CSWEA

2022 Educational Seminar

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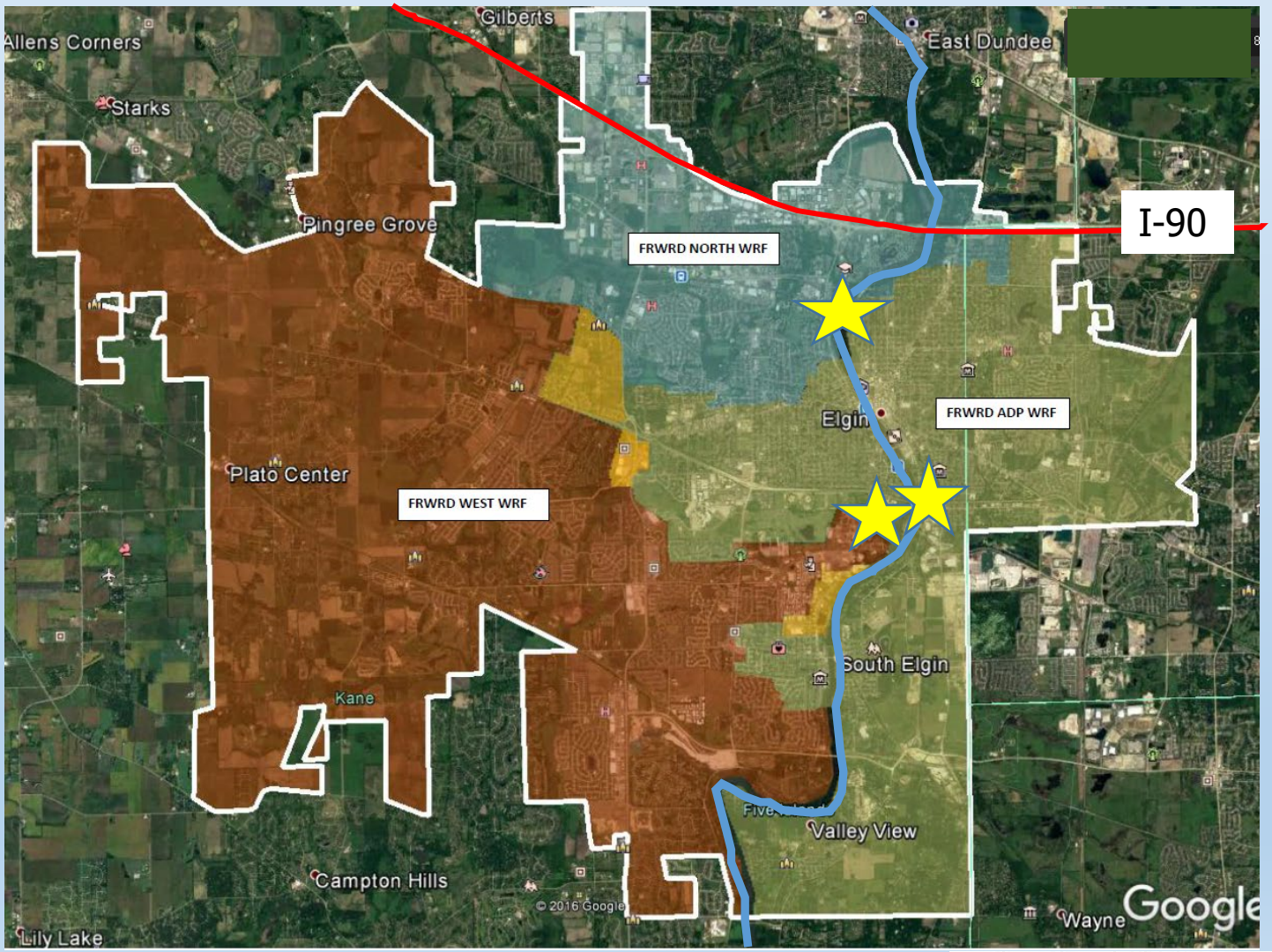
Data: What Does It Mean? How Do You Get it? How Do You Really Use It?

And Is There Such a Thing as Too Much?

Outline

- FRWRD Overview & Project Focus
- Data:
  - What Does It Mean?
  - How Do You Get It?
  - How Do You Use It?
  - Is There Such a Thing as Too Much?
- Lessons Learned
- Now Implementing for ADP WRF

FRWRD Overview



FRWRD Overview

- Service: City of Elgin, Village of South Elgin, Poplar Creek Drainage Basin of MWRD, Village of West Dundee, Village of Bartlett and other service agreements
- 37.75 mgd total capacity at 3 plants
  - North WRF – 7.75 mgd
  - ADP WRF – 25 mgd (previously called South or Main)
  - West WRF – 5 mgd
- Approximately 200,000 people served – 81,000 from MWRD area
- All biosolids processing occurs at the ADP WRF
- Focus on Phosphorous Removal
  - ~$60 Million in 2 years

FRWRD Overview

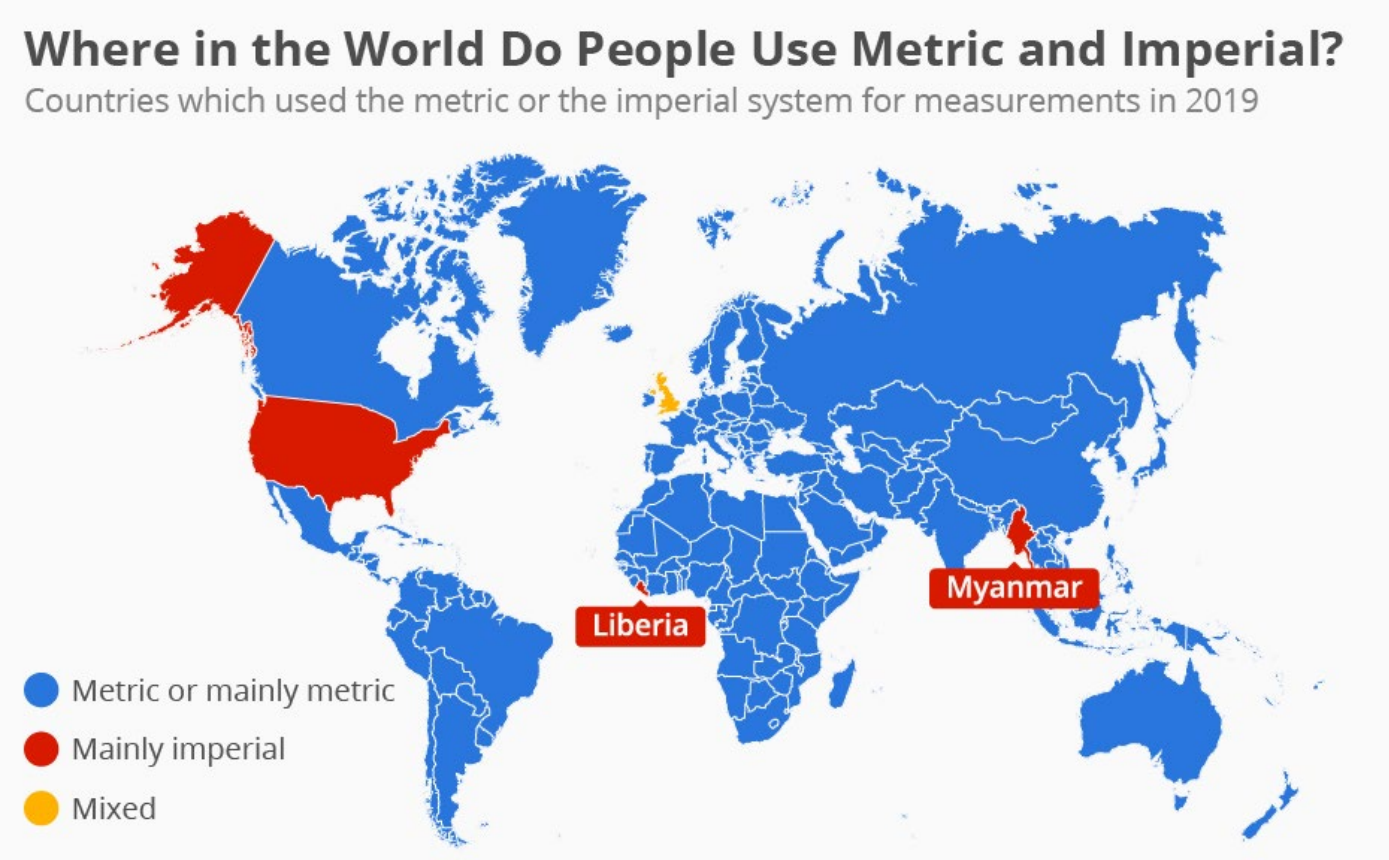
- P Removal at FRWRD
  - West WRF Currently 5 Stage Bardenpho
  - ADP WRF
    - Bio P ~$18,000,000 Liquid Phase
    - ~$12,000,000 Biosolids (Struvite Removal)
  - North ~$26,000,000
  - Modified West Bank Side Stream EBPR
    - New Mixing Basins
    - New Fermenter
    - New RAS PS
    - Aeration Tank and Blower Modifications
    - Primary Sludge Pumping
    - Hydraulic Improvements
    - Odor Control

