NORTH TEXAS SECTION OF THE
WATER ENVIRONMENT ASSOCIATION OF TEXAS

Kennedy/Jenks Consultants






Full Scale and Demonstration Primary Filter Projects Demonstrate Great Promise

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Presented by
Onder Caliskaner, Ph.D., P.E.

Co-authors
George Tchobanoglous, Ph.D., P.E., Terry Reid, P.E., Brian Davis, P.E. ,
Zoe Wu, Ryan Young, P.E., Eassie Miller, P.E., Ryan Atterbury, P.E., Catrina Paez

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- California Energy Commission
- Full scale installation - Linda County Water District
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- Primary Filter System: Aqua Aerobics Systems, Inc.
- Thickening System: Process Wastewater Technologies, Inc.
- Third party verification - Base Energy
- Kennedy Jenks CA and HI offices

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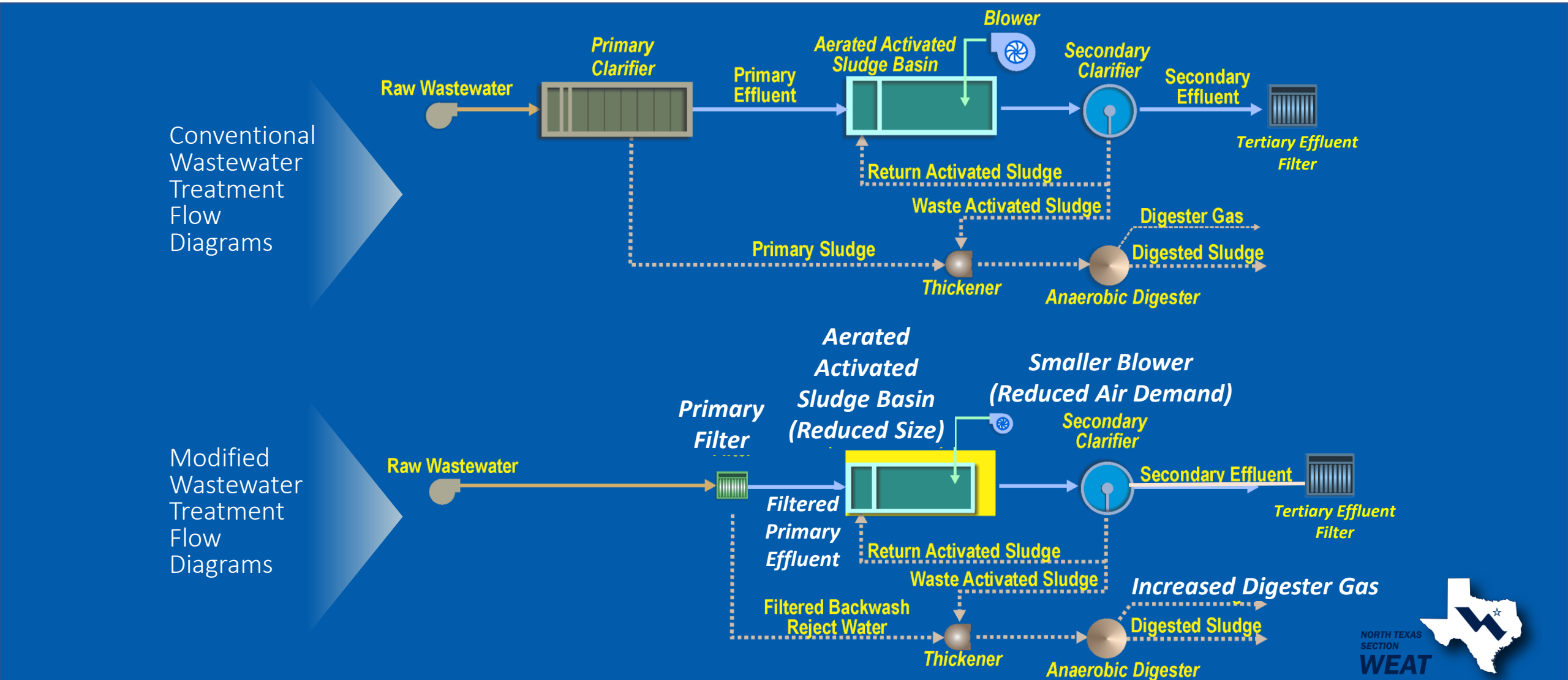
Topics

- Primary Filtration for Carbon Diversion
  - Background
  - Objectives
  - Pilot and Demonstration Projects
  - First Full Scale Installation
- Conclusions
- Questions / Discussion

