Better Plants
U.S. DEPARTMENT OF ENERGY

Biological Wastewater Treatment Training Series Presentation #14: Using the Bio-Tiger Model in DOE MEASUR – Case Study #1

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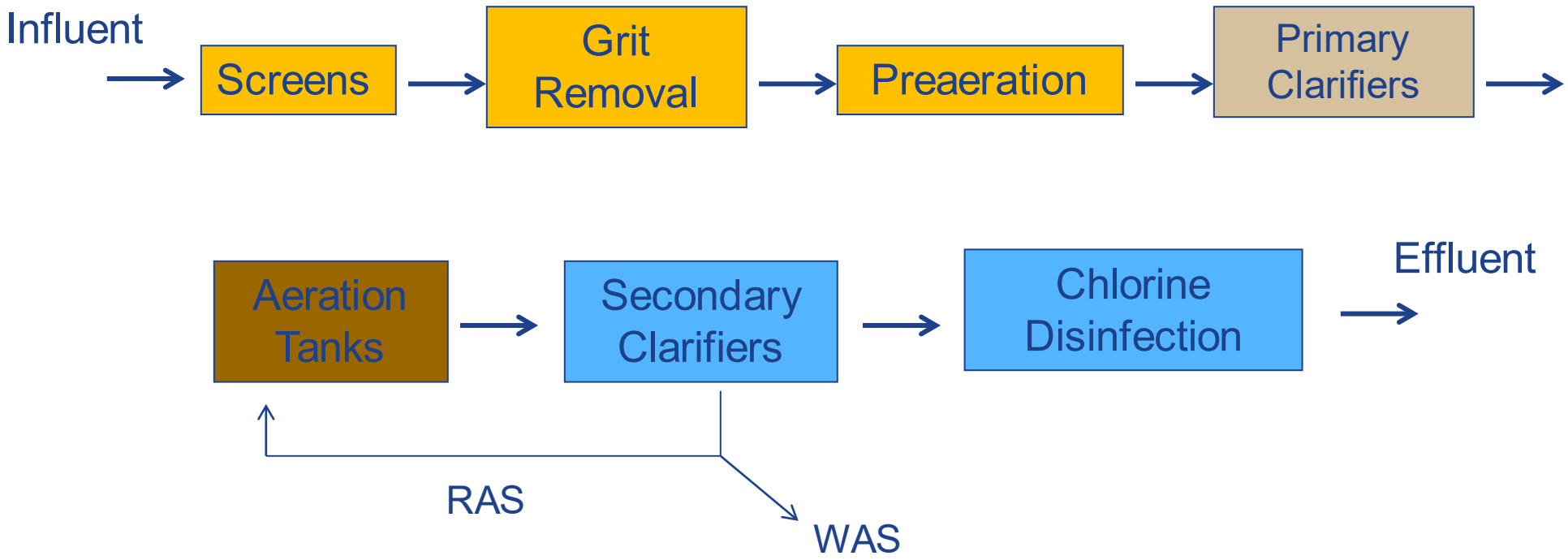
Case Study: Military Base WWTP



*Aeration basin diffusers are flexible-membrane, fine-bubble diffusers (tapered aeration in each plug-flow reactor).

Design Parameters for Military Base WWTP: Conventional Activated Sludge Design

Flow rate	=	2.5 mgd (ave. daily)
$CBOD_5$	=	250 mg/L (ave)
TSS	=	350 mg/L (ave)
TKN	=	45 mg/L (ave)
Ammonia-N	=	25 mg/L (ave)

Summer NPDES Limits for Military Base WWTP

$CBOD_5$	=	12 mg/L (mo. ave)
TSS	=	30 mg/L (mo. ave)
Ammonia-N	=	3 mg/L (mo. ave)

*Winter limits are secondary treatment limits (25/30/20).

Existing Conditions: Military Base WWTP

Total average daily flow rate	0.58 mgd (half to each aer tank)
Aeration volume in service	0.66 mil gal (0.33 mil gal each)
Sec. influent BOD_5 concentration	90 mg/L
Sec. influent BOD_5 mass loading	435 lb/day
Sec. influent TSS mass loading	484 lb/day (100 mg/L)
Type of activated sludge process	Conventional plug flow (design)

Existing Conditions: Military Base WWTP

Type of Aeration System	Fine bubble diffusers
Type of blower	Positive displacement (no VFD)
Horsepower of blower	60 hp
MLSS	3500 mg/L
MLVSS	2600 mg/L

Existing Conditions: Military Base WWTP

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One 60-hp PD blower runs 22 hrs/day for aeration basin

One 75-hp PD blower runs 24 hrs/day for aerobic digesters

TSS in activated sludge effluent	19 lb/day (4 mg/L)
VSS destroyed in aerobic digesters	390 lb/day
Oxygen required for aerobic digestion = (2.3 x VSS destroyed)	900 lb/day

Existing Energy & Chemical Use: Military Base WWTP

Total Energy Use	**86,000 kWh/mo**
Total Energy Use	**4,900 kWh/mil gal**
Typical activated sludge energy use	1,800 kWh/mil gal
Energy use vs. typical	172% more
Potential for energy savings	Excellent
Soda ash addition for alkalinity	$15,000/yr

Existing Conditions: Military Base WWTP

Total Oxygen Supplied by aer. basin blower	**1,400 lb/day**
Mixing intensity in aeration tanks with 60 hp	91 hp/mil gal
DO in aeration basins (average)	4.5 mg/L
RAS flow rate	0.66 mgd (114%)
WAS flow rate	0.0018 mgd
RAS TSS concentration	6500 mg/L

Existing Conditions: Effluent Quality

$CBOD_5$ Concentration	3 mg/L
TSS Concentration	4 mg/L
Ammonia-N Concentration	0.1 mg/L
NO_x Concentration	30 mg/L (145 lb/day)
TKN Concentration	1 mg/L
Total Nitrogen concentration	31 mg/L

Energy Conservation Measure #1: Use Only One Aeration Basin and Run the Blower Only 16 Hours/Day

Total average daily flow rate	0.58 mgd (all to one aeration tank)
Aeration volume in service	0.33 mil gal (one basin)
Sec. influent BOD_5 concentration	90 mg/L
Sec. influent BOD_5 mass loading	435 lb/day (total)

Energy Conservation Measure #2: Use Only One Aeration Basin; Run Blower 16 Hours/Day at 60% Speed; Reduce MLSS to 2,500 mg/L

Total average daily flow rate	0.58 mgd (all to one aeration tank)
Aeration volume in service	0.33 mil gal (one basin)
Sec. influent BOD_5 concentration	90 mg/L
Sec. influent BOD_5 mass loading	435 lb/day (total)

Energy Conservation Measure #3: Run the Aerobic Digester Blower Only 12 Hours/Day … Energy Savings ≈ 17,000 kWh/mo

Current digester blower use	24 hrs/day full speed
Primary sludge VSS destroyed	390 lb/day
O_2 needed for digesting prim. sludge	900 lb/day
O_2 needed for digesting waste act. sludge	0 lb/day
Digester blower O_2 transfer rate	26 lb/hp-day
O_2 supplied by digester blower	1950 lb/day
Blower run time = 900 lb/1950 lb/day	0.46 day (11 hours)

Thank you!

For Questions or Comments please reach out to the following:

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