# Wastewater Characterization from Type III Marine Sanitation Devices

Presented By

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# What is a Marine Sanitation Device?

## According to the EPA…

Section 312 of the Clean Water Act requires the use of operable, U.S. Coast Guard certified MSDs on board vessels that are:

1. Equipped with installed toilets, and
2. Operating on U.S. navigable waters

# The 3 Types of MSD's

All 3 of the following types of MSD's are contained on-board the boat.

Type I-A treatment system that relies on maceration and chlorination of the effluent. The waste may be discharged after treatment. This type of MSD is found on offshore recreational boats.

Type II-A treatment system that uses a biological or aerobic digestion system. After treatment the waste may be discharged. This type of MSD is found on commercial boats.

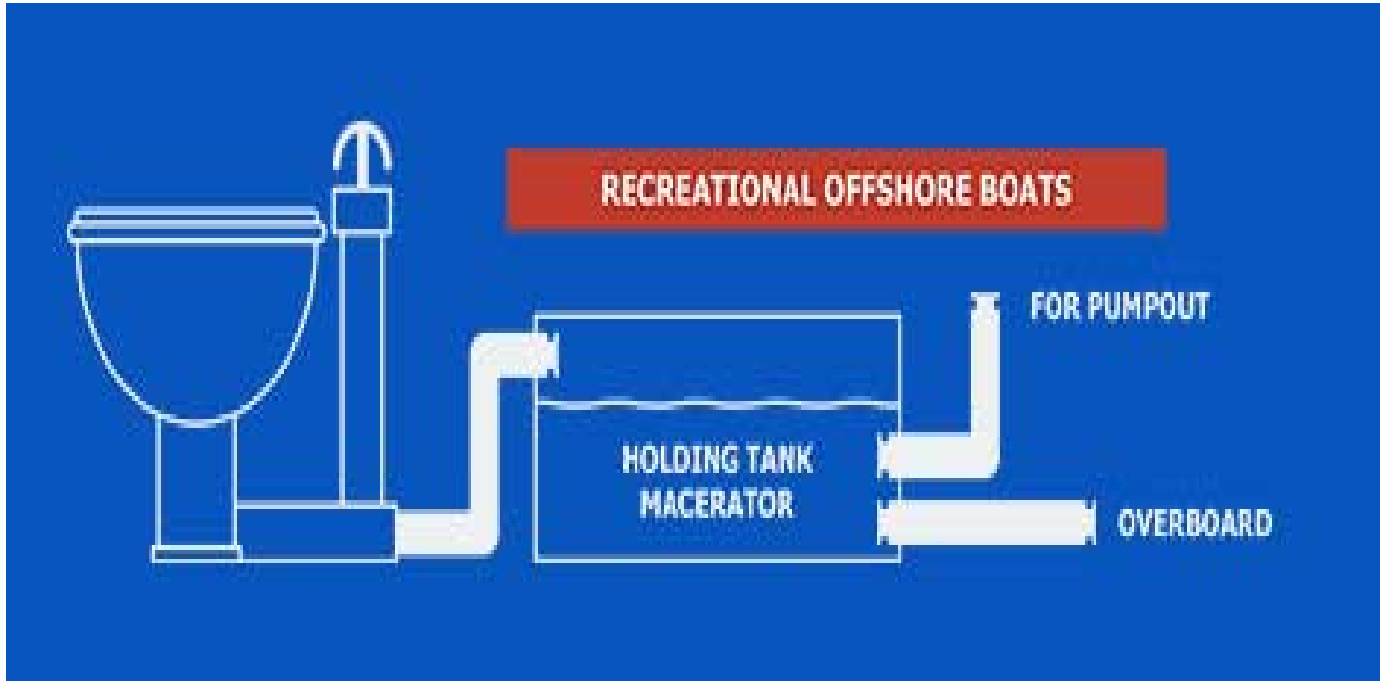
Type III-A holding tank located in the hull of the boat. The only treatment is the natural aerobic and anaerobic process between the atmosphere in the tank and the effluent. This type of MSD should not be discharged and must be pumped out. Some boats may have a "Y" pipe for direct discharge.

# Type I MSD

Type I-A treatment system that relies on maceration and chlorination of the effluent.

The waste may be discharged after treatment.

This type of MSD is found on offshore recreational boats.

