NUVODA

Innovative Wastewater Solutions

MOB™ Process in an SBR

Washington Township Waste Authority SBR

Barto, Washington Township, Berks County, PA

2021

CONTENTS

EXECUTIVE SUMMARY

The Washington Township Waste Authority (WTWA) SBR is a two train, 250,000 GPD SBR process with 4-hr cycle times. In March 2020, WTWA installed Nuvoda's MOB™ Process in one of the two trains. Over the course of a ten month trial, a significantly increased flow through the MOB™ Process train was used to test and demonstrate the MOB™ Process' ability to handle both increased flow and peak flow events (>10x design). Results showed the MOB™ Process in the SBR was capable of handling up to 70% increased flow above design while maintaining effluent discharge requirements, and in the case of phosphorus, lowering effluent levels at increased flow. Furthermore, the MOB™ Process also handled the very high peak flow events (>10x design) while maintaining effluent TSS levels and clarity.

PROJECT BACKGROUND

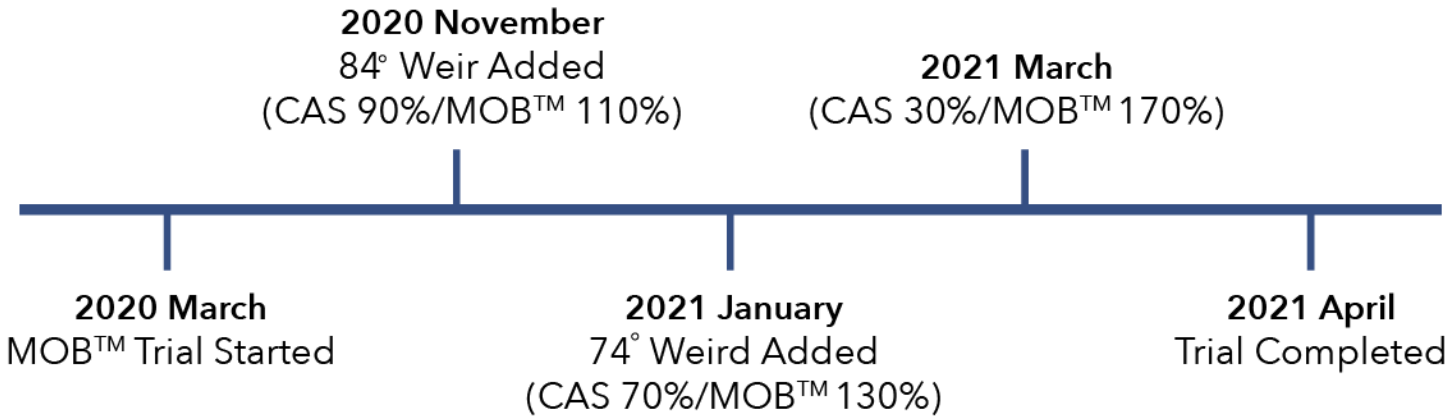
The Washington Township Waste Authority (WTWA) SBR is a two train, 250,000 GPD SBR process with 4-hr cycles. In March, 2020, WTWA SBR installed Nuvoda's MOB™ Process Trial in one of the two trains. Throughout the trial, the WTWA SBR have collaborated with Nuvoda to conduct sample collections and effluent quality tests twice a week. During the trial, the Washington Township Waste Authority SBR conducted flow diversion with weirs to slowly increase flow distribution into the MOB™ Process train (from rated capacity to 70% increase over rated capacity). These process changes were recorded and presented in this report. The unchanged SBR will be labeled as "CAS" (Conventional Activated Sludge), and the MOB™ trial SBR will be labeled as "MOB™".

FACILITY INFORMATION

SBR SPECIFICATION

	Unit	*Value*
Reactor Type	-	ICEAS SBR
Reactor Volume, Each	gal	97,090 (low) 132,396 (high)
SWD	ft	11-15
Number of Trains	-	2
Cycle per day	cycle/day	6
Cycle Time	hr/cycle	4
Max Fill & React	min	120
Settle, Decant & Waste	min	120

