

Water Reuse in Action: Bayberry Hills, Yarmouth MA





- Yarmouth Septage Treatment Facility (YSTF) is a regional facility for the proper disposal of septic system waste on Cape Cod
 - Grade 6 facility
- Address: 47 Workshop Rd, South Yarmouth MA
 - off old exit 8 on the mid cape highway
- Operating since 1992
 - Run under the direction of Weston & Sampson since 2009

Operational Overview

- All influent is received exclusively from septic trucks serving residential and commercial septic systems on Cape Cod
- YSTF is designed to treat the high-strength, low-volume septage pumped from on-site septic systems
- Septage is treated biologically in oxidation ditches where nitrification and denitrification processes occur followed by ozone addition, sand filtration, and ultraviolet disinfection
- Average annual flow: 105,000 gpd Monday to Friday, 25,000 gpd Saturdays
 - Peak flow (Summer) 125,000+ gpd Monday to Friday, 50,000+ gpd Saturdays
 - Closed on Sundays
- Septage received in 2021: 29.7 million gallons

Portion of effluent discharge is applied to the Bayberry Hills Golf Course

Crash Course in Septage Treatment



Preliminary Treatment



Mechanical Bar Rack

The image shows a large industrial mechanical bar rack. It consists of a vertical frame with several horizontal bars. A large metal hopper is positioned below the bars, and a motorized mechanism is visible at the top. The hopper is labeled 'WRIGHT SELF DUMPING HOPPER' and 'MCCULLOUGH INDUSTRIAL, INC.'. A yellow 'CAUTION' sticker is also visible on the hopper.



Grit Chamber

The image shows a large, blue, cylindrical grit chamber. It has a curved top and a rectangular opening on the side. A yellow hopper is positioned above it, and a large metal hopper is positioned below it. The hopper is labeled 'WRIGHT SELF DUMPING HOPPER' and 'MCCULLOUGH INDUSTRIAL, INC.'. A yellow 'CAUTION' sticker is also visible on the hopper.