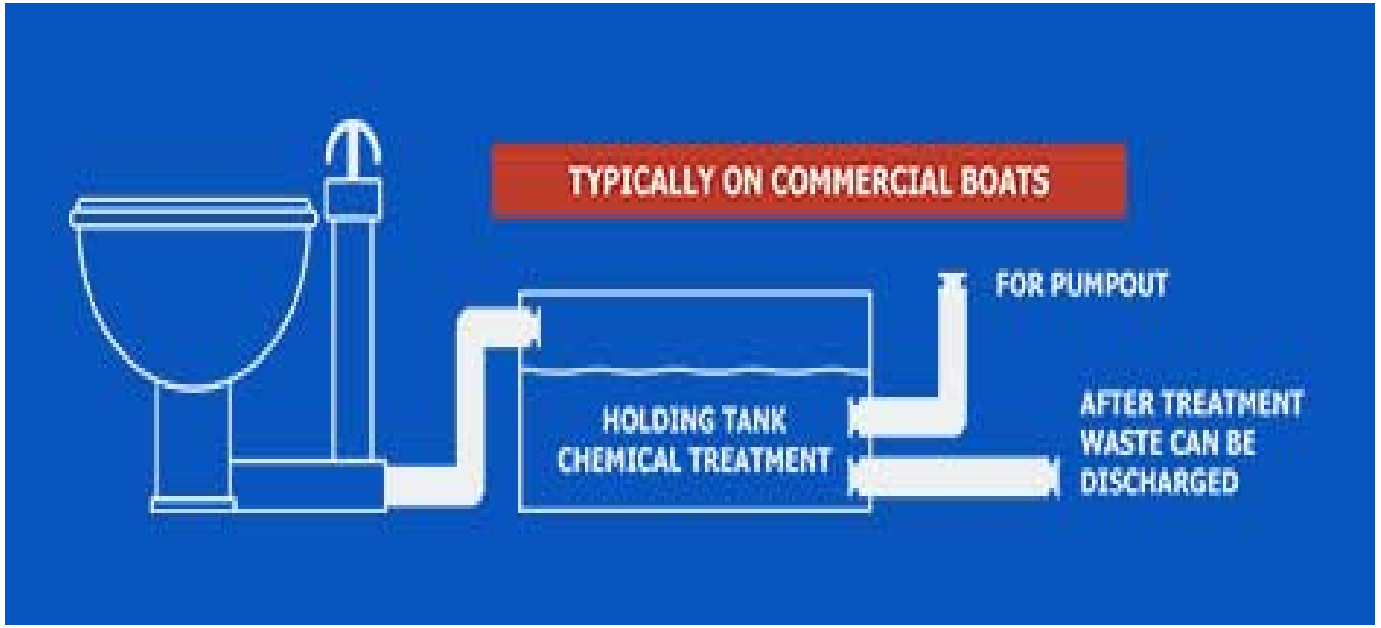


# Type II MSD

Type II-A treatment system that uses a biological or aerobic digestion system.

After treatment the waste may be discharged.

This type of MSD is found on commercial boats.

