Optimizing Performance of Large Nitrogen-Reducing Septic Systems & Small Package Treatment Plants

May 2, 2019

buzzards BAY COALITION

www.savebuzzardsbay.org

Agenda & Speakers

Part I.

Operating & Maintaining Large Denitrifying Septic Systems: What Operators Need to Know to Optimize Service & Performance

12:30 p.m. Introduction & Importance of O & M – Maureen Thomas, BBC & George Heufelder, MASSTC

12:40 p.m. Ampidrome - Mollie Caliri, F.R. Mahony & Associates

1:00 p.m. Biobarrier – Michael Moreau, J & R Sales & Service

1:20 p.m. Bioclere - Mark Lubbers, Aquapoint

1:40 p.m. RUCK CFT & GPC Filter - Michael McGrath, Holmes & McGrath

2:00 p.m. SanTOE - John Smith, KleanTu

2:20 p.m. SeptiTech – Lauren Usilton, J&R Sales & Service, Wastewater Treatment Services

2:40 p.m. Panel with Q & A

Importance of Operation & Maintenance for Optimization of System Performance

George Heufelder - MS, RS

Massachusetts Alternative Septic System Test Center

The Amphidrome® Treatment System

Mollie Caliri

F. R. Mahony & Associates, Inc.
273 Weymouth Street
Rockland, MA
781-982-9300

Today's Topics

The Amphidrome® Treatment System

Installing the Amphidrome® System

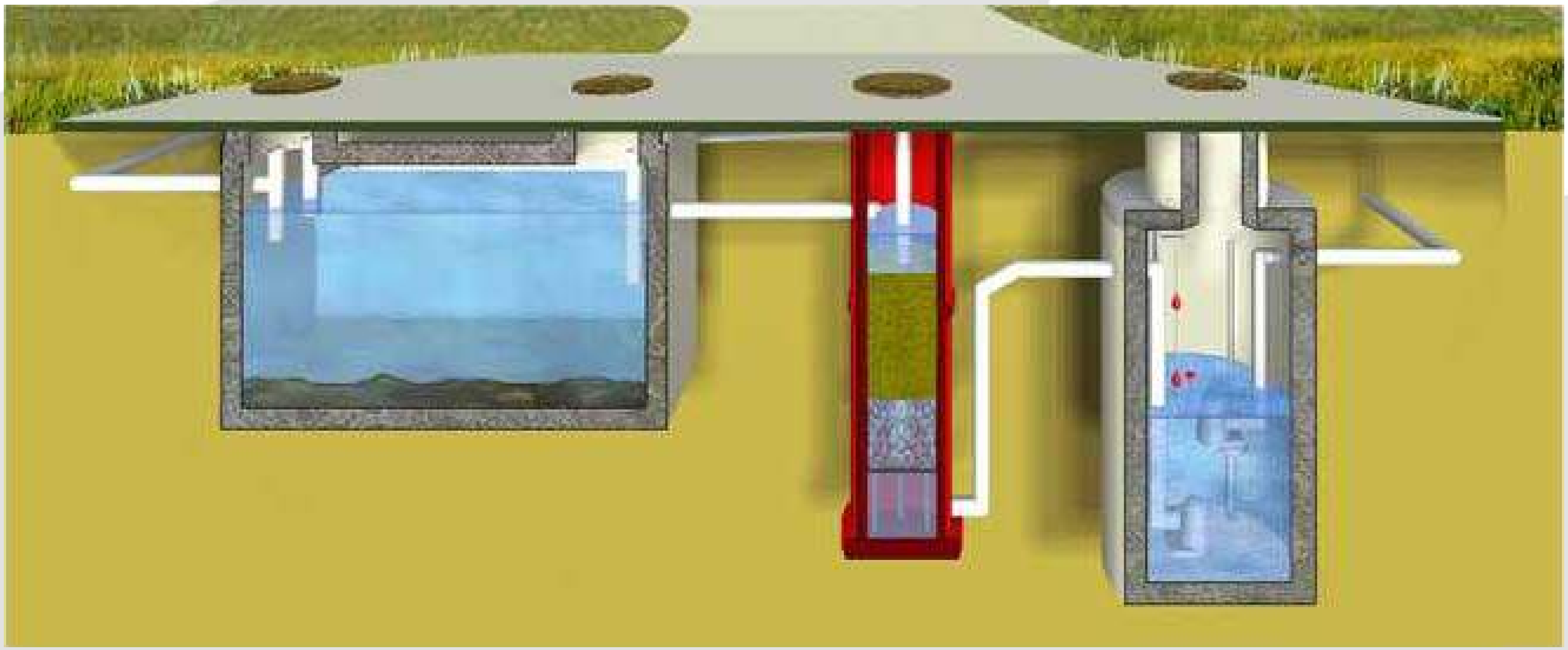
Operating the Amphidrome® System

frma

Amphidrome®

The Amphidrome System has

General, Provisional and Remedial Approval in MA



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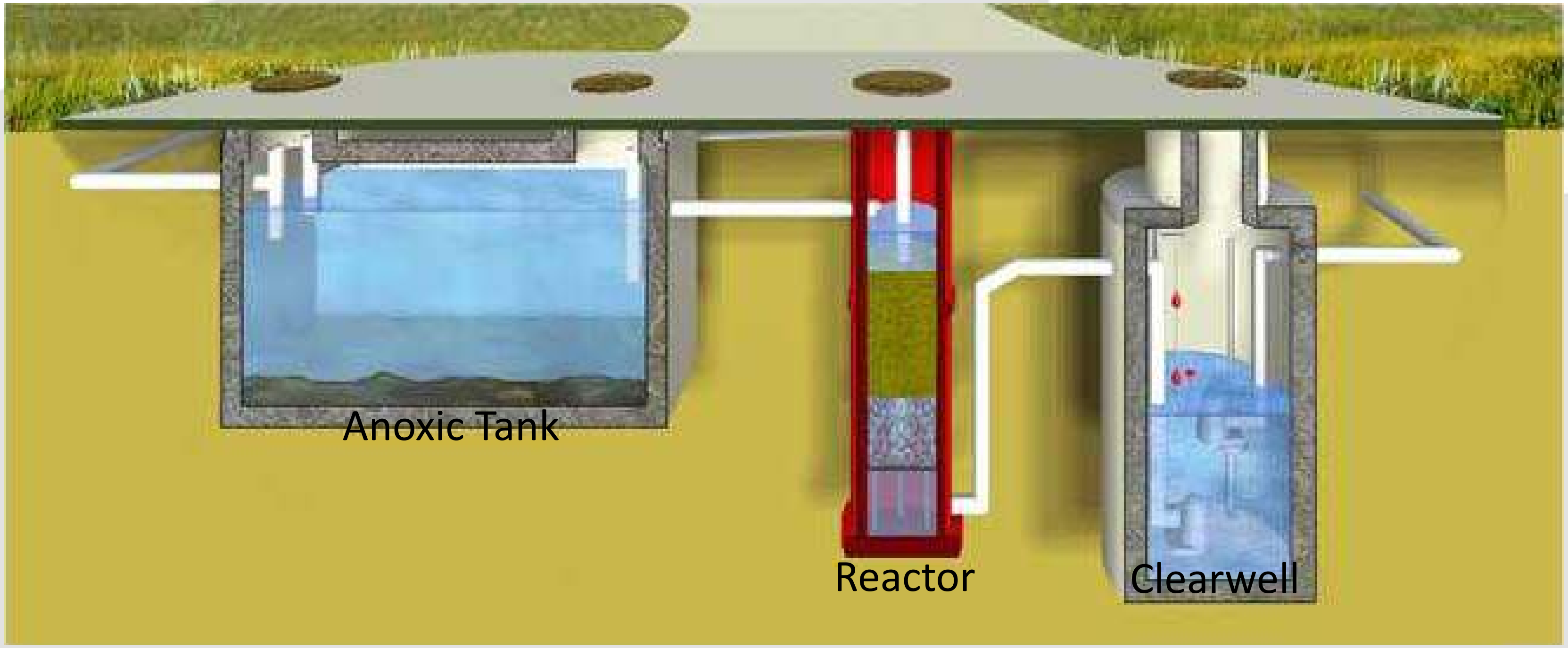
Amphidrome®

What is the Amphidrome System?

A submerged attached growth bioreactor (S.A.G.B.) operating in sequencing batch mode

BAF = Biological Active Filter



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S.A.G.B.

Media is always submerged in liquid

High specific surface area of media provides high concentration of biomass

- Media acts as a physical filter for low TSS
- Submerged media protected from cold weather effects
- Intermittent aeration provides warm air to reactor

Process Description

Biological Nutrient Removal (BNR) Process

- TSS
- BOD_5
- Total Nitrogen

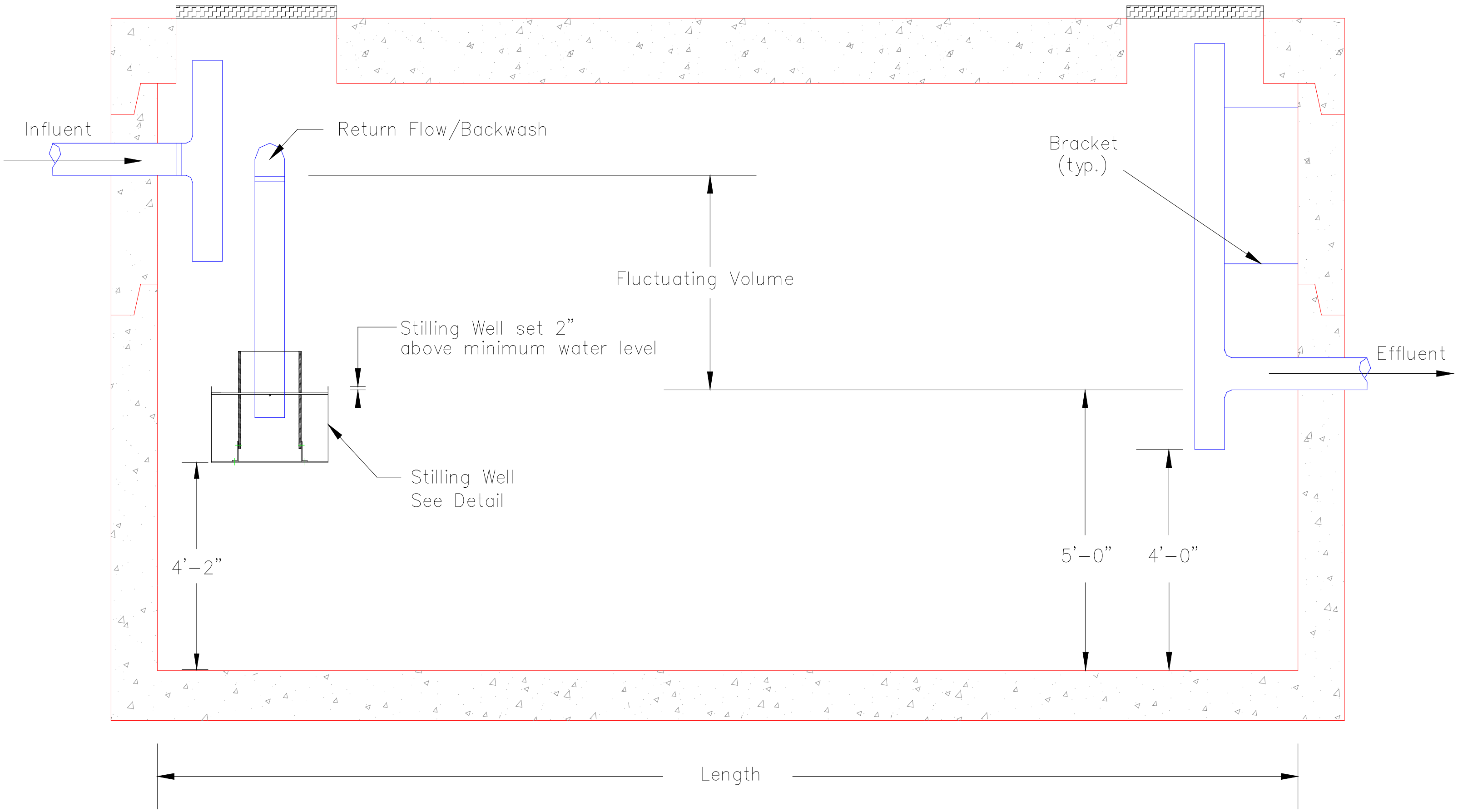
- One Reactor

Concept

Three different reactions by two different bacteria must be promoted within one reactor

- Oxidation of carbonaceous matter (Removal of BOD)
  - Aerobic conditions
- Oxidation of ammonium (Nitrification)
  - Aerobic conditions
- Oxidation of carbonaceous matter (Denitrification)
  - Anoxic conditions

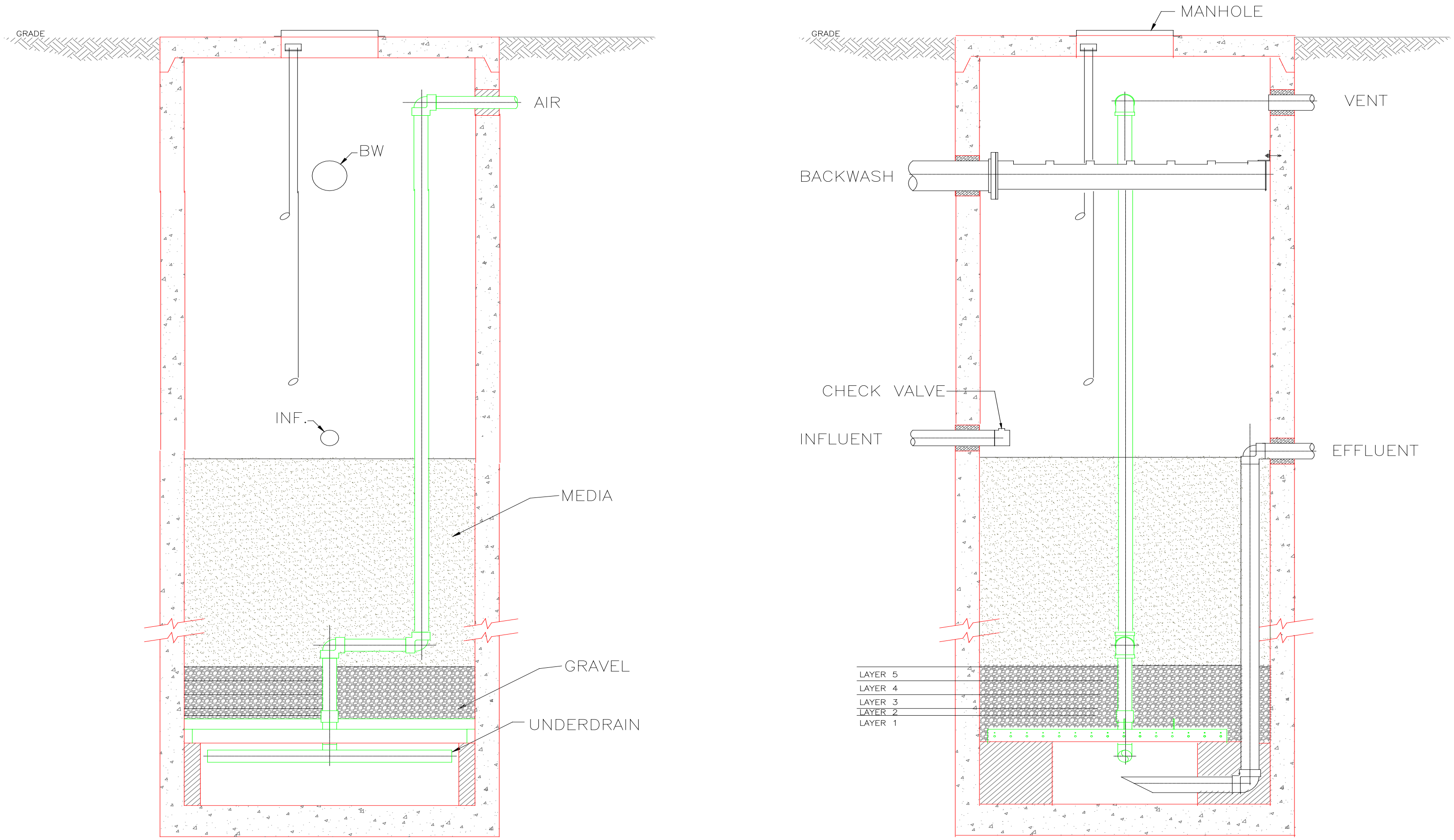
Anoxic Equalization Tank



Anoxic Equalization Tank

- Equalization Zone
- Settling
- Sludge Storage

Amphidrome Reactor



Reactor Description

Underdrain

Even distribution of air & water at the bottom of reactor

- Supports gravel
- Fits different reactor vessel sizes
- Made of either stainless steel or HDPE encased concrete blocks