Data: What Does It Mean?

- The overall question: Are we meeting our permit limit?
  - 1.0 mg/L annual average effluent TP, data counts 3/31/2022 for North WRF - Bio P

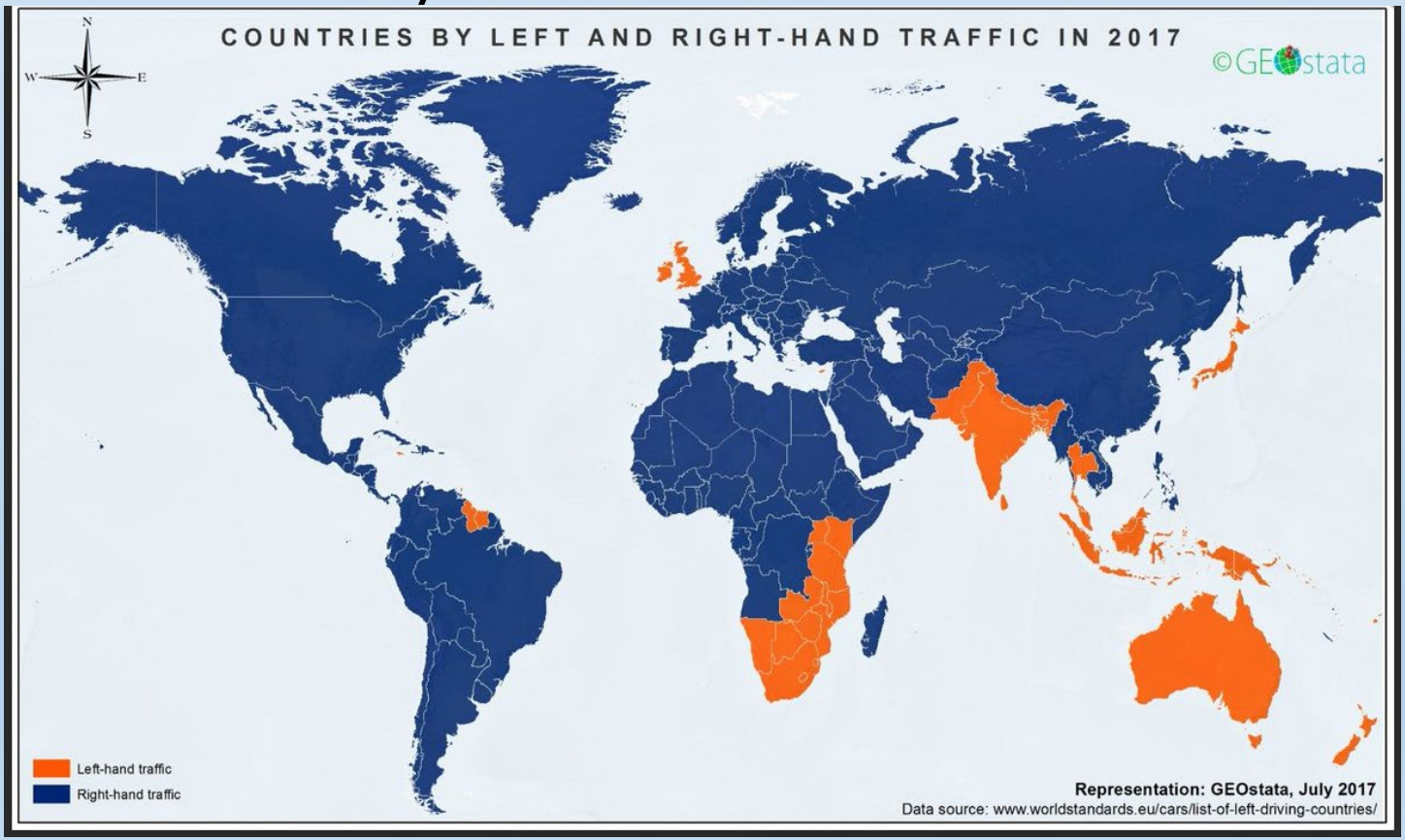
Data: What Does It Mean?

- Different Things to Different People – MPH or Km/H
  - Speed Limits



Data: What Does It Mean?

- Different Things to Different People
  - Should I really rent that car on vacation in Ireland?