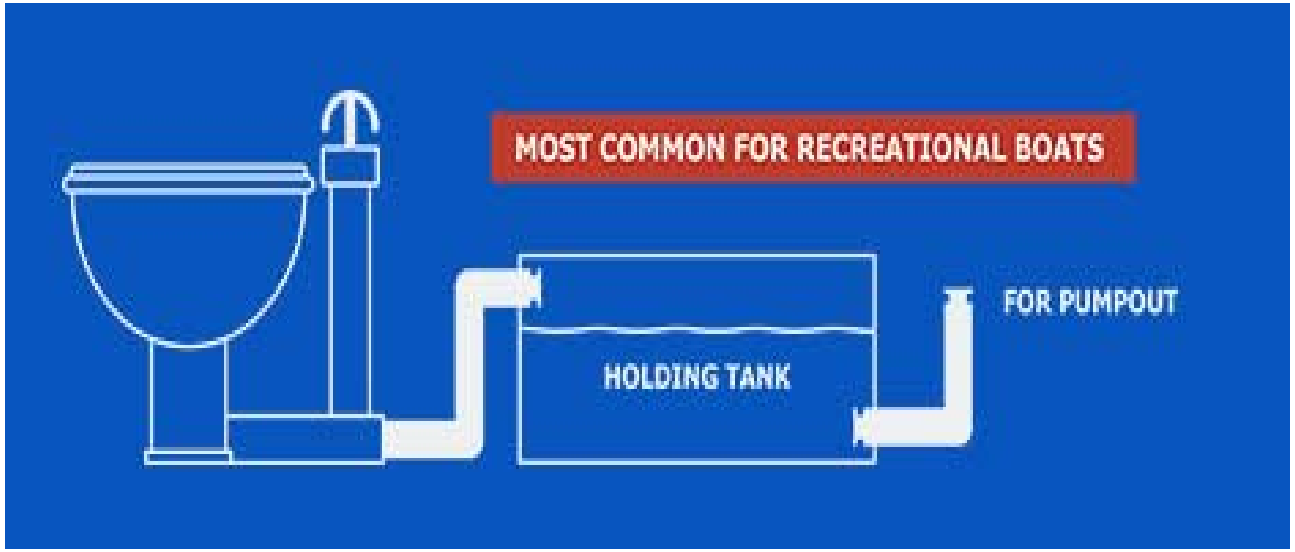


# Type III MSD

Type III-A holding tank located in the hull of the boat.

The only treatment is the natural aerobic and anaerobic process between the atmosphere in the tank and the effluent.

This type of MSD may not be discharged and must be pumped out.



# Type III MSD's

-Typically found on small to medium sized recreational boats
-The boat will be equipped with a toilet and a separate tank located below deck in the hull.
-There will be a sanitary pump out cap located along the edge of the exterior deck or gunnel.
-Typically a holding tank sanitizer and odor treatment chemical is added to control odors.
-The Type III MSD holding tank must be pumped out regularly at a marina.  Some Type III MSDs may have a Y pipe for direct discharge.

# Typical sized boats with Type III MSD’s

# Typical Type III MSD
# Toilet

# Physical Characteristics of Wastewater From Type III MSD's

-Wet
-Slurry
-Soilds
-Stinky

Domestic Sewage Compared with Holding Tank Effluent

| Parameter | Domestic Sewage mg/L | Holding Tank Effluent mg/L |
|---|---|---|
| Suspended Solids | 200-290 | 2400-4200 |
| Biochemical Oxygen Demand (BOD) | 200-290 | 3000 |
| COD | 500-750 | 11,000 |
| Total Nitrogen | 35-100 | 1600 |
| Total Phosporus | 6-24 | 117 |
| Grease and Oils | 25-150 | |
| Coliform Bacteria | 10^6-10^8/100mL | 10^6-10^8/100mL |
| Disinfectants and Cleaners | Household Cleaners | Additives for odor control |
| | | |

# Bio-Chemical Oxygen Demand or BOD

BOD is the measure of the amount of bio-degradable organic chemicals in the waste.

The biological activity in the septic tank will remove 30-55% of BOD.

BOD receives highly effective treatment by the combination of the biological crust growth and the surrounding soil.  Typically full treatment of the BOD is within the first 4’ of travel through the soil.

# Total Suspended Solids

This concentration is used as an indicator of the amount of solids in the effluent. It is generally measured as the weight of solids collected on a particular filter that has received a measured flow of the effluent. That filter is then dried and weighed.

The septic tank removes 60-80% of the suspended solids.

An outlet filter on the septic tank is important to ensure that excessive solids do not clog a leaching field system.

# Coliform Bacteria

Coliform bacteria are a type of bacteria which are native to the intestinal tract of humans And warm-blooded animals.  Therefore, always present in sewage.

The vertical separation distance between the leaching field system and the saturated groundwater is the zone where beneficial microbes in the soil remove harmful bacteria And viruses in the leachate.

# Nitrogen

Fresh sewage is high in organic nitrogen. This will first break down into ammonia nitrogen. In the presence of oxygen, ammonia nitrogen is oxidized into nitrite and then nitrate. The oxidation primarily takes place near the infiltrative surface of the leaching system.

Septic systems remove approximately
30% of the total nitrogen, with the remaining 70% being discharged to groundwater in the form of nitrate.

In Connecticut, septic systems with a design flow of 5,000 gallons per day or more are designed to have a calculated nitrogen concentration of 10 mg/L or less at the sensitive receptor (waterbody, property line) down gradient from the septic leaching field.

Smaller discharge septic systems rely on the CT Public Local Health Code required separation distances to protect the wells or waterbodies from high nitrogen concentrations.

# Phosphate

Phosphate is an nutrient which is essential for plant growth, but only a small amount can cause algae growth in a water body.

Phosphates combine readily with the minerals, such as iron or aluminum in soils, to form insoluble deposits which are readily removed by filtration through the first foot or 2 of soil.

In Connecticut, the goal of phosphate removal by the soil system is no discharge to a water body or across a property line.