Reactor Description

Media

Surface for attached growth

- Filtration of suspended solids
- Effective size 2.3mm to 3.0mm
- Spherisity 0.8 to 0.85

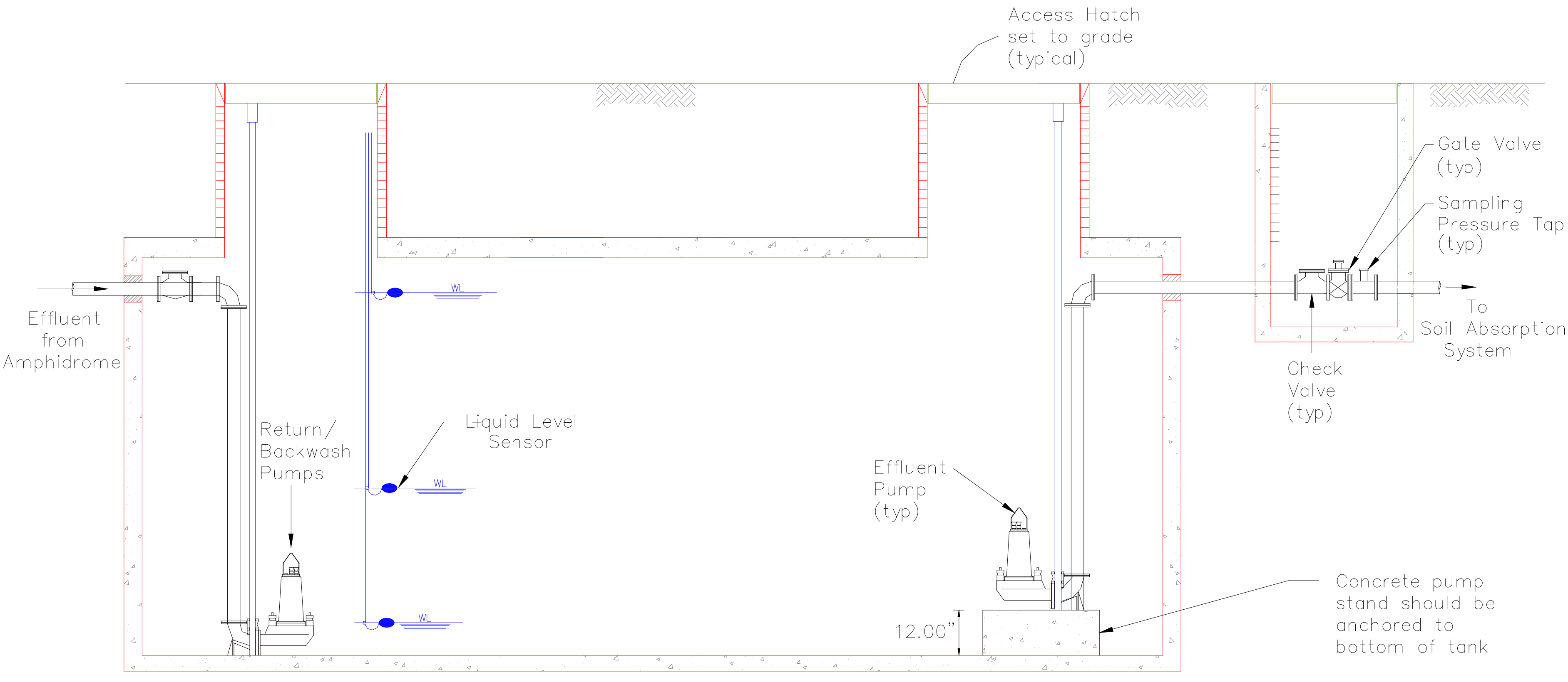
Reactor Description

Backwash Trough

Returns flow to anoxic/equalization tank

– Provided on 4 foot reactors and larger

Clear Well



Access Hatch
set to grade
(typical)
Gate Valve
(typ)
Sampling
Pressure Tap
(typ)
WL
To
Soil Absorption
System
Effluent
from
Amphidrome
Check
Valve
(typ)
Return/
Backwash
Pumps
Liquid Level
Sensor
Effluent
Pump
(typ)
Concrete pump
stand should be
anchored to
bottom of tank
12.00"

Clear Well

Used to store effluent for backwash of reactor

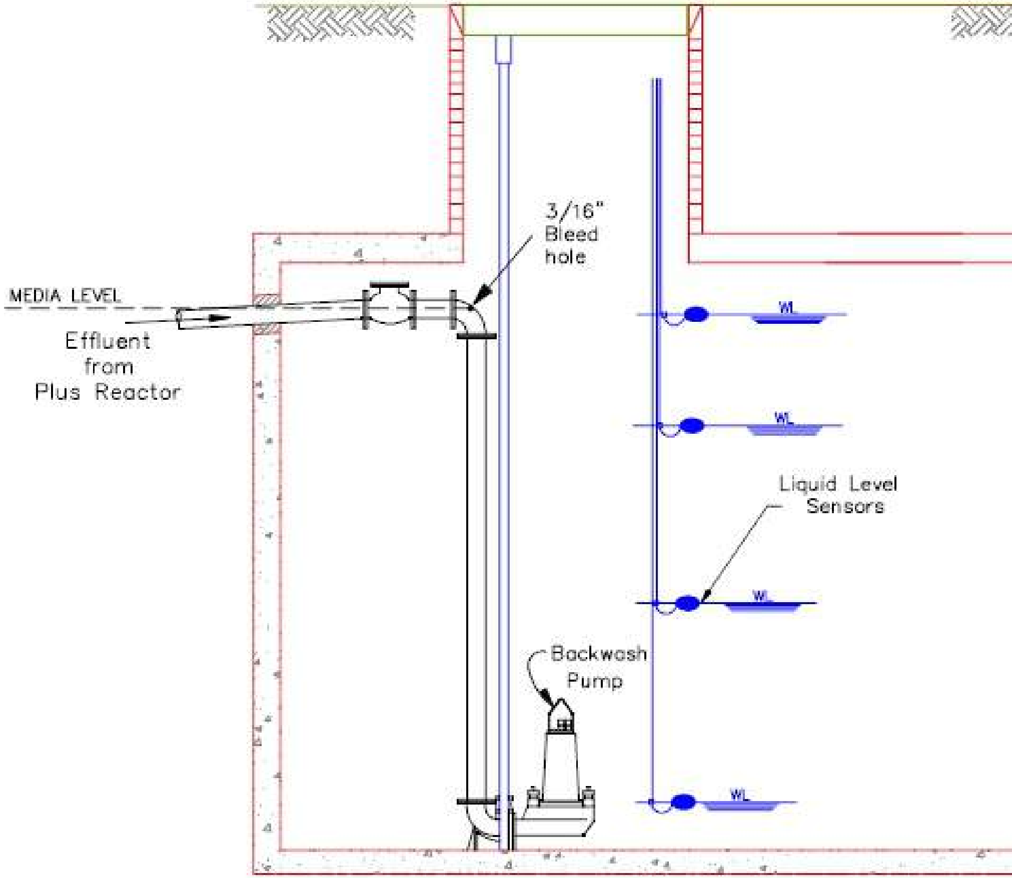
Used to store discharge effluent

- Floats used to control a portion of blower run time

Clear well

Pipe inlet to clear well

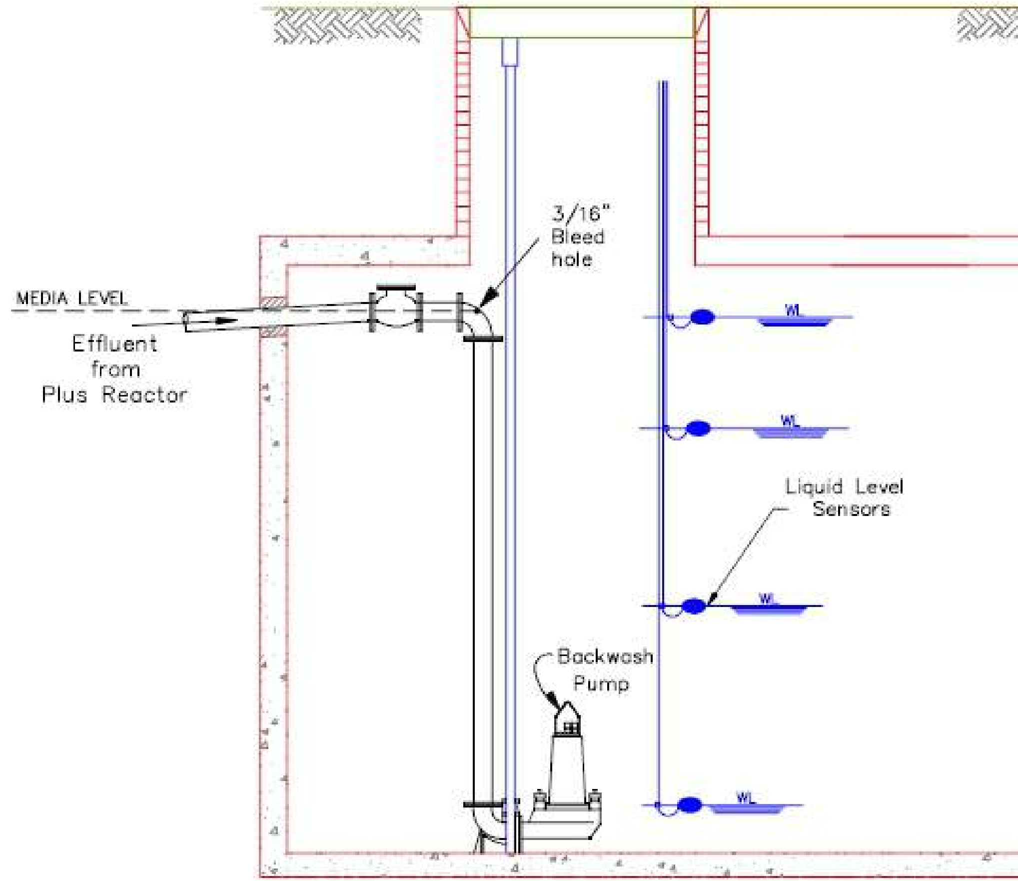
- Sloped upward into clear well to prevent air entrapment. (No sags)
- Provide air bleed to release air and to prevent siphoning of reactor.



Clear well

Return & Backwash Pump Lines

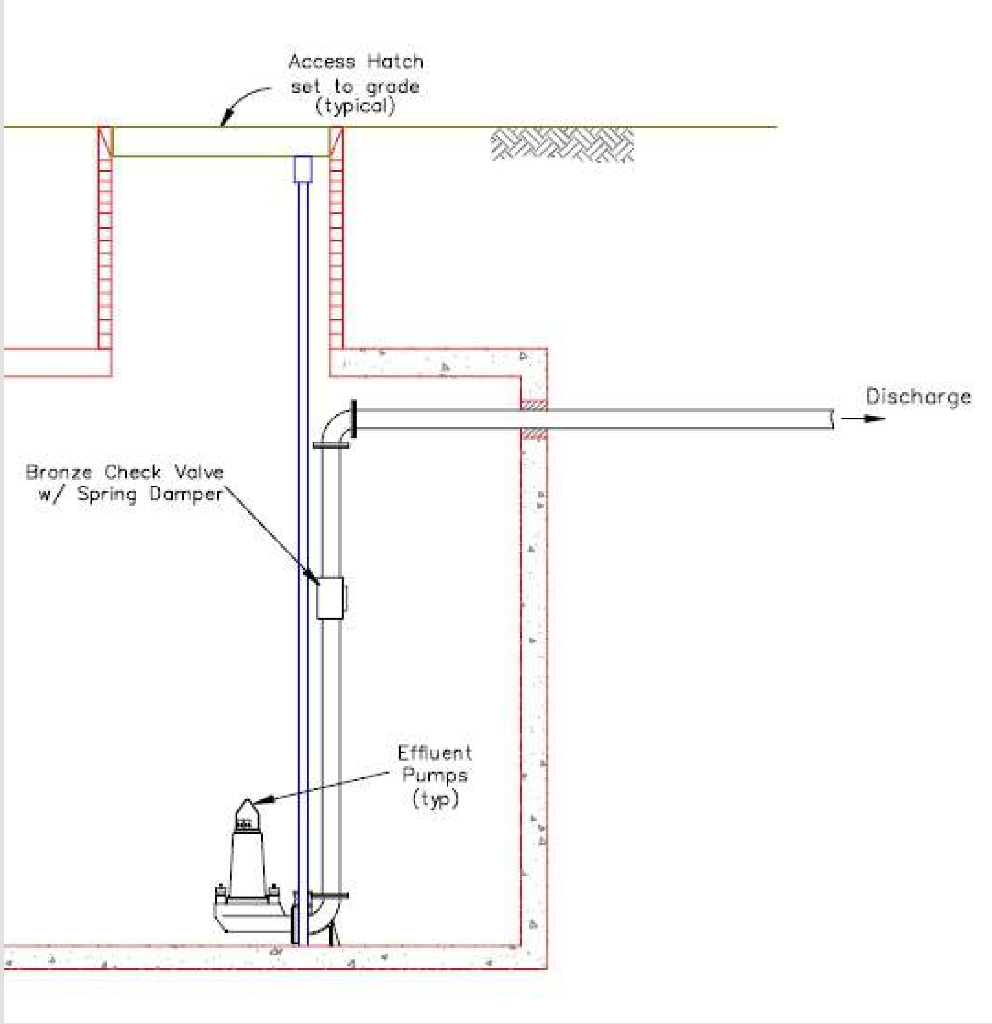
- Return pump has NO check valve to allow forward and reverse flow to and from reactor.
- Backwash has check valve and operates with return pump during backwashes.



Clear well

Discharge Pumps

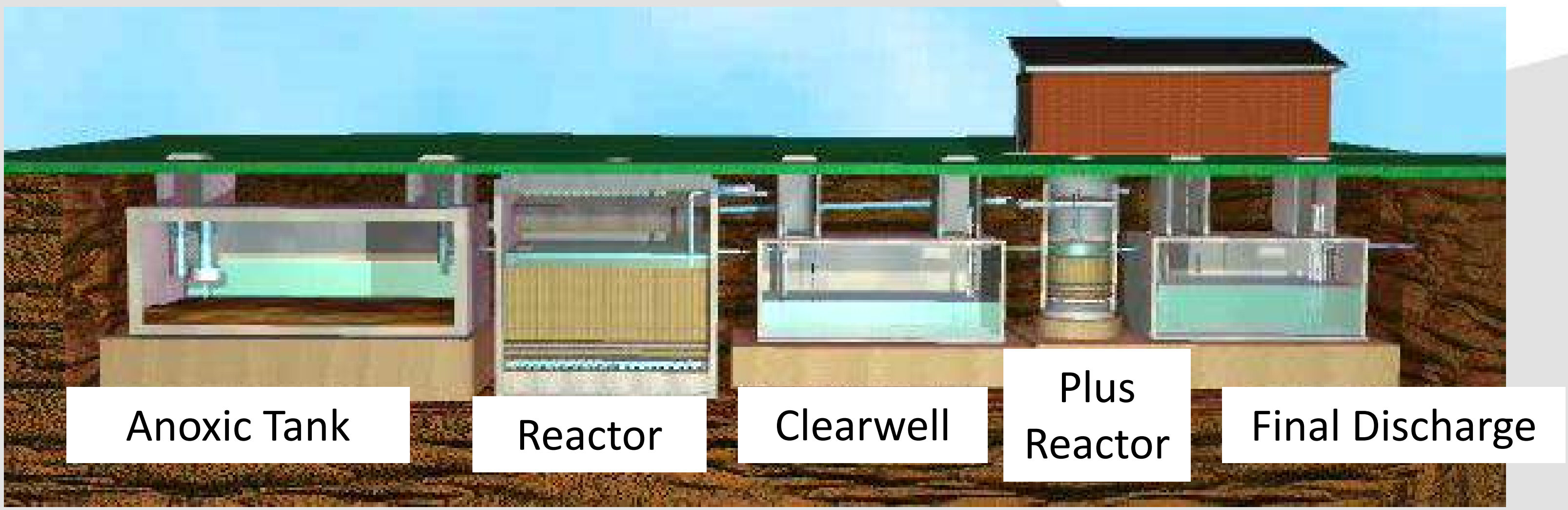
- Each pump is set up with inline check valves like a typical lift station configuration.