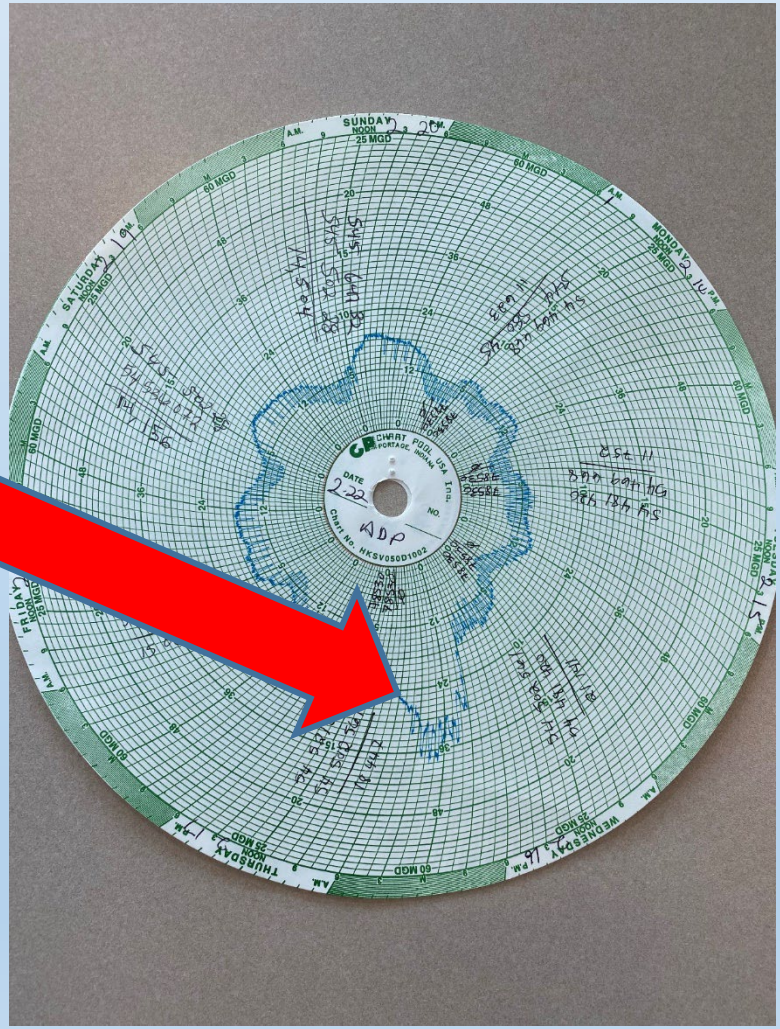


FRWRD

Data: How Do You Get It?

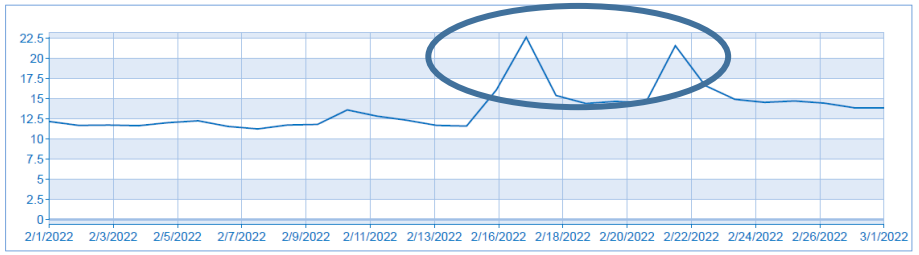
- Chart recorders at Flume
- Quick Visual - What's Different
- Flow meter data – Availability

High Flows,
Did it Rain?



ADP Monthly Flow (MGal)

Date	Influent AVG	Influent MAX	Influent MIN	Excess
02/01/2022	12.077	16.567	6.380	0.000
02/02/2022	11.641	15.530	4.890	0.000
02/03/2022	11.789	15.691	6.105	0.000
02/04/2022	11.545	15.230	4.654	0.000
02/05/2022	12.042	17.012	5.990	0.000
02/06/2022	12.247	16.782	5.063	0.000
02/07/2022	11.498	16.378	4.684	0.000
02/08/2022	11.377	15.557	6.211	0.000
02/09/2022	11.819	16.268	6.073	0.000
02/10/2022	11.702	16.253	5.070	0.000
02/11/2022	13.964	18.853	6.805	0.000
02/12/2022	12.616	17.246	5.231	0.000
02/13/2022	12.144	17.638	4.667	0.000
02/14/2022	11.745	15.650	6.504	0.000
02/15/2022	11.801	15.824	6.663	0.000
02/16/2022	21.317	38.818	7.940	0.000
02/17/2022	18.408	27.900	9.041	0.000
02/18/2022	15.060	18.084	8.096	0.000
02/19/2022	14.141	18.619	7.481	0.000
02/20/2022	14.713	19.954	7.513	0.000
02/21/2022	15.355	24.512	8.004	0.000
02/22/2022	21.929	61.448	10.707	0.000
02/23/2022	15.764	18.883	8.372	0.000
02/24/2022	14.771	19.626	8.105	0.000
02/25/2022	14.608	17.984	8.104	0.000
02/26/2022	14.506	18.358	8.094	0.000
02/27/2022	14.329	17.909	7.183	0.000
02/28/2022	14.058	17.551	8.393	0.000



Data: How Do You Get It?

- Quality of Data – Sample Collection
  - Both automatic type and grab samples
    - Human factor
    - Two people, same sample, different results?
- Sampler – Equipment and Location
    - Does it actually work?
    - Power loss, did the sampler work when required (CSO sample during a storm)
    - Is the sample pipe clogged (Representative sample?)

Data: How Do You Get It?

- Now Looking at Normal Operating Data Critically
- Add Extra Testing for Optimization
  - ➢ Extra Staff Time (Lab and Operations)

North Plant Sampling Schedule

Extra Samples to be collected for phosphorus removal startup

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Grab	Primary Sludge						x	
Grab	Fermented Primary Sludge						x	
Grab (2)	Fermentate (1 preserved) (1 unpreserved)		x					
Grab	Pre-Anoxic Zone 1				x			
Grab	Pre-Anoxic Zone 2				x			
Grab	Anaerobic Zone 1				x			
Grab	Anaerobic Zone 4				x			