Conventional and Modified Wastewater Treatment Flow Diagrams - Primary Filtration

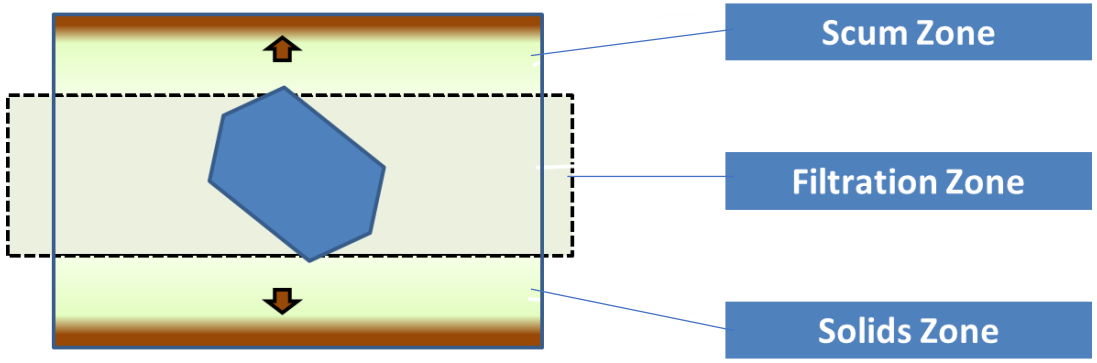


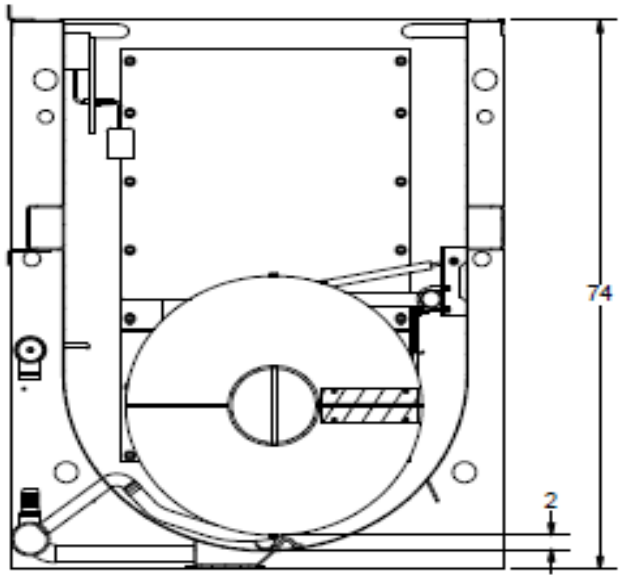
Primary Filtration

Primary filtration is another emerging technology based on successful demonstration of primary effluent filtration for 2 years

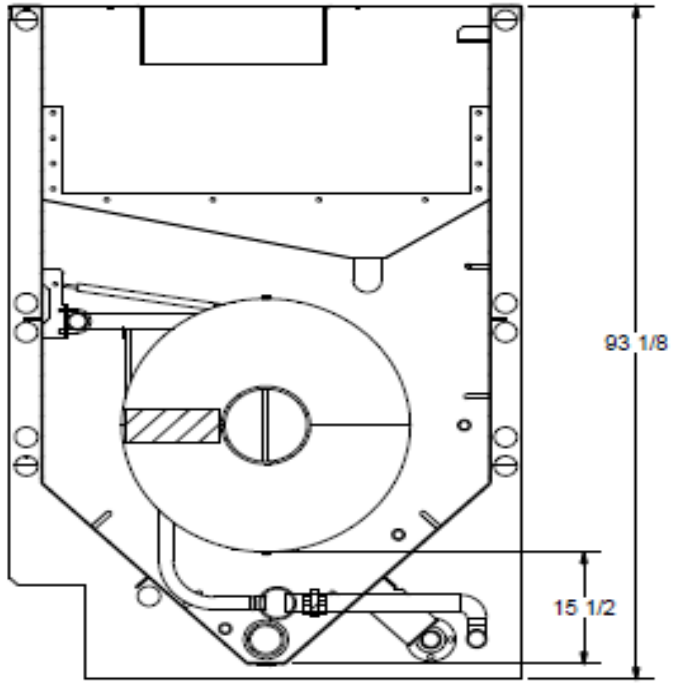
- Similar objectives (as PEF) for energy savings and plant capacity increase
- Replaces primary clarifiers with primary filters
  - 50 – 60% higher TSS/VSS removal efficiency
  - 40 – 50% higher BOD/COD removal efficiency
  - 70 – 80% reduction in footprint

Primary Filter Comparison





Tertiary Filter



Primary Filter

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What is the most important criteria for design and operation of a primary treatment system?