Amphidrome Plus

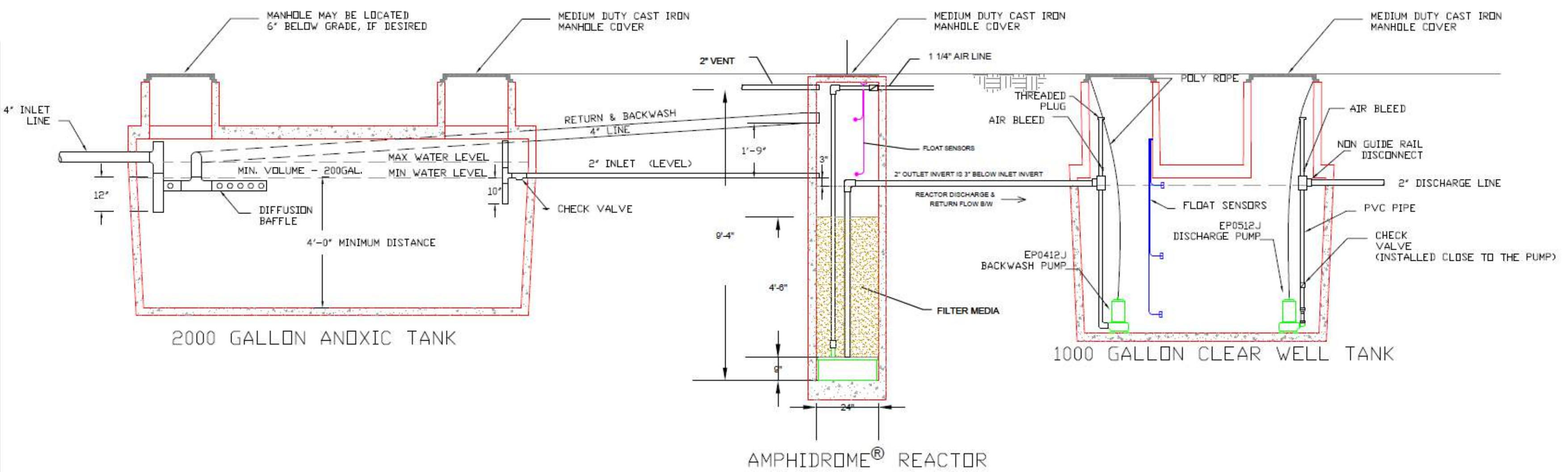
- Used to achieve lower nitrogen discharge levels.

-Takes nitrified wastewater stored in the clear well and pumps it into the Amphidrome® Plus filter with an additional carbon source.



Single Family Amphidrome

- Small single family systems are scaled down versions of our larger systems utilizing smaller equipment.



Installation

Tank construction

- The system is intended to be below grade.
  - Constant temperature for better process.
  - Less issues of visibility, noise, odors.
  - Better use of the land.
- Designed to use precast tanks where possible, or formed and poured in place concrete.
- Goal is to allow construction using standard tanks available to installers in many regions.
  - Precast tanks may require minor modifications to typical inlet and discharge locations.
  - Additional access hatches.

Installation

- Each system is constructed on site to meet the specific design criteria and civil engineering requirements of the property.
- Design plans are reviewed and site inspections are performed at key intervals. Typically system include:
  - Design review
  - Submittals
  - Pre-construction meeting
  - Reactor(s) bubble testing prior to installing media
  - Clear water startup
    - Controls programming and shake down
  - Process startup support.


U-Block Underdrain (under construction)
15,000 to 200,000 gpd

f

Air –Pattern or “bubble test”

Large system prior to media placement.

Round Underdrain (under construction)

Air –Pattern or “bubble test” Prior to media placement.


Round Reactor Completed

Control Building

- Options are variable depending on the site requirements.
- Buildings can be designed to fit the landscape and surrounding building styles.
- These buildings house the following:
  - Control panel
    - Flow recording equipment
    - Alarm monitoring
  - Blowers
  - Chemical feed systems (when required)
  - Disinfection equipment (when required)
  - Lab sink and lavatory (when provided)

Start Up

- Clear water start up and final commissioning.
  - State Start Up on Larger Plants >10,000 gpd
  - Local BOH on smaller plants <10,000 gpd
  - Other agencies as may be required, Cape Cod Commission for example.

water treatment and pollution control equipment

Sampling

- Where do you sample and what do you test for?

Field Test Equipment

- NH_3
- NO^-_2/NO^-_3
- Alkalinity
- PH
- Dissolved Oxygen
- Sludge Depth

Raw Influent

- Clean sample from Lift station or inlet pipe.
  - BOD
  - TSS
  - TKN
  - pH

Anoxic Tank

- Observe for heavy solids;
  - floating or in sludge
- Measure sludge. Maintain blanket at least 2 feet beneath the discharge pipe.
  - D.O Influent end
  - D.O, Effluent end
  - Alkalinity
  - Waste sludge periodically to maintain small inventory as noted above.

Clear Well

- Check for residual D.O.
  – Remember Anoxic Conditions?
- Samples
  – Alkalinity
  – pH
  – Ammonia (NH_3). If < 1mg/l test for TN
  – TN

Final Effluent Pump Chamber

- Check for residual D.O.
- Samples
  - – Alkalinity
    - (Should be 50-100 mg/l)
  - – pH
  - – TN
  - – Nitrate (NO3)

frma

Questions?

f.r. mahony & associates inc.

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273 Weymouth Street • Rockland MA 02370

Phone: 781-982-9300 FAX: 781-982-1056

water supply and pollution control equipment

www.amphidrome.com

J&R Sales and Service, Inc.

Over 20 years in Onsite Wastewater Solutions.

BIO MICROBICS®

BETTER WATER. BETTER WORLD.®

SeptiTech®

Solving Wastewater Problems with Technology

Wastewater Pretreatment Systems

GEOFLOW SUBSURFACE DRIP

Subsurface Wastewater Disposal

About Us…

- J&R established in 1990
- Over 20 years experience in the wastewater treatment market
- We began Piloting in Massachusetts with FAST® and GEOFLOW in 1998 at the Alternative Septic System Test Center
- First FAST® single home installation in 1995; first GEOFLOW in 2000
- BioMicrobics acquired SeptiTech in 2013
- BioBarrier Approval in 2012
- Pioneers in the onsite market throughout New England
- Over 3,000 systems installed – primarily in Massachusetts and Rhode Island
- We maintain greater than 80% of these installations through our service division, Wastewater Treatment Services

Our Products…

- **GEOFLOW Subsurface Drip Dispersal**
  - The first drip system to be approved in New England
  - Superior quality – made in the USA
  - Affordable, alternative option
- **BioMicrobics FAST®**
  - FAST wastewater treatment system
  - Over 3,000 systems installed
- **BioMicrobics BioBarrier**
  - Membrane technology for the onsite market
- **BioMicrobics STARR**
  - Recently acquired SeptiTech – for a trickling filter treatment option

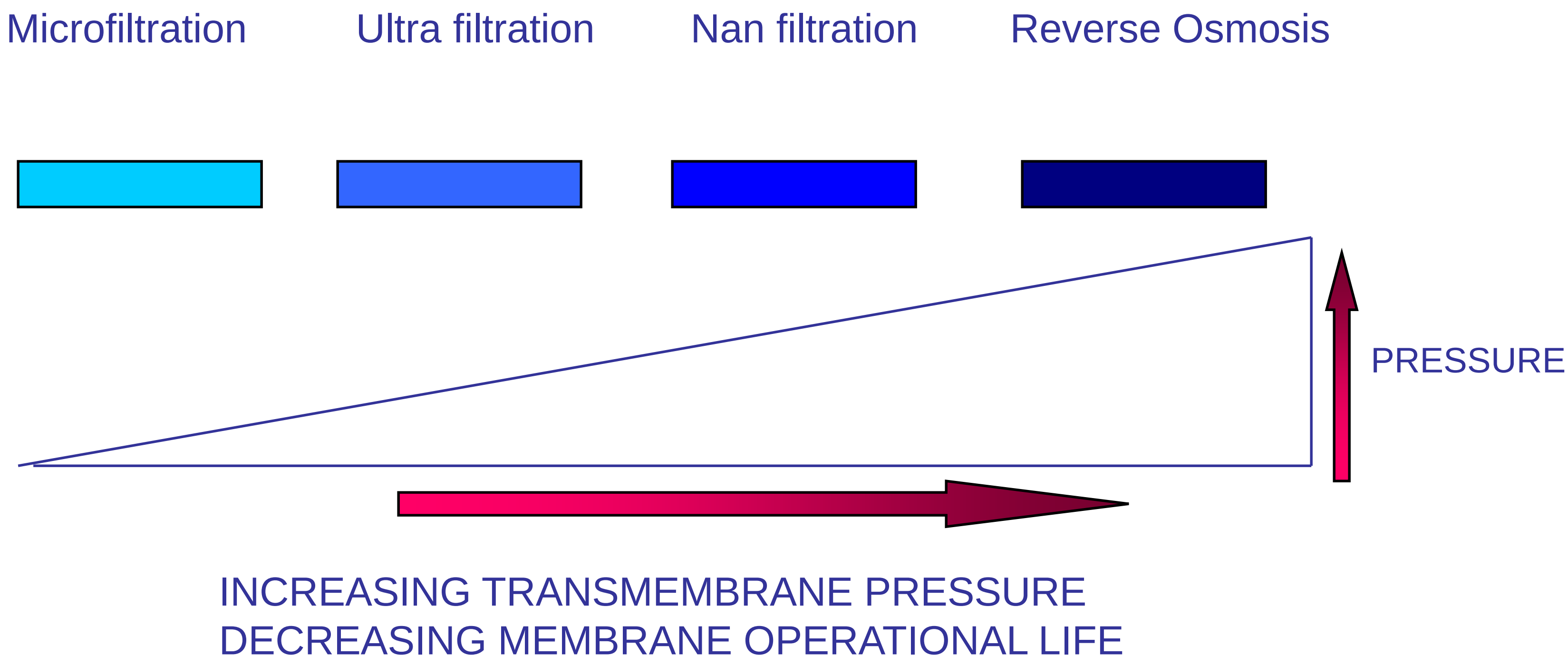
BioBarrier®

Membrane BioReactors (MBR)

Membranes: What They Are

- Membrane are thin barriers or films of material that allow certain substances to pass.
- Synthetic membranes are usually 100 to 500 microns thick.
- Membranes that allow only some substrates to pass through them are called *semi permeable* membranes.
- Useful membranes can be made from polymers, ceramics, metals, or porous materials impregnated with liquid or gelatin-like substances.

Membrane Spectrum

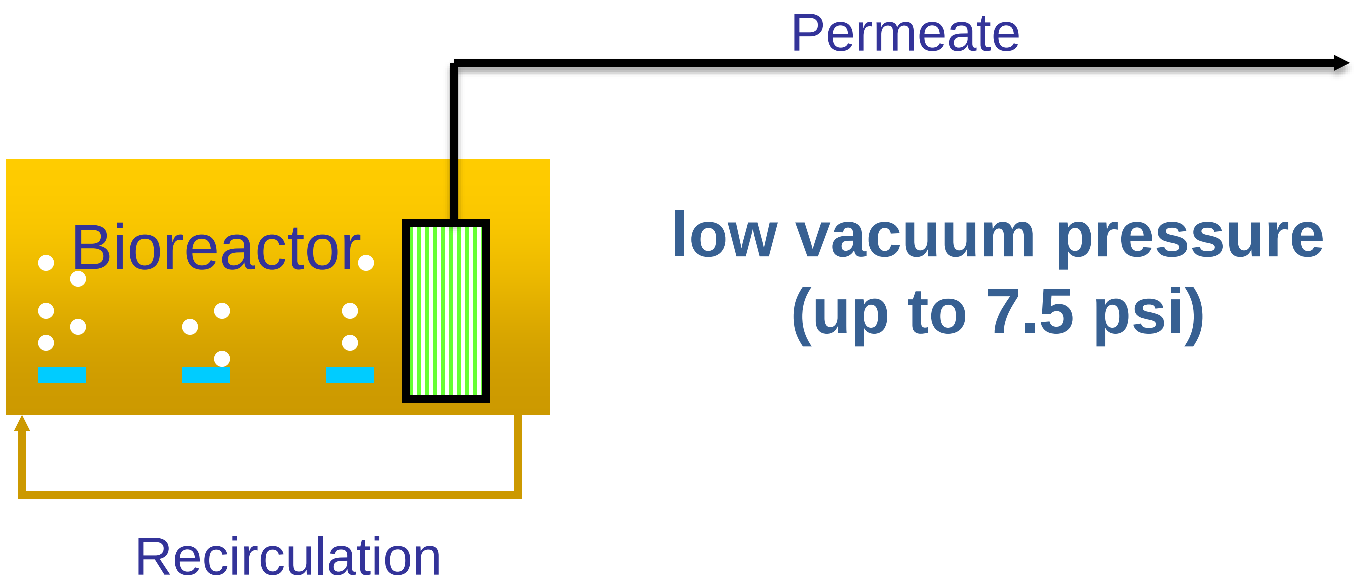


Filtration in the 0.1 micron range is the most widely used membrane type in wastewater treatment applications.

Immersed Membrane MBR

High surface area – reduced energy consumption

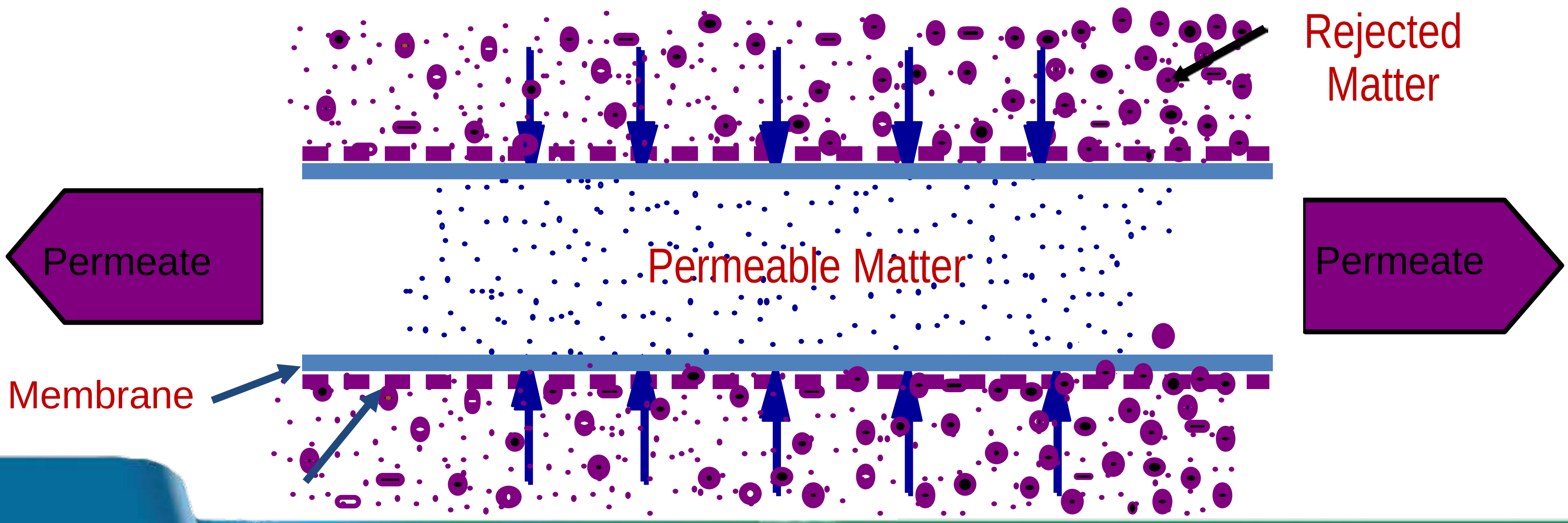
Commercialized 1990's



low vacuum pressure (up to 7.5 psi)