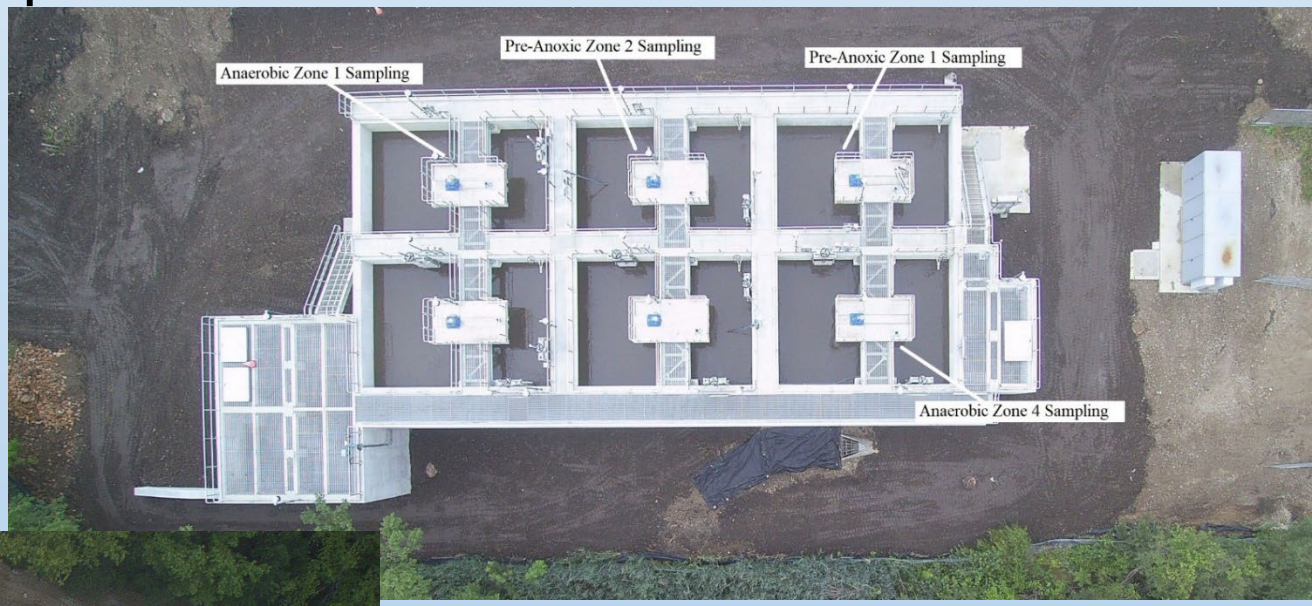
North Plant Sampling Schedule

Effective January 1, 2022

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
24 Hour Composites	Raw		x			x		
	Primary Effluent		x			x		
	Final Effluent		x			x		
Grab for Alkalinity	Final Effluent		x					
Grab for VFAs	Primary Effluent		x					
Grab for Fecal Coliform	Final Effluent (May – October)		x	x	x	x	x	
Grab	Mixed Liquor #3		x	x	x	x	x	x
	Mixed Liquor #4		x	x	x	x	x	x
	Return Sludge		x	x	x	x	x	x

Data: How Do You Get It?

- Extra testing for optimization locations
  - Staff Time - 1 Operator



Data: How Do You Get It?

- Startup Data Spreadsheet - Just for North Plant Phosphorus

Fox River Water Reclamation District

North WRF Phosphorus Removal Start Up Laboratory Data

		Influent					Primary Effluent				Aeration Tanks					Mixing Basins						Final Effluent 24 Hour Composite					Fermentate				Sludge				Mixing Basin Direc	
																Pre-Anoxic Zone 1		Pre-Anoxic Zone 2		Anaerobic Zone 1	Anaerobic Zone 4									Primary		Thickened Fermented		RAS	Prian Effle
	Date	Flow (MGD)	BOD (mg/L)	COD (mg/L)	Total Suspended Solids (mg/L)	Ammonia (mg/L as N)	Total Phosphorus (mg/L as P)	Total Suspended Solids (mg/L)	Total Suspended Solids Percent Removal	BOD (mg/L)	COD (mg/L)	Suspended Solids #3 (mg/L)	Suspended Solids #4 (mg/L)	Return Suspended Solids (mg/L)	Daily Average RAS Flow (MGD)	Daily Wasting Rate (1000 Gal)	Nitrate (mg/L as N)	Ammonia (mg/L	Nitrate (mg/L as N)	ortho-phosphorus	Nitrate (mg/L as N)	ortho-phosphorus	Nitrate (mg/L as N)	Hanna Checker ortho-phosphorus (mg/L as P)	ortho-phosphorus (mg/L as P)	Total phosphorus (mg/L as P)	Total Suspended Solids (mg/L)	Total VFA (mg/L)	Ammonia (mg/L as N)	Total suspended solids (mg/L)	COD (mg/L)	TS (%)	VS (%)	TS (%)	VS (%)	Daily Flow Rate (MGD)	Daily Flow (MG
234	2/13/2022	2.84	107	252	76	17.84	3.45	NS							1.76	64							15.1		2.32	3.09	1								0.501	0.32
235	2/14/2022	3.02										2888	NS	4604	1.80	72												86.7	28.1	88						0.504	0.32
236	2/15/2022	2.98										2860	NS	4252	1.80	64																				0.504	0.32
237	2/16/2022	3.90	139		136	16.73	3.74	140	-2.9	207		2600	NS	8032	2.30	64	<0.1	18.52	<0.1	7.63	<0.1	11.7	13.5		1.46	1.59	6									0.503	0.31
238	2/17/2022	3.61										3480	NS	6424	2.17	66																				0.507	0.33
239	2/18/2022	3.47										3128	NS	5280	2.06	56																0.20	50.00	4.31	89.87	0.506	0.33
240	2/19/2022	3.24													1.90	55																				0.502	0.30
241	2/20/2022	3.27	232	437	196	17.43	5.39	228	-16.3	268					2.00	54							3.9		0.27	0.53	1									0.501	0.30
242	2/21/2022	3.49										2744	NS	4140	2.21	54												110.4	27.0	80						0.493	0.30
243	2/22/2022	4.32										3552	NS	7304	2.55	54																				0.503	0.30
244	2/23/2022	3.74	117		120	15.46	2.48	132	-10.0	178	352	3504	NS	6244	2.30	50	<0.1	10.73	<0.1	6.01	<0.1	15.1	3.0		0.31	0.36	12									0.438	0.30
245	2/24/2022	3.64										2908	NS	5572	1.80	51																				0.435	0.30
246	2/25/2022	3.69										3228	NS	5832	1.80	54																1.01	73.07	4.18	90.23	0.436	0.30
247	2/26/2022	3.48										2952	NS	5176	1.76	54																				0.438	0.30
248	2/27/2022	3.41	118	274	88	17.46	3.31	160	-81.8	226	417				1.70	54							3.5	0.2	0.37	0.46	0									0.436	0.30
249	2/28/2022	3.58										2564	NS	3176	2.20	54								0.3				66.5	24.1	80	420					0.494	0.30
250	3/1/2022	3.55										3064	NS	6024	1.70	48																				0.495	0.30
251	3/2/2022	3.55	105		76	18.10	4.24	104	-36.8	158	296	3168	NS	6128	1.80	51	<0.1	14.64	<0.1	13.28	<0.1	26.0	10.1	0.3	0.46	0.56	0									0.495	0.30
252	3/3/2022	3.52										3008	NS	5852	1.69	54								0.4												0.436	0.30
253	3/4/2022	3.36										3148	NS	6252	1.34	50								0.7								0.13	42.86	8.26	89.73	0.502	0.30
254	3/5/2022	3.35										3200	NS	5148	1.68	47								0.9												0.503	0.30
255	3/6/2022	3.31		269	80	16.11	3.23	124	-55.0		397				1.68	49								0.8	0.47	0.55	1									0.500	0.30
256	3/7/2022	3.61										2692	NS	5208	1.86	49								0.4				127.4	25.9	84	550					0.502	0.33
257	3/8/2022	3.53										3488	NS	6328	1.75	49								0.3												0.500	0.33
258	3/9/2022															45								0.3													
259																																					
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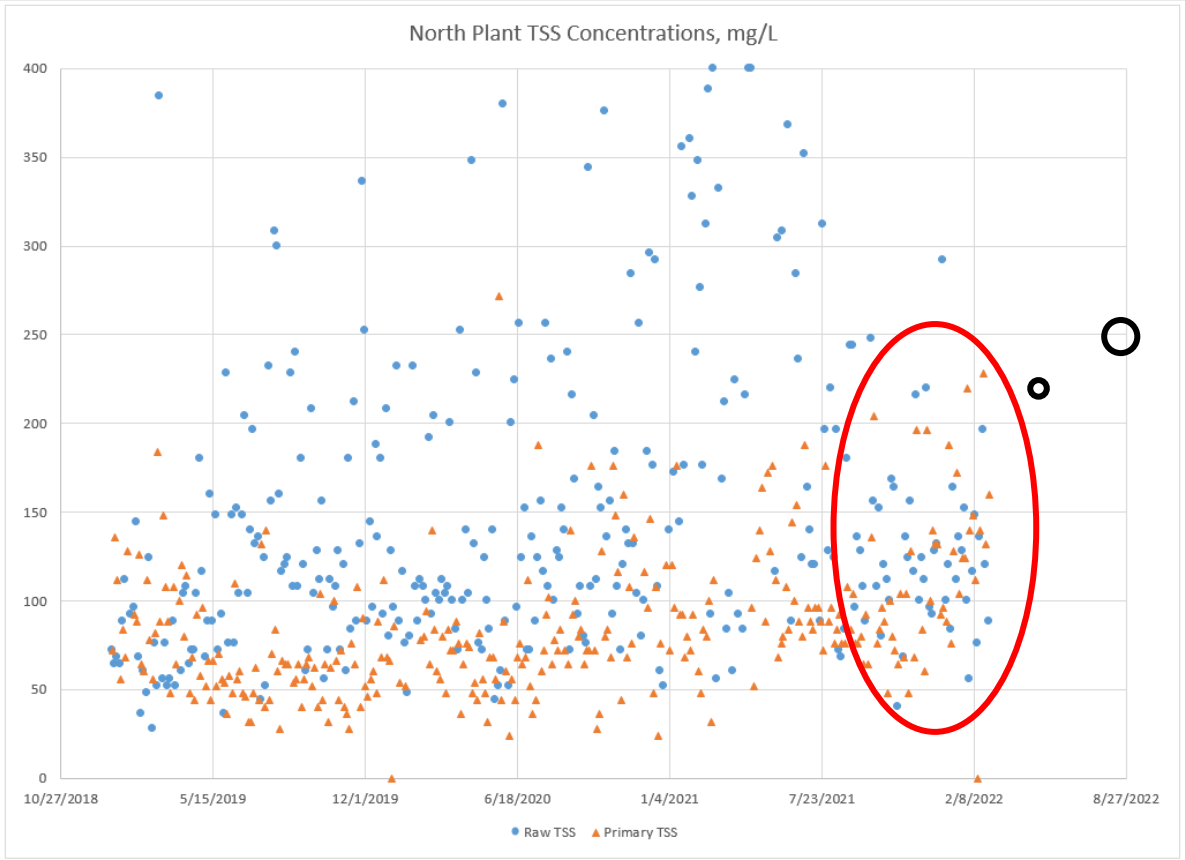
- Each entry is a data point, from either a grab sample, composite sample, SCADA, or handheld field instrument
- Lab runs tests and then enters into spreadsheet to discuss weekly