Grit Classifier

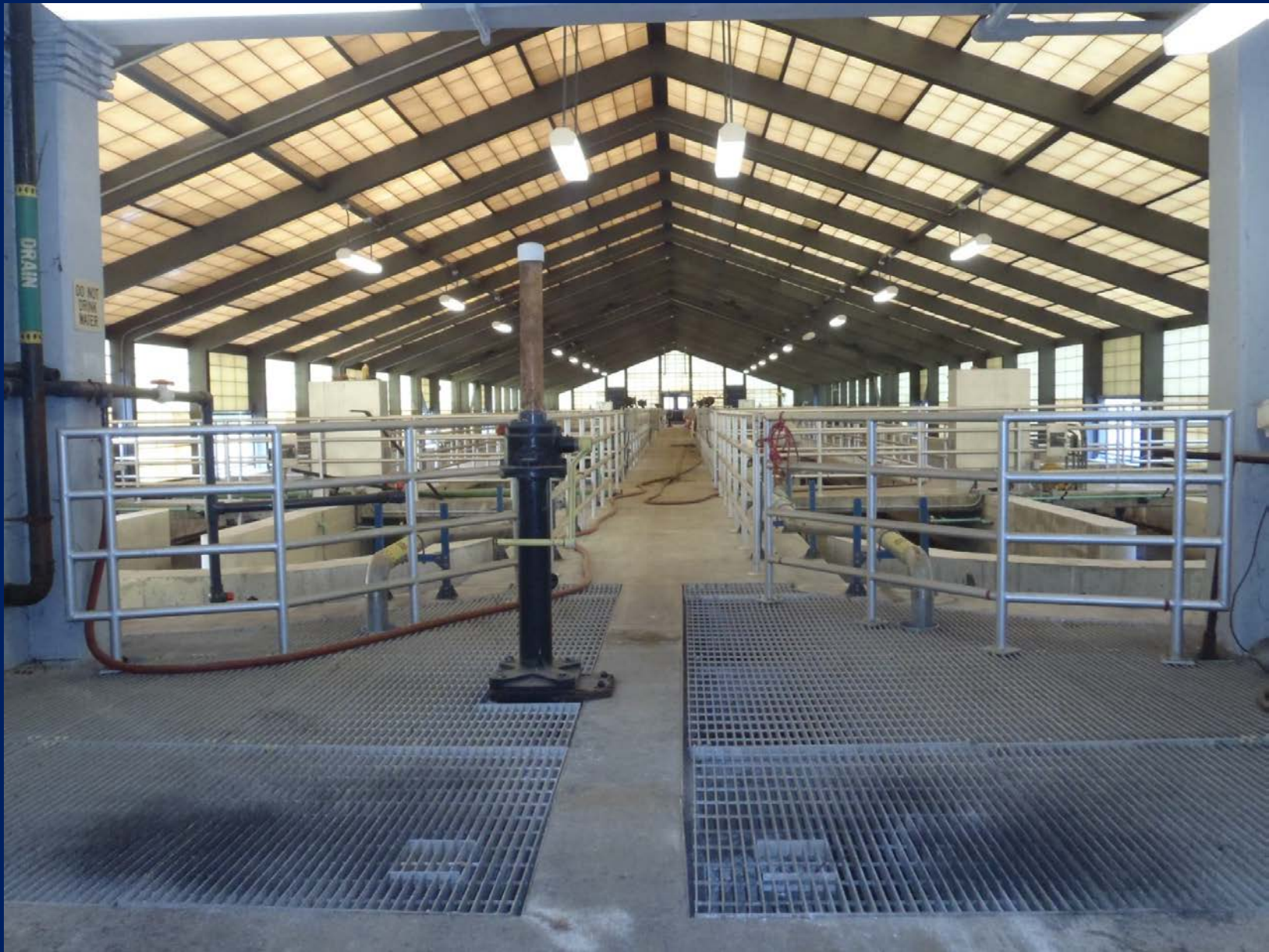
The image shows a large, blue, cylindrical grit classifier. It has a curved top and a rectangular opening on the side. A yellow hopper is positioned above it, and a large metal hopper is positioned below it. The hopper is labeled 'WRIGHT SELF DUMPING HOPPER' and 'MCCULLOUGH INDUSTRIAL, INC.'. A yellow 'CAUTION' sticker is also visible on the hopper.

- From the grit chamber, the flow is distributed into two 230,000gal equalization tanks & then pumped up to a splitter box