Immersed Membrane

Membrane submerged directly in process, outside to inside flow under vacuum

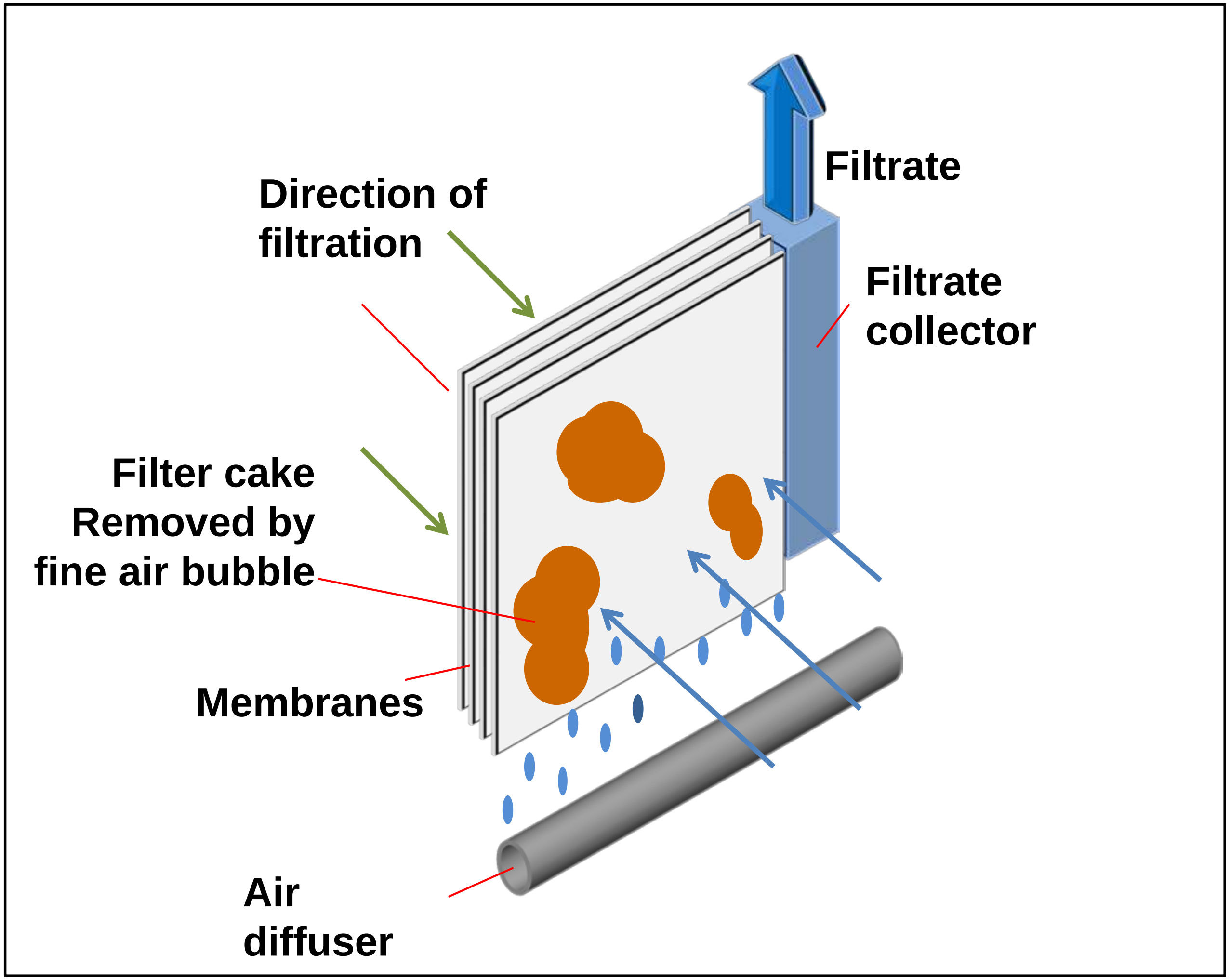


Types of Immersed Membranes

Hollow Fiber

Flat Sheet

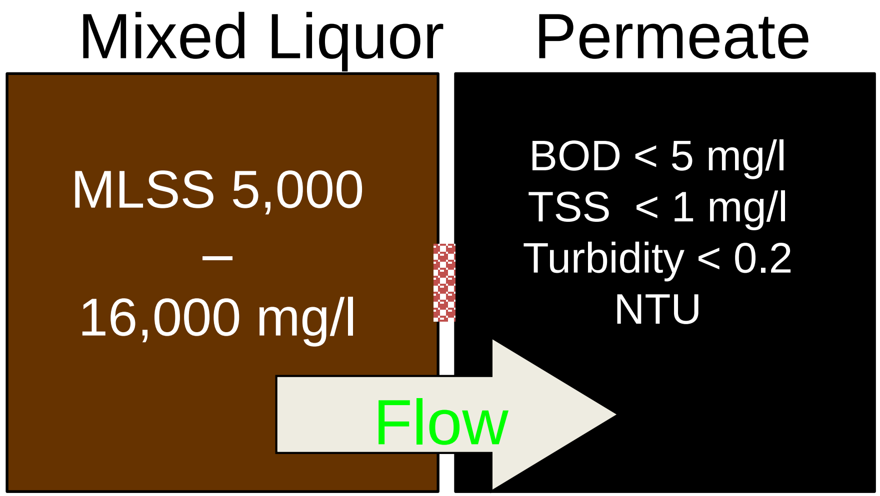
Filter Operation



BioBarrier®

- **The Highest, Consistent Effluent Quality**
  - BOD $\leq$ 5 mg/L
  - TSS $\leq$ 2 mg/L
  - Turbidity $\leq$ 0.5 NTU
  - Fecal coli form $\leq$ 200 CFU/100 mL (without disinfection)
  - Significant nutrient removal capability
  - Virus removal
  - Reduction of pharmaceutical byproducts

Why MBR?


Mixed Liquor
Permeate
MLSS 5,000
–
16,000 mg/l
BOD < 5 mg/l
TSS < 1 mg/l
Turbidity < 0.2
NTU
Flow

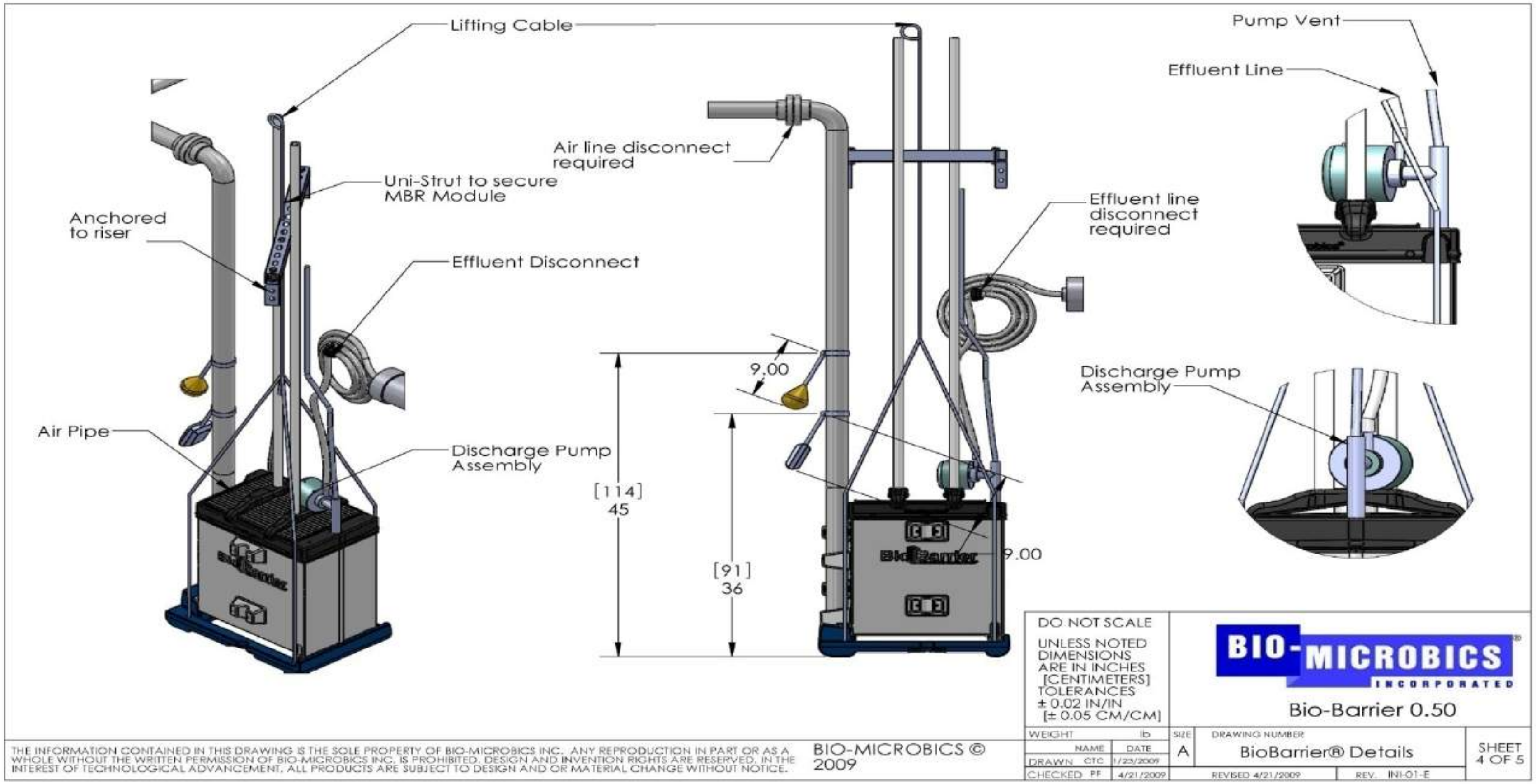
Basic Components

- SaniTEE® Screen
- Aeration Tank with Anoxic Zone
- Membrane Module with Aeration Grid
- Blower
- Permeate Pump
- Control
- Level Floats
- Supplemental Aeration for HSMBR

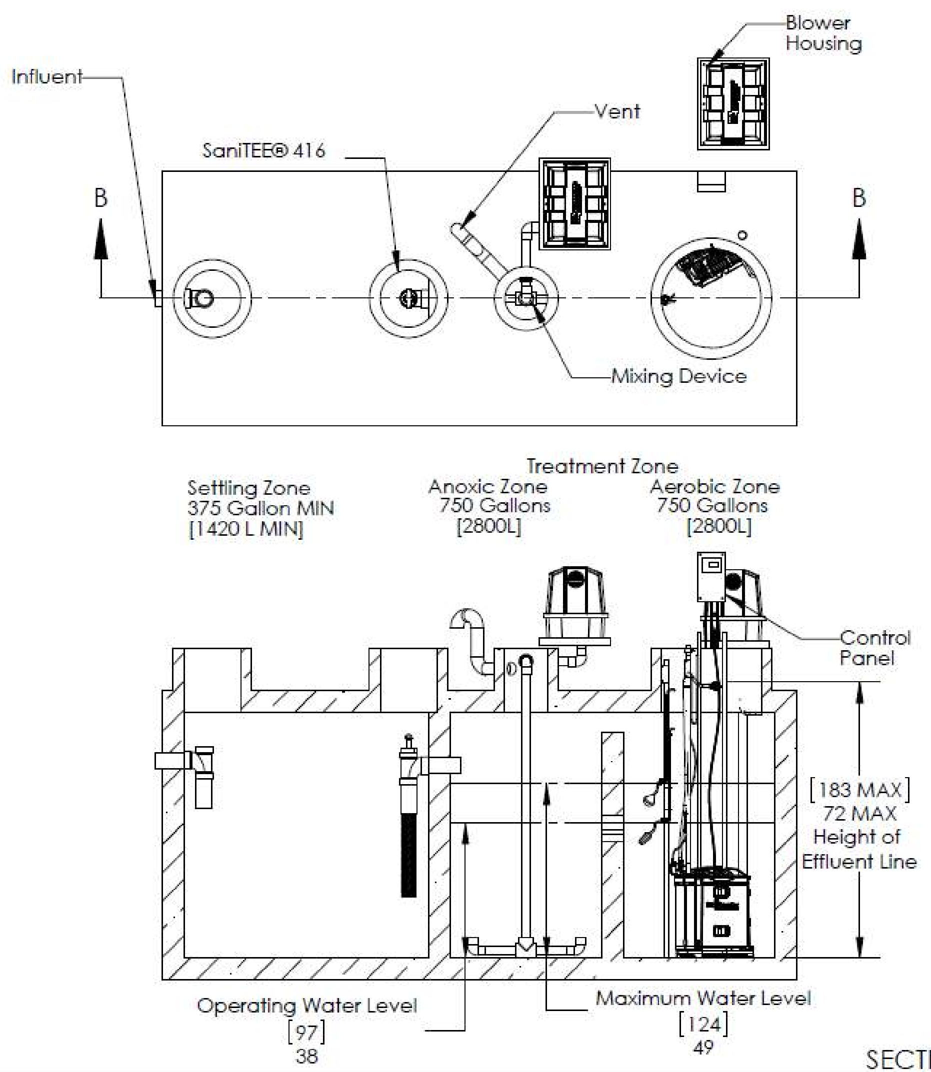
Residential BioBarrier Systems

Model	Bedrooms	Tank Requirements (min)
BioBarrier 0.5	1-4 (up to 500 gallons)	375/750/750 Gallons
BioBarrier 1.0	5-9 (up to 1,000 gallons)	700/1,500/1,500 Gallons
BioBarrier 1.5	10-14 (up to 1,500 gallons)	Sized for each application

BioBarrier® 0.5



BioBarrier® 0.5-N



SECTION B-B

NOTES

1. Blower piping to BioBarrier® MBR® may not exceed 40 FT [12 m] total length and use 4 elbows maximum per train. For distances greater than 40 FT [12 m] - consult factory. Blowers must be located above flood/standing water levels on concrete bases 26" X 20" X2" [65 X 50 X 5cm] minimum.
2. Run vent(s) to desired location above finish grade and cover opening(s) with vent grate(s) w/at least 12 sq in. [77 sq. cm] of total open surface area. Secure with stainless steel screws. Vent piping must not allow excess moisture build up or back pressure.
3. All appurtenances to BioBarrier® (e.g. tank pump outs, etc.) must conform to all country, state, province, and local plumbing and electrical codes.
4. The BioBarrier® MBR® control systems are provided by Bio-Microbics, Inc.
5. The primary compartments may be a separate tank.
6. The baffle separating the settling and the treatment chambers shall be sealed to the top of the tank, as shown on the drawing. Ventilation for the settling zone shall be provided for in the same manner as a traditional septic tank.
7. All inspection, viewing, access, and pump out ports must be secured, to prevent accidental or unauthorized access.
8. Tank, anchors, piping, conduit, blower housing pads and vents are provided by others.
9. All piping and ancillary equipment installed after BioBarrier® MBR® , must not impede or restrict filtrate pump.
10. BioBarrier® MBR® assemblies must be secured to the tanks to prevent movement or floatation(see Installation Instructions for details).
11. If less than any of the specified minimums is considered necessary, consult factory for guidance.
12. For enhanced nitrogen removal.
    - Anoxic Zone
        - Baffle wall should evenly distribute the volume in the Treatment Zone between the anoxic and aerobic zone.
        - Mixing device is required.