PROCESS CHANGE TIMELINE



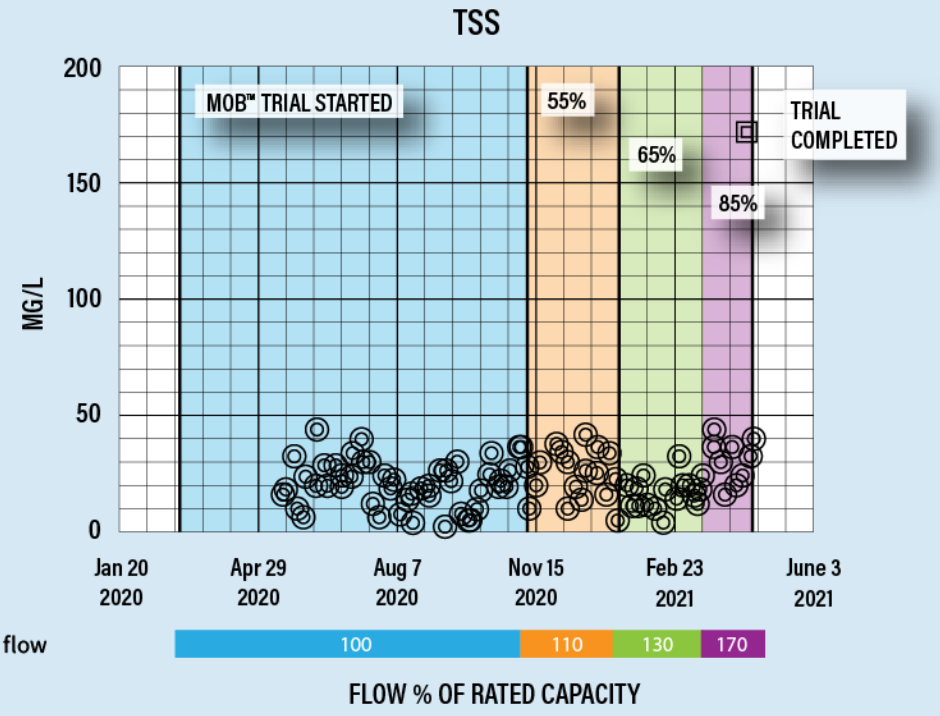
MOB™ PROCESS DESIGN PARAMETERS

Property	Unit	Value
Media Outer Surface Area	m^2/g	0.076
Media Total Surface Area (Including Pores)	m^2/g	1.76
Media Dry Density	kg/m^3	263
Media Specific Surface Area (Outer)	m^2/m^3	20,000
Media Specific Surface Area (Total)	m^2/m^3	463,000
Desired Net SSA (Outer)	m^2/m^3 tank	250
Desired Net SSA (Total)	m^2/m^3 tank	5,785
Media Fill Fraction	m^3 media/m^3 tank x 100%	1.25
Media Addition in Reactors	kg/m^3 tank	3.29
	lb/gal tank	0.0275
Media Specific Gravity (wet)	-	1.056