FRWRD

Data: How Do You Get It?

- Quality of Data
  - Primary Effluent TSS Data vs Raw Sample



Hmmm, that looks weird.

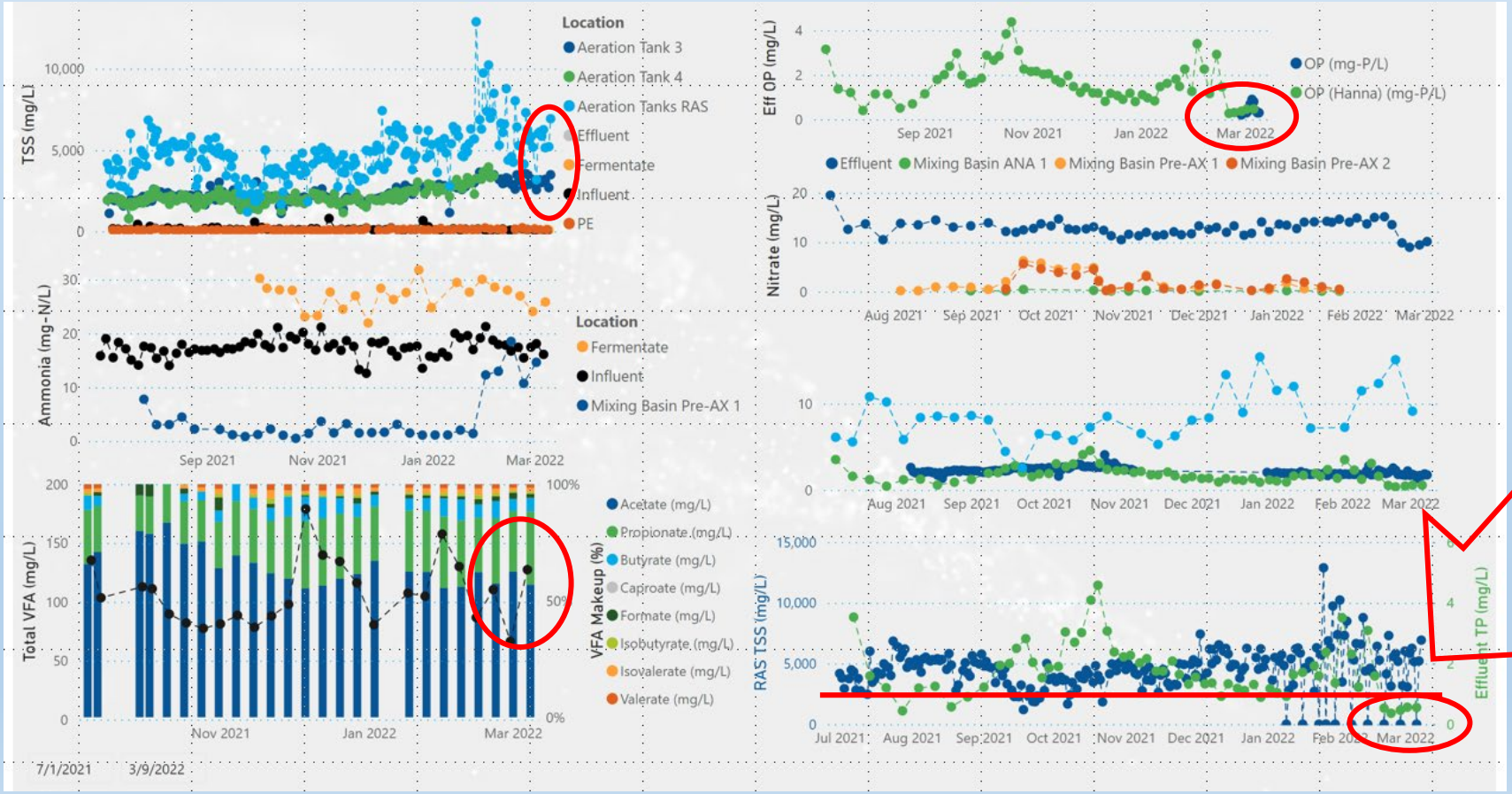
Data: How Do You Use It?

