for desired bacterial growth
- Improved settleability
  - Improved effluent quality
    - Less solids in effluent
    - Reduced chemical usage

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So why use MCRT? Stable MCRT will result in a more stable FM ratio. Maintaining a stable MCRT creates a selective environment for the desired bacterial growth to occur. The settleability will be improved, which means less clarifier carryover, thus less solids in the effluent. If the solids are reduced in the effluent, less chemicals will be needed. And…

Why use MCRT

- Reduced foaming
- Reduced oxygen demand
  - Reduced energy usage
- Improved sludge dewaterability

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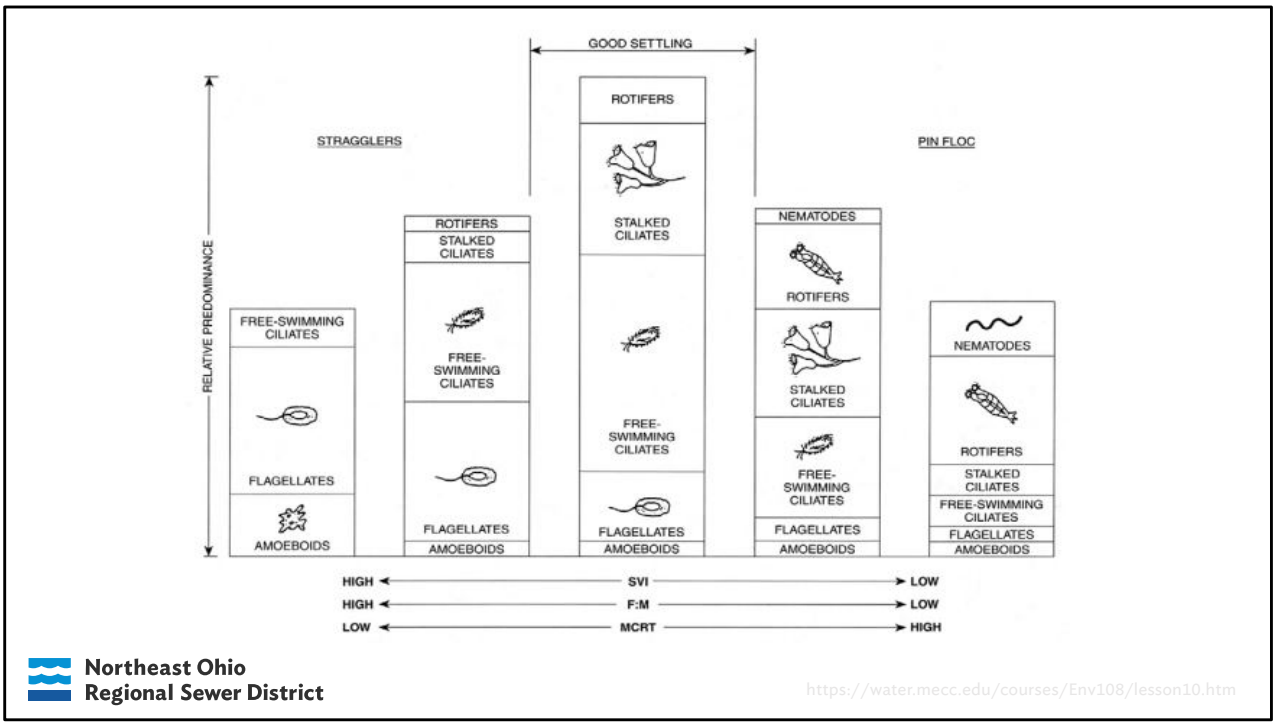
By maintaining a healthy bacterial environment, you will above the young sludge foam and the old sludge foam. Other benefits are a reduction in oxygen demand which is a driver to maintain lower energy usage (mention that most plants do not have a electrical generating turbine like Southerly). Lastly, healthy sludge dewaters better which is a benefit to solids handling within the treatment plant.



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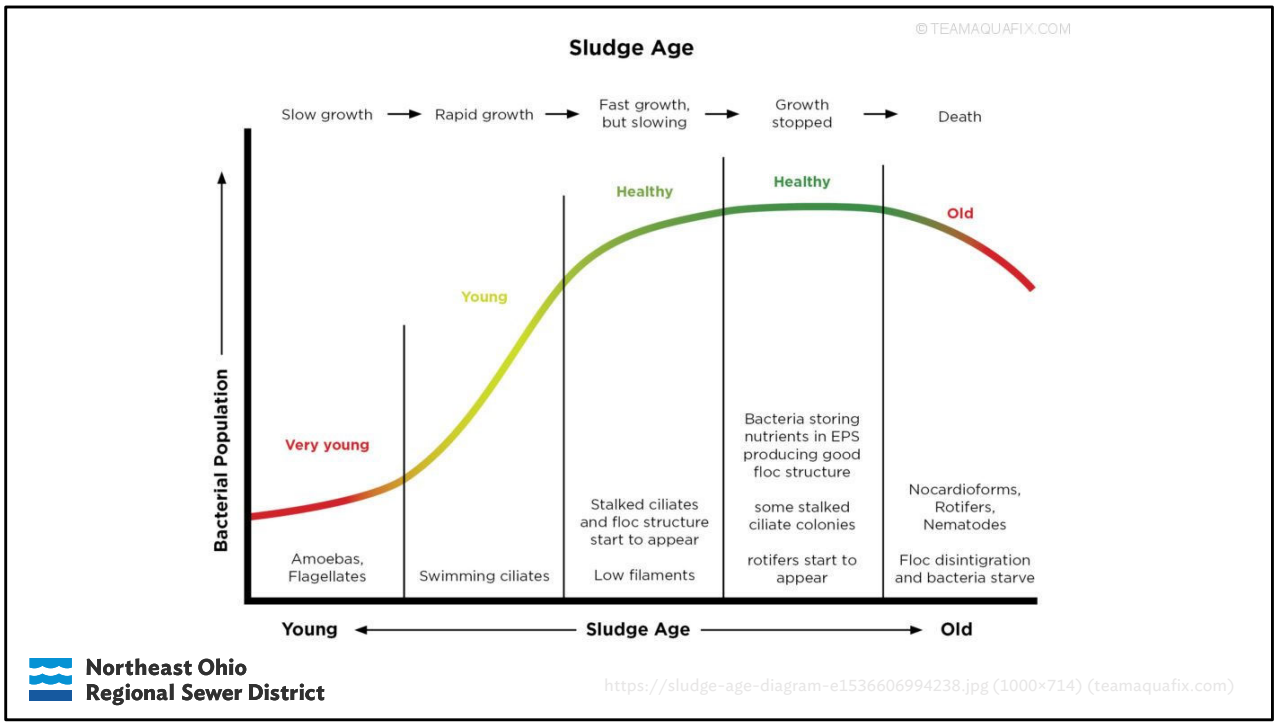
https://water.mecc.edu/courses/Env108/lesson10.htm

This chart shows the ideal mixture of microorganisms.

Too young and they will remain disperse and non-floc forming. Too old and pin floc can develop.



By controlling the MCRT, we are essentially determining the growth rate of the organisms.

Why MCRT Dashboards at NEORSD

- Group each plant's NPDES results in one location
- Provide data for informed process decision-making
- Leverage available technology platforms
- Standardize process controls strategies

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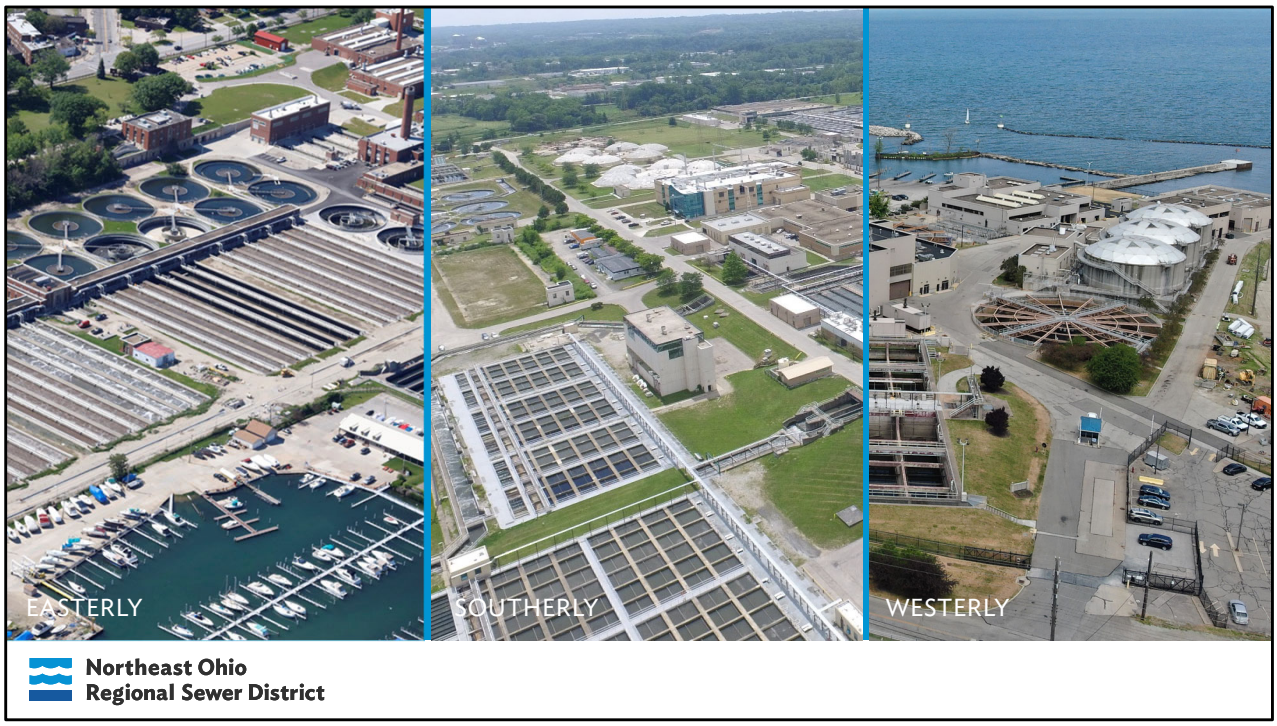
Why were MCRT dashboards adopted at the District. I was able to be part of a team to develop and implement MCRT dashboards. This was implemented to: group each treatment plant's permit results in one location, provide data for informed decision making, use more functionality of the software platforms available, and standardize process controls strategies.