A Operational simplicity / flexibility

B Treatment performance

C Footprint

D Capital and operational costs

E Carbon management / diversion

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Primary Filtration Main Objectives and Advantages

- ✓Higher removal of organic load (BOD):
  - Secondary treatment capacity ⬆
  - Aeration power consumption ⬇
  - Secondary treatment volume requirement ⬇
- ✓Reduction in primary treatment area ⬇
- ✓Higher removal of volatile suspended solids (VSS)
  - Digester biogas energy production ⬆
- ✓Particle size modification: biological treatment efficiency ⬆

City and County of Honolulu
Sand Island Primary Filtration Testing
(August 2016 – May 2017)

Average Flow Design Capacity: 90 MGD

Testing of Filtration for 3 MGD Sidestream Treatment System

Testing of Primary Filtration

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City and County of Honolulu Sand Island Sidestream Filtration Testing Results

Combined Sidestream Filtration System Concentration Ranges and Average Removal Performances					
Constituent	Sidestream, mg/L		Filtered Sidestream, mg/L		Typical Average Removal Efficiency
	Range	Average	Range	Average	Percent
VSS	100-510	223	10-140	75	66%
TSS	240-590	325	81-170	123	62%
COD	400-820	557	130-500	300	46%
BOD_5	142-360	213	89-210	122	43%
$CBOD_5$	170	170	99	99	42%
Soluble BOD_5	81	81	71	71	13%
Ammonia	49-81	66	28-83	62	6%
TKN	64-110	91	35-91	71	21%

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City and County of Honolulu Sand Island Primary Filtration Testing Results

Primary Influent Filtration System Concentration Ranges and Average Removal Performances

Constituent	Primary Filter Influent, mg/L		Primary Filter Effluent, mg/L		Constituent Average Removal Efficiency
	Range	*Average*	*Range*	*Average*	*Percent*
VSS	110-190	155	17-40	27	82%
TSS	120-260	188	24-62	41	78%
COD	230-1000	389	67-270	178	54%
BOD_5	110-210	154	55-86	73	53%
Soluble BOD_5	47-63	55	38-56	47	15%
Soluble COD	100	100	96	96	4%
TKN	22-27	24	20-26	22	8%

City and County of Honolulu - Sand Island Primary Filtration Particle Size Distribution Results

Percentage of particles smaller than the indicated size					
		Particle size			
Date	**Sample Type**	**2 µm**	**5 µm**	**10 µm**	**20 µm**
5/4/2017	Influent	1.3	2.2	5.2	12.8
5/4/2017	Effluent	12.4	17.2	30.2	52.2

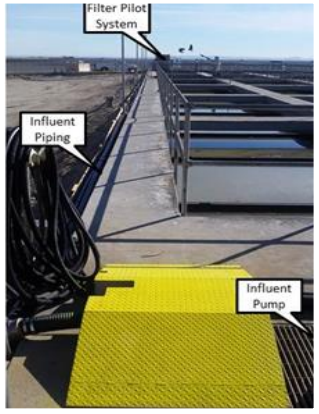
Date	**Mean particle size (volumetric), Influent (µm)**	**Mean particle size (volumetric), Effluent (µm)**	**Relative change, percent**
5/4/2017	96.6	20.4	79%

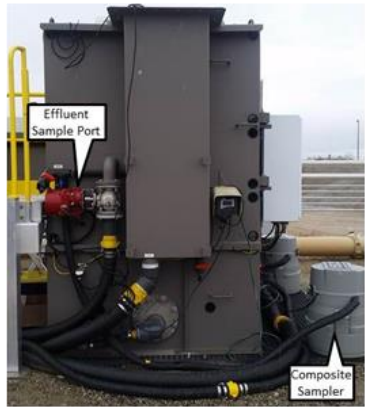
Mean particle size reduced by approximately 80 percent

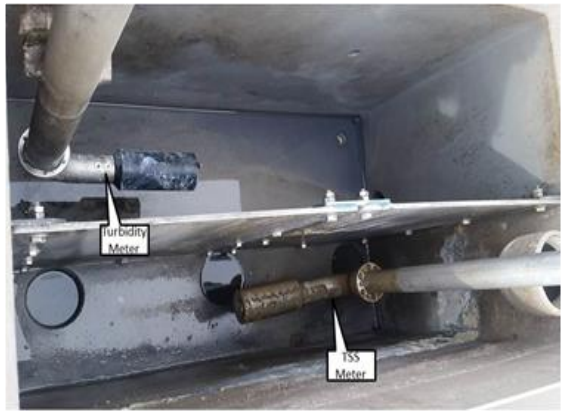
Los Angeles County Sanitation District - City of Lancaster Primary Filtration Demonstration Project
(November 2016 - November 2017)