TRIAL DATA & ANALYSIS

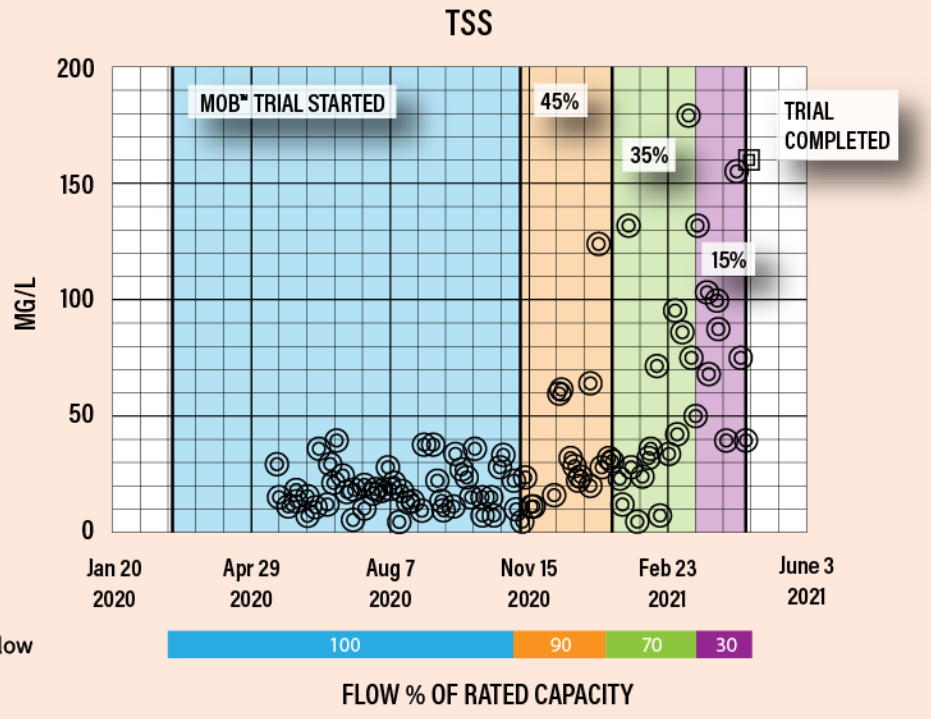
EFFLUENT TSS

MOB™



% = Percentage of total plant influent flow

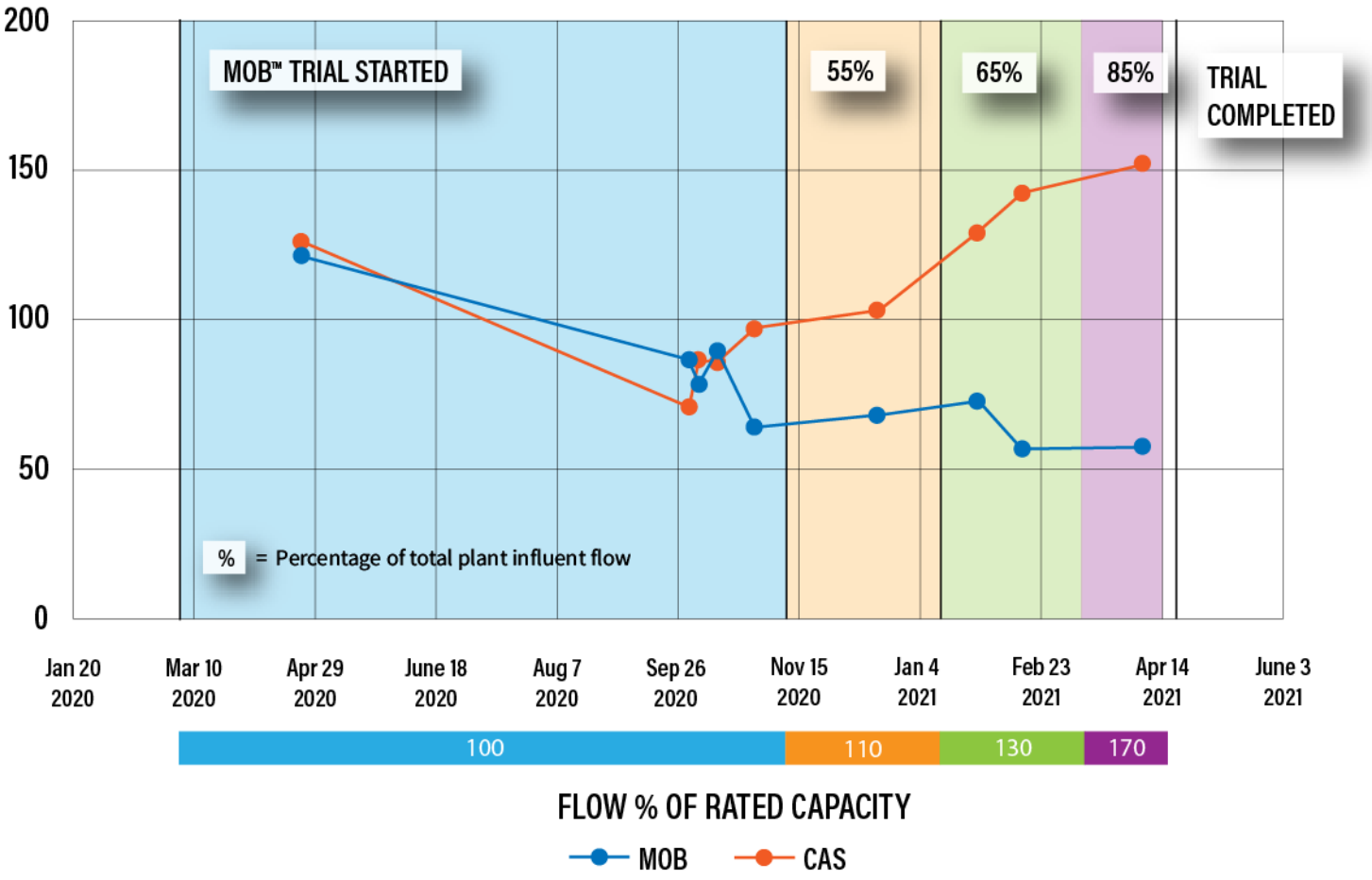
CAS



% = Percentage of total plant influent flow

MOB™ CONTROLLED EFFLUENT TSS AT 170% OF CAPACITY