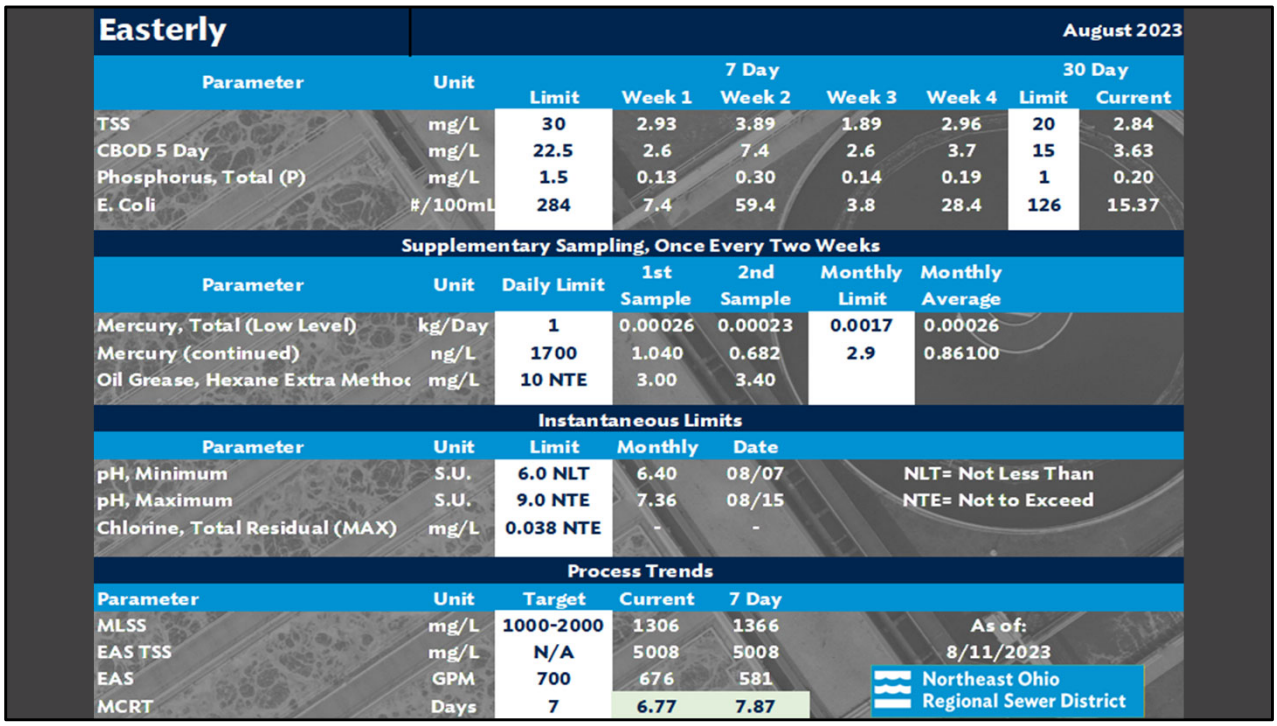


Plant metrics—Southerly-Avg Flow=120 MGD, 735 Capacity, Easterly-Avg Flow=85 MGD, 400 Capacity, Westerly-Avg Flow=33 MGD, 100 Capacity.

Easterly is standard aeration, Westerly is trickling filter, and Southerly uses two aeration systems in series (first is focused on carbonaceous removal while the second is focused on nitrogenous).

All three plants are unique in size and process, but we aimed to….

Squeeze them all into more standardized units. This makes the District more modular in nature, easing interplant personnel transfers, standardizing control strategies, and reducing subjectivity in operational methods.



Easterly

August 2023

Parameter	Unit	7 Day Limit	Week 1	Week 2	Week 3	Week 4	30 Day Limit	30 Day Current
TSS	mg/L	30	2.93	3.89	1.89	2.96	20	2.84
CBOD 5 Day	mg/L	22.5	2.6	7.4	2.6	3.7	15	3.63
Phosphorus, Total (P)	mg/L	1.5	0.13	0.30	0.14	0.19	1	0.20
E. Coli	#/100mL	284	7.4	59.4	3.8	28.4	126	15.37

Supplementary Sampling, Once Every Two Weeks

Parameter	Unit	Daily Limit	1st Sample	2nd Sample	Monthly Limit	Monthly Average
Mercury, Total (Low Level)	kg/Day	1	0.00026	0.00023	0.0017	0.00026
Mercury (continued)	ng/L	1700	1.040	0.682	2.9	0.86100
Oil Grease, Hexane Extra Metho	mg/L	10 NTE	3.00	3.40		

Instantaneous Limits

Parameter	Unit	Limit	Monthly	Date
pH, Minimum	S.U.	6.0 NLT	6.40	08/07
pH, Maximum	S.U.	9.0 NTE	7.36	08/15
Chlorine, Total Residual (MAX)	mg/L	0.038 NTE	-	-

NLT= Not Less Than
NTE= Not to Exceed

Process Trends

Parameter	Unit	Target	Current	7 Day
MLSS	mg/L	1000-2000	1306	1366
EAS TSS	mg/L	N/A	5008	5008
EAS	GPM	700	676	581
MCRT	Days	7	6.77	7.87

As of:
8/11/2023

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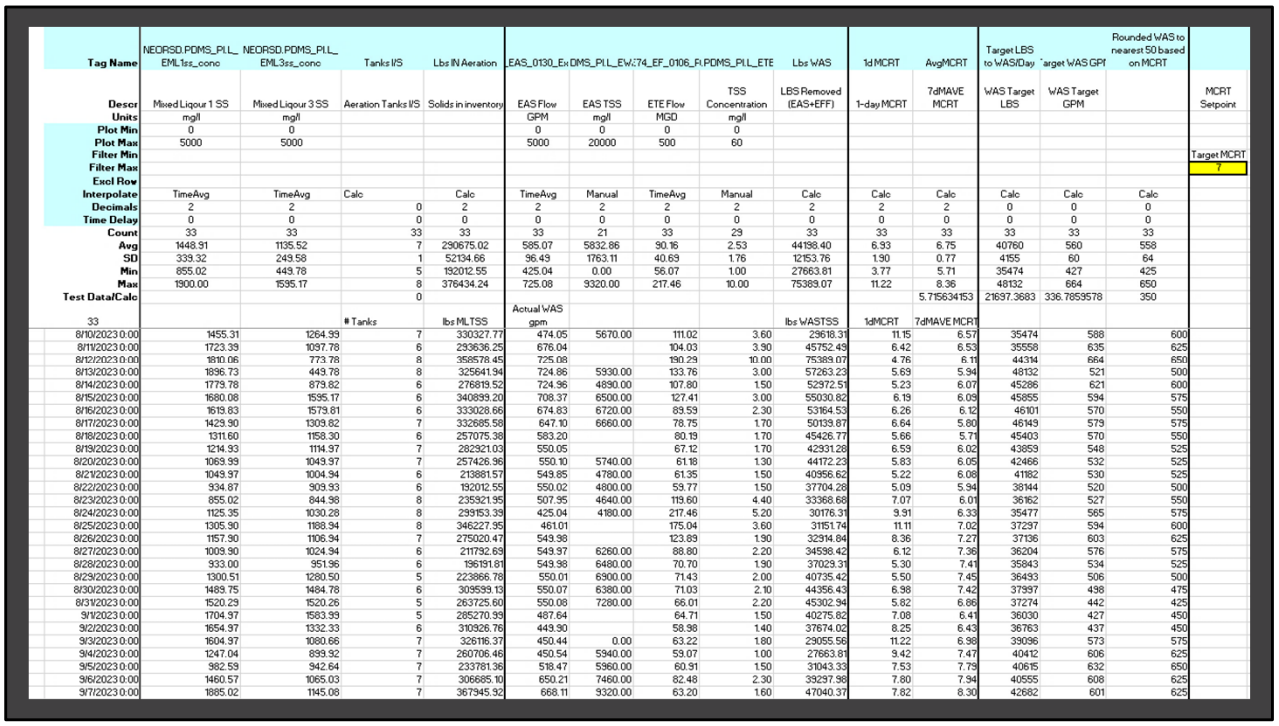
Here is our Easterly dashboard. All three plants are extremely similar in design so that if personnel are familiar with one, they can easily use a different one.

This is spreadsheet working in the background that produces the dashboards. We are now going to dive into its functionality.