Tertiary Treatment – 18 MGD

Serves approximately 160,000 people







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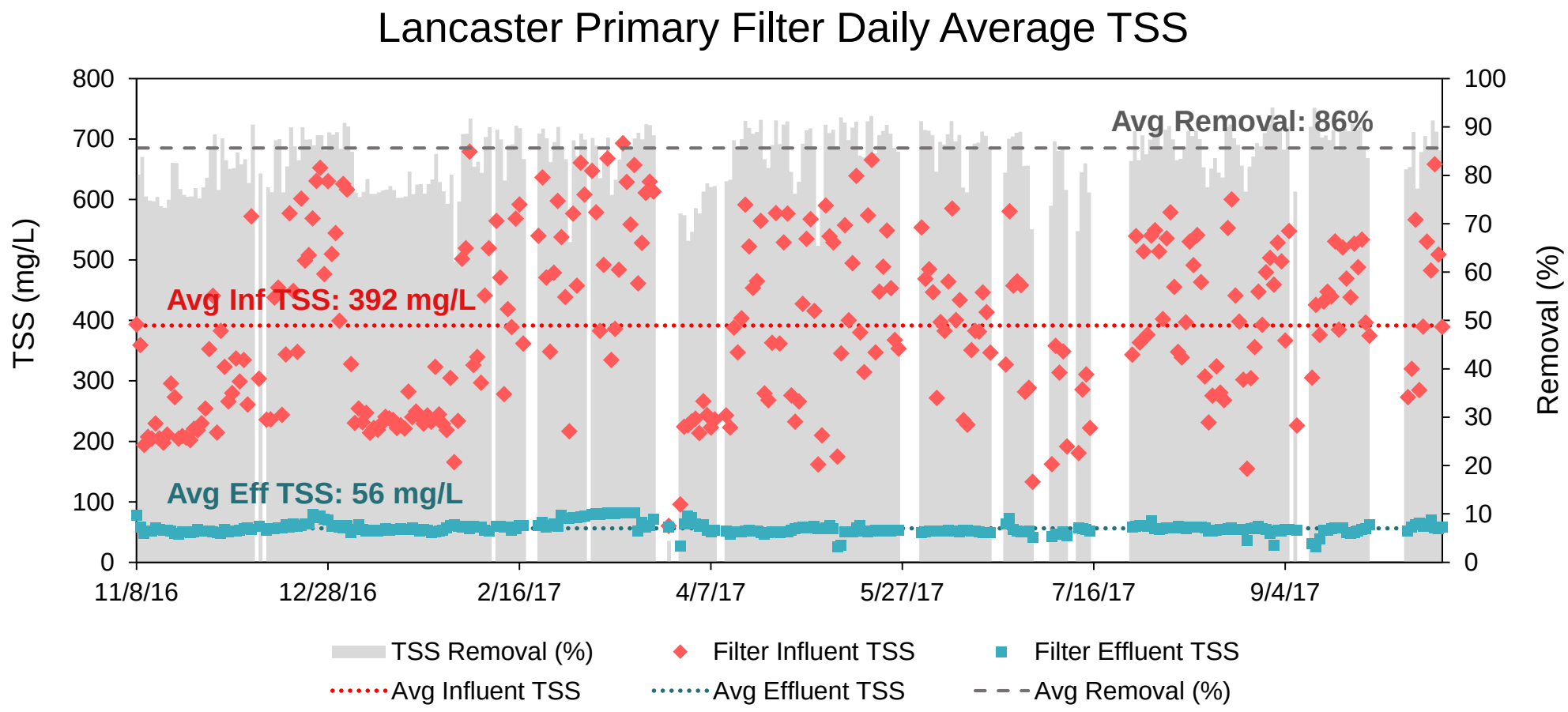
Los Angeles County Sanitation District - City of Lancaster - Primary Filtration Demonstration Project