DO NOT SCALE

UNLESS NOTED DIMENSIONS ARE IN INCHES [CENTIMETERS] TOLERANCES ± 0.02 IN/IN [± 0.05 CM/CM]

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MBR 0.5

WEIGHT	lb	SIZE	DRAWING NUMBER	SHEET
	NAME / DATE	A	MBR® 0.5-N	2 OF 6
DRAWN	CTC / 11/25/2009			
CHECKED	PF / 8/15/2014		REVISED 8/15/2014 — REV. INI-04-G	

500 gallon BioBarrier® modules

Double-Stacked BioBarrier®

Commercial BioBarrier Systems

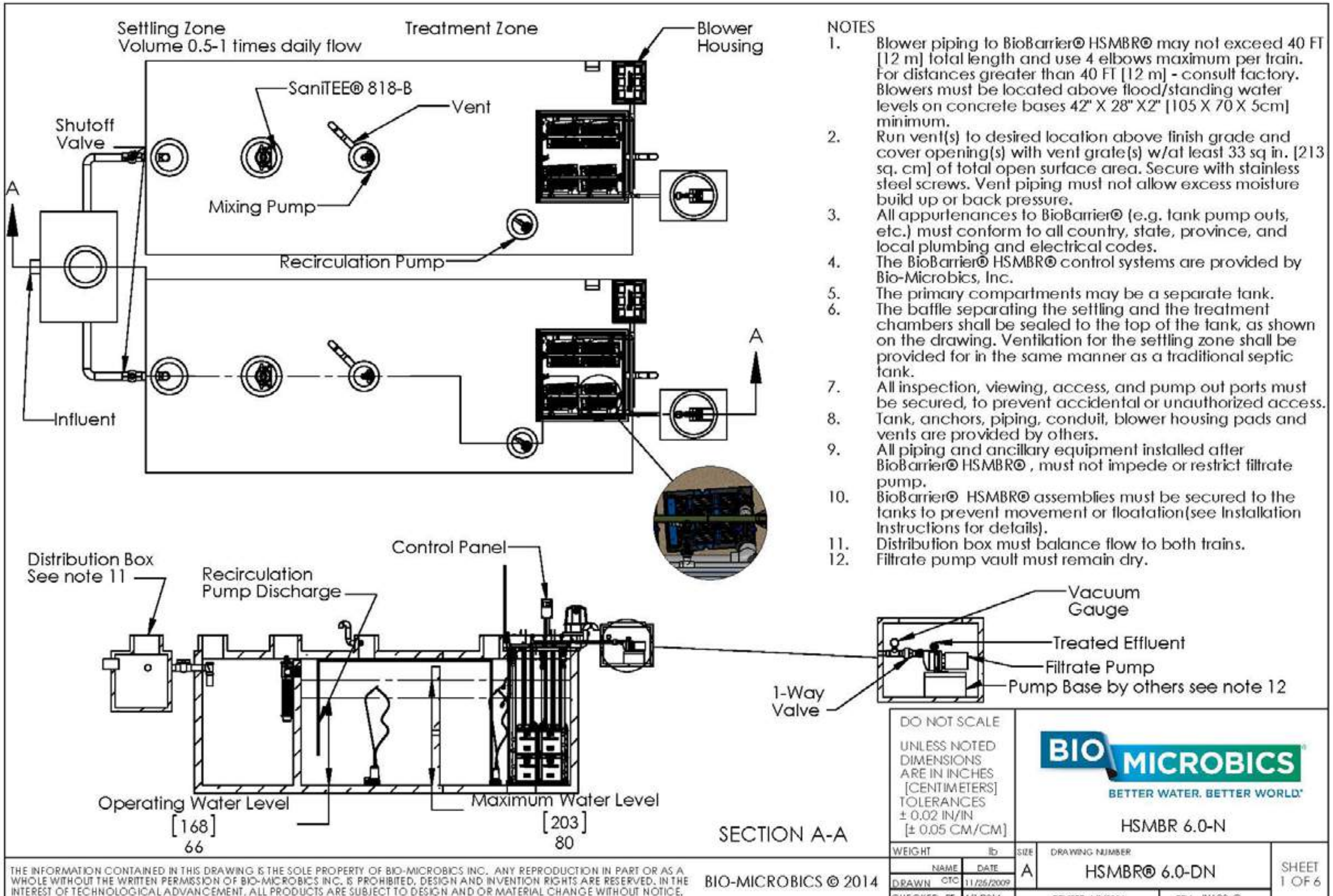
Model	Hydraulic Flows	Tank Requirements (min)
HSMBR 3.0	Up to 3,000 gpd	Sized for each application
HSMBR 4.5	Up to 4,500 gpd	Sized for each application
HSMBR 6.0	Up to 6,000 gpd	Sized for each application
HSMBR 9.0	Up to 9,000 gpd	Sized for each application

Sizing for Commercial Applications

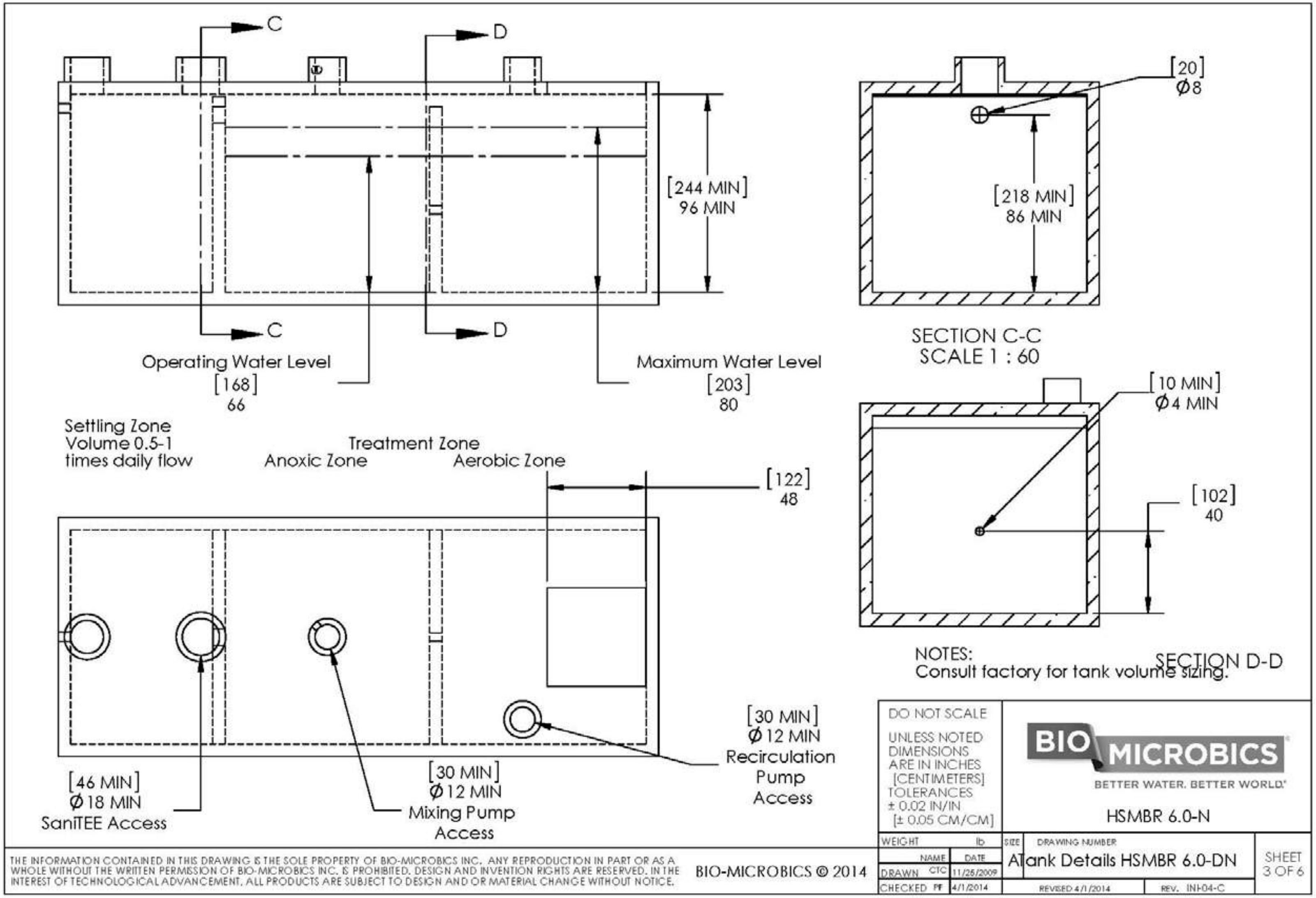
- Sized for both flow and strength
  - Hydraulic flows of the unit determine run time for membranes; typically sized to allow for not more than 12 hrs. of run time per day
- Duel or single train
  - Smaller flows allow for a single train option; a duel train option is suggested to allow for redundancy and to allow maintenance time
- BioRobic for high bod applications
  - Placed in the same compartment as the membrane cassettes
- Recycle and mixing built into the treatment process to allow for modification during system operation
- Chemical feeds often used for augmentation of the wastewater

HSMBR 6.0DN

Tank size varies based on application – anywhere from 10,000-18,000 total tankage required



HSMBR 6.0DN


C
D
[20]
Ø8
[244 MIN]
96 MIN
[218 MIN]
86 MIN
SECTION C-C
SCALE 1 : 60
Operating Water Level
[168]
66
Maximum Water Level
[203]
80
[10 MIN]
Ø4 MIN
Settling Zone
Volume 0.5-1
times daily flow
Treatment Zone
Anoxic Zone
Aerobic Zone
[122]
48
[102]
40
NOTES:
Consult factory for tank volume sizing.
SECTION D-D
[30 MIN]
Ø12 MIN
Recirculation
Pump
Access
[46 MIN]
Ø18 MIN
SaniTEE Access
[30 MIN]
Ø12 MIN
Mixing Pump
Access
DO NOT SCALE
UNLESS NOTED
DIMENSIONS
ARE IN INCHES
[CENTIMETERS]
TOLERANCES
± 0.02 IN/IN
[± 0.05 CM/CM]
BIO MICROBICS
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HSMBR 6.0-N
WEIGHT lb
NAME DATE
DRAWN CTC 11/25/2009
CHECKED PF 4/1/2014
SIZE A
DRAWING NUMBER
Tank Details HSMBR 6.0-DN
SHEET
3 OF 6
REVISED 4/1/2014
REV. INH04-C
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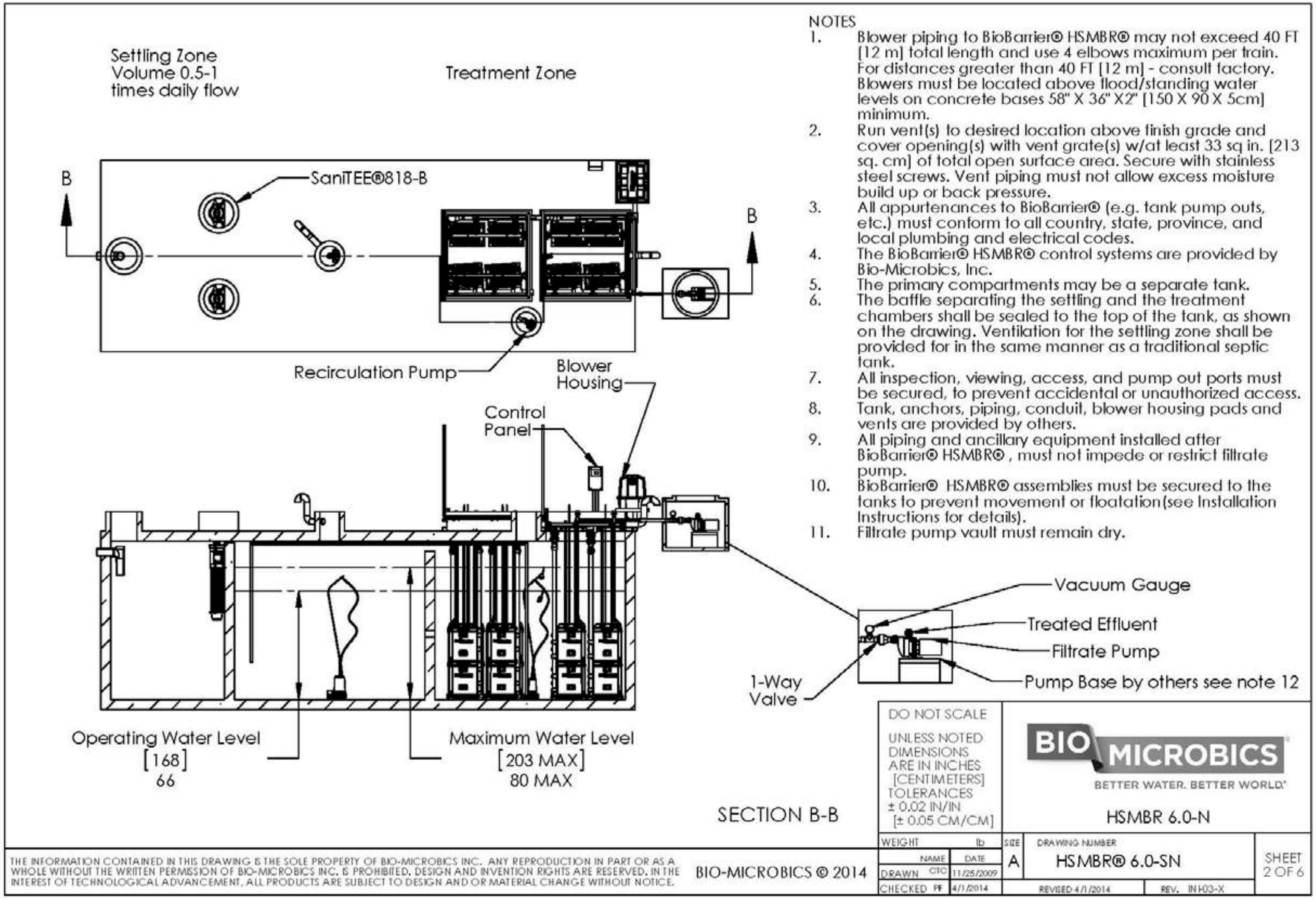
HSMBR 6.0DN


Settling Zone
Volume 0.5-1
times daily flow
Treatment Zone
SaniTEE®818-B
B
B
Recirculation Pump
Blower
Housing
Control
Panel
Operating Water Level
[168]
66
Maximum Water Level
[203 MAX]
80 MAX
SECTION B-B
1-Way
Valve
Vacuum Gauge
Treated Effluent
Filtrate Pump
Pump Base by others see note 12
NOTES
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9. All piping and ancillary equipment installed after BioBarrier® HSMBR®, must not impede or restrict filtrate pump.
10. BioBarrier® HSMBR® assemblies must be secured to the tanks to prevent movement or floatation (see Installation Instructions for details).
11. Filtrate pump vault must remain dry.
DO NOT SCALE
UNLESS NOTED DIMENSIONS ARE IN INCHES [CENTIMETERS] TOLERANCES ± 0.02 IN/IN [± 0.05 CM/CM]
BIO MICROBICS
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HSMBR 6.0-N
WEIGHT lb
NAME DATE
DRAWN CTC 11/25/2009
CHECKED PF 4/1/2014
SIZE A
DRAWING NUMBER
HSMBR® 6.0-SN
SHEET 2 OF 6
REVISED 4/1/2014
REV. INH03-X
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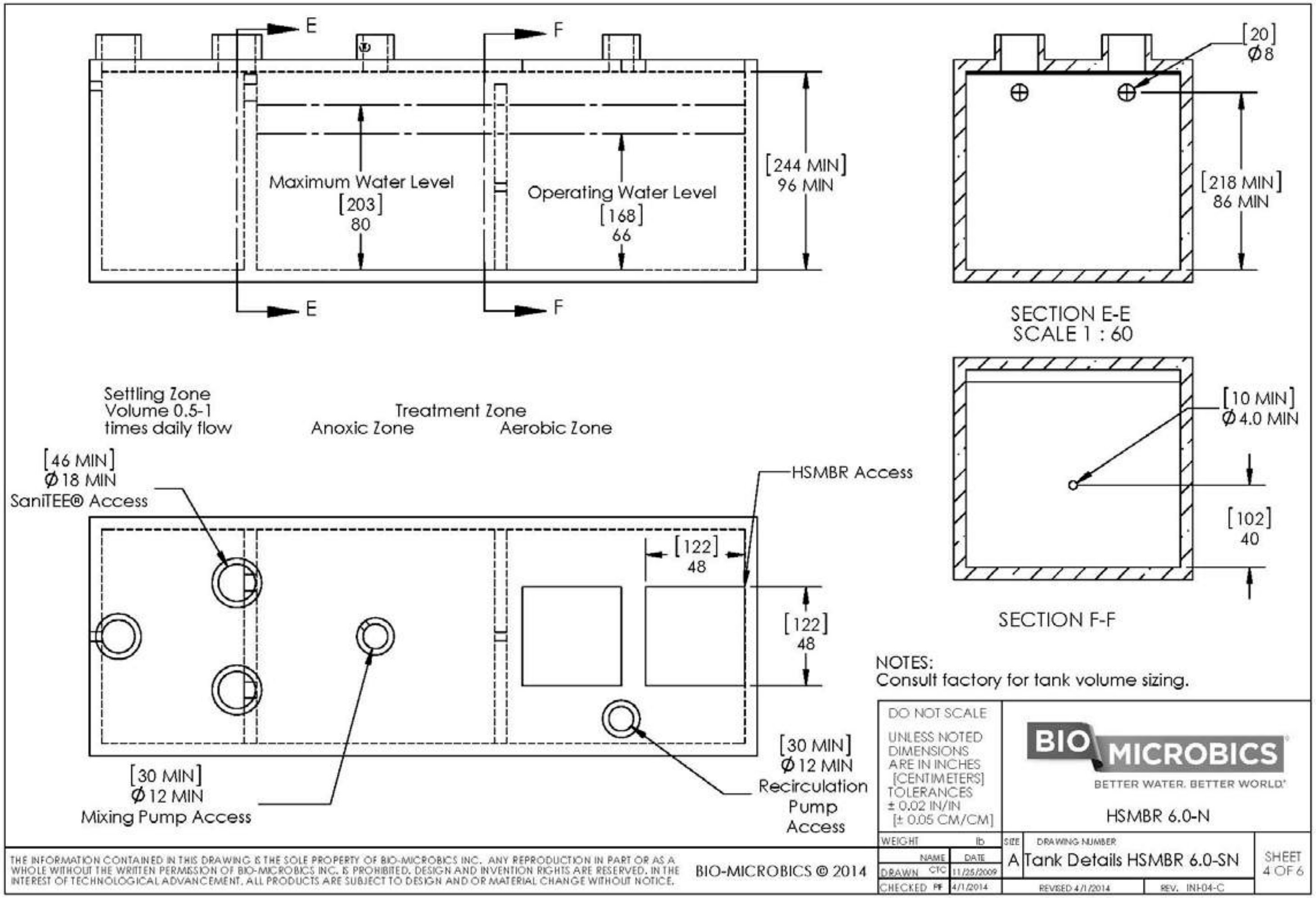
HSMBR 6.0DN