Tag Name	NEORSD.PDMS_PLL_EML1ss_conc	NEORSD.PDMS_PLL_EML3ss_conc	Tanks I/S	Lbs IN Aeration	EAS_0130_Ex	DMS_PLL_EW:74_EF_0106_FI	PDMS_PLL_ETE	Lbs WAS	1d MCRT	AvgMCRT	Target LBS to WAS/Day	Target WAS GPI	Rounded WAS to nearest 50 based on MCRT	
Descr	Mixed Liqour 1 SS	Mixed Liqour 3 SS	Aeration Tanks I/S	Solids in inventory	EAS Flow	EAS TSS	ETE Flow	TSS Concentration	LBS Removed (EAS+EFF)	1-day MCRT	7dMAVE MCRT	WAS Target LBS	WAS Target GPM		MCRT Setpoint
Units	mg/l	mg/l			GPM	mg/l	MGD	mg/l							
Plot Min	0	0			0	0	0	0							
Plot Max	5000	5000			5000	20000	500	60							
Filter Min															Target MCRT
Filter Max															7
Excl Row															
Interpolate	TimeAvg	TimeAvg	Calc	Calc	TimeAvg	Manual	TimeAvg	Manual	Calc	Calc	Calc	Calc	Calc	Calc	
Decimals	2	2	0	2	2	2	2	2	2	2	2	0	0	0	
Time Delay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Count	33	33	33	33	33	21	33	29	33	33	33	33	33	33	
Avg	1448.91	1135.52	7	290675.02	585.07	5832.86	90.16	2.53	44138.40	6.93	6.75	40760	560	558	
SD	339.32	249.58	1	52134.66	96.49	1763.11	40.69	1.76	12153.76	1.90	0.77	4155	60	64	
Min	855.02	449.78	5	192012.55	425.04	0.00	56.07	1.00	27663.81	3.77	5.71	35474	427	425	
Max	1900.00	1595.17	8	376434.24	725.08	9320.00	217.46	10.00	75389.07	11.22	8.36	48132	664	650	
Test Data/Calc			0								5.715634153	21697.3683	336.7859578	350	
33			# Tanks	lbs MLTSS	Actual WAS gpm				lbs WASTSS	1dMCRT	7dMAVE MCRT				
8/10/2023 0:00	1455.31	1264.39	7	330327.77	474.05	5670.00	111.02	3.60	29618.31	11.15	6.57	35474	588	600	
8/11/2023 0:00	1723.39	1097.78	6	293636.25	676.04		104.03	3.90	45752.49	6.42	6.53	35558	635	625	
8/12/2023 0:00	1810.06	773.78	8	358578.45	725.08		130.29	10.00	75389.07	4.76	6.11	44314	664	650	
8/13/2023 0:00	1896.73	449.78	8	325641.94	724.86	5930.00	133.76	3.00	57263.23	5.69	5.94	48132	521	500	
8/14/2023 0:00	1779.78	879.82	6	276819.52	724.96	4890.00	107.80	1.50	52972.51	5.23	6.07	45286	621	600	
8/15/2023 0:00	1680.08	1595.17	6	340899.20	708.37	6500.00	127.41	3.00	55030.82	6.19	6.09	45855	594	575	
8/16/2023 0:00	1619.83	1579.81	6	333028.66	674.83	6720.00	89.59	2.30	53164.53	6.26	6.12	46101	570	550	
8/17/2023 0:00	1429.90	1309.82	7	332685.58	647.10	6660.00	78.75	1.70	50139.87	6.64	5.80	46149	579	575	
8/18/2023 0:00	1311.60	1158.30	6	257075.38	583.20		80.19	1.70	45426.77	5.66	5.71	45403	570	550	
8/19/2023 0:00	1214.93	1114.97	7	282921.03	550.05		67.12	1.70	42931.28	6.59	6.02	43859	548	525	
8/20/2023 0:00	1069.99	1049.97	7	257426.96	550.10	5740.00	61.18	1.30	44172.23	5.83	6.05	42466	532	525	
8/21/2023 0:00	1049.97	1004.94	6	213881.57	549.85	4780.00	61.35	1.50	40956.62	5.22	6.08	41182	530	525	
8/22/2023 0:00	934.87	909.93	6	192012.55	550.02	4800.00	59.77	1.50	37704.28	5.09	5.94	38144	520	500	
8/23/2023 0:00	855.02	844.98	8	235921.95	507.95	4640.00	119.60	4.40	33368.68	7.07	6.01	36162	527	550	
8/24/2023 0:00	1125.35	1030.28	8	299153.39	425.04	4180.00	217.46	5.20	30176.31	9.91	6.33	35477	565	575	
8/25/2023 0:00	1305.90	1188.94	8	346227.35	461.01		175.04	3.60	31151.74	11.11	7.02	37297	594	600	
8/26/2023 0:00	1157.90	1106.94	7	275020.47	549.98		123.89	1.90	32914.84	8.36	7.27	37136	603	625	
8/27/2023 0:00	1009.90	1024.94	6	211792.69	549.97	6260.00	88.80	2.20	34598.42	6.12	7.36	36204	576	575	
8/28/2023 0:00	933.00	951.96	6	196191.81	549.98	6480.00	70.70	1.90	37029.31	5.30	7.41	35843	534	525	
8/29/2023 0:00	1300.51	1280.50	5	223866.78	550.01	6900.00	71.43	2.00	40735.42	5.50	7.45	36493	506	500	
8/30/2023 0:00	1489.75	1484.78	6	309599.13	550.07	6380.00	71.03	2.10	44356.43	6.98	7.42	37997	498	475	
8/31/2023 0:00	1520.29	1520.26	5	263725.60	550.08	7280.00	66.01	2.20	45302.94	5.82	6.86	37274	442	425	
9/1/2023 0:00	1704.97	1583.99	5	285270.99	487.64		64.71	1.50	40275.82	7.08	6.41	36030	427	450	
9/2/2023 0:00	1654.97	1332.33	6	310926.76	449.90		58.98	1.40	37674.02	8.25	6.43	36763	437	450	
9/3/2023 0:00	1604.97	1080.66	7	326116.37	450.44	0.00	63.22	1.80	29055.56	11.22	6.98	39096	573	575	
9/4/2023 0:00	1247.04	839.92	7	260706.46	450.54	5940.00	59.07	1.00	27663.81	9.42	7.47	40412	606	625	
9/5/2023 0:00	982.59	942.64	7	233781.36	518.47	5960.00	60.91	1.50	31043.33	7.53	7.79	40615	632	650	
9/6/2023 0:00	1460.57	1065.03	7	306885.10	650.21	7460.00	82.48	2.30	39297.96	7.80	7.94	40555	608	625	
9/7/2023 0:00	1885.02	1145.08	7	367945.92	668.11	9320.00	63.20	1.60	47040.37	7.82	8.30	42682	601	625	

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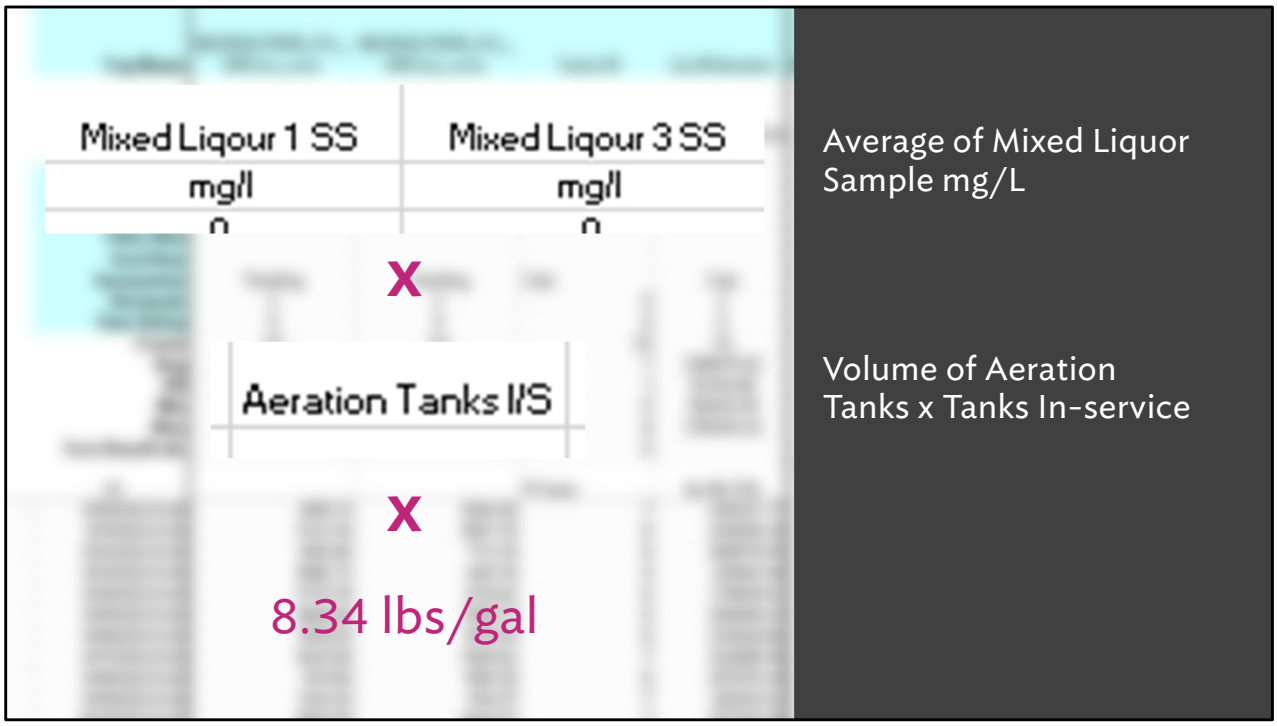
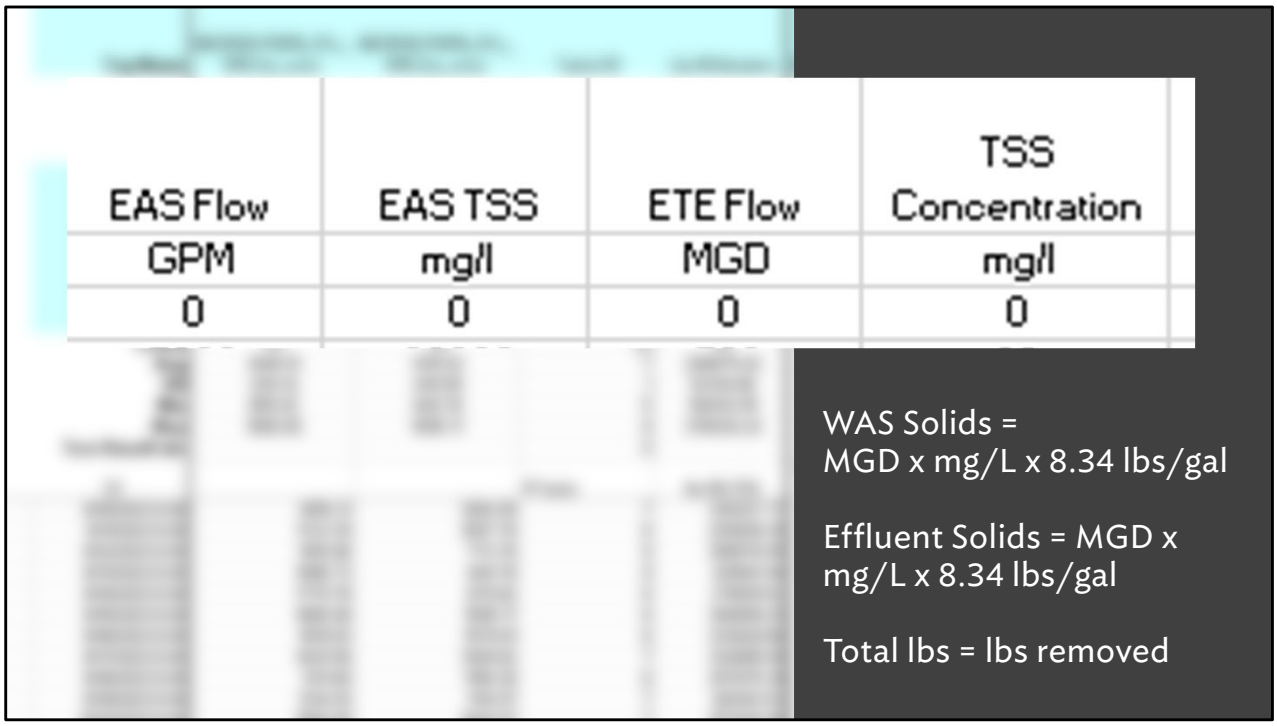