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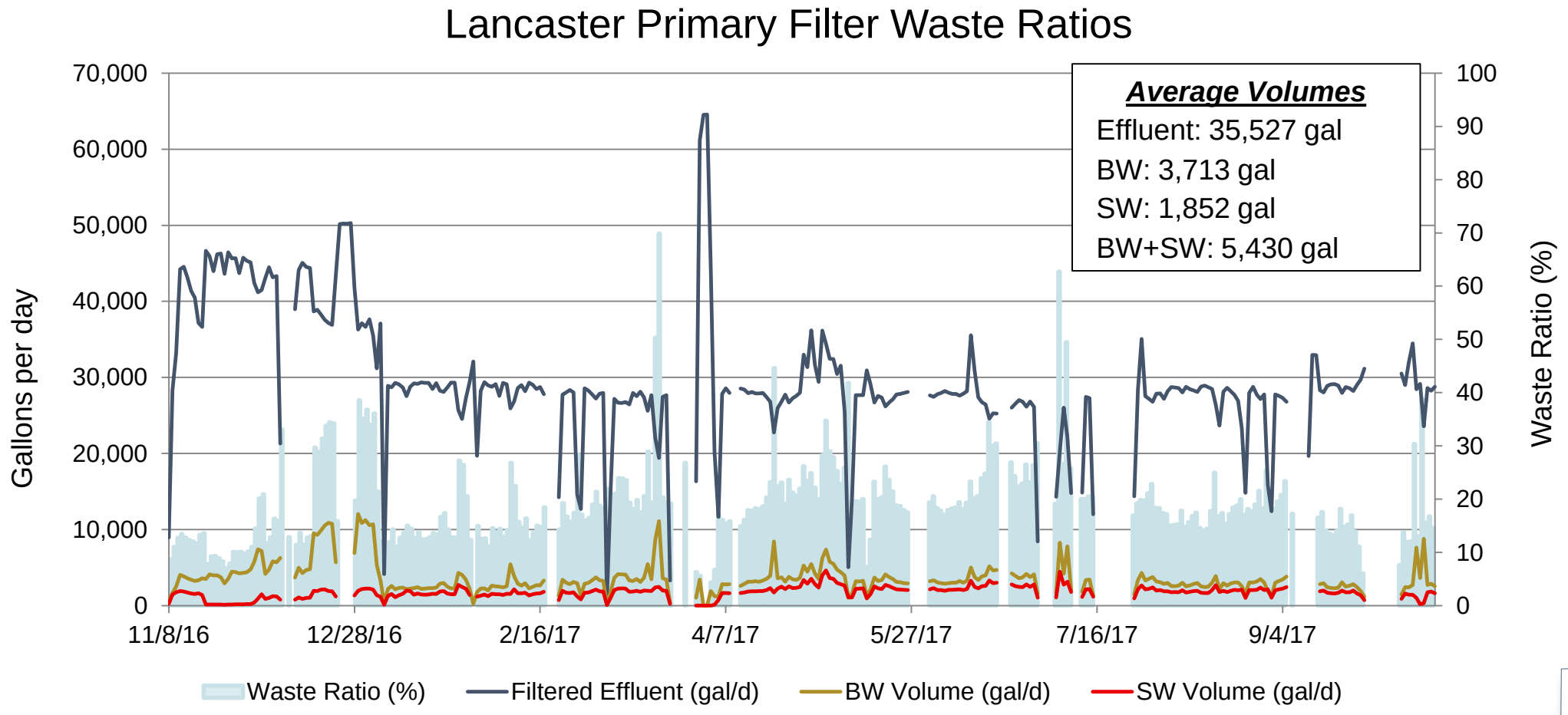
Los Angeles County Sanitation District - City of Lancaster - Primary Filtration Demonstration Project



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First Full Scale Installation
Linda County Water District WWTP

Average Flow : 1.2 MGD (2016-2017)

2.5 MGD (2018-2019)

Downstream Process:

Nitrogen Removal, Tertiary Filtration

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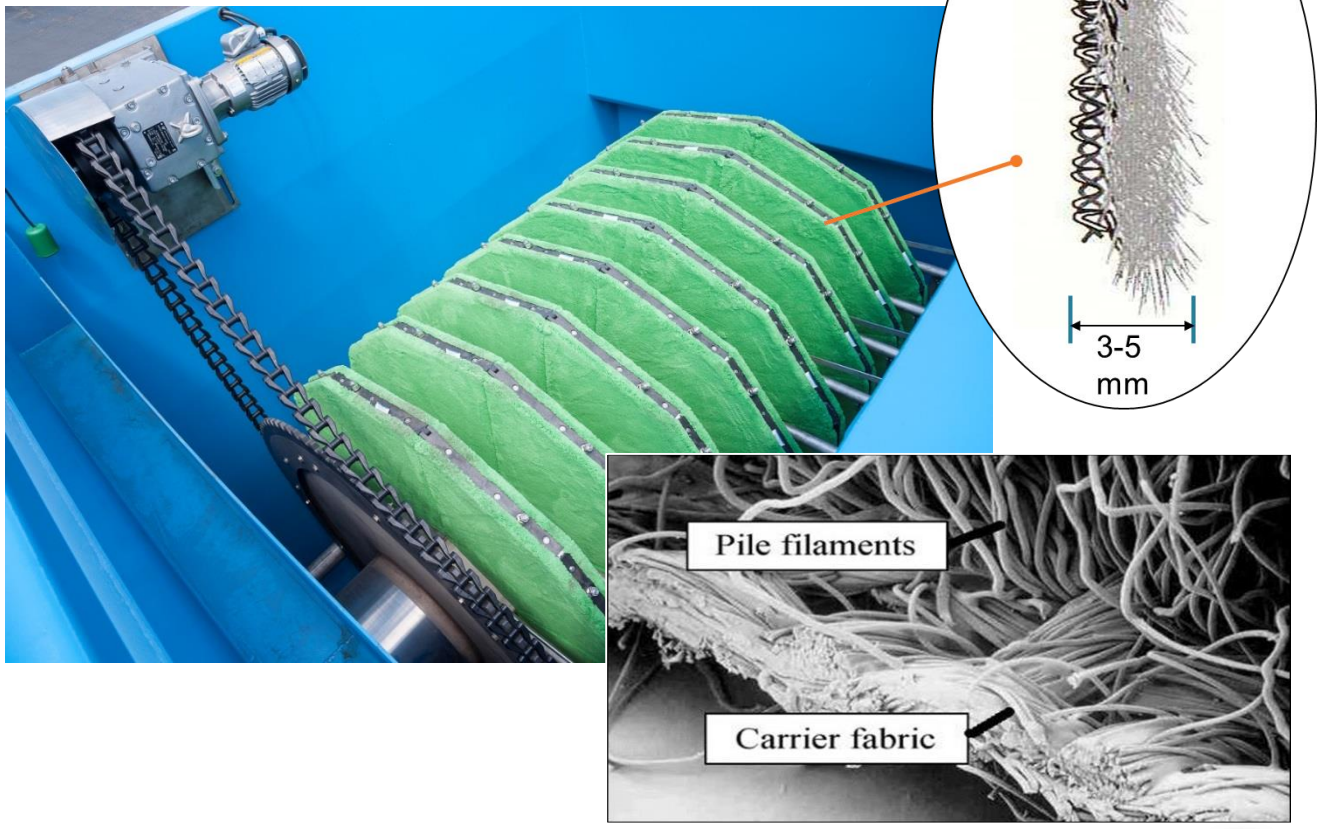
First Full Scale Installation
Linda County Water District WWTP

Primary Filter Capacity:

Average Flow - 1.5 MGD

Peak Flow - 3 MGD



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First Full Scale Installation – Linda County Water District WWTP

Design Completed in June 2016

Construction Started in October 2016

Started-up in August 2017

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First Full Scale Installation
Linda County Water District WWTP

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First Full Scale Installation
Primary Filter – Cloth Depth Filter

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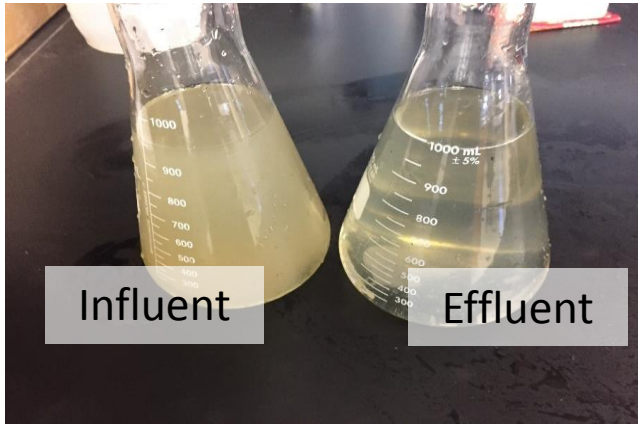
First Full Scale Installation
Primary Filter – Cloth Depth Filter



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First Full Scale Installation
Thickening System - Volute Thickener

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First Full Scale Installation
Thickening System – Phase Separator