Goal: Optimize the plant to meet permit limits

- Compile data and review with group
- Things to Remember:
  - When do you need data?
  - Typically results are from 1 week ago
  - Logistics – Time for results
    1. Grab sample 2x per week,
    2. Transport
    3. Lab Testing
    4. Compile Data
  - Huge effort required from Lab and Ops teams
  - Every sample point is work to be done

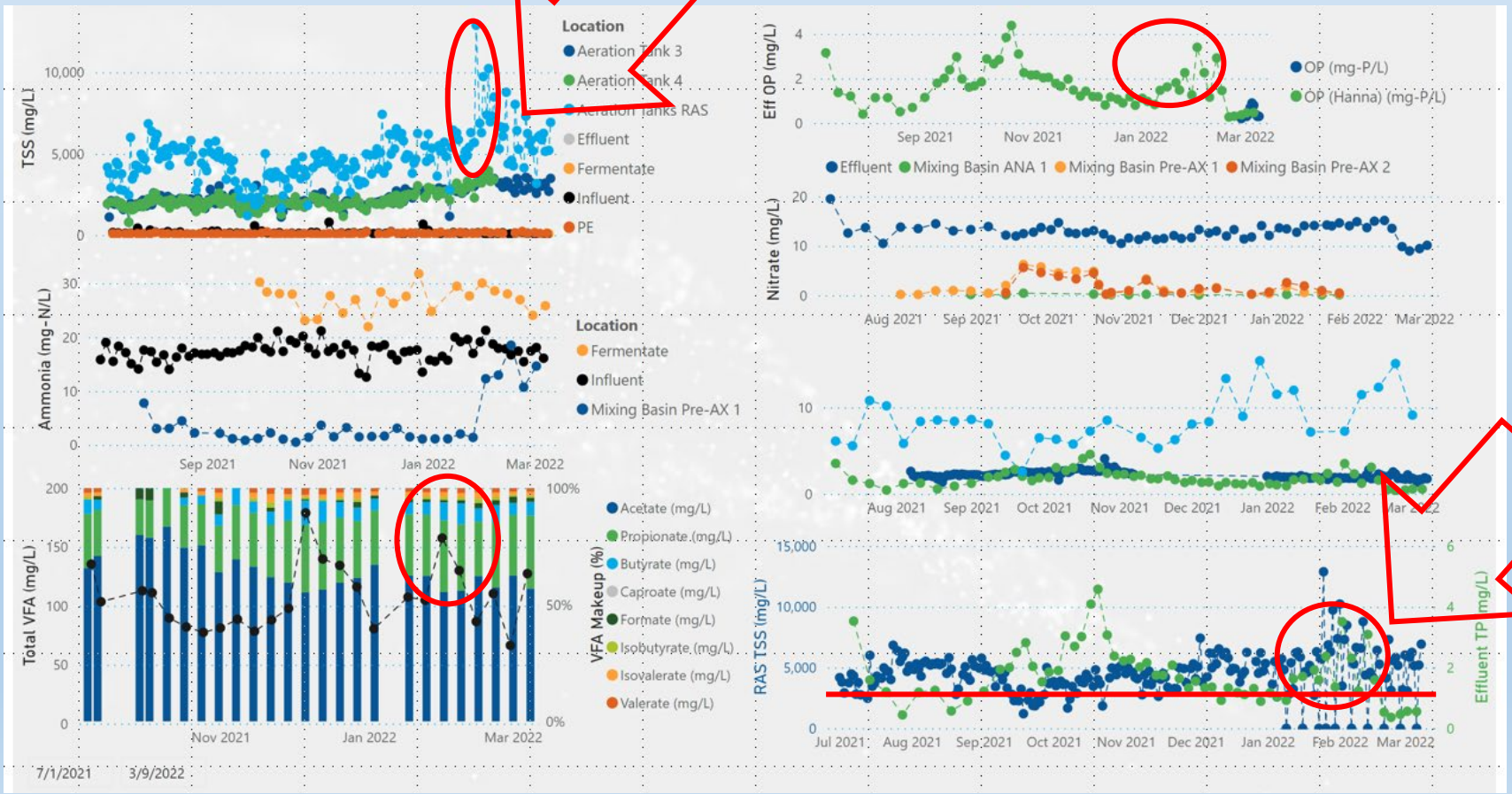
Data: How Do You Use It?

- Dashboard – Same data as spreadsheet, but can see the trends and relationships. July - March



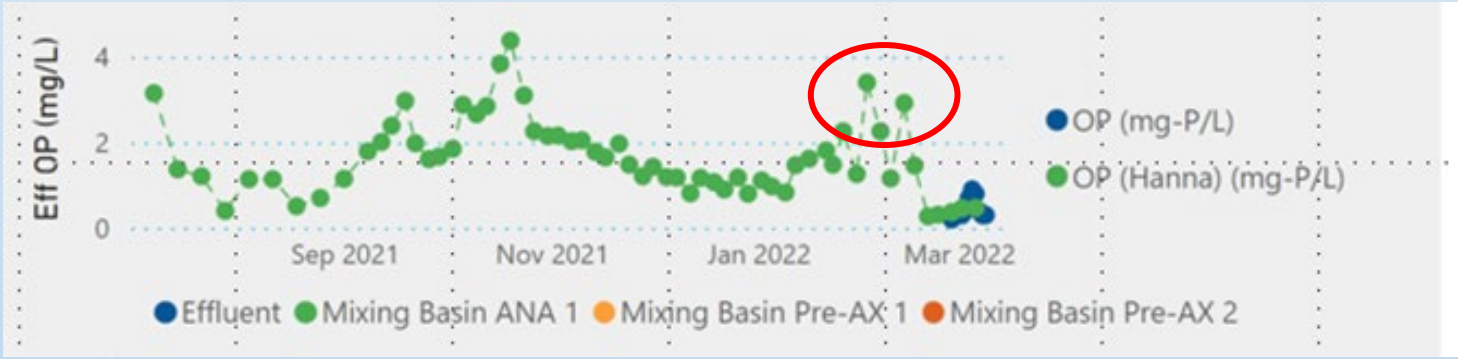
Data: How Do You Use It?

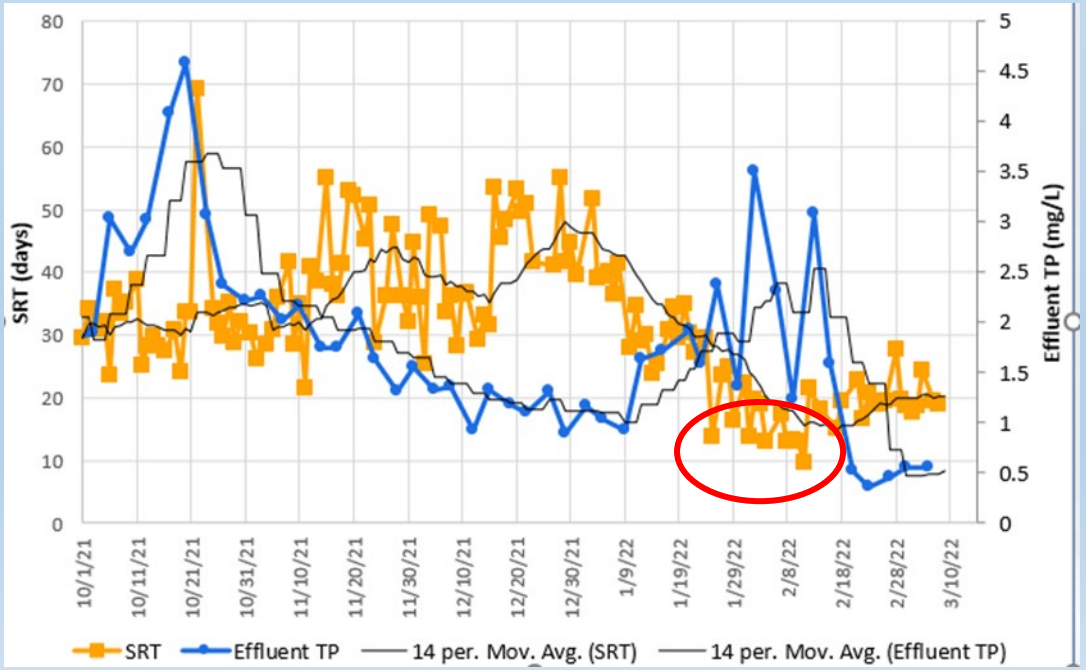
- Dashboard – What is different? What is causing changes?