The first portion of the MCRT equation is “solids inventory”. Here we are pulling the analytical services results from the daily composite sample on the East half and the West half of the Easterly treatment plant. The 5-day moving average of the samples is multiplied by the volume of the aeration system. This is automatically calculated by the number of tanks in service times their individual volume. To automate the process, the spreadsheet pulls SCADA data into the spreadsheet and is used within evaluated with formulas to determine if a tank is “in-service”

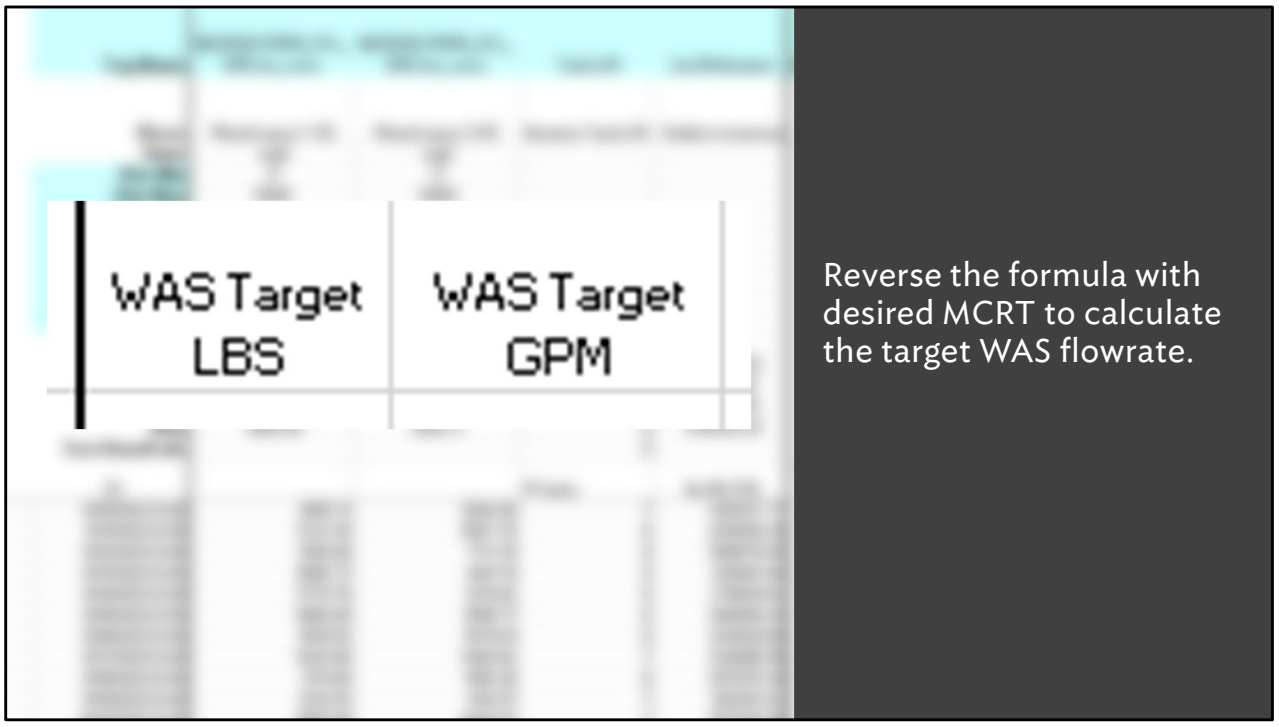


The next portion of the MCRT equation is the solids removed. The WAS flow is a 24-hour time weighted average that is pulled into the spreadsheet from the SCADA historian. This number can change if the sheet is calculated multiple times throughout the day. The flow is multiplied by the analytical services results of the WAS TSS concentration (which is also a 5-day moving average). The effluent TSS is calculated by pulling the time weighted 24-hour flow and the analytical services TSS results (which is a 14-day moving average).

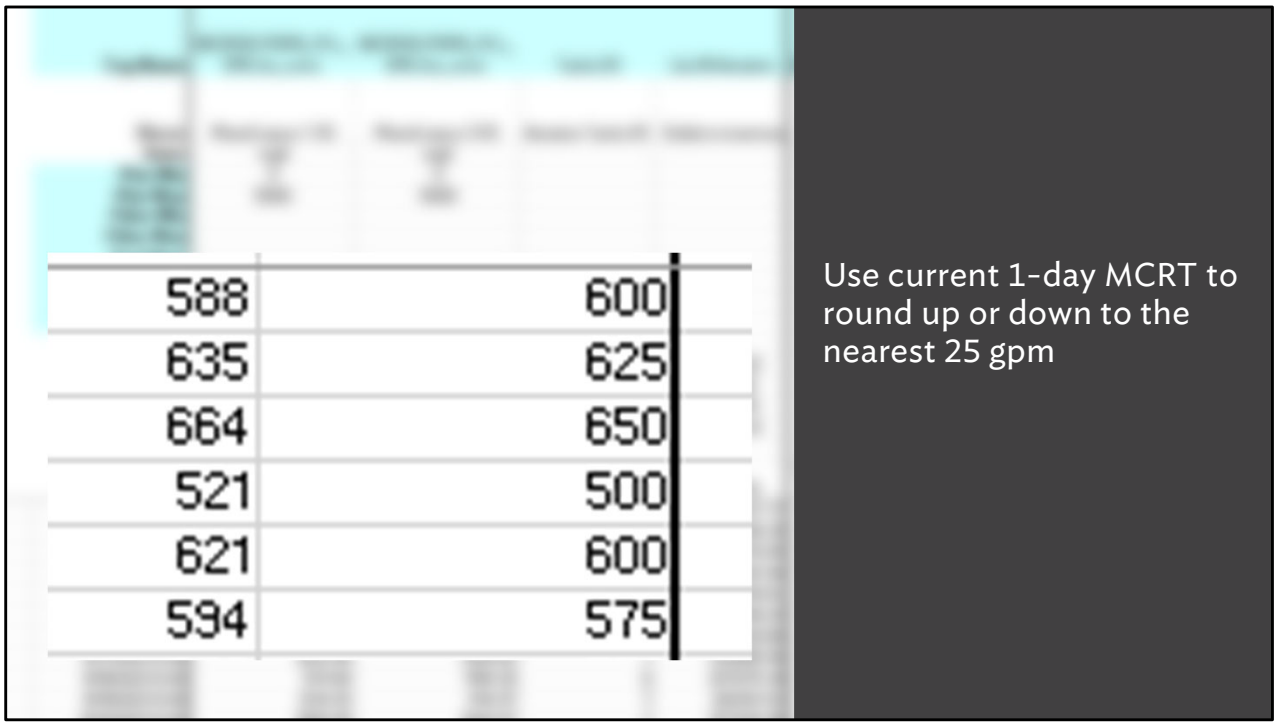
The results of both solids sources are summed to get the

total solids removed.

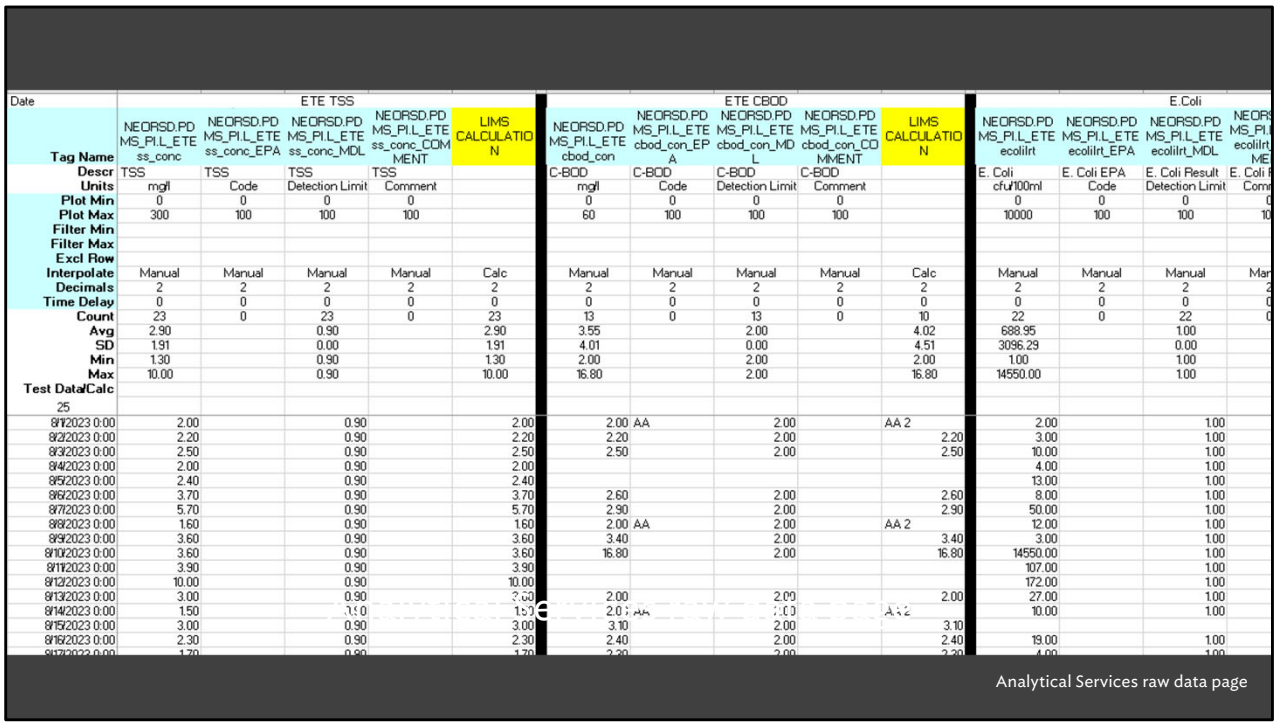
All the results are then used to calculate the current MCRT. A 7-day moving average is also included to help the user see trending.