Two, 10ft, 5,872gal Primary Clarifiers



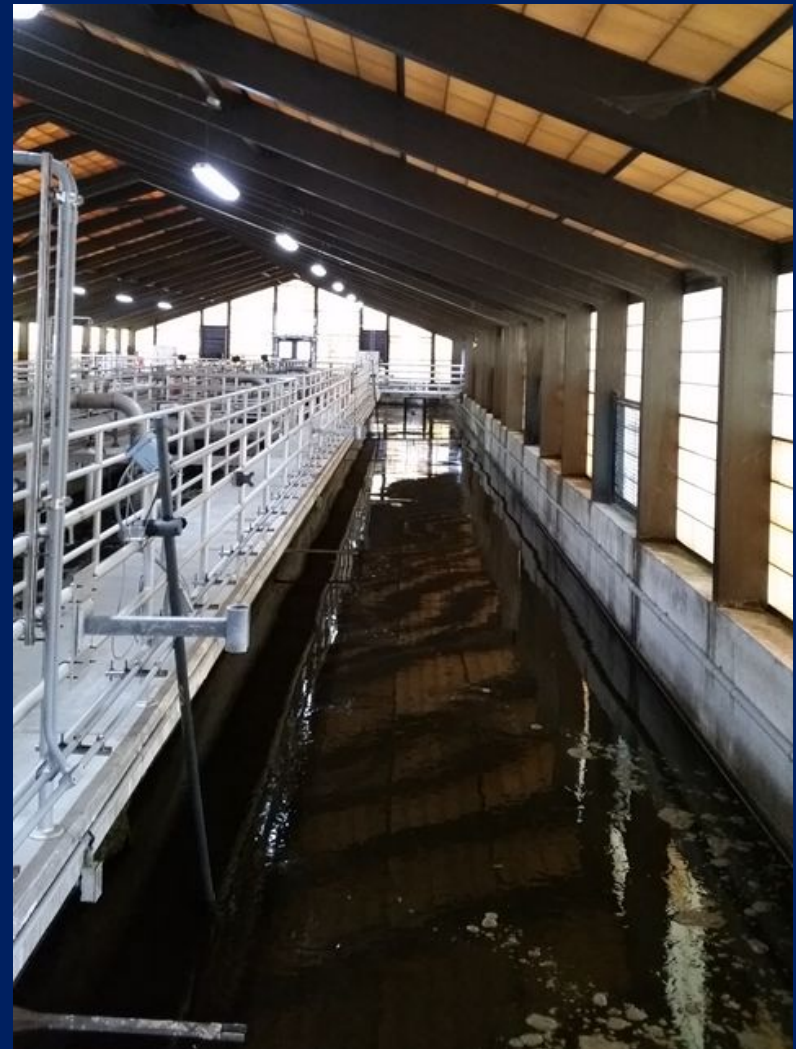
OXIDATION DITCH



Oxidation Ditches

- Each Ditch is 452,500 Gallons, 215' Long
- Two sections:
 - Aerobic zone (Nitrification)
 - Anoxic zone (Denitrification)
- Two mixers (8' in diameter) per ditch
 - keep the Mix Liquor in suspension
 - located in the beginning and the end of the Anoxic zone
- Polymer is added at the end of the Oxidation Ditch to help the settling in the Secondary Clarifier
- No carbon source needed, plenty of food for the bugs

OXIDATION DITCH



Oxidation Ditch Con't.



Two, 15 ft, 15,900gal SECONDARY CLARIFIERS



Tertiary Treatment: 3 Step Process

1. Ozonation (O₃)

- generated on-site by passing O₂
- through a high-voltage electrical field

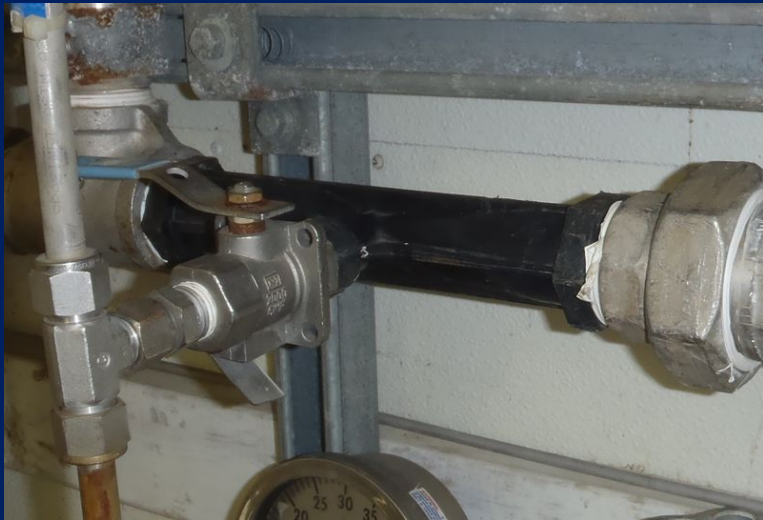
2. Rapid-Sand Filtration

- 3 – 55 ft² filters, 105gpm max

★ Turbidity Monitoring, 2 NTUs (year-round)