Data: How Do You Use It?

- Dashboard – Showed Impact of Different SRT on P Removal



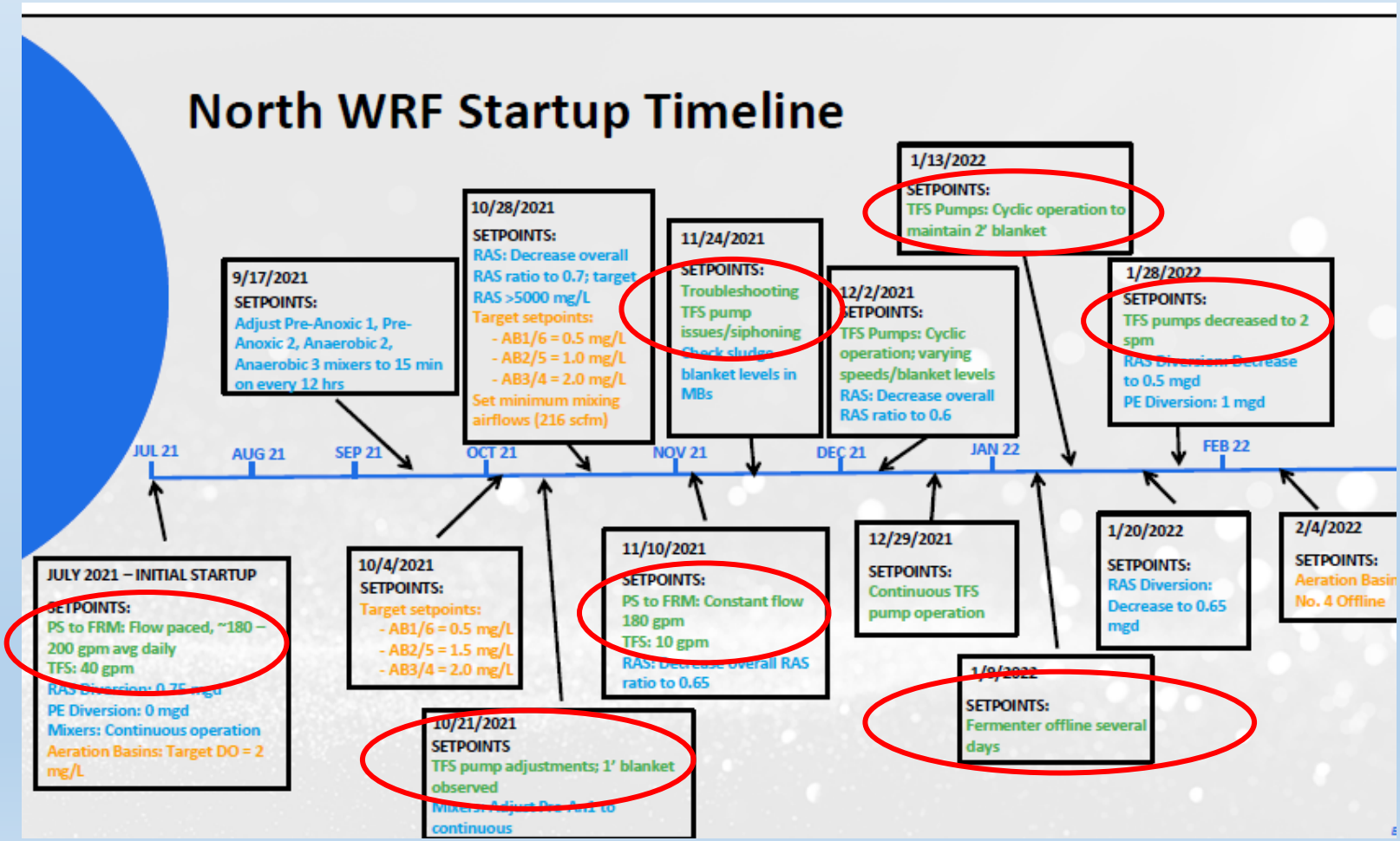


Data: How Do You Use It?

- Dashboard is in Microsoft Power BI
- Review data and discuss on calls with all decision makers
  - Engineer
  - Operations Management
- Develop action plan
  - Ex: This week we will decrease RAS flow to Mixing Basins
  - See how process responds
- Time Delay
  - Review->Discuss->Action->Response->Sample->Results
  - You are looking at the past to decide future actions
- Quality of Data
- Do we have a steady state, Yes/No?
  - Not always, Ex: our fermenter pump plugged with rags

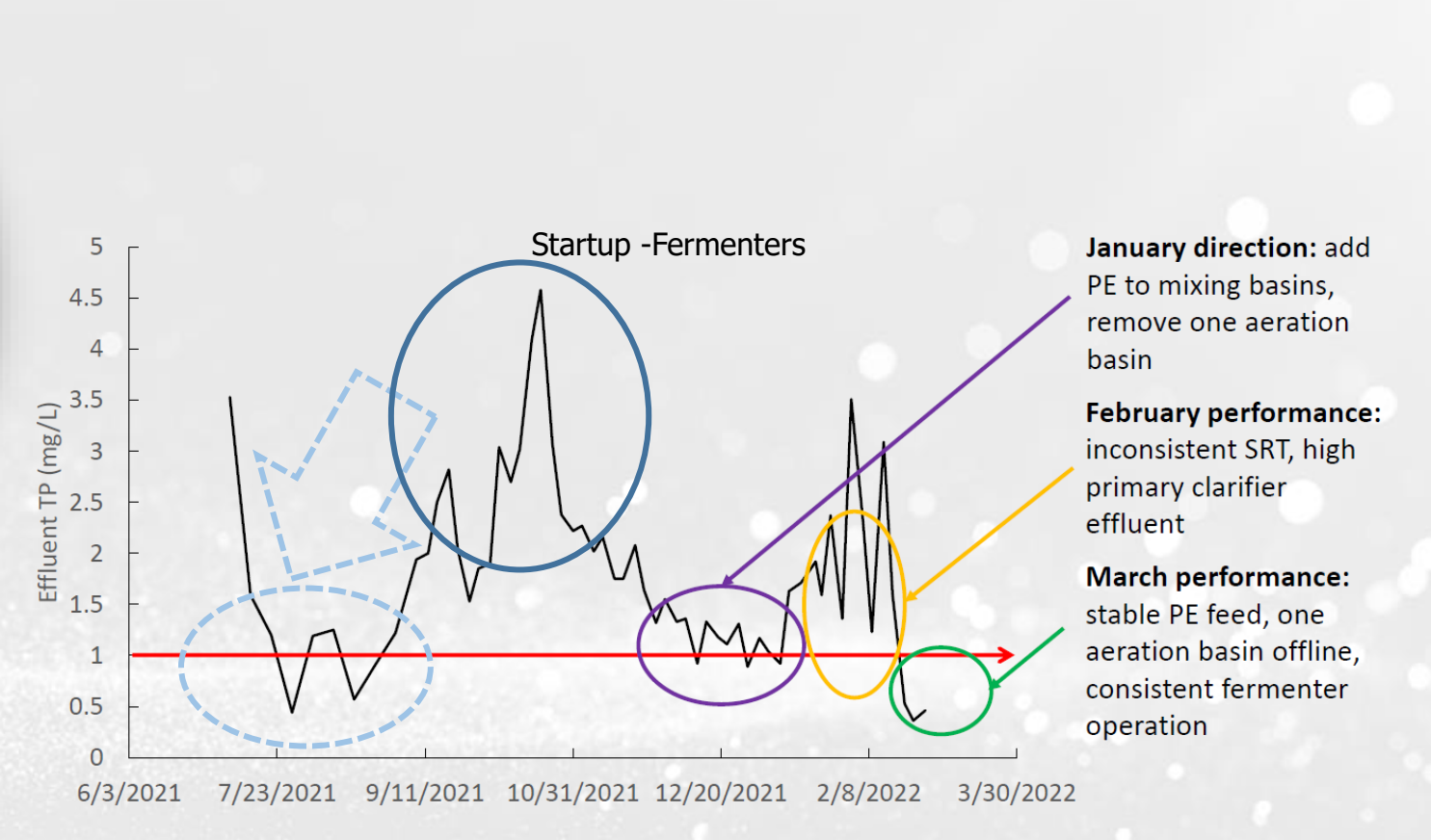
Data: How Do You Use It?