Maximum Water Level
[203]
80
Operating Water Level
[168]
66
[244 MIN]
96 MIN
E
F
[20]
Ø 8
[218 MIN]
86 MIN
SECTION E-E
SCALE 1 : 60
[10 MIN]
Ø 4.0 MIN
[102]
40
SECTION F-F
Settling Zone
Volume 0.5-1
times daily flow
Treatment Zone
Anoxic Zone
Aerobic Zone
[46 MIN]
Ø 18 MIN
SaniTEE® Access
HSMBR Access
[122]
48
[122]
48
[30 MIN]
Ø 12 MIN
Mixing Pump Access
[30 MIN]
Ø 12 MIN
Recirculation
Pump
Access
NOTES:
Consult factory for tank volume sizing.
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SHEET 4 OF 6
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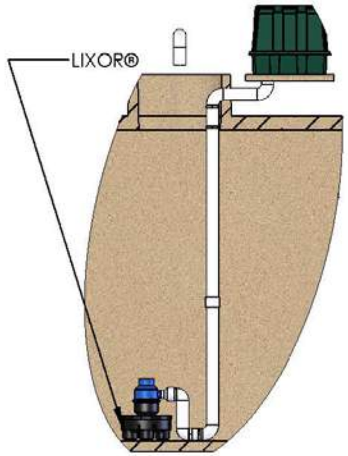
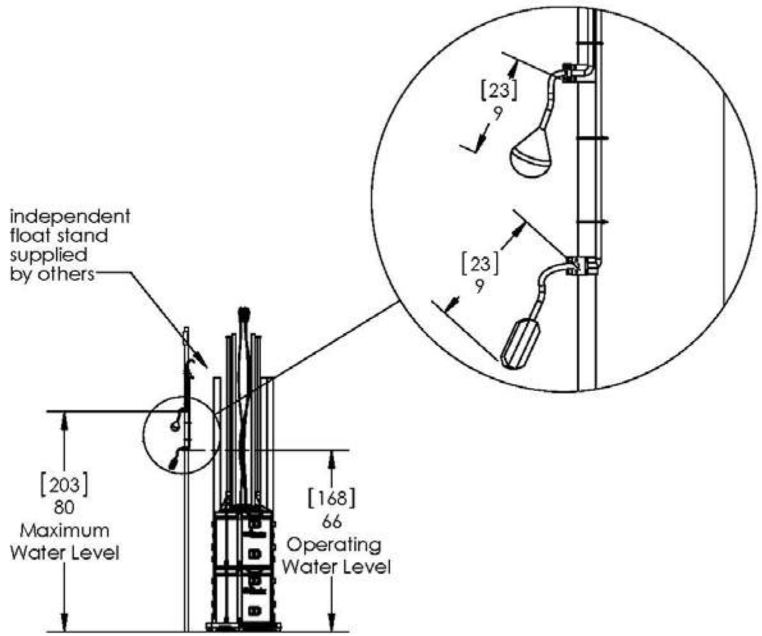
HSMBR 6.0DN



Supplemental Air
see note 4,5, & 6



Notes:
1. Filtrate Pump must be secured in a dry vault and not be exposed to freezing temperatures.
2. Float stand should be located away from the MBR modules within the treatment zone to prevent float chatter.
3. Utilize SS lifting cable to remove the MBR module.
4. Supplemental aeration with LIXOR® will be required for wastewater with higher than 300mg/L BOD.
5. See LIXOR® Drawings for more details.
6. Provide additional ventilation as required per LIXOR specifications.

DO NOT SCALE
UNLESS NOTED DIMENSIONS ARE IN INCHES [CENTIMETERS] TOLERANCES ± 0.02 IN/IN [± 0.05 CM/CM]

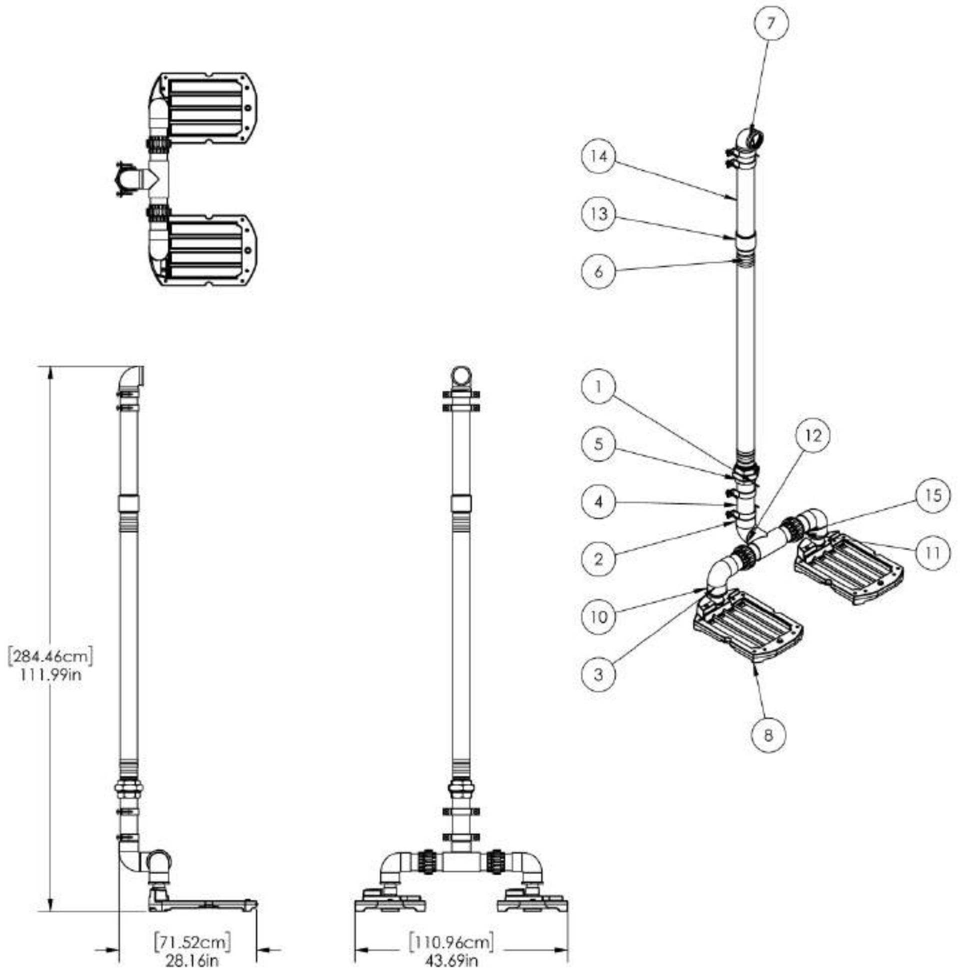
BIO MICROBICS
BETTER WATER. BETTER WORLD.

HSMBR 6.0-N

WEIGHT	lb	SIZE	DRAWING NUMBER	SHEET
NAME	DATE	A	HSMBR® Details	5 OF 6
DRAWN CTC	11/25/2009			
CHECKED PF	4/1/2014		REVISED 4/1/2014 REV. INH03-X	

BioRobic 4.0

Add on for additional treatment



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	350.6-PCSS3TW	Pipe Clamp SS 3" Thin Wall	4
2	402-EL90CPVC80SCHSXST3	ELBOW 90 CPVC SCH80 SLIP X STREET 3"	1
3	402-EL90CPVC80SCHSXS3	ELBOW 90 CPVC SCH80 SLIP X SLIP 3"	2
4	402-NCPVC80SCHTOE3X12	NIPPLE CPVC SCH 80 THREADED ONE END 3 X 12"	1
5	406-UNION304SS40SCHFXF3	UNION 304SS SCH40 150 PSI FIPT X FIPT 3"	1
6	510-HOSE372½	CONAG 3" ASSY 72-1/2"	1
7	406-EL90SS304FXFS3	ELBOW 90 SS FIPT X FIPT 3"	1
8	221.2-ALGRID24	BioAeration Grid Thin Wall Installation <3/8" Thick	2
9	412-PCPVC80SCH2X2⅞	PIPE CPVC SCH80 2 X 2⅞"	2
10	402-BCPVC80SCHSXS3X2	BUSHING CPVC SCH80 SLIP X SLIP 3 X 2"	2
11	402-UNIONCPVC80SCHSXS3	UNION CPVC SCH 80 SLIP X SLIP 3"	2
12	402-TEECPVC80SCHSSS3	TEE CPVC SCH80 SLIP X SLIP X SLIP 3"	1
13	SS COUPLING	COUPLER 304SS FIPT X FIPT 3"	1
14	SS Pipe Nipple 3	PIPE 304SS MPT X MPT 3"X24"	1
15	412.1-PPVC80SCH3X5		4

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DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES AND TOLERANCES ARE AS FOLLOWS
X° ±1°
.X ± .50
.XX ± .25

BIO MICROBICS
BETTER WATER. BETTER WORLD

DRAWN BY: HRA
DATE: 4/4/2019
APPROVED BY: JR
APPROVED BY DATE: 4/4/2019

DESCRIPTION: 2.0 BIOAERATION GRID
PART NUMBER: 720-BAG2.0
REV: B

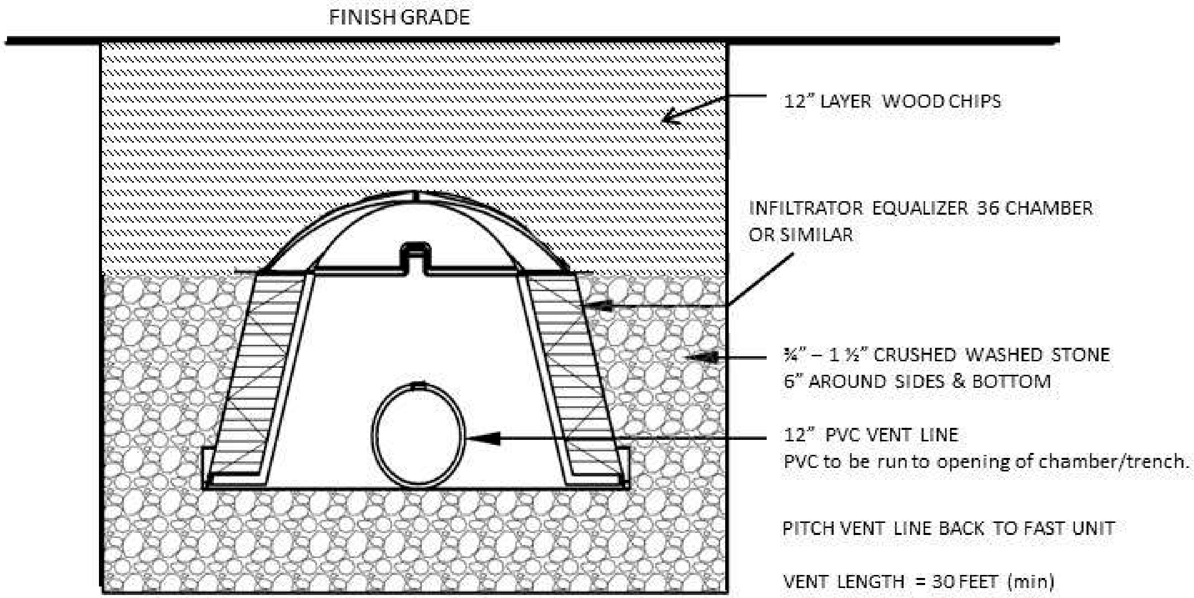
SHEET 1 OF 1
SCALE: 1:20
SIZE: B

BioBarrier Commercial Installation

- J&R provides membranes, blowers, filtrate pumps, recycle pumps, mixing pumps, control panels, stainless steel mounting rails, all internal PVC connections, and system startup
- A shed or enclosure can house blowers, filtrate pumps, chemical feed systems (if applicable)
- System start up includes seeding of system
- System CANNOT be run until seeded

Aesthetic Options

HSMBR 6.0 SN – Underground Vent Section Detail



Blower Enclosure Options…

BioBarrier Shed/Building

Permitting Requirements

MA DEP Requirements

- BioBarrier® is approved for Piloting Use in Massachusetts
- Flows up to 10,000 gpd under MA DEP
- Residential service requirements; quarterly service, quarterly testing
- Commercial service requirements are typically weekly inspections for the first six months, then monthly
  - Monthly influent and effluent sampling

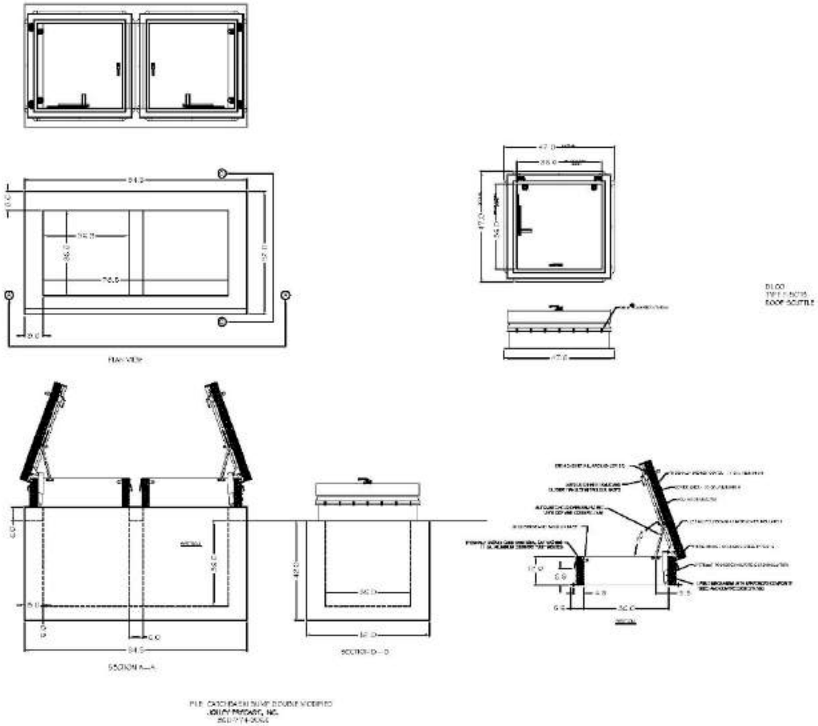
Operations and Maintenance

BioBarrier Commercial Operations and Maintenance

- All commercial systems are equipped with an autodialer for alarm notification
- Operational data can be downloaded into Excel format; 6 months of historical data
- Control panel allows for modification of system rest time, recycle rate, and mixing
- Display will show last filtration time and last long term relaxation time
- BioBarrier is only part of the treatment process
  - Be sure to pump as recommended
  - Maintain grease traps and settling tanks
  - Monitor run times to ensure hydraulic flows are at or below sizing; also allows for monitoring of potential infiltration

BioBarrier Membrane Cleaning

- Membranes will eventually HAVE to be cleaned; the time frame will vary from site to site
- All commercial systems sized for approx. 6 months between cleaning and pumping
- We see much longer; about double or more
- Membranes can be cleaned in place, or removed for deep cleaning