1. UV (Ultraviolet Disinfection)

OZONE ADDITION

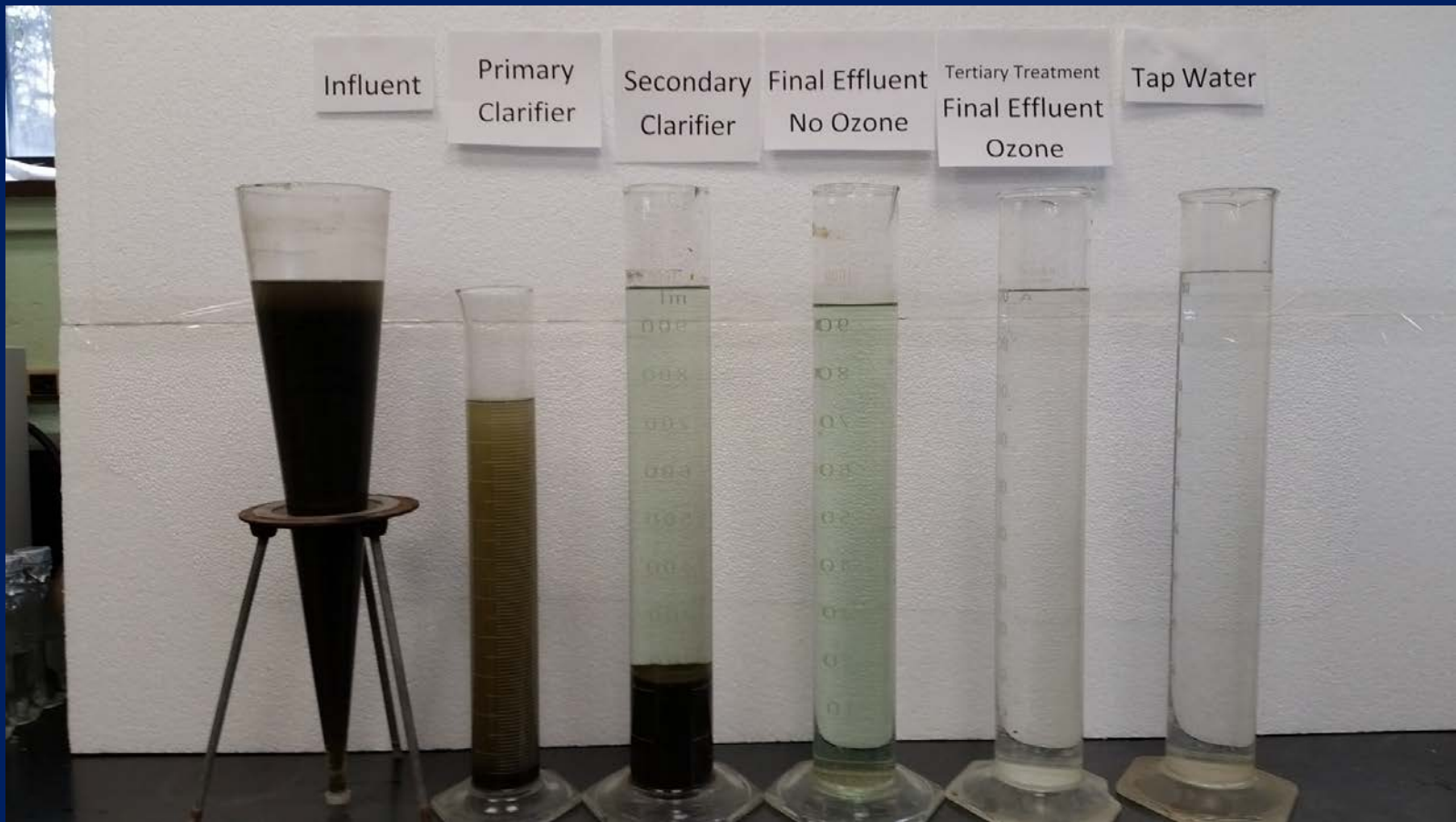


Sand Filters

Turbidity Monitoring

UV (Ultraviolet) Disinfection





- From UV disinfection, the effluent goes into a 187,000-gal irrigation tank

Sludge Cake

- 2 Belt Feed Press
- 1.5-meter presses
- 68 gals/min
- 20% to 22% solids produced
- Can run both at once, but overloads the EQ
- Yearly total of cake produced: ~2,000 tons
- Pressing Monday to Saturday in the summer


**SEPTAGE TREATMENT
AND
DISPOSAL FACILITIES**

Effluent Storage Tank

Belt Feed Press, Grease, Cake Building

Ops, Septage Bays, Lab, etc.