# Oils and Grease or FOG

The oils and grease found in domestic sewage are not as prevalent in the Type III MSD holding tank effluent due to the lack of grease generating appliances on this size boat.

A septic will remove up to 70% of the FOG in the effluent.

# Odor Control Additives

Generally 2 types of treatments

Chemical Treatments and
Biological Treatments

# Chemical Treatments

## 6 most Commonly used chemicals

Formaldehyde, Bronopol, Dowicil, Glutaraldehyde, Paraformaldehyde, and Para-dichlorobenzene.

-Intended to control odor by chemical suppression of the waste breakdown process.

-Controls the bacteria digestion process and preserves the waste.

-Perfumes also added for odor control.

# Biological Treatments

-Works by adding large quantities of beneficial bacteria to the waste to promote the waste breakdown process and keep the digestion of the waste in the aerobic zone opposed to the anaerobic zone.
-Typically non-toxic.
-Includes enzyme treatments.

# 2 Examples from CTDEEP’s Experience

-Marine HQ Pump out Station and Holding Tank

-Hammonasset Beach State Park RV Dump Stations

# DEEP Marine HQ Marina Pump Out Station

-Located at the DEEP Marine HQ located at the mouth of the Connecticut River in Old Lyme CT.

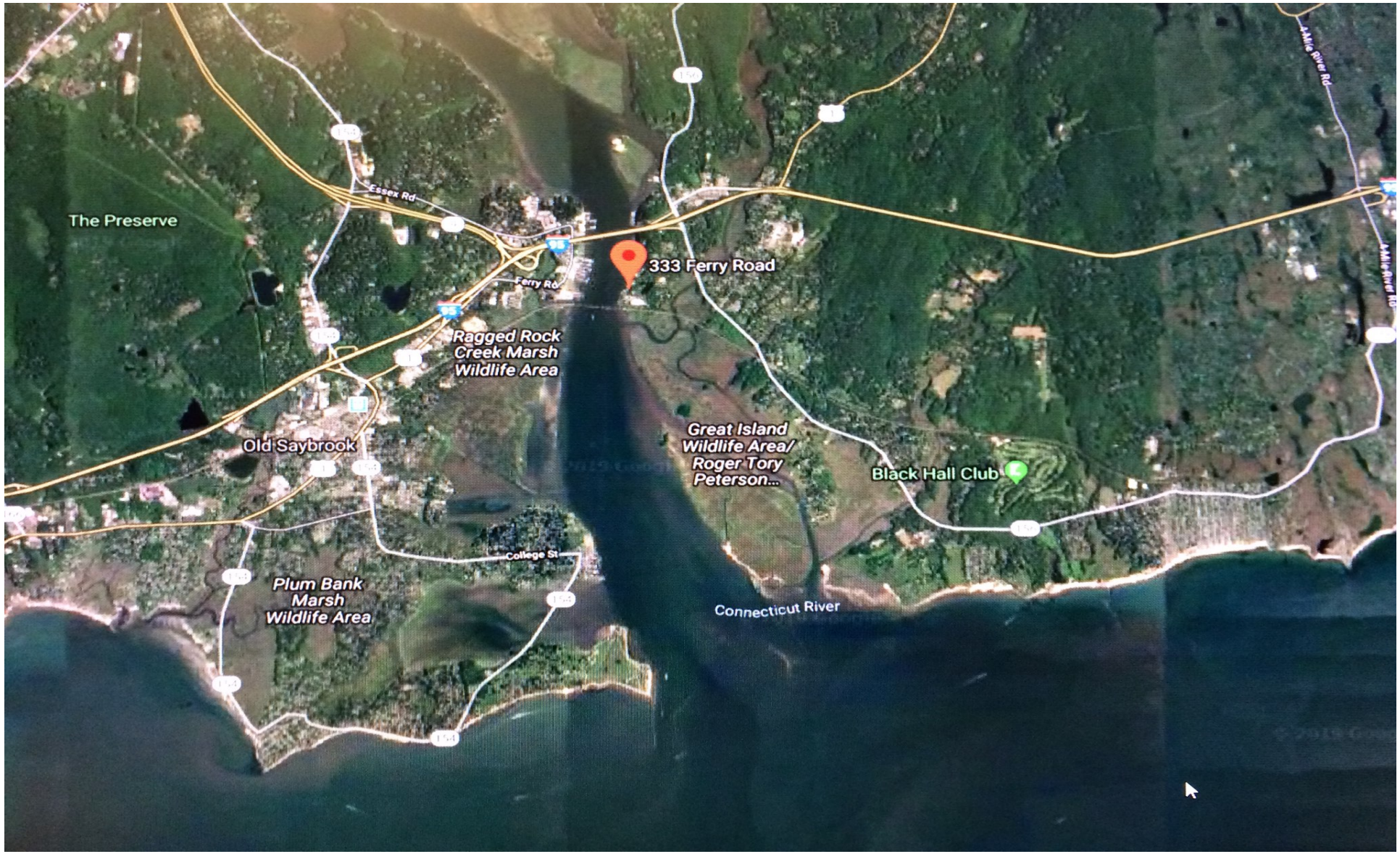
-1500g holding tank located adjacent to the boat pier and boat launch.