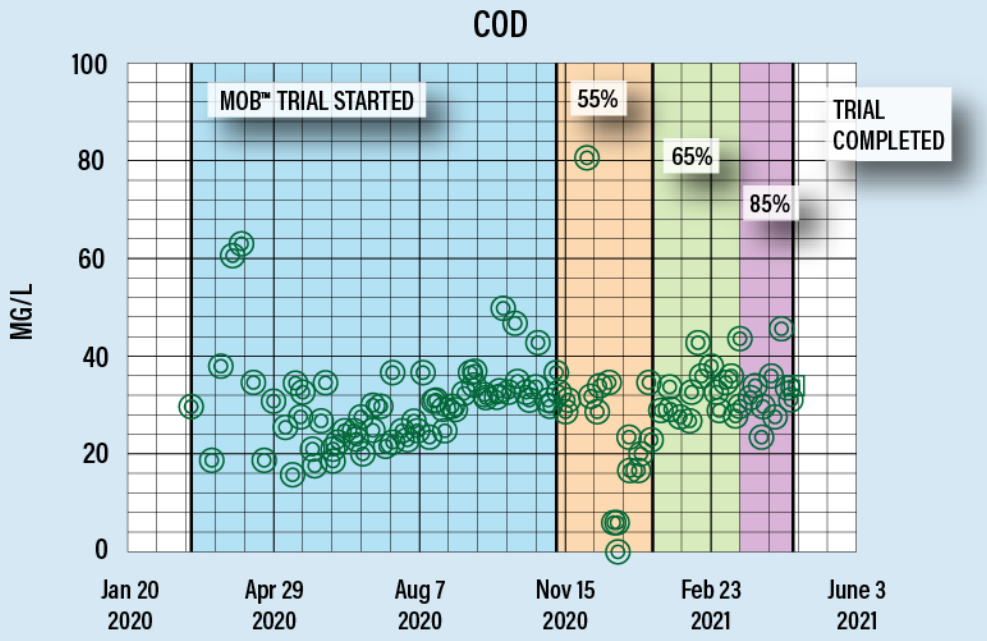
SVI



BETTER SVI AT 170% OF CAPACITY

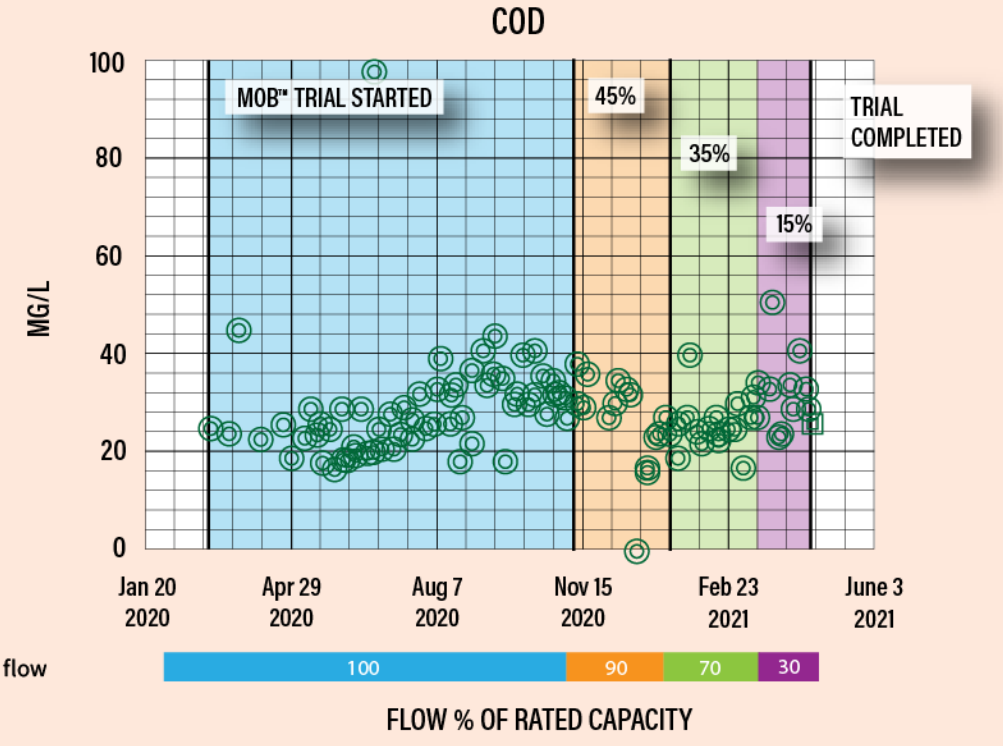
EFFLUENT COD

MOB™



% = Percentage of total plant influent flow

CAS



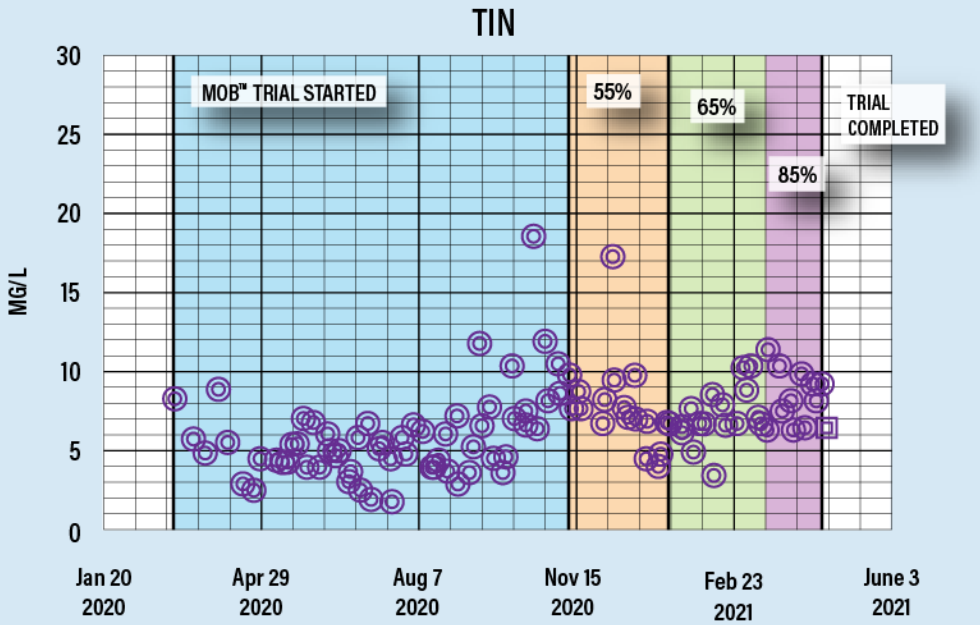
% = Percentage of total plant influent flow