Oxidation Ditches

Town of
Yarmouth, Massachusetts
Wright-Pierce
Topsham, ME


What do we do with the final Effluent?

It depends on the time of Year.

December 1st to February 28th

- All effluent is pumped from the irrigation tank to the effluent storage tanks
 - Two, 5.25-million-gal storage tanks
- Monthly Fecal Ozone is off
- We can not discharge any effluent
- BOD 30mg/l, TSS 30mg/l, Total Nitrogen 10mg/l

March 1st to March 31st

- All effluent is pumped from the irrigation tank to the effluent storage tanks
 - Two, 5.25-million-gal storage tanks

Daily Fecal Coliform & Ozone turned on

- *Need special Permission from state to discharged on to our spray field*

April 1st to November 30th

- Bayberry Hills Golf Course uses Effluent!
 - Golf course takes 7 to 14 million gals
- We can use our Spray field
 - Spray up to 21 million gals on our 19-acre field
- Daily fecal, ozone on
- Ozone was added to process control in 1999 to accommodate for golf course application
 - Ozone takes the greenish color out of the effluent, 2005 study came back as Acid Blue #9 (food dye), also used in Porta-Potties

Permit / Sampling

- Year round: Weekly BOD and TSS; 2x Monthly TN
- YSTF can discharge up to 28-million-gals total effluent

Golf Course

□ BOD	10 mg/l
□ TSS	5.0 mg/l
□ TN	14 mg/l

Spray Field

□ BOD	30 mg/l
□ TSS	30 mg/l
□ TN	10 mg/l

Effluent to Bayberry Hills

- Mid-April to early May, YSTF distributes water to golf course
 - depended on rainfall in early spring
- From the Irrigation Tank, there are two dedicated golf course pumps with their own control panels and one VFD for both pumps
- Golf course irrigation system calls for water at 8pm and applies water to golf green until 5am
- The YSTF system maintains a pressure at 90-110 psi to pop the heads for the irrigation system at Bayberry Hills

Effluent Con't.

- Golf course takes 100,000 to 180,000 gals per night which exceeds the capacity of YSTF effluent production per day
- The solution is to bring stored water from effluent storage tanks
- Manually set gallonage each night to about 100 to 125gpm
- Water from storage tanks is introduced at the sand filter distribution box, goes through the sand filters, is monitored for its turbidity, and gets blinded by the (UV) light once again!

What parts of the course get water?

9-Hole: 2 through 8

18-Hole: We can when supplying water to the irrigation pond

How and when do we sample the golf course?

9-Hole: T-2, F-2, F-4, G-4, G-7, T-8, F-8, G-8

18-Hole: T-7, F-15, F-16

Monthly we inspect the lysimeter

What do we sample for?

NO₃, NO₂, TKN, NH₃, O-Phos, T-Phos

Effluent to Spray Field

- Starting in mid September, the golf course cannot take the volume that YSTF needs to discharge to empty the storage tanks for winter
- Instead, water is sent to the 19-acre Spray Field via a 3 mile long forced main
- Spray continues from mid September to November 30
 - Spray from 200,000 to 250,000gal a day

November 30th

- Effluent storage tank is empty!
- And the process starts all over again...

Issues and Challenges

- High flow since 2017, maxing plant out
- Plant is 30 years old
- Variable flow from day to day, time of year, challenging for operators
- Copper turns black, major electrical issues
- Winter too low flow

Pros

- No collection system to worry about
- Zero I & I
- Refusal of loads
- Grease system separate
- All indoors, except the short walk from the Ops Building to the Cake Building

In the Works

- Direct line from YSTF to golf course irrigation pond

End