The entire MCRT formula is reconfigured using the target MCRT to determine what the current WAS target flow should be.



This result is then rounded up or down to the nearest 25 gpm depending on if the 1-day MCRT is above or below the target value.



Date	ETE TSS					ETE CBOD					E.Coli			
Tag Name	NEORSD.PDMS_PI.L_ETEss_conc	NEORSD.PDMS_PI.L_ETEss_conc_EPA	NEORSD.PDMS_PI.L_ETEss_conc_MDL	NEORSD.PDMS_PI.L_ETEss_conc_COMMENT	LIMS CALCULATION	NEORSD.PDMS_PI.L_ETEcbod_con	NEORSD.PDMS_PI.L_ETEcbod_con_EPA	NEORSD.PDMS_PI.L_ETEcbod_con_MDL	NEORSD.PDMS_PI.L_ETEcbod_con_COMMENT	LIMS CALCULATION	NEORSD.PDMS_PI.L_ETEecolilrt	NEORSD.PDMS_PI.L_ETEecolilrt_EPA	NEORSD.PDMS_PI.L_ETEecolilrt_MDL	NEORS MS_PI ecolilrt ME
Descr	TSS	TSS	TSS	TSS		C-BOD	C-BOD	C-BOD	C-BOD		E. Coli	E. Coli EPA	E. Coli Result Detection Limit	E. Coli Comm
Units	mgl	Code	Detection Limit	Comment		mgl	Code	Detection Limit	Comment		cfu/100ml	Code		
Plot Min	0	0	0	0		0	0	0	0		0	0	0	0
Plot Max	300	100	100	100		60	100	100	100		10000	100	100	10
Filter Min														
Filter Max														
Excl Row														
Interpolate	Manual	Manual	Manual	Manual	Calc	Manual	Manual	Manual	Manual	Calc	Manual	Manual	Manual	Man
Decimals	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Time Delay	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count	23	0	23	0	23	13	0	13	0	10	22	0	22	0
Avg	2.90		0.90		2.90	3.55		2.00		4.02	688.95		1.00	
SD	1.91		0.00		1.91	4.01		0.00		4.51	3096.29		0.00	
Min	1.30		0.90		1.30	2.00		2.00		2.00	1.00		1.00	
Max	10.00		0.90		10.00	16.80		2.00		16.80	14550.00		1.00	
Test Data/Calc														
25														
8/1/2023 0:00	2.00		0.90		2.00	2.00	AA	2.00		AA 2	2.00		1.00	
8/2/2023 0:00	2.20		0.90		2.20	2.20		2.00		2.20	3.00		1.00	
8/3/2023 0:00	2.50		0.90		2.50	2.50		2.00		2.50	10.00		1.00	
8/4/2023 0:00	2.00		0.90		2.00						4.00		1.00	
8/5/2023 0:00	2.40		0.90		2.40						13.00		1.00	
8/6/2023 0:00	3.70		0.90		3.70	2.60		2.00		2.60	8.00		1.00	
8/7/2023 0:00	5.70		0.90		5.70	2.90		2.00		2.90	50.00		1.00	
8/8/2023 0:00	1.60		0.90		1.60	2.00	AA	2.00		AA 2	12.00		1.00	
8/9/2023 0:00	3.60		0.90		3.60	3.40		2.00		3.40	3.00		1.00	
8/10/2023 0:00	3.60		0.90		3.60	16.80		2.00		16.80	14550.00		1.00	
8/11/2023 0:00	3.90		0.90		3.90						107.00		1.00	
8/12/2023 0:00	10.00		0.90		10.00						172.00		1.00	
8/13/2023 0:00	3.00		0.90		3.00	2.00		2.00		2.00	27.00		1.00	
8/14/2023 0:00	1.50		0.90		1.50	2.00	AA	2.00		AA 2	10.00		1.00	
8/15/2023 0:00	3.00		0.90		3.00	3.10		2.00		3.10				
8/16/2023 0:00	2.30		0.90		2.30	2.40		2.00		2.40	19.00		1.00	
8/17/2023 0:00	1.70		0.90		1.70	2.20		2.00		2.20	4.00		1.00	

Analytical Services raw data page

This is a small portion of the second sheet within the Dashboard workbook. This sheet pulls all permit related results from the analytical services department in real time.

As you can see, we have the effluent TSS, cBOD, and E. coli on this snippet.

Lessons learned

FIVE FACTS ABOUT OUR DATA AND DASHBOARDS

Here are the lessons learned along the process of developing and utilizing the dashboards.

Composite samplers improved MLSS results.

Switching the MLSS samples to composite samplers drastically improved the results and reduced sampling variability.

Averages of 5-7 days made the data stable without dampening excessively.

A 5-7 day moving average improved the result without dampening them.

Analytical results were uploaded with less lag time

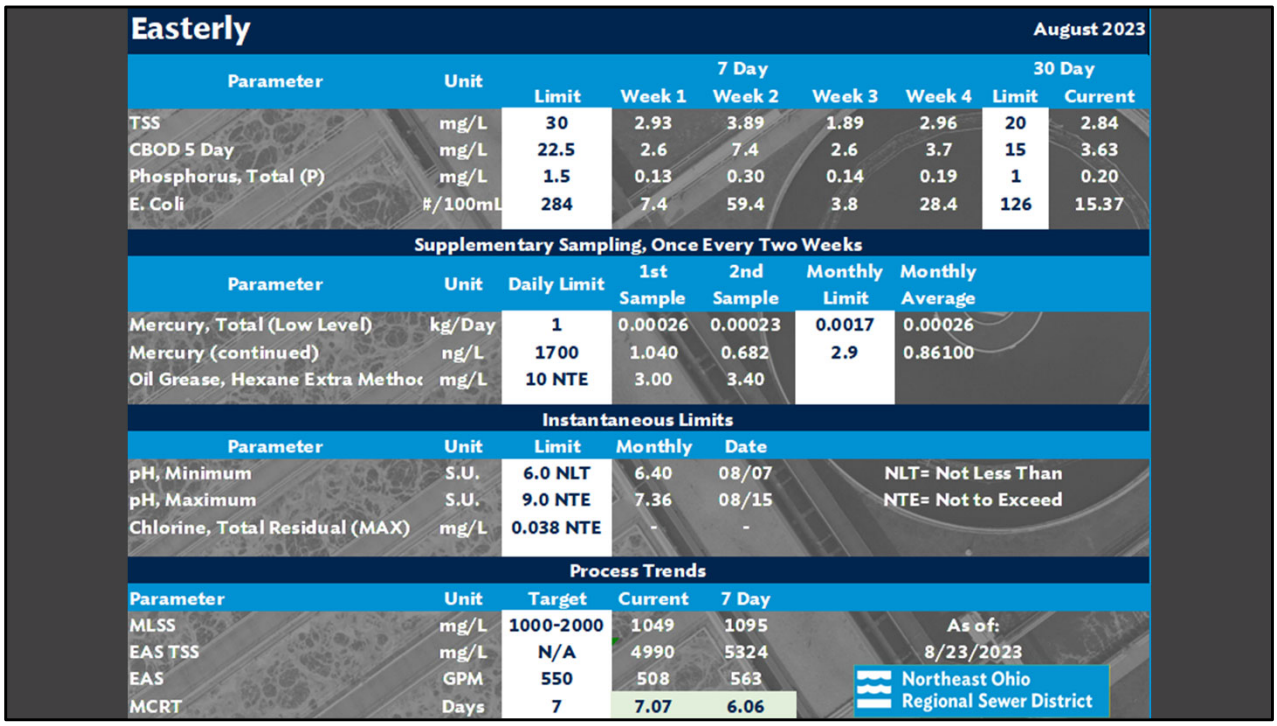
Analytical results for process control parameters were streamlined to get the results uploaded faster.

Anomalies need to be reviewed by a subject matter expert.

There still needs to be oversight from a subject matter expert. This is not a set it and forget system. Instruments can act up, samples can be unrepresentative, data can be problematic.

Time invested in the development will yield great returns.

Taking the time to development the dashboard properly will yield great results. The Easterly and Westerly dashboards took almost a year of use and adjustment to fine tune.