-This is pumped out frequently through the season.

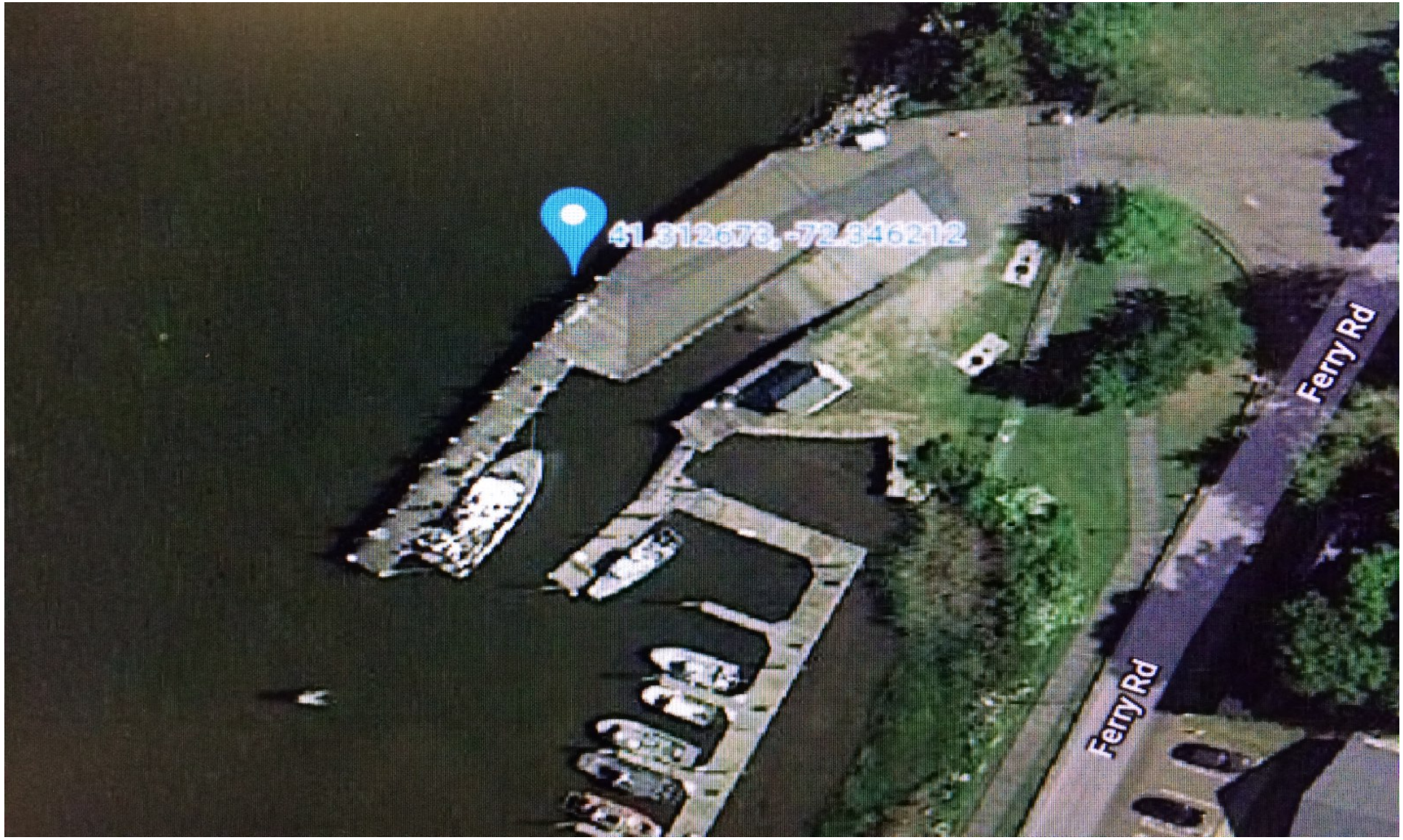
-This station serves boaters and local pump out boats.