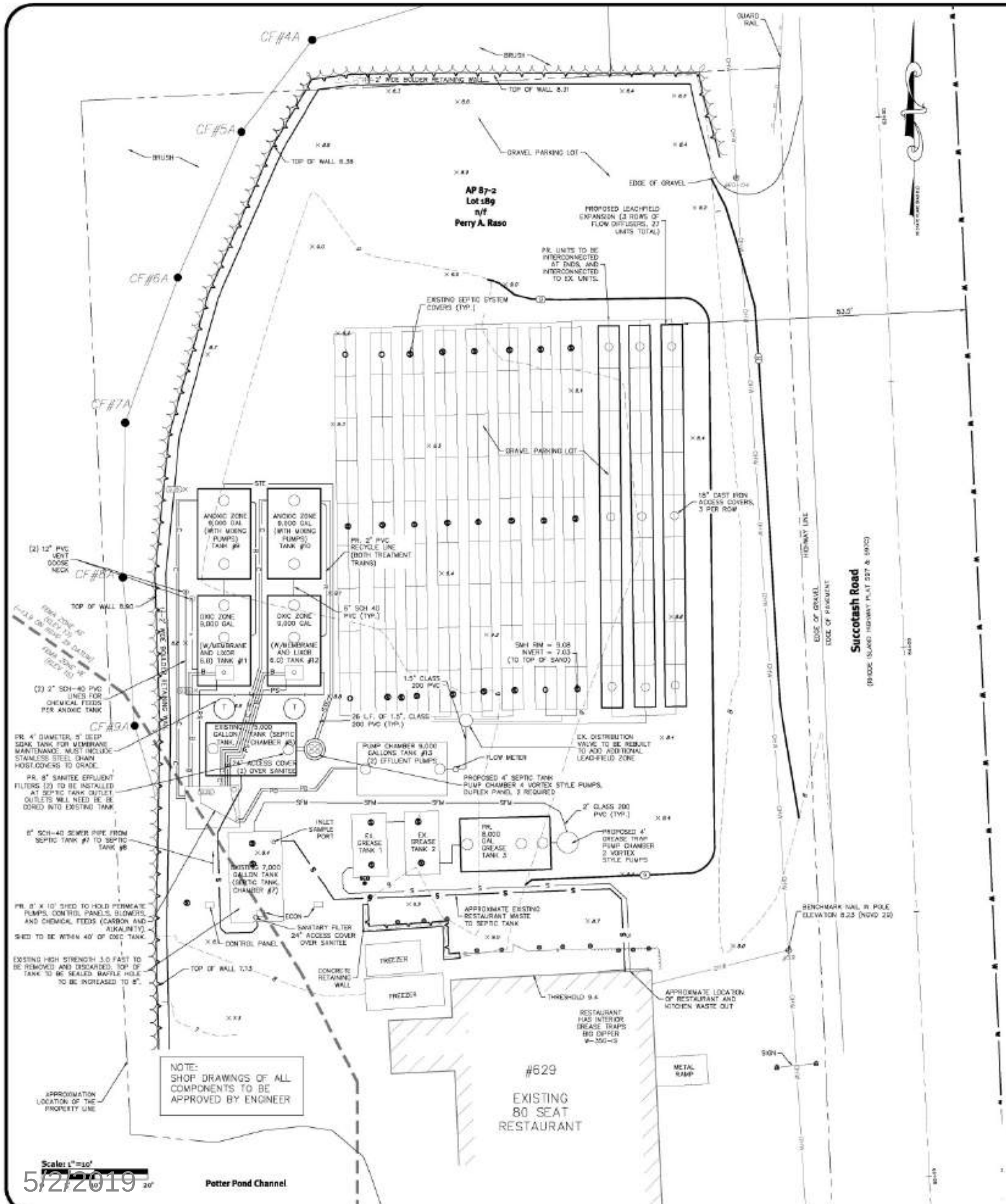
SECTION A—A
SECTION D—D

Other Maintenance

- Membrane plants run mixed liquor concentration up to about 10,000 mg/L TSS (or MLSS)
- System is “wasted” at that point to keep optimal biological activity
- Typically about 2/3 of the tank is pumped
- Membranes can stay in place; or cleaning coordinated for the same time
- Membranes must stay wet once wet
- 1/3 left in tank is seeding for “restart” of the system

Commercial BioBarrier Installation

- Seafood Restaurant
- Peak flows of 5,000+ gpd
- Average flows of 3,500 gpd
- (4) 9,000 gallon tanks
- HSMBR 6.0 - DN
- Startup May 2016



Dimensional Regulations

ZONING: CW	
MINIMUM LOT AREA:	40,000 S.F.
MINIMUM FRONTAGE:	100 FEET
MINIMUM FRONT YARD SETBACK:	40 FEET
MINIMUM CORNER SIDE YARD SETBACK:	40 FEET
MINIMUM SIDE YARD SETBACK:	30 FEET
MINIMUM REAR YARD SETBACK:	30 FEET
LOT BUILDING COVERAGE:	25%
MAXIMUM BUILDING HEIGHT:	35 FEET

Legend

NOT ALL ITEMS SHOWN WILL APPEAR ON THE SURVEY

BUILDING
ASPHALT
AP ASSESSOR'S PLAT
N/F NOW OR FORMERLY
(D) DEED
(M) MEASURED
(C) CALCULATED
(CA) CHORD ANGLE
HC HANDICAPPED
PROPERTY LINE
ASSESSORS LINE
TREELINE
GUARDRAIL
FENCE
RETAINING WALL
STONE WALL
MINOR CONTOUR LINE
MAJOR CONTOUR LINE
W WATER LINE
S SEWER LINE
SFM SEWER FORCE MAIN
G GAS LINE
E ELECTRIC LINE
OHW OVERHEAD WIRES
D DRAINAGE LINE

NAIL FOUND/SET
DRILL HOLE FOUND/SET
IRON ROD/PIPE FOUND/SET
BOUND FOUND/SET
SIGN
BOLLARD
SOIL EVALUATION
CB CATCH BASIN
DCB DOUBLE CATCH BASIN
DMH DRAINAGE MANHOLE
FES FLARED END SECTION
GUY POLE
EMH ELECTRIC MANHOLE/HANDHOL
UP UTILITY/POWER POLE
LIGHTPOST
SMH SEWER/SEPTIC MANHOLE
SEWER VALVE
CLEANOUT
HYDRANT
IRRIGATION VALVE
WATER VALVE
WELL
MONITORING WELL
UNKNOWN MANHOLE
GAS VALVE
WETLAND FLAG
BENCH MARK
BUSH
TREE

General Notes

1. THE PARCEL IS FOUND ON ASSESSOR'S PLAT 87-2, LOT 189 IN THE TOWN OF SOUTH KINGST WASHINGTON COUNTY, RHODE ISLAND.
2. THE OWNER PER DEED BOOK 1345, PAGE 734 IS PERRY A. RASO.
3. BY GRAPHICAL PLOTTING ONLY, THE PARCEL IS LOCATED IN ZONE AE (EL 13) & VE (EL 16) FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP 44009C0194J, DAT OCTOBER 16, 2013.
4. THE PARCEL IS ZONED CW PER THE ASSESSOR'S ONLINE DATABASE. PLEASE CONTACT THE ZONING DEPARTMENT FOR ANY ADDITIONAL INFORMATION OR FOR A CERTIFICATE OF ZONING.
5. FIELD SURVEY PERFORMED BY DIPRETE ENGINEERING ON NOVEMBER 18, 2014. THIS PLAN REFLECTS ON THE GROUND CONDITIONS AS OF THAT DATE.
6. ALL UNDERGROUND UTILITIES SHOWN ON THIS PLAN HAVE BEEN LOCATED FROM FIELD SURVEY OBSERVATIONS ONLY TOGETHER WITH EXISTING PLANS BY OTHERS. DIPRETE ENGINEERING IS RESPONSIBLE FOR MISSING UNDERGROUND UTILITIES, EITHER IN SERVICE OR ABANDONED, NOT OBSERVED AT THE TIME OF THE SURVEY. (PLEASE CONTACT DIGSAFE 72 WORKING HOURS P TO ANY CONSTRUCTION AT 1-888-344-7233)
7. BOUNDARY LINE AND HIGHWAY CENTER LINE SHOWN IS APPROXIMATE ONLY AND IS NOT BASE GROUND SURVEY BY DIPRETE ENGINEERING.
8. THIS PLAN DEPICTS AN OWTS REPAIR BASED ON THE EXISTING PERMIT NUMBER 0032-0215.

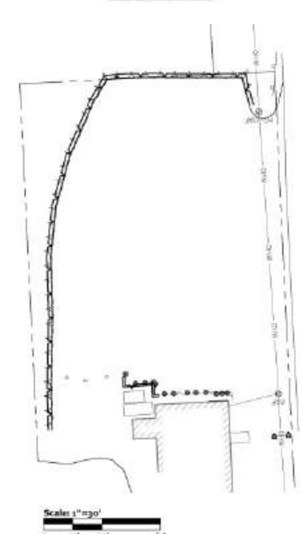
Legend

SFM GREASE TRAP SEWER FORCE MAIN
C 2" PVC SCH 40 CHEMICAL FEED
B 3" GALVANIZED BLOWER PIPING
V 12" PVC VENT LINE
PS 1 1/4" PERMEATE SUCTION
PD 1" PERMEATE DISCHARGE
STE 1.5" SCH 200 PVC SEPTIC TANK EFFLUENT
R 2" PVC RECYCLE
T SOAK TANK
TANK 8 NUMBERED TANK (TYP.)
PUMP CHAMBER

Datum Note:

1. ELEVATIONS SHOWN HEREON, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NATIONAL GEODET VERTICAL DATUM OF 1929 (NGVD 29).

Parking Limits Detail



System Elevations:

OWTS COMPONENT INVERT TABLE	
DESCRIPTION	ELEV.
RESTAURANT WASTE OUT	5.93'
RESTAURANT KITCHEN WASTE OUT	5.93'
EXISTING GREASE TANK 1 INV. IN	5.00
EXISTING GREASE TANK 1 INV. OUT	4.75
EXISTING GREASE TANK 2 INV. IN	4.71
EXISTING GREASE TANK 2 INV. OUT	4.46
PR. GREASE TANK 3 INV. IN	4.42
PR. GREASE TANK 3 INV. OUT	4.17
PR. GREASE TANK 4 INV. IN	4.13
PR. GREASE TANK 4 INV. OUT	3.88
PR. GREASE TANK 5 INV. IN	3.84
PR. GREASE TANK 5 INV. OUT	3.59
PR. GREASE TANK 6 INV. IN	3.55
PR. GREASE TANK 6 INV. OUT (PRESSURE)	3.30
EXISTING SEPTIC TANK 7 INV. IN	4.44
EXISTING SEPTIC TANK 7 INV. OUT	4.19
EXISTING SEPTIC TANK 8 INV. IN	3.80
EXISTING SEPTIC TANK 8 INV. OUT (PRESSURE)	5.00
ANOXIC TANKS INV. IN (BOTH TANKS AT SAME ELEVATION)	6.75
ANOXIC TANKS INV. OUT (BOTH TANKS AT SAME ELEVATION)	6.25
OXIC TANKS INV. IN (BOTH TANKS AT SAME ELEVATION)	6.20
OXIC TANKS INV. OUT (BOTH TANKS AT SAME ELEVATION)	5.00
PUMP CHAMBER (TANK #13) INV. IN	6.75
PUMP CHAMBER (TANK #13) INV. OUT (PRESSURE)	5.00

LEACHFIELD ELEVATIONS		ELEV.
EX. LEACHFIELD	INV. LATERALS @ FLOW DIFFUSERS	8.33
	COVER MINIMUM	9.83
	COVER MAXIMUM	10.83
PR. LEACHFIELD ZONE	INV. LATERALS @ FLOW DIFFUSERS	8.33
	COVER MINIMUM	9.83
	COVER MAXIMUM	10.83


CAT

BioMicrobics BioBarrier®

Restaurant - design flow 3,290 - sized for 6,000 gpd

	INFLUENT									EFFLUENT									
	BOD mg/L	TSS mg/L	pH mg/L	TKN mg/L	Nitrate mg/L	Nitrite mg/L	Ammonia mg/L	Alkalinity mg/L	FOG mg/L	BOD mg/L	TSS mg/L	pH mg/L	TKN mg/L	Nitrate mg/L	Nitrite mg/L	TN mg/L	Ammonia mg/L	Alkalinity mg/L	FOG mg/L
6/24/2016	740	136	5.5	81.1	ND	ND	61.6	424	N/A	<4.0	5.5	7.7	3.05	4.80	3.81	11.66	1.45	183	2.1
7/29/2016	1,220	240	5.7	99.9	ND	ND	103.0	543	96.6	<4.0	<4.0	8.0	0.65	4.87	ND	5.52	ND	183	1.6
8/19/2016	1,180	192	5.6	155.0	ND	ND	112.0	615	71.3	<4.0	<4.0	7.8	1.06	10.60	ND	11.66	ND	167	<1.2
9/14/2016	960	100	5.7	114.0	ND	3.94	109.0	549	1,970	<4.0	5.5	8.0	1.00	4.09	ND	5.09	ND	199	N/A
10/19/2016	960	140	5.5	99.3	ND	ND	62.5	429	48.8	<4.0	<4.0	7.7	1.18	2.58	0.27	4.03	ND	199	1.7
11/18/2016	4,010	2,850	5.9	126.0	0.5	ND	82.0	501	2,160	<4.0	<4.0	7.6	0.97	3.86	ND	4.83	0.56	208	2.2
12/15/2016	1,120	315	5.9	80.4	ND	ND	0.17	455	216	<4.0	<4.0	8.1	1.11	1.32	ND	2.43	ND	222	1.5
1/19/2017	800	87	6	70.2	ND	ND	57.80	414	50	<4.0	7	8.1	0.69	2.23	ND	2.92	ND	222	3.6
2/14/2017	810	86	6	61.1	0.91	ND	52.00	377	49	<4.0	8.5	8.0	0.79	1.61	ND	2.40	0.2	224	<1.2
3/15/2017	720	60	6.5	76.3	ND	ND	66.70	438	51	<4.0	24.5	8.4	1.01	1.59	ND	2.60	ND	189	1.6
4/13/2017	1,190	109	6	91.1	ND	ND	87.50	482	61	<4.0	8	8.0	0.96	2.81	ND	3.77	0.14	214	<1.2
5/17/2017	980	316	5.6	70.5	ND	ND	57.80	369	440	<4.0	8	7.8	0.92	3.99	ND	4.91	0.27	183	<1.2
6/14/2017	990	78	6.1	104.0	ND	ND	92.00	560	45.9	<4.0	<4.0	7.6	0.88	3.33	ND	4.21	0.21	231	1.9
7/24/2017	1,220	142	6.1	168.0	ND	ND	143.00	828	70.1	<4.0	9	7.9	1.81	3.20	ND	5.01	0.18	279	<1.2
8/24/2017	1,830	580	6.1	155.0	ND	ND	148.00	843	410.0	<4.0	<4.0	7.8	1.24	3.06	0.32	4.30	0.7	254	<1.2
9/13/2017	1,220	334	5.8	143.0	ND	ND	120.00	608	380.0	<4.0	<4.0	7.4	1.38	5.72	0.62	7.10	0.23	172	<1.2
10/27/2017	1,460	500	5.9	128.0	ND	ND	124.00	579	275.0	<4.0	<4.0	7.6	0.88	3.89	ND	4.77	0.11	182	<1.2
11/21/2017	410	6,930	5.8	553.0	ND	ND	112.00	557	258.0	<4.0	<4.0	7.6	1.29	3.45	ND	4.74	0.5	208	1.3
12/14/2017	2,500	1,630	5.9	103.0	ND	ND	56.70	399	735.0	<4.0	<4.0	8.0	2.00	1.44	ND	3.44	0.33	167	<1.2
1/11/2018	1,910	1,040	5.7	101.0	ND	4.77	72.50	513	505.0	<4.0	<4.0	7.7	1.15	3.98	ND	5	0.37	193	1.4
2/15/2018	1,140	58	5.9	113.0	ND	ND	81.10	632	60.0	<4.0	<4.0	7.9	1.03	2.89	ND	3.92	0.21	253	<1.4
3/23/2018	1,040	170	6.42	116.0	ND	ND	14.10	530	120.0	<4.0	6.5	8.0	1.96	2.47	ND	4.43	4.63	273	<1.4
4/12/2018	1,110	162	6.1	104.0	3.98	ND	83.40	72.7	71.6	<4.0	<4.0	7.9	1.33	1.24	ND	2.57	0.13	251	<1.2
5/21/2018	1,290	135	6.1	147.0	ND	0.34	103.00	652	62.4	12.2	<4.0	8.0	3.16	1.27	0.32	4.75	1.85	270	<1.2
6/14/2018	1,100	162	5.8	92.8	ND	5.48	67.60	506	133.0	8.1	11.5	7.7	15.90	ND	ND	15.90	67.6	506	<1.2
7/12/2018	1,130	98	5.8	89.1	ND	ND	108.00	704	57.3	<4.0	4	7.7	1.46	0.52	ND	1.98	0.53	235	<1.2
8/2/2018	1,100	108	6	135.0	0.93	3.38	104.00	648	34.3	<4.0	<4.0	7.7	1.05	2.81	1.26	5.12	0.28	251	<1.2
9/14/2018	933	536	5.9	88.9	0.57	ND	52.50	435	68.3	11	<4.0	7.9	1.80	0.87	ND	2.67	0.12	136	1.3
10/19/2018	731	300	5.7	104.0	ND	ND	83.70	519	207.0	<4.0	<4.0	7.6	1.09	ND	0.27	1.36	0.27	102	<1.2
11/19/2018	738	128	5.9	50.0	16.8	4.83	47.80	329	133.0	<4.0	<4.0	7.9	ND	4.33	ND	4.33	ND	202	<1.2
12/27/2018	260	103	6.8	111.0	ND	ND	87.20	378		<4.0	<4.0	8.0	0.84	0.96	ND	1.80	ND	177	
AVG	**1187**	**575**	**5.926**	**120.3**	**ND**	**ND**	**82.3**	**512.54**	**304.8**	**<4.0**	**5.5**	**7.843**	**1.82**	**3.60**	**2.04**	**7.59**	**1.45**	**217**	**2.12**

	% Removal TN	% Removal BOD	% Removal TSS	% Removal FOG
Average	**94%**	**99.7%**	**99%**	**99%**

Massachusetts
Commercial BioBarrier® Installation

- Convenience/Gas/Coffee
- Peak flows of 3,000+ gpd
- Startup January 2017

Test Results
Average 2018

	% Removal TN	% Removal BOD	% Removal TSS
Overall Average	89%	99.41%	97%

RI Medical Facility - 2018 Installation – Startup August 2018

5/2/2018


LOWE'S

2018 Test Results

Date	Influent BOD	Influent TSS	Influent pH	Influent TKN	Effluent BOD	Effluent TSS	Effluent pH	Effluent TN	% Removal
September 2018	476	80	6.5	41.4	8.8	<4.0	7.4	5.84	98.2% BOD, 95% TSS, 86% TN
October 2018	297	55	7.2	106	<4.0	<4.0	7.6	2.61	98.6% BOD, 93% TSS, 98% TN
November 2018	162	75	6.9	59	<4.0	<4.0	7.3	4.66	98% BOD, 95% TSS, 92% TN
December 2018	785	276	6	74.55	<4.0	<4.0	7.3	5.84	99.5% BOD, 99% TSS, 92.2% TN

Benefits

- MBR is an attractive and feasible technology for on-site treatment applications.
- Smaller footprint for commercial flows vs. other technology options
- Commercial systems can treat high BOD and TKN applications
- Consistent nutrient removal is possible with MBR system.....Water reuse… Less than 10 mg/L TN, <5 mg/L BOD, <5 mg/L TSS
- Extras: fecal removal, pharmaceutical degradation, virus removal
- MBR is more effective in treating wastewaters that are challenging for conventional biological treatment systems.