MOB™ PROCESS COD CONSUMPTION INCREASED AS FLOW INCREASED, MAINTAINING COD EFFLUENT LEVELS

EFFLUENT NITROGEN

A. TOTAL INORGANIC NITROGEN (TIN)

MOB™



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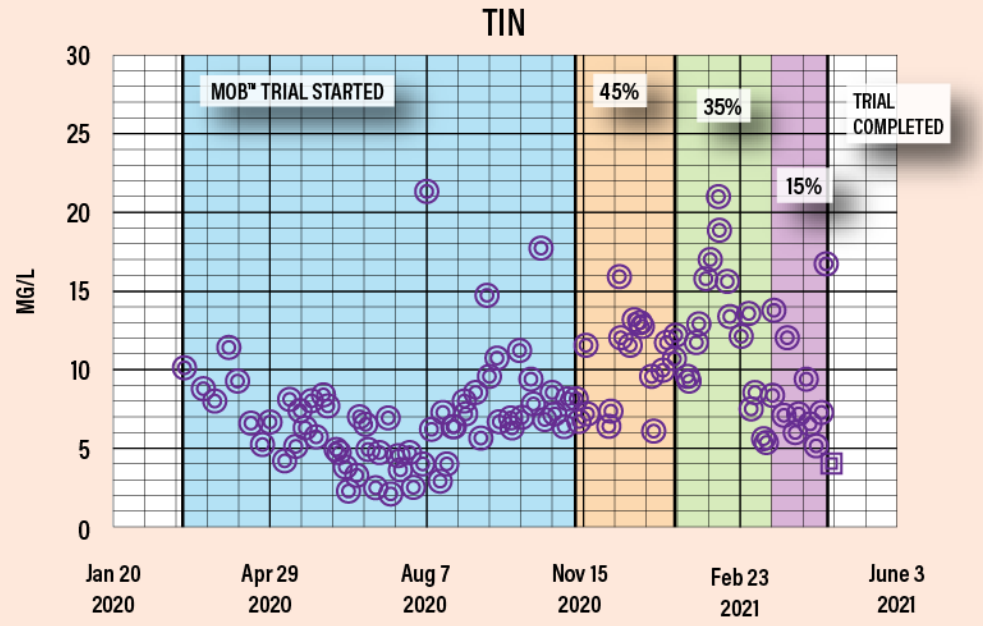
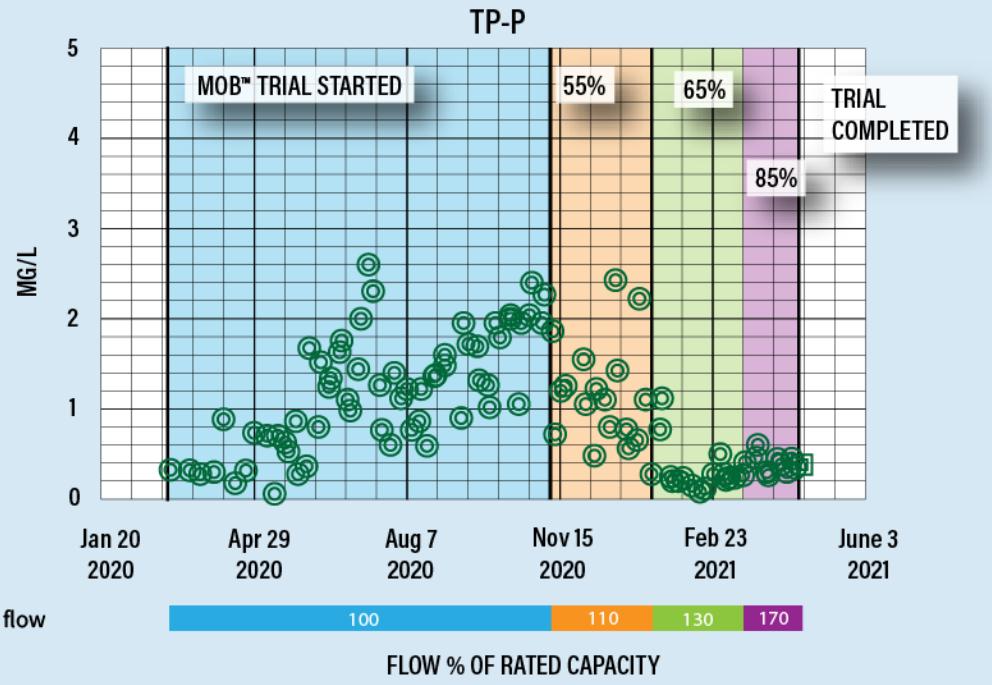