-This tank is pumped out weekly during the busy season.

# Location of CTDEEP Marine HQ



# Location of the Boat Pump Out



# DEEP Marine HQ Marina Pump Out Station

Located at the DEEP Marine HQ located at the mouth of the Connecticut River in Old Lyme CT

1500g holding tank located adjacent to the boat pier and boat launch

This is pumped out weekly through the season

This station serves boaters and local pump out boats

# Pump Out Shed and Controls

-Easy Access for boaters

-Pump outs by DEEP staff

# Pump and Controls

-Peristaltic Pump for smoother flow, formerly a diaphragm pump.

# Pump out Controller

# Pump out hose clamp

-Sight glass just above the clamp.

-Clamps on to a standard fitting located on the gunnel of the boat.

# Record Sheet

Date

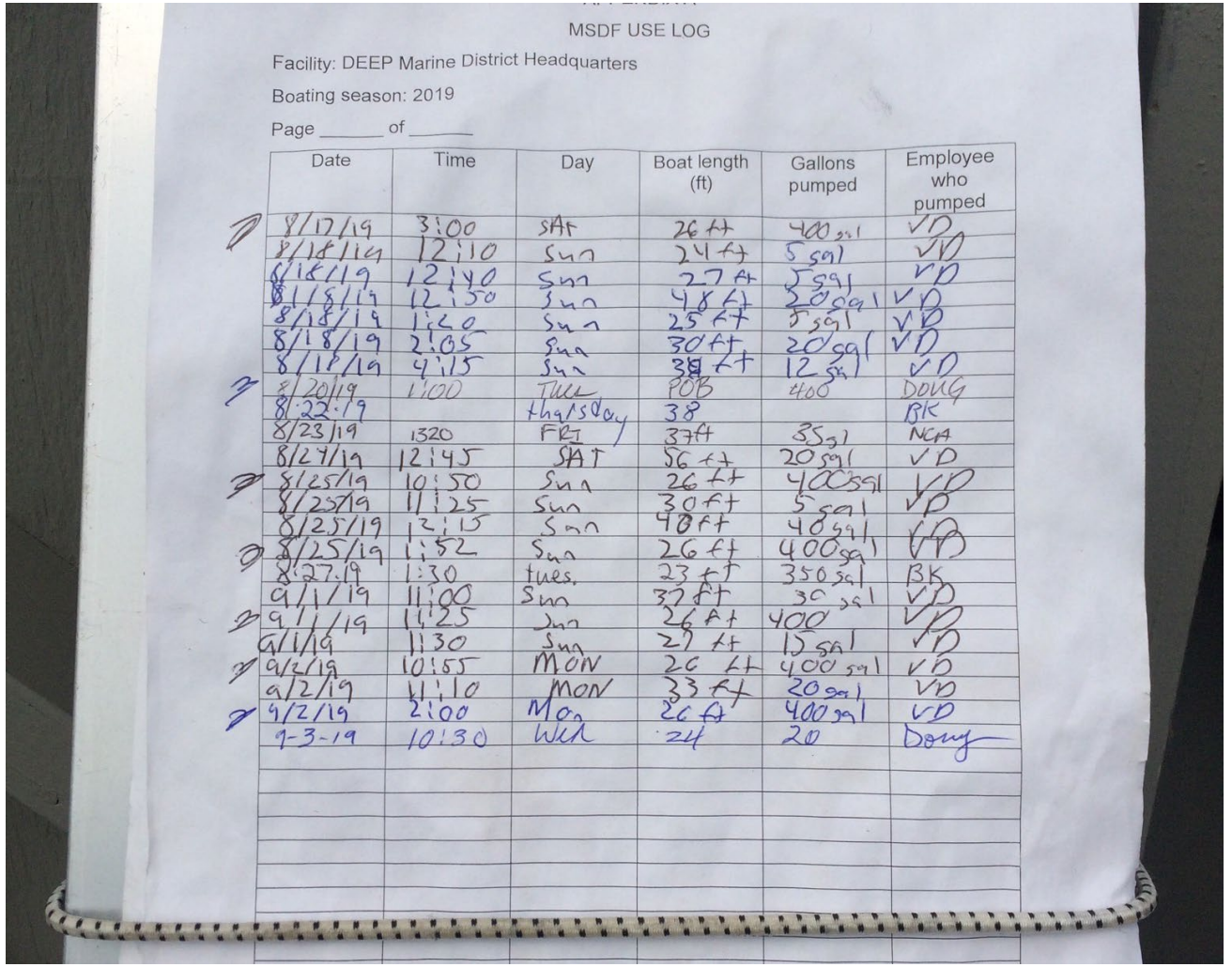
Time

Day of the week

Boat length

Gallons pumped

Employee



MSDF USE LOG

Facility: DEEP Marine District Headquarters

Boating season: 2019

Page _____ of _____

| Date | Time | Day | Boat length (ft) | Gallons pumped | Employee who pumped |
|---|---|---|---|---|---|