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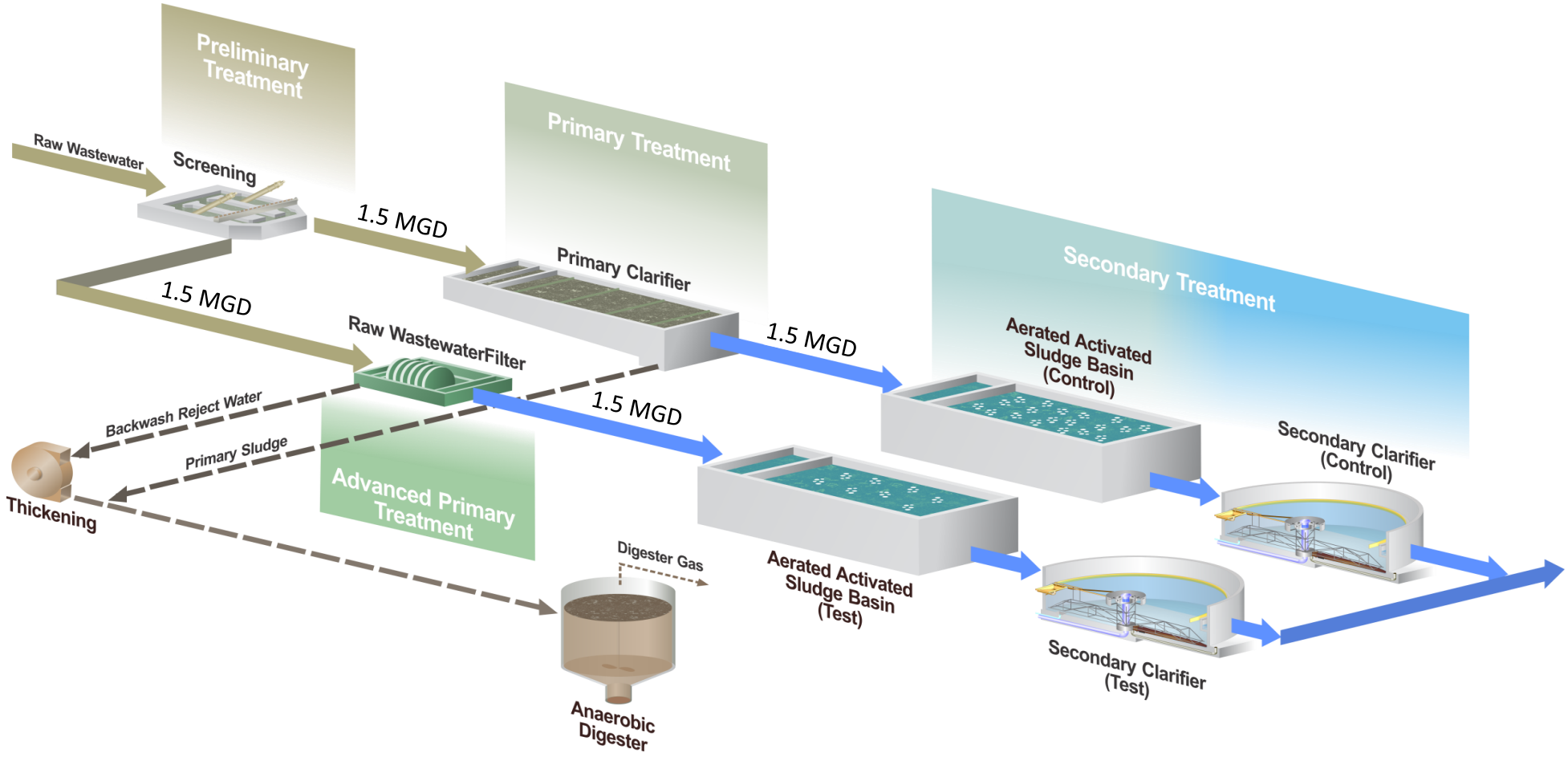
Flow Diagram– Linda County Water District WWTP