CONTROL & DECREASE OF EFFLUENT TOTAL NITROGEN AT MOB™ PROCESS ELEVATED FLOW

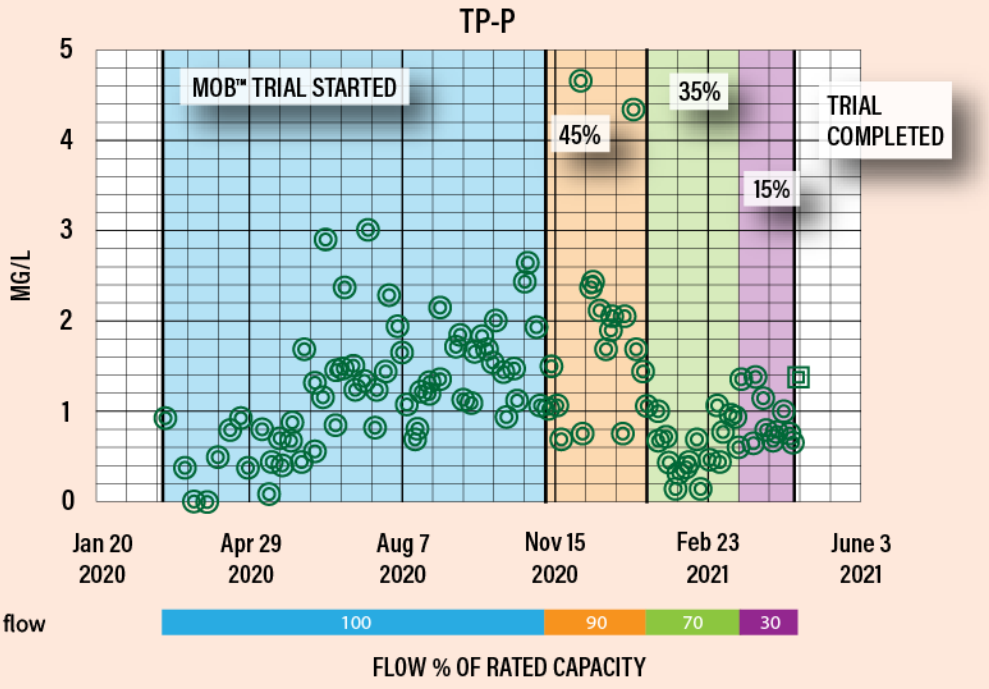
EFFLUENT PHOSPHORUS

MOB™



% = Percentage of total plant influent flow

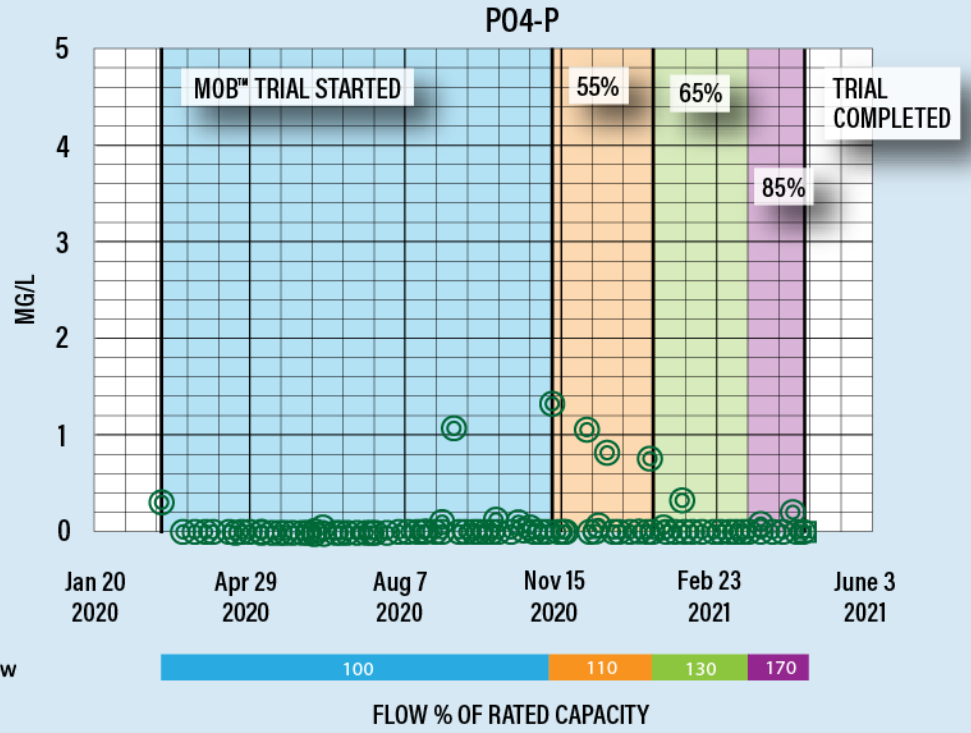
CAS



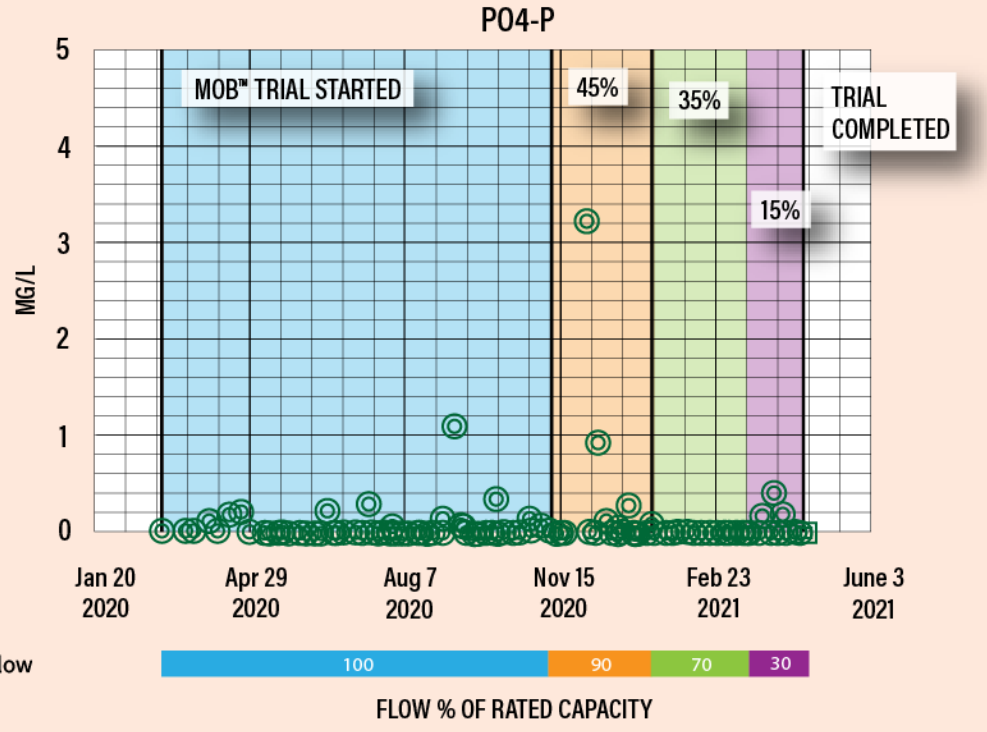
% = Percentage of total plant influent flow