| 8/17/19 | 3:00 | SAT | 26 ft | 400 gal | VD |
| 8/18/19 | 12:10 | Sun | 24 ft | 5 gal | VD |
| 8/18/19 | 12:40 | Sun | 27 ft | 5 gal | VD |
| 8/18/19 | 12:50 | Sun | 48 ft | 20 gal | VD |
| 8/18/19 | 1:40 | Sun | 25 ft | 5 gal | VD |
| 8/18/19 | 2:05 | Sun | 30 ft | 20 gal | VD |
| 8/18/19 | 4:15 | Sun | 38 ft | 12 gal | VD |
| 8/20/19 | 1100 | Tues | POB | 400 | DOUG |
| 8/22/19 | | thursday | 38 | | BK |
| 8/23/19 | 1320 | FRI | 37ft | 35 gal | NCA |
| 8/24/19 | 12:45 | SAT | 56 ft | 20 gal | VD |
| 8/25/19 | 10:50 | Sun | 26 ft | 400 gal | VD |
| 8/25/19 | 11:25 | Sun | 30 ft | 5 gal | VD |
| 8/25/19 | 12:15 | Sun | 40 ft | 40 gal | VD |
| 8/25/19 | 1:52 | Sun | 26 ft | 400 gal | VD |
| 8/27/19 | 1:30 | tues. | 23 ft | 350 gal | BK |
| 9/1/19 | 11:00 | Sun | 32 ft | 30 gal | VD |
| 9/1/19 | 11:25 | Sun | 26 ft | 400 | VD |
| 9/1/19 | 11:30 | Sun | 29 ft | 15 gal | VD |
| 9/2/19 | 10:55 | MON | 26 ft | 400 gal | VD |
| 9/2/19 | 11:10 | MON | 33 ft | 20 gal | VD |
| 9/2/19 | 2:00 | Mon | 26 ft | 400 gal | VD |
| 9-3-19 | 10:30 | Wed | 24 | 20 | Doug |