Easterly

August 2023

Parameter	Unit	7 Day Limit	Week 1	Week 2	Week 3	Week 4	30 Day Limit	30 Day Current
TSS	mg/L	30	2.93	3.89	1.89	2.96	20	2.84
CBOD 5 Day	mg/L	22.5	2.6	7.4	2.6	3.7	15	3.63
Phosphorus, Total (P)	mg/L	1.5	0.13	0.30	0.14	0.19	1	0.20
E. Coli	#/100mL	284	7.4	59.4	3.8	28.4	126	15.37

Supplementary Sampling, Once Every Two Weeks

Parameter	Unit	Daily Limit	1st Sample	2nd Sample	Monthly Limit	Monthly Average
Mercury, Total (Low Level)	kg/Day	1	0.00026	0.00023	0.0017	0.00026
Mercury (continued)	ng/L	1700	1.040	0.682	2.9	0.86100
Oil Grease, Hexane Extra Metho	mg/L	10 NTE	3.00	3.40		

Instantaneous Limits

Parameter	Unit	Limit	Monthly	Date
pH, Minimum	S.U.	6.0 NLT	6.40	08/07
pH, Maximum	S.U.	9.0 NTE	7.36	08/15
Chlorine, Total Residual (MAX)	mg/L	0.038 NTE	-	-

NLT= Not Less Than
NTE= Not to Exceed

Process Trends

Parameter	Unit	Target	Current	7 Day
MLSS	mg/L	1000-2000	1049	1095
EAS TSS	mg/L	N/A	4990	5324
EAS	GPM	550	508	563
MCRT	Days	7	7.07	6.06

As of:
8/23/2023

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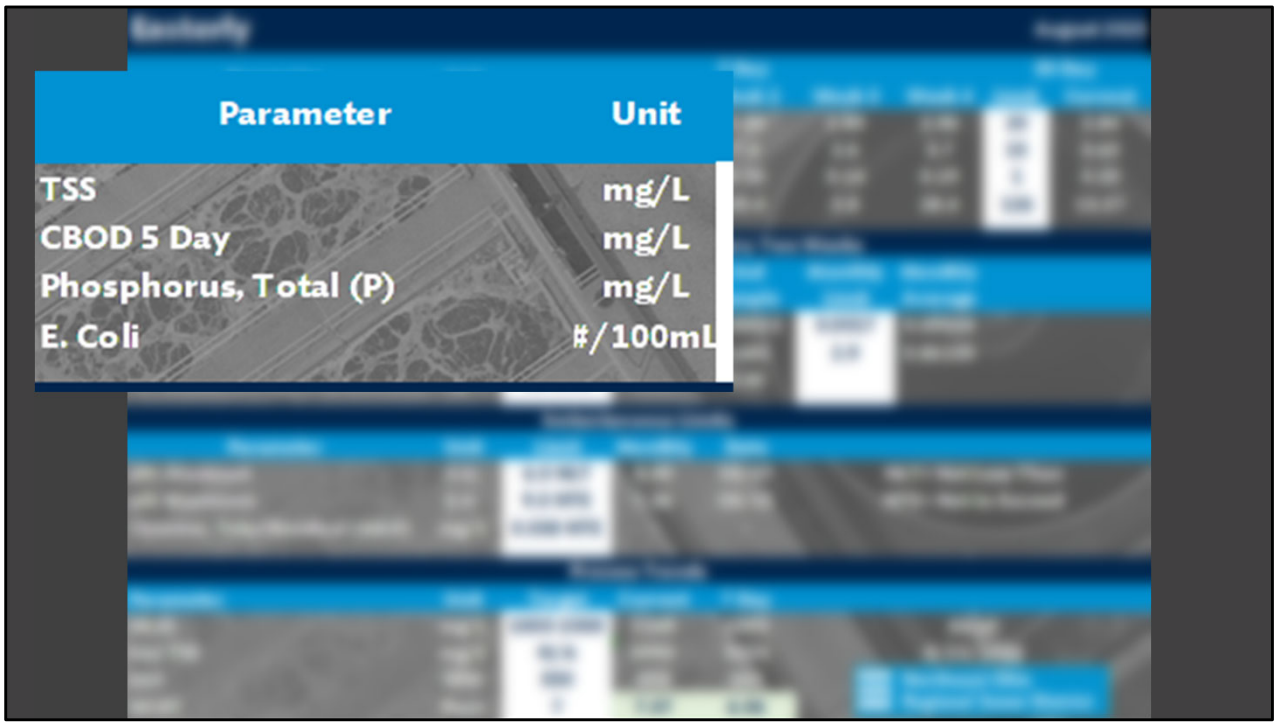
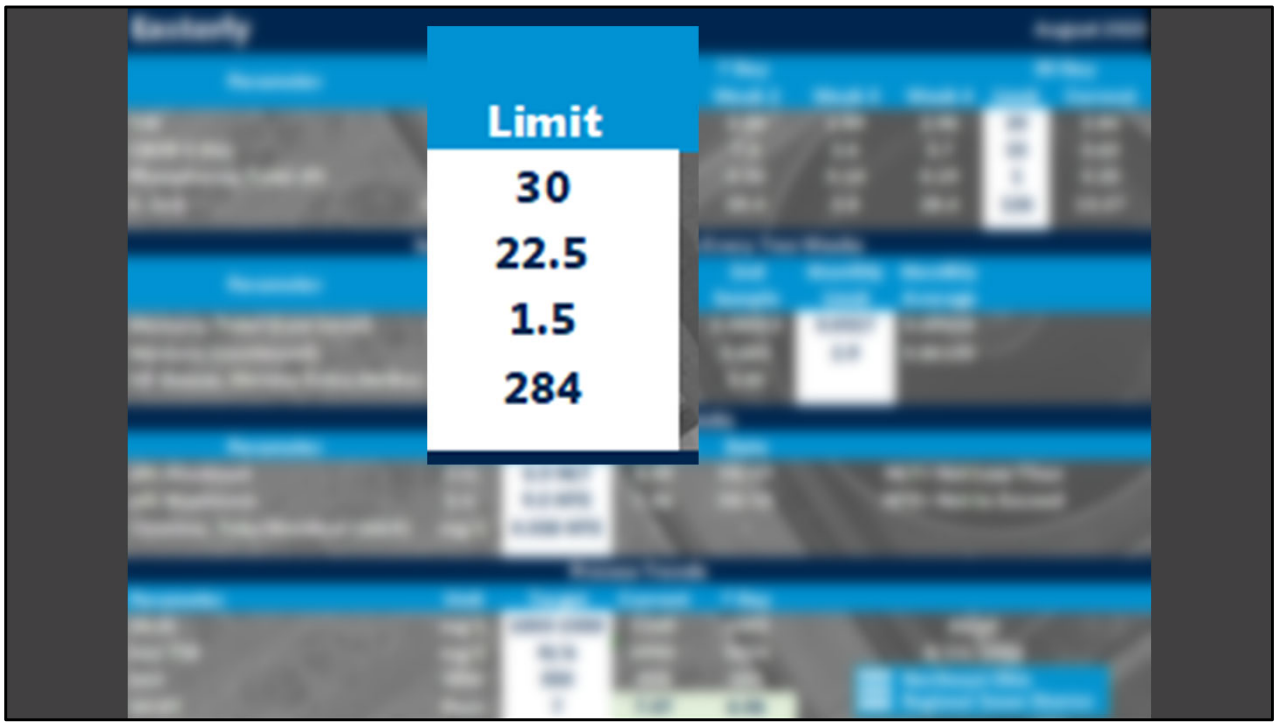
All the dashboard data is populated when the file is opened.



Each dashboard contains the key permit parameters, …



...the corresponding permit limitation levels (weekly, monthly, and instantaneous, ...

… the results from analytical services, and the crucial process control parameters are derived from the dashboard to ensure a healthy microorganism population. The dashboard is available to all plant personnel and displays all data in real time. Conditional formatting was added to highlight permit excursion levels.

What else could be done with this data tool?

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If the Dashboard can compare the results to the permit, why not automate its notifications so that the sheet does not need to be reviewed daily.

Risk Alerts

- Level 1
  - Plant Management
  - Deputy Director
- Level 2
  - Director of Operation & Maintenance
  - Superintendent of Environmental Services
  - Manager of Environmental Health & Safety
- Level 3
  - Chief Operating Officer

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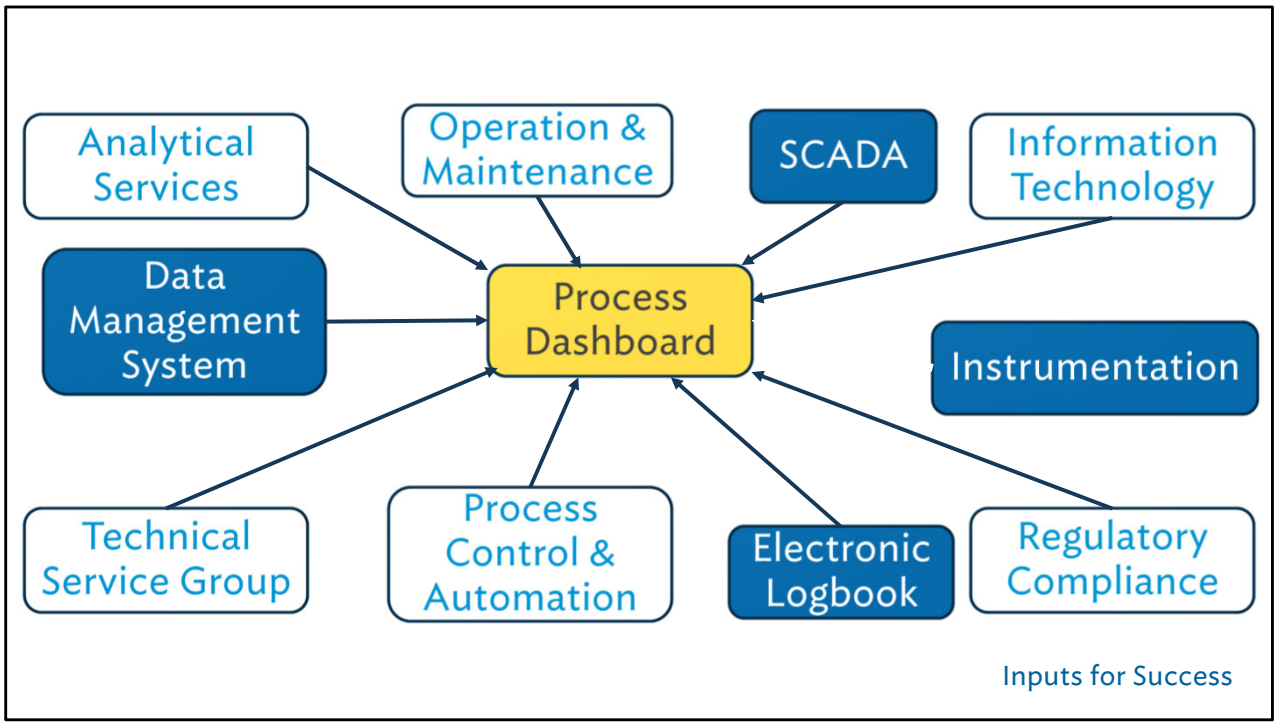
Which is what we did by using the dashboard to build an early warning system for potential permit excursions. The dashboard performs a mathematical risk assessment in the background and triggers automated alert emails to cascading levels of staff depending on the risk level.