DRAMATIC REDUCTION OF TP-P USING MOB™ PROCESS

MOB™



CAS



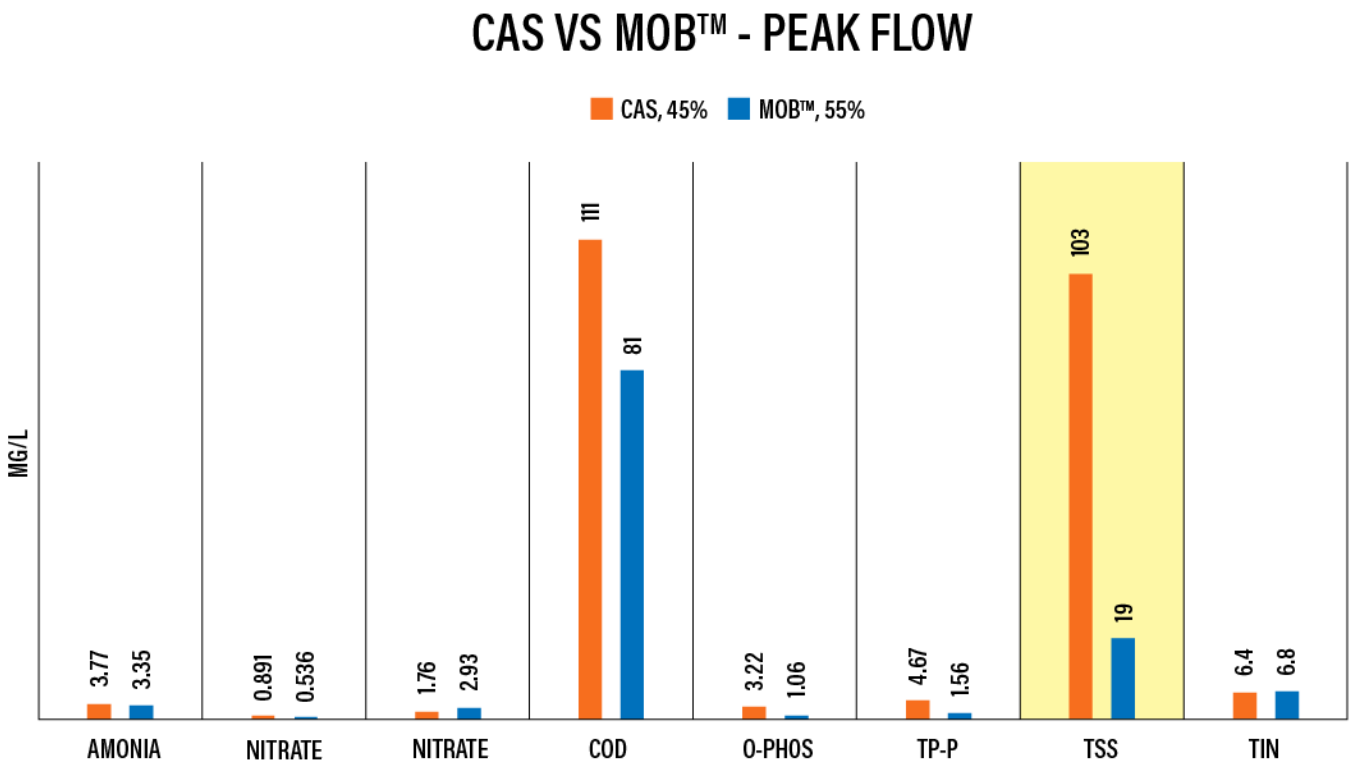
DRAMATIC REDUCTION IN PO4-P USING MOB™ PROCESS

PEAK FLOW PERFORMANCE COMPARISON

A. STORM EVENT INFORMATION

Sampling Date	11/30/2020
24-hour Rainfall Prior to Sampling	3.1"
Influent Flow Rate	200-300% AADF Influent Q