# Typical Pump Out Boat

# Hammonasset Dump Station

As-built Plan

Updated this system in 2000

2-2000g septic tanks

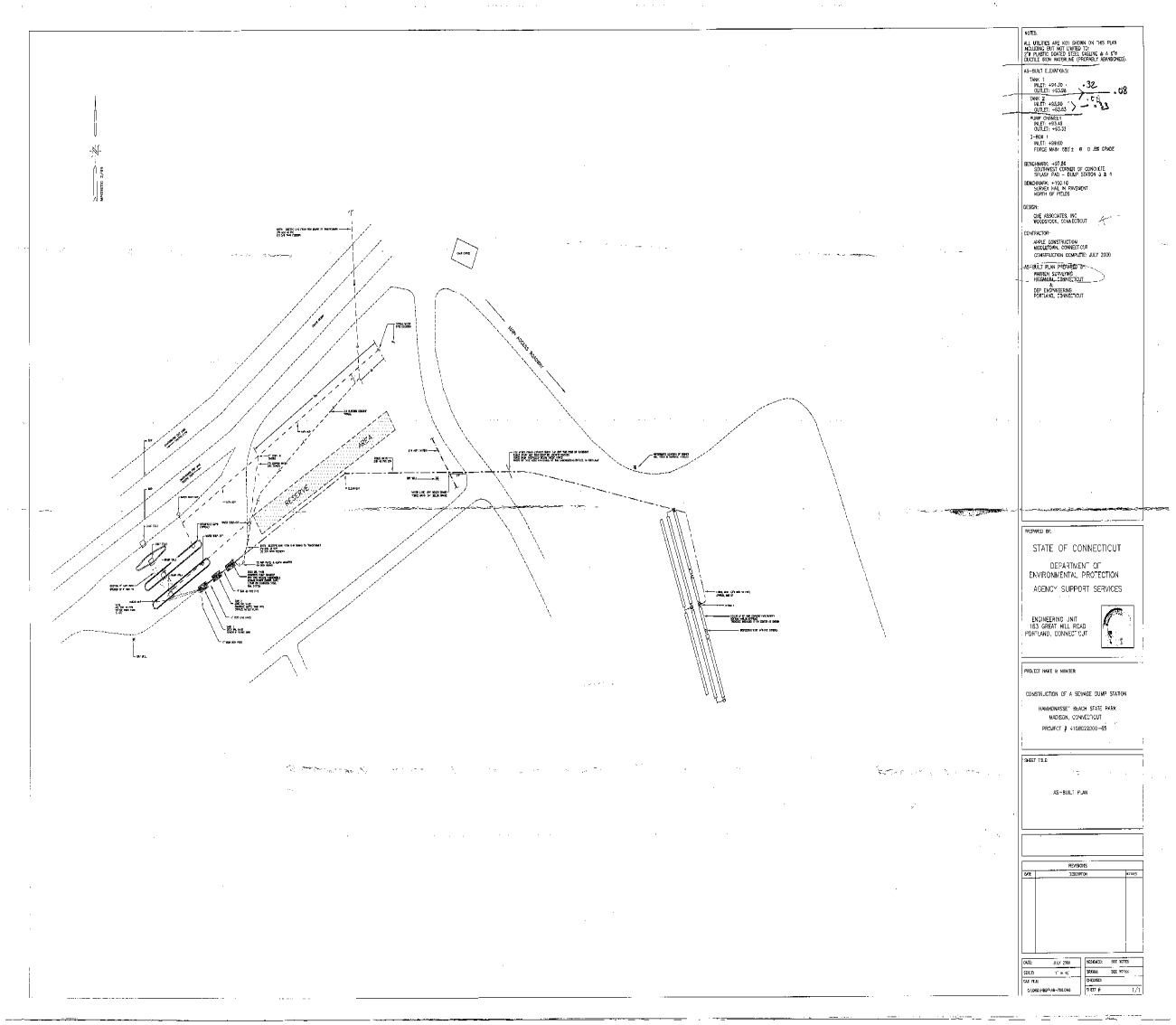
1-2000g pump chamber

Duplex pumps

960’ of force main

520’ of high capacity plastic infiltrator units

Set up to allow for a high level overflow distribution



# Hammonasset Dump Station Design Information

RV holding tank between 40-100g
Use 70g for design
Peak Weekends 75 RV's per day
Typical 44 RV's per day
Peak 75x70g=5250 gpd
Avg. 44x70g=3080 gpd
5-day Avg flow=4382 gpd
**Design is 4400 gpd ******

Septic Tank Effluent- Sampled prior to design
TSS 420 mg/L
Ammonia Ni 870 mg/L
Design Values
Total Nitrogen 25 mg/L
Phosphate 60mg/L
BOD5 100mg/L

# Key Questions Prior to Starting the Design of a Septic System

-Does this State Allow Septic Systems for holding tank wastes?
-Is there area for this type of treatment and will the soils support it?
-Seasonal high ground water level?
    Mottling Layer
    Season Measurements
-Soil Profile?
-Depth to Ledge?

# Design of a Septic System

-Design Flow, look at printed information, but interview others in the area, in the business.
-Sample the effluent, the waste strength will dictate the size of the system as much as the flow information.
-Plan for future expansion
    -More storage capacity
    -Additional Fields
-Allow for Ease of Maintenance
    -Access to Tanks for Pumping
    -Access and Monitroing ports
-Maintain the system, don’t walk away, you’ll pay later!

# Other Options

-Advanced Treatment Systems

-Holding Tanks

# Advanced Treatment Systems

-RI, MA and NY

-Settling/Aeration in the primary settling tank

-Recirculation/Clarification in secondary tank

-Typically a 2 compartment system

-Size of a Septic tank/Pump Chamber

-Controls allow for remote monitoring/Alarms

# Holding Tanks

-May be a better option if land area is at a premium.

-Size tank for optimal pumping schedule based on use.

-Cost per gallon (In CT) is $0.10-$0.20

# Take-Aways from this presentation

-Holding Tank Effluent is considerably stronger than domestic sewage.
-Sampling of the intended waste stream prior to design is crucial.
-Adequate septic tank volume is important.

Type III MSD’s can be and usually are a little smelly!