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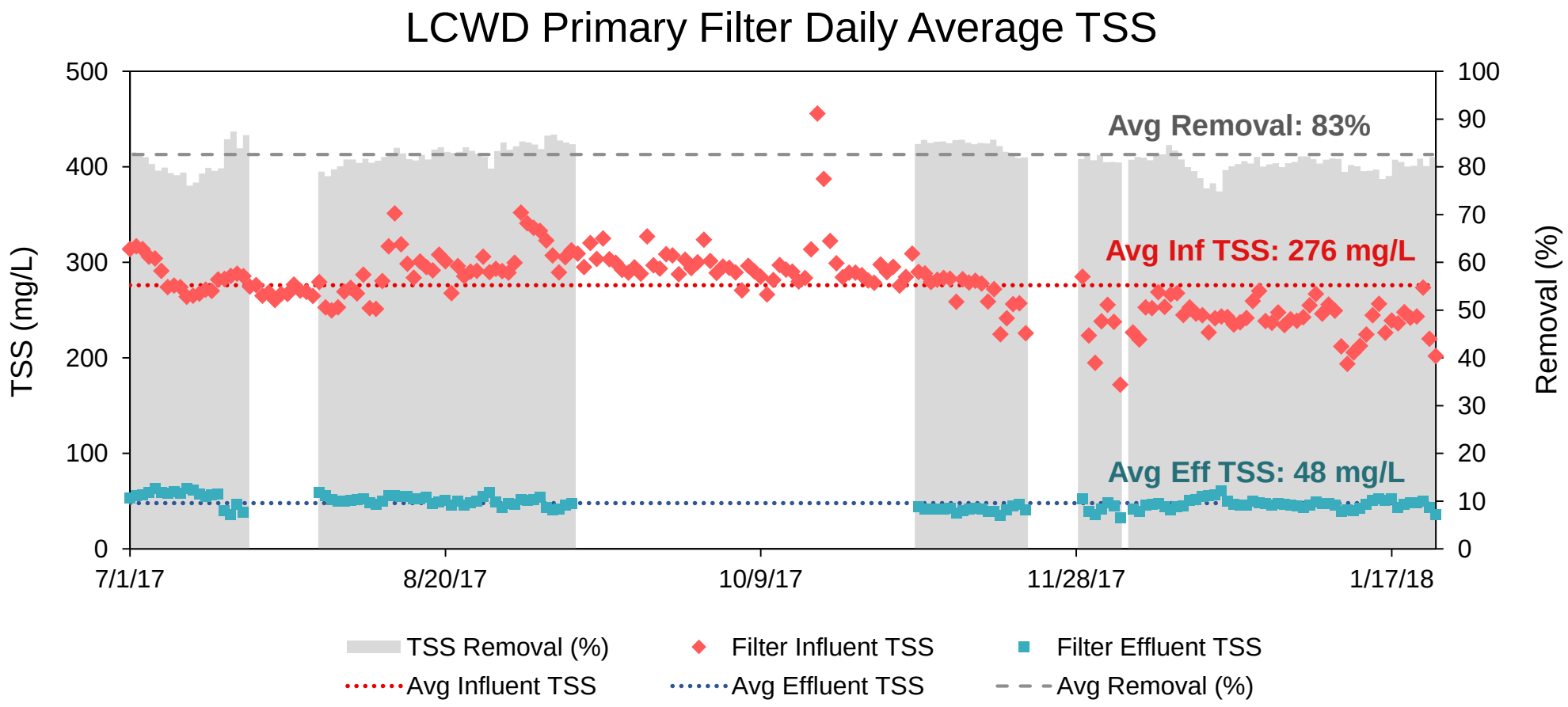
Primary Filter System Initial Performance
Linda County Water District



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Summary of Average Wastewater Characteristics (Linda County Water District)

Parameter	Primary Clarifier Influent	Primary Clarifier Effluent	Primary Filter	
	Avg Value (mg/L)	% Removal *	Avg Value (mg/L)	% Removal
BOD_5	220	26%	106	52%
Soluble BOD_5	51	0%	51	0%
COD	501	24%	254	49%
TSS	200	50%	40	80%
VSS	188	47%	38	80%
TKN	46	0%	41	11%

* Based on historical data at LCWD WWTP

Conclusions

Primary filtration is an emerging advanced primary treatment technology for increased carbon diversion

Replaces primary clarifiers with primary filters:

TSS/VSS removal efficiency	50-70 percent ↑
BOD/COD removal efficiency	40-55 percent ↑
Footprint	80 to 85 percent ↓

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Conclusions

Actual performance/feasibility will be site specific

- Plant size
- Influent characteristics
- Efficiency of existing aeration system
- Available capacity
- Power cost
- Use of digester gas

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Conclusions

Observed/expected side benefits:

- Response to upset conditions
- Load equalization
- Overall improvement in downstream biological treatment

Other considerations:

- Impact on denitrification
- Comparison with other technologies with similar concept
- Material/enclosure considerations compared to tertiary filters
- Digester design considerations

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Conclusions
Primary Filtration Potential Benefits

25-30 % ↓ in aeration costs

20-25 % ↑ in secondary treatment capacity

30-40 % ↑ in digester gas energy production

80 - 85 % ↓ Primary treatment footprint

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Estimated Savings

Assuming a 10% implementation of the (primary filtration technology) in US, the estimated present value of the savings will be approximately $5B

Wastewater Treatment System Cost Savings Resulting from Primary Filtration

	Savings Per MGD
Construction Cost Saving	$600,000
Annual O&M Costs Saving	$30,000
Net Present Value	$1,100,000

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QUESTIONS & COMMENTS

Kennedy/Jenks Consultants

Onder Caliskaner

E-mail: ondercaliskaner@kennedyjenks.com

Phone: (916)-858-2738

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