





Presentation Overview

- Town of Warren, RI is facing significant challenges with their wastewater system primarily due to:
 - Capacity needs
 - Nitrogen limits
 - > Aging infrastructure
- At the onset of the planning effort, the Town, RIDEM and Woodard & Curran negotiated a NPDES permit that met the water quality goals and provided flexibility to handle wet weather flows and reduce project costs.





WWTF Background

- WWTF built as a primary facility in 1951; upgraded to secondary treatment in 1981
- WWTF serves a population of 8,000 with a discharge to the Warren River
- Prior NPDES Permit (Issued in 2002)
 - Monthly Average Permitted Flow = 2.01 MGD
 - Typical secondary treatment limits (BOD₅, TSS=30/45/50 mg/L, FC=200/400/400 col/100 ml, TN = Monitor Only)
- Current (2010-2015) flows average 1.88 MGD with max month flows exceeding 3 MGD and estimated peak flows of 9 MGD during Spring conditions





Next Steps – Warren, RI WWTP – Daily Flow vs. Permit







Permitting Drivers

- Permitted capacity (i.e., flow exceedances)
- Total nitrogen discharge into Warren River: Palmer River (tidal impacts upstream) Narragansett Bay
- DEM determined allowable seasonal N Loads:

Summer – 83.8 lbs/day Winter – 239.7 lbs/day



2010 NPDES Permit & 2013 Modification

- 2010 Permit included both monthly TN mass and conc. limits
- WWTF also needed flow limit increase
- 2013 Permit Modification integrated both higher monthly flow limits and seasonal nitrogen limits that kept the mass load constant but had alternative concentration limits

Permit Season	Flow	Monthly Mass Limit	Seasonal Mass Limit	Equivalent Concentration based on Seasonal Load Limit	Monthly Average Concentration Limit in Permit
		Limits	from 2010 N	IPDES Permit	
Winter	2.01	239.7	N/A	14.3	14.3
Summer	2.01	83.8	N/A	5.0	5
	Limits	with typ	ical monthly	y flow limit appro	oach
Winter	3.43	239.7	N/A	8.4	8.4
Summer	3.43	83.8	N/A	2.9	2.9
	Limi	ts from 20	013 NPDES F	Permit Modificat	ion
Winter	3.43	N/A	239.7	8.4	9.5
Summer	2.53	N/A	83.8	4.0	5



Next Steps – Warren, RI WWTP – Daily Flow vs. Permit







WWTF Upgrade Drivers

Facility needs:

Increased wet weather capacity Seasonal low level TN removal Overall/Reliability Updates

Facility Challenges: Constrained site

Secondary clarifiers



Process Evaluation and Selection

- Initial screening of alternatives
- Biological Process Alternatives Evaluated:
 - Biomag
 - ► IFAS
 - Variable Operating Mode (VOM) Process





Process Evaluation and Selection

- VOM Process recommended alternative
 - Flexible operation through seasonal permit seasons
 - Allows operators to "dial in" MLSS to match secondary clarifier capacity
 - Excellent wet weather capacity
 - > Does not require proprietary equipment
 - > 10% lower capital,
 - ➢ 35% lower operating
 - > 20% lower present worth costs





Variable Operating Mode (VOM) Process Summary

- Summer Permit Season
 - 4-Stage Bardenpho mode
 - > 5 mg/L monthly TN limit, 4 mg/L seasonal limit
- Winter Permit Season
 - Modified Ludzack-Ettinger (MLE) mode
 - > 9.5 mg/L monthly TN limit, 8.3 mg/L seasonal limit
- Wet Weather Operation
 - Contact Stabilization mode
 - Higher monthly and seasonal average limits reduce impact on compliance
 - Process modelling predicts TN performance of 8-15 mg/L





The Variable Operating Mode (VOM) Process

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VOM MODE 1 - 4-STAGE BARDENPHO (SUMMER PERMIT)



The Variable Operating Mode (VOM) Process

VOM MODE 2 - MODIFIED LUDZACK-ETTINGER PROCESS (MLE) (WINTER PERMIT)



The Variable Operating Mode (VOM) Process

VOM MODE 3 - MODIFIED CONTACT STABILIZATION (WET WEATHER)

PRIMARY EFFLUENT



Conclusions

A cooperative effort between the Town, RIDEM and Woodard & Curran resulted in:

- An NPDES permit that achieves the water quality goals
- A facility with the flexibility to meet stringent nutrient limits and handle wet weather flows, and
- A project with lower capital and operating costs than a standard permitting approach would allow







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Questions?

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