To accomplish this level of functionality involved multiple groups of District staff with a range of various skillsets, as seen on the slide. We also relied on multiple technologies within the District, these include the bridge between the plant equipment and the operator control interface, SCADA. The data management system PDMS, and the online logbook entry platform

Outcomes

- Improved data communication to plant personnel
- Streamlined laboratory process testing results
- Stability in waste activated sludge flow rates
- Development of a precise notification system

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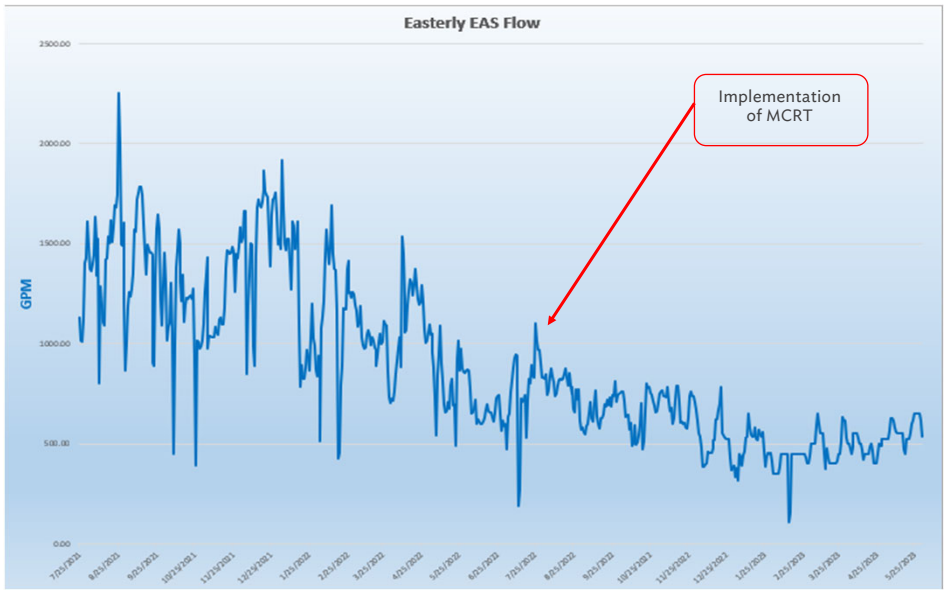
A few positive outcomes of the project include: an improvement in providing data to plant personnel in a convenient package, streamlining of testing and result reporting from analytical services, a higher level of stability within the activated sludge control, and the development of a notification system with an increased level of precision.



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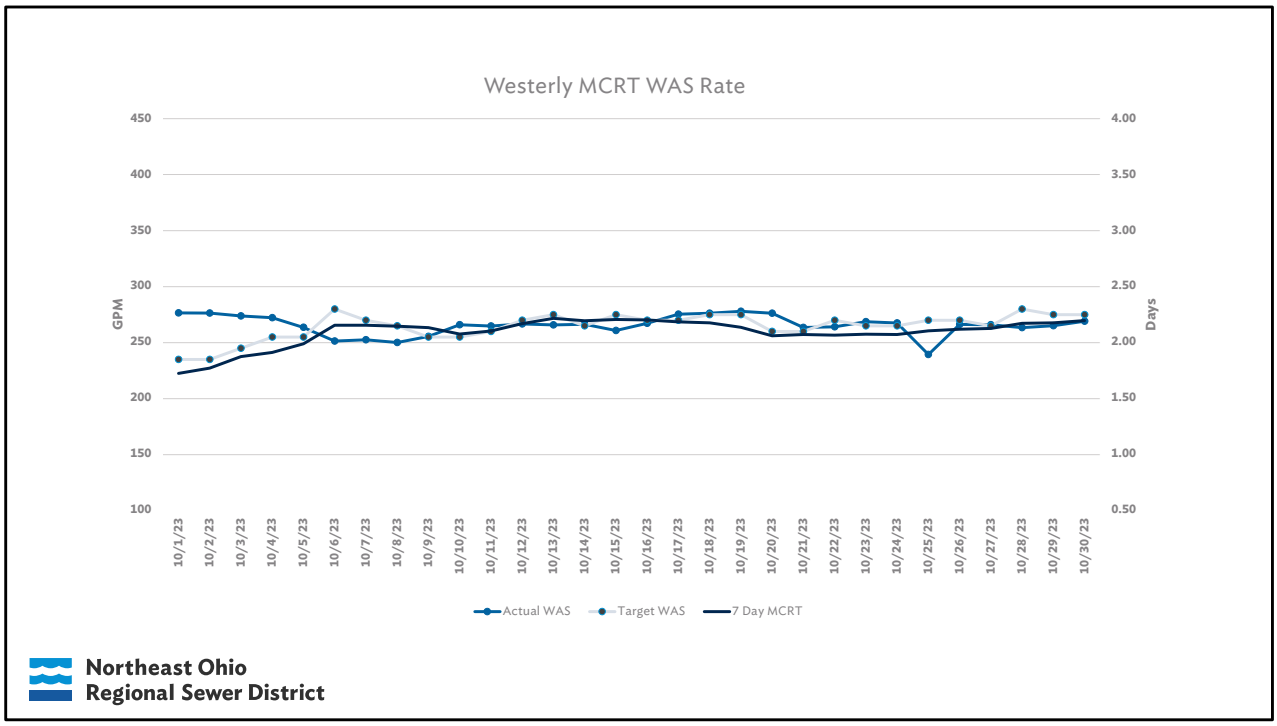
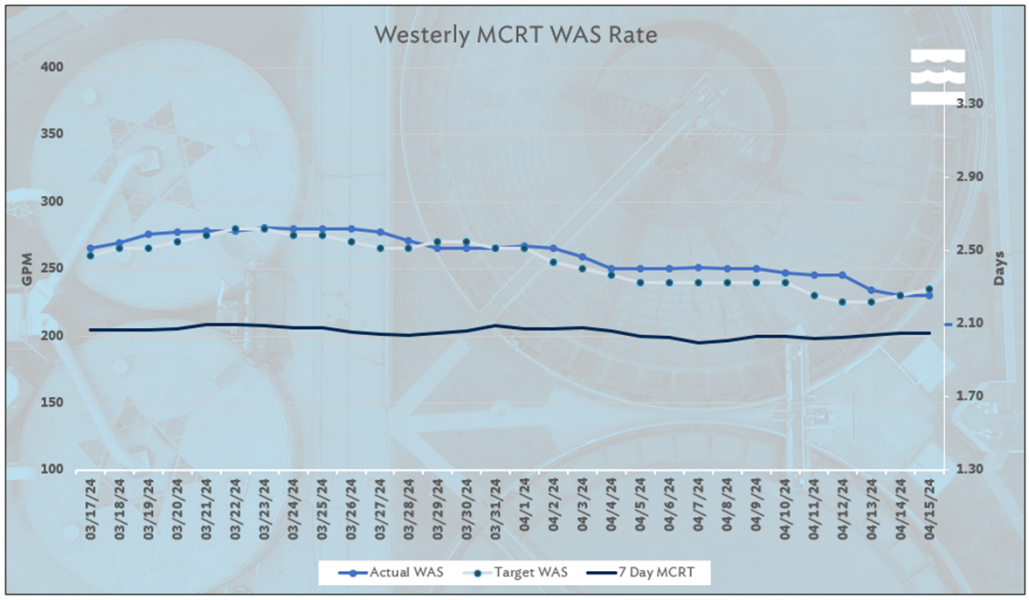
As can be seen on this one-year graph, the variability in the Easterly flowrate of the sludge removed from the activated sludge process has been greatly reduced. This has improved the activated sludge biological processes, which ultimately improves the effluent quality. The improvement is achieved without an increase in chemical usage, and in many cases reduces chemical needs.



The graph for Westerly sludge displays the high level of accuracy that has developed within the process control strategy in October of 2023. The chart shows a deviation of less than ½ a day on the sludge age results. Holding the MCRT within plus or minus ½ a day is quite an accomplishment but is this attainable long term.....