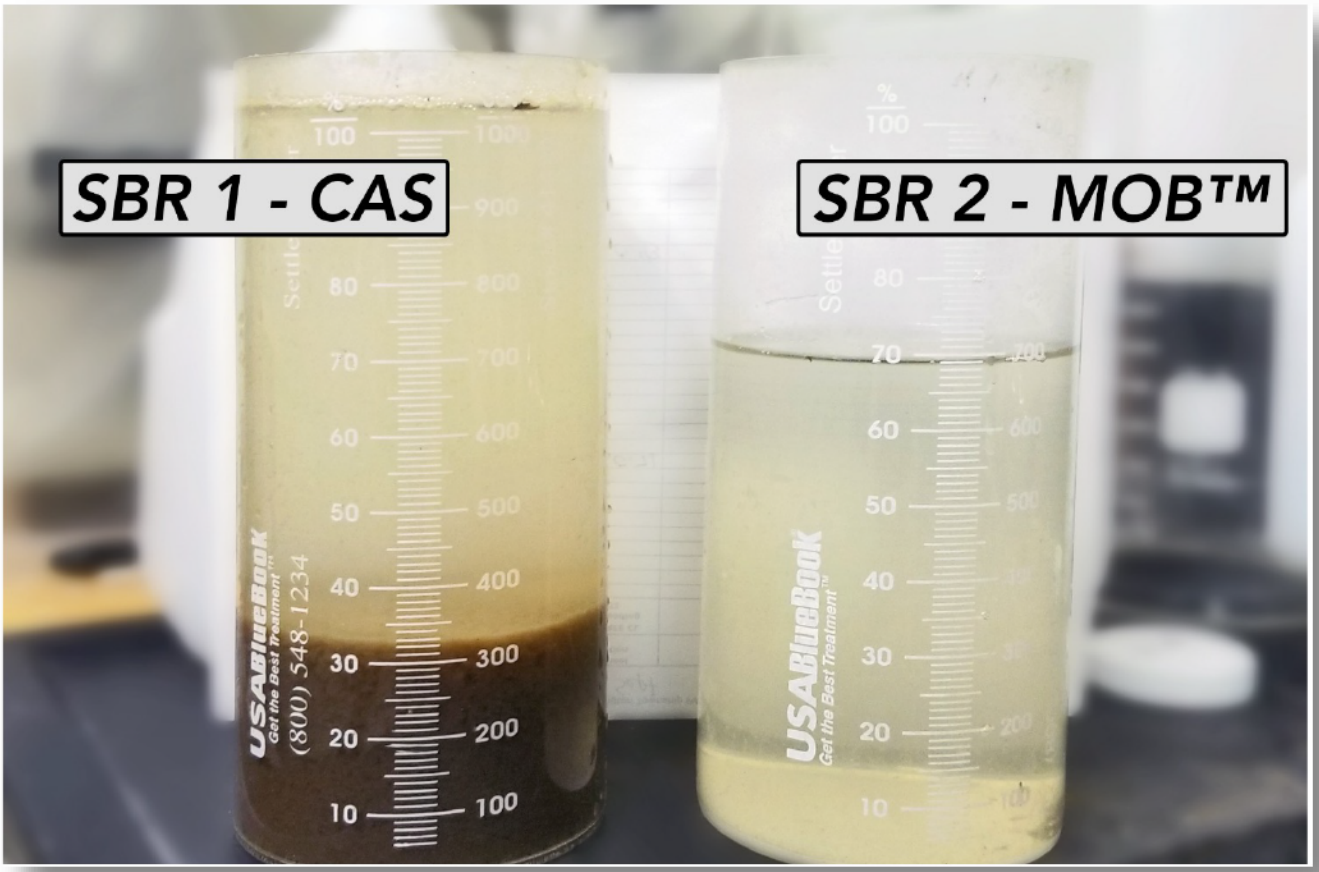
B. PEAK FLOW EFFLUENT DATA



The MOB™ Process had 1/5 of the TSS in the effluent compared to the CAS reactor.

C. EFFLUENT QUALITY COMPARISON IMAGES

PEAK FLOW/ STORM EVENT



CAS effluent had a settled sludge volume of approximately 300 mL/L, while MOB™ effluent had no observable sludge volume after the same settling time during high flow event (> 10x design).

DISCUSSION & CONCLUSION

A. SETTLING & WASHOUT PREVENTION

Despite an increase of capacity of 170% through the MOB™ SBR, the process was able to consistently demonstrate a sludge volume index (SVI) below 80 mg/L. In addition to settling, the MOB™ ballast prevented MLSS washout during peak flow conditions, ultimately avoiding the loss of nitrification and improved effluent. Evidence of the washout prevention can be observed in Section C of Effluent Quality Comparison Images.

B. PHOSPHORUS REMOVAL

The MOB™ Process demonstrated Total nitrogen < 7.0 mg/L and Total Phosphorus concentrations < 1 mg/L throughout most of the trial despite a 170% increase in capacity. Both nutrient concentrations were well below permitted values and would provide sufficient data for a process rerate which would double capacity.