- Dashboard – What is different - Time line



Data: How Do You Use It?

- Time line as a Picture showing Effluent Total Phosp.



Data: How Do You Use It?

Look at what was going on:

- Higher wasting in response to observed rising MLSS
- Observed increase in MLSS corresponded to increasing RAS (prep for cold water)
- Observed SRT decreased in January - high solids conc.
- At that time did following things:
  - Took Aeration Tank off line,
  - Reduced air flow requirements for nitrification
  - Tried to decrease SRT, younger sludge for carbon- P removal

Data: How Do You Use It?

- Impacts at North –what did we see?
  - Fermenter out of service, loss of carbon
  - Needed to add prim. effluent for additional carbon
  - Tried too much at one time
- Able to take out 1/6 of aeration tanks, to aid phosp, still keep nitrification given low plant flows
  - Reduce air flow requirements
  - Reduce energy still ok for ammonia removal

Data: Is There Such a Thing As Too Much?

- YES!!!!!
- People lose interest and get overwhelmed with big spreadsheets
- Someone/something needs to review and give summary
  - Dashboard
- Online analyzers give real-time data
  - Lots of data points
  - Need to be able to parse through the data
- Look for what is different
  - Process spikes
  - Loss of treatment
  - Equipment failure – fermenter
- What is important? Permit Limits

Lessons Learned

- Trends tell a story (ups and downs)
- Look forward by actually looking back (time/dashboard)
- Small steps (learn process, SRT, fermenter)
- Quality vs quantity (no data is better than bad data)
  - Samplers
  - Consistency during sample collection
- Don't lose focus (regular effluent permit limits)
  - Even during construction of new facilities
- Lessons learned for the next one
  - ADP WRF optimization

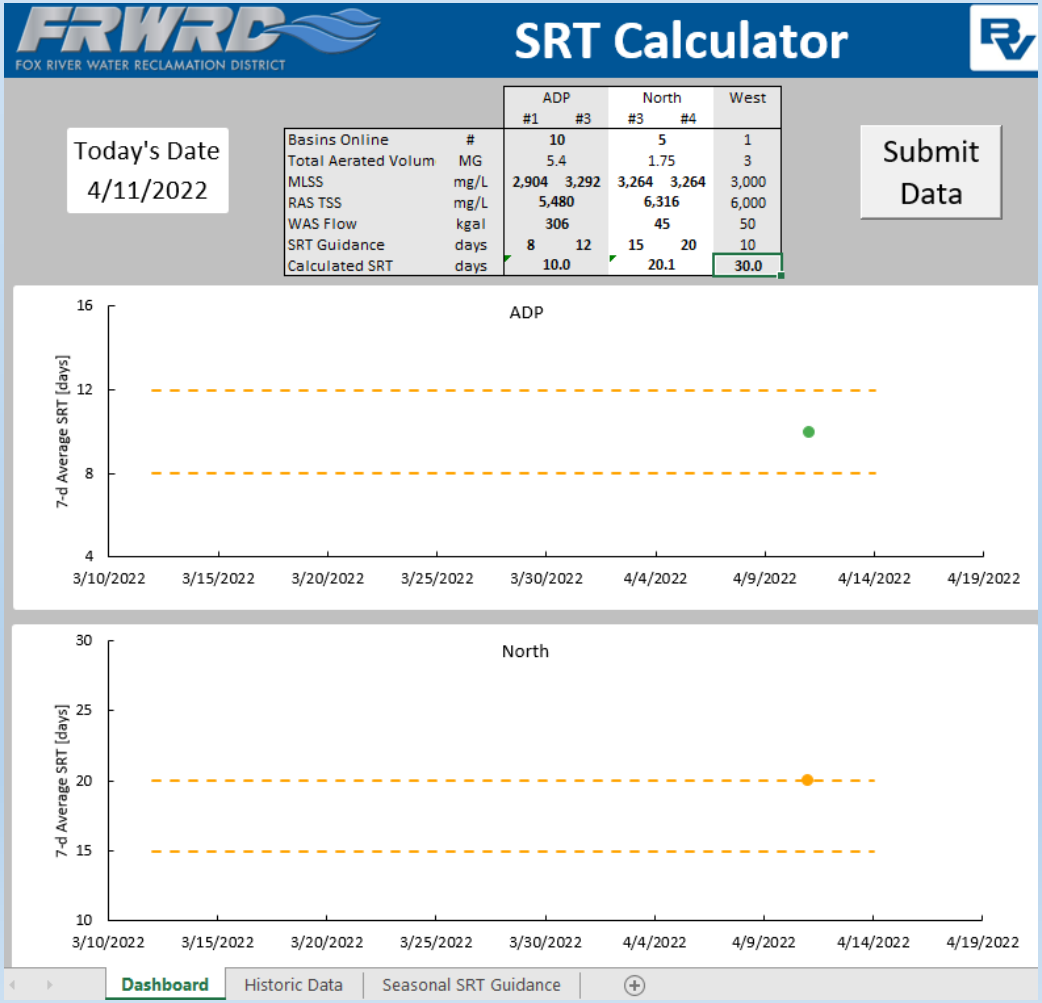
Lessons Learned

A lot of things are different

- New processes
- New limit
- New data
- Old and New

Lessons Learned

- Working on an SRT calculator



Acknowledgements

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  - Bob, Beth, Jack, Steve, Ed, Dave, Ops, Maint.
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  - Ryan, Jenny, Scott, Leon, Antwan, Deb, Dave
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QUESTIONS?

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FRWRD