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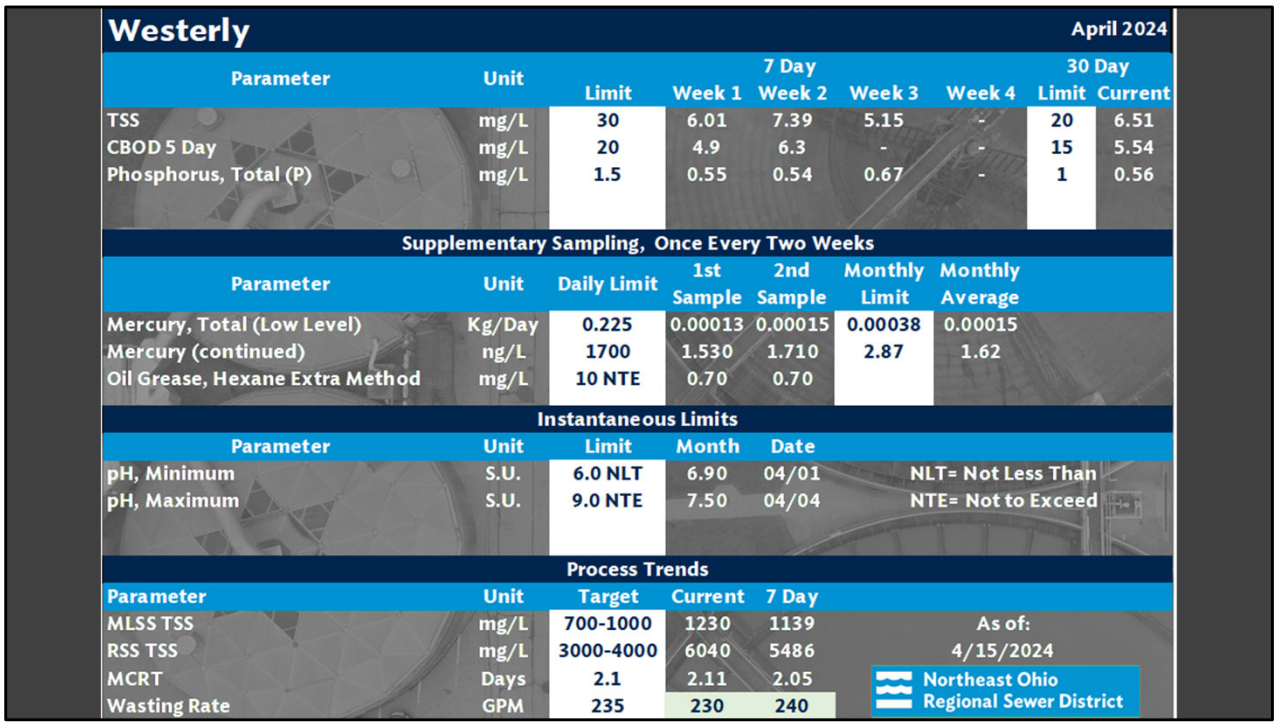
Here is a recent graph of Westerly that shows the stability of the MCRT is extremely precise, but how precise?



Westerly

April 2024

Parameter	Unit	7 Day Limit	Week 1	Week 2	Week 3	Week 4	30 Day Limit	30 Day Current
TSS	mg/L	30	6.01	7.39	5.15	-	20	6.51
CBOD 5 Day	mg/L	20	4.9	6.3	-	-	15	5.54
Phosphorus, Total (P)	mg/L	1.5	0.55	0.54	0.67	-	1	0.56

Supplementary Sampling, Once Every Two Weeks

Parameter	Unit	Daily Limit	1st Sample	2nd Sample	Monthly Limit	Monthly Average
Mercury, Total (Low Level)	Kg/Day	0.225	0.00013	0.00015	0.00038	0.00015
Mercury (continued)	ng/L	1700	1.530	1.710	2.87	1.62
Oil Grease, Hexane Extra Method	mg/L	10 NTE	0.70	0.70		

Instantaneous Limits

Parameter	Unit	Limit	Month	Date
pH, Minimum	S.U.	6.0 NLT	6.90	04/01
pH, Maximum	S.U.	9.0 NTE	7.50	04/04

NLT= Not Less Than
NTE= Not to Exceed

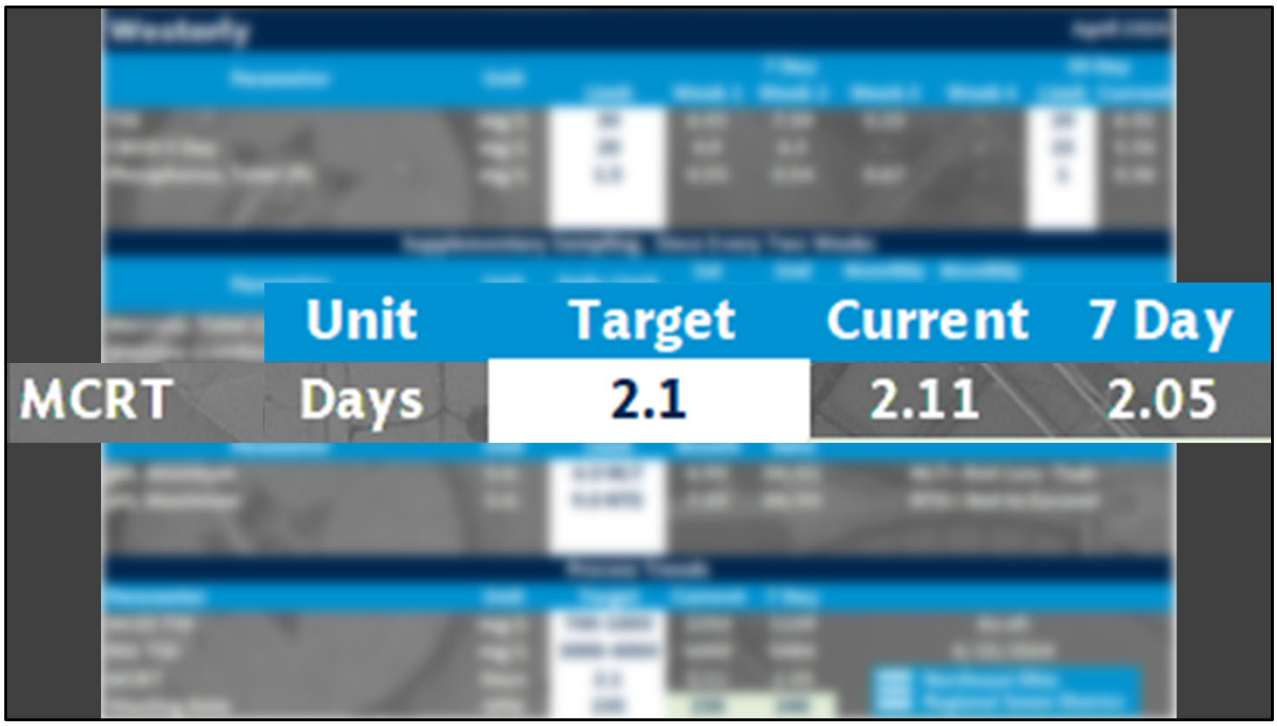
Process Trends

Parameter	Unit	Target	Current	7 Day
MLSS TSS	mg/L	700-1000	1230	1139
RSS TSS	mg/L	3000-4000	6040	5486
MCRT	Days	2.1	2.11	2.05
Wasting Rate	GPM	235	230	240

As of:
4/15/2024

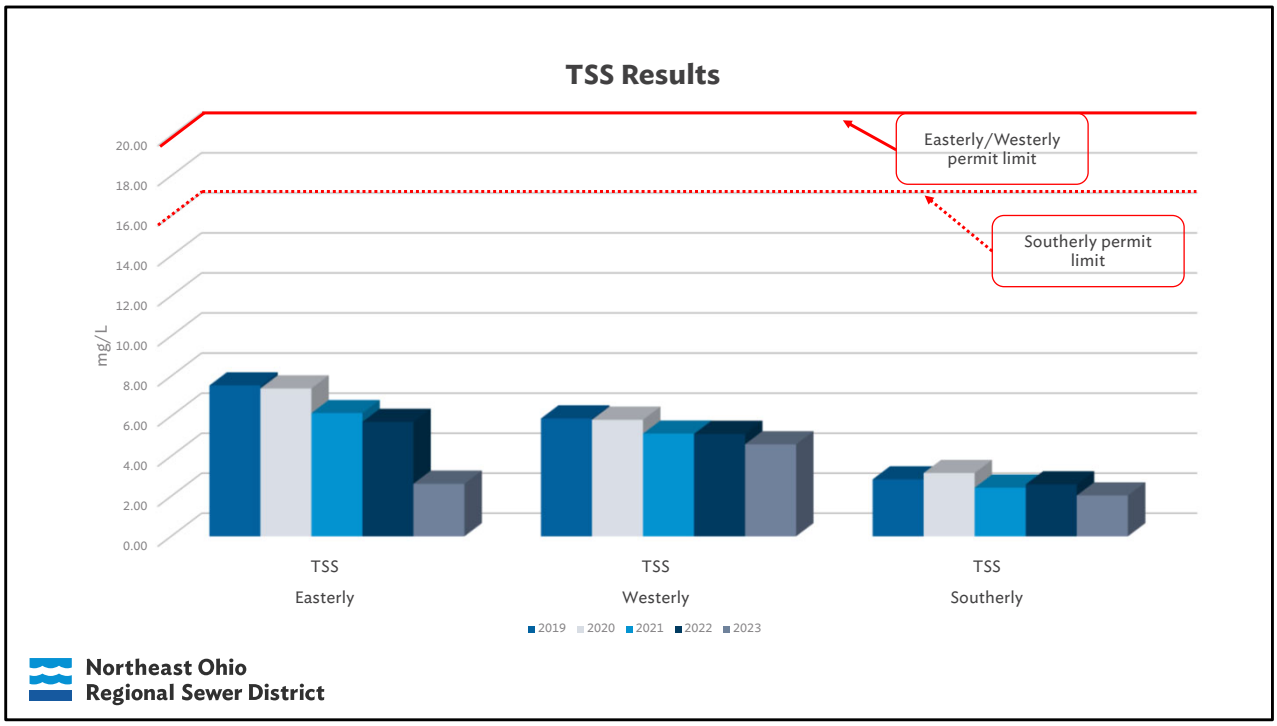
Northeast Ohio Regional Sewer District

This snapshot of the Westerly dashboard shows the numerical results….



	Unit	Target	Current	7 Day
MCRT	Days	2.1	2.11	2.05

The current target MCRT is 2.1 days, with the current actual at 2.11 days and the 7-day average is 2.05 days. This means the 7-day average is within 2-hours of the targeted MCRT while the current is within less than a half hour! But at the end of the day, what is the value added?



As can be seen, the three plants at the District have been operating at a high level. The chart shows the effluent TSS of each plant from 2019-2023 and the red line is the corresponding permit limits. Easterly had the benefit of nearly a one-year head start on the dashboard implementation and was able to improve the TSS results. So, if we can improve just by adjusting how we control the plant processes, why would we not want to?

Determining the Proper Wasting Rate of Activated Sludge

MATT GAUGLER, SUPERINTENDENT

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