For more information

Visit

www.jrsalesinc.com

www.biomicrobics.com

www.septitech.com

www.geoflow.com

Welcome

Buzzards Bay Coalition
Decision Makers Workshop

Optimizing Performance of Nitrogen Reducing Septic Systems

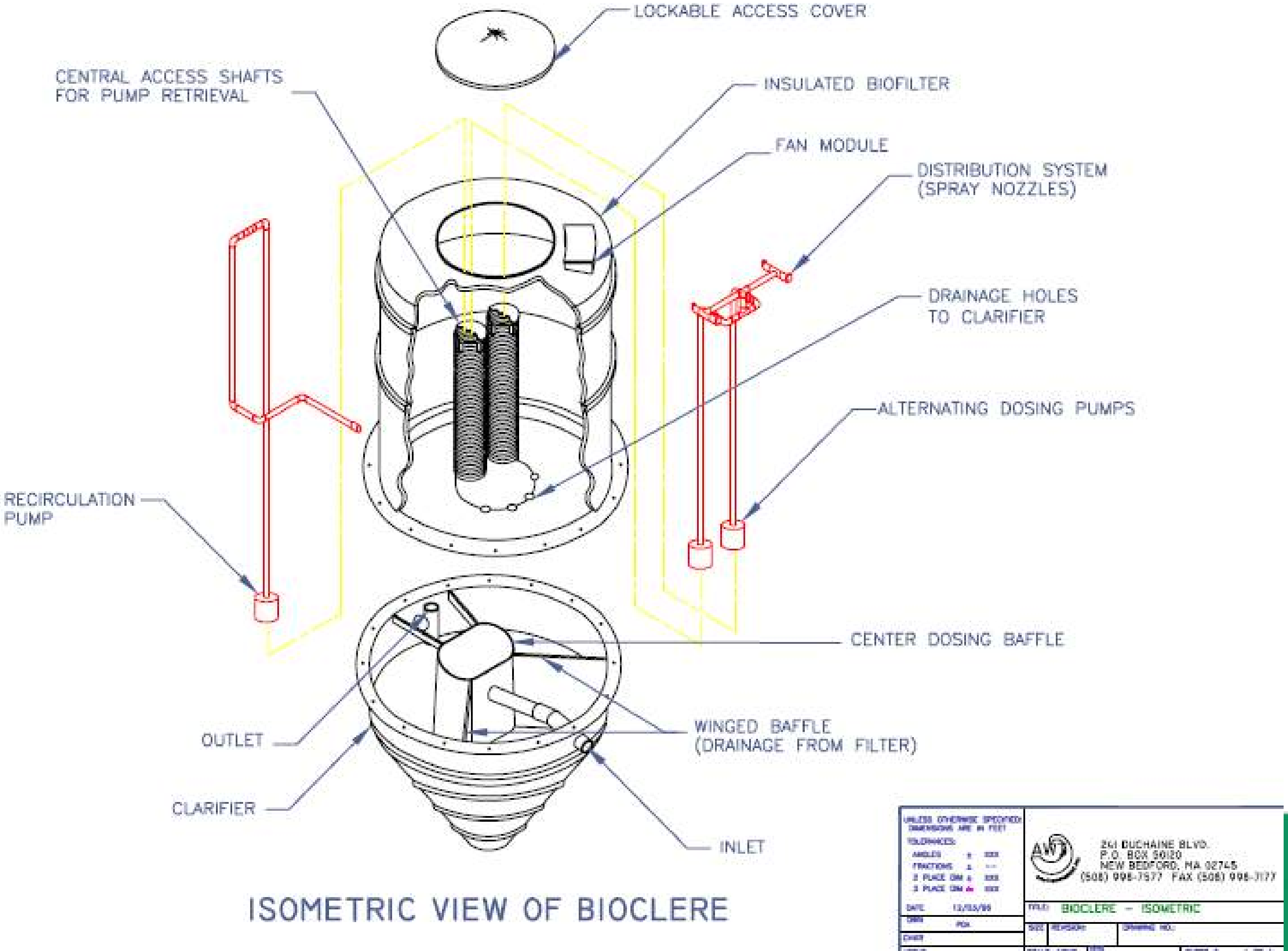
Bioclere™ Technology

Mark Lubbers

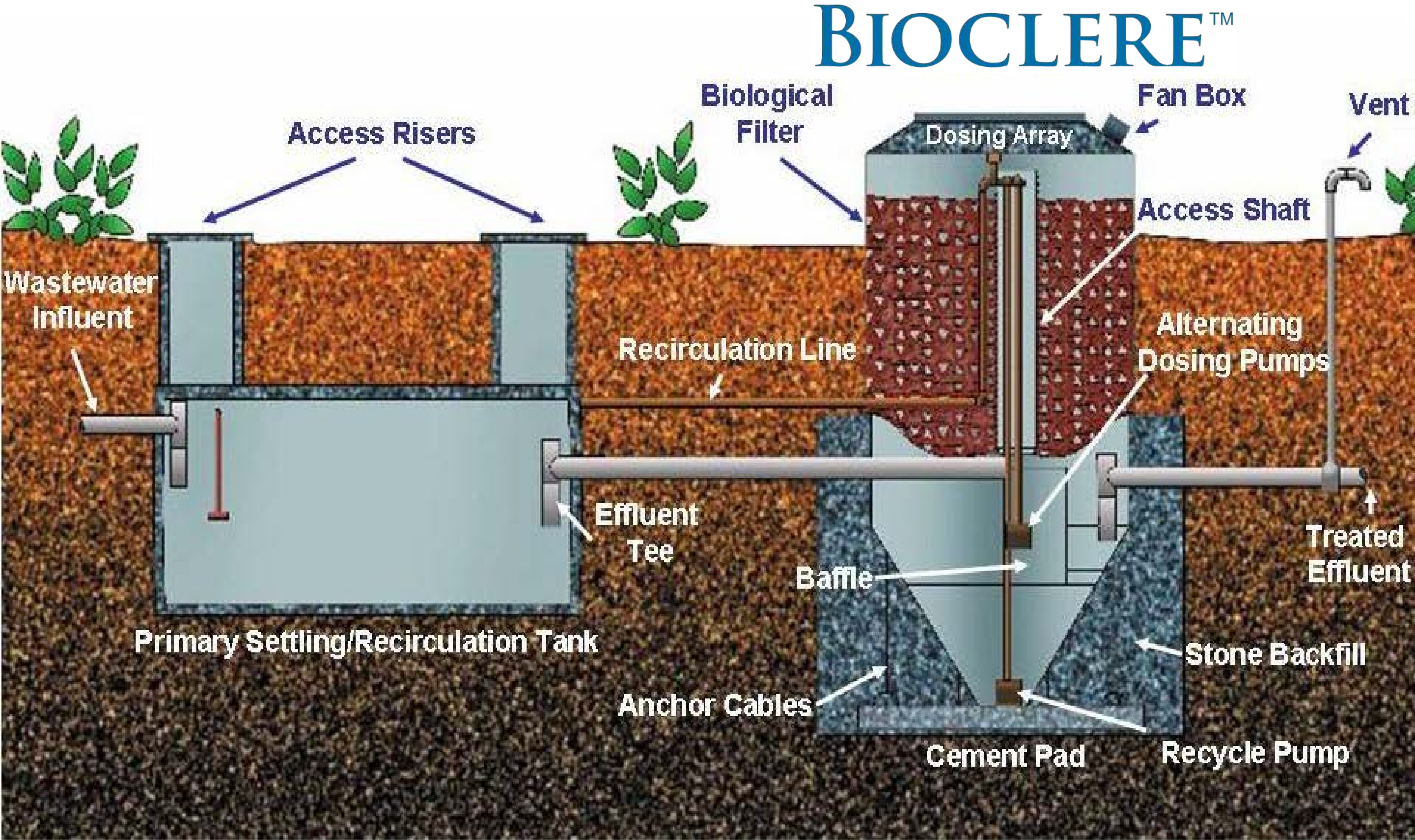
Bioclere - The High Points

- Simple & adjustable
- Quiet
- Energy Efficient
- Low odor
- Flexible - Modular & Scalable
- Easy to Install- light weight modular units
- Easy to Maintain
- Proven Performance
- Direct to Manufacturer Service & Support
- Robust: > 50 years service life

Bioclere Isometric View

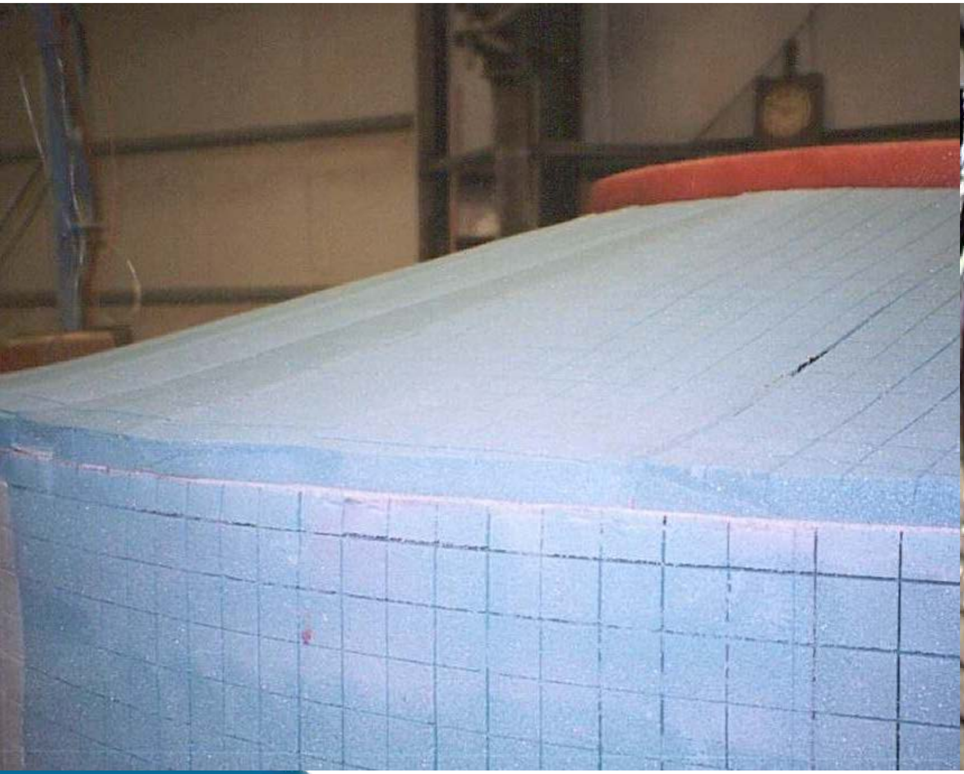


Bioclere Schematic



Bioclere Physical Characteristics

Insulated Foam Core



Double-wall insulated fiberglass (FRP) provides near constant temperature conditions and durability

Media Bed

Plastic media is randomly packed, biologically inert & mechanically durable

Bioclere Design Details

Organic/Inorganic Loading Rates

BOD

- +/- 1.5 lbs BOD / m^3 volume

or

- 15 g /sq meter

NH_3

- +/- 0.12 lbs NH_3 / m^3 volume or
- 1.1 g / sq. meter

- Media Surface Area (m^2/m^3)
- Hufo: 105
- Flocor: 140 & 230

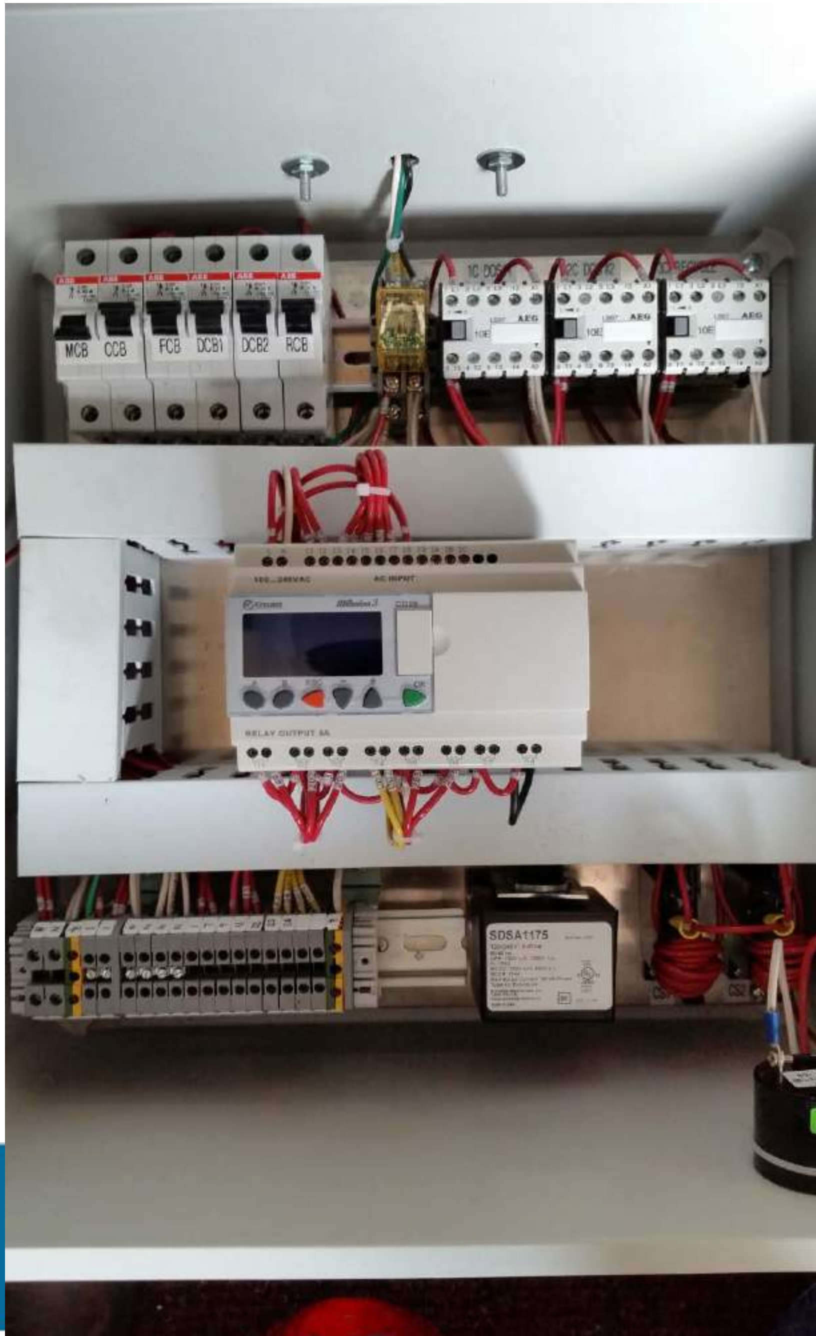
Yields BOD /TSS < 30 mg/l &
Full Nitrification of Ammonia
Assumes domestic strength WW &
10-20 degrees C

Three media densities

Media Surface Area (m^2/m^3)

Hufo: 105

Flocor: 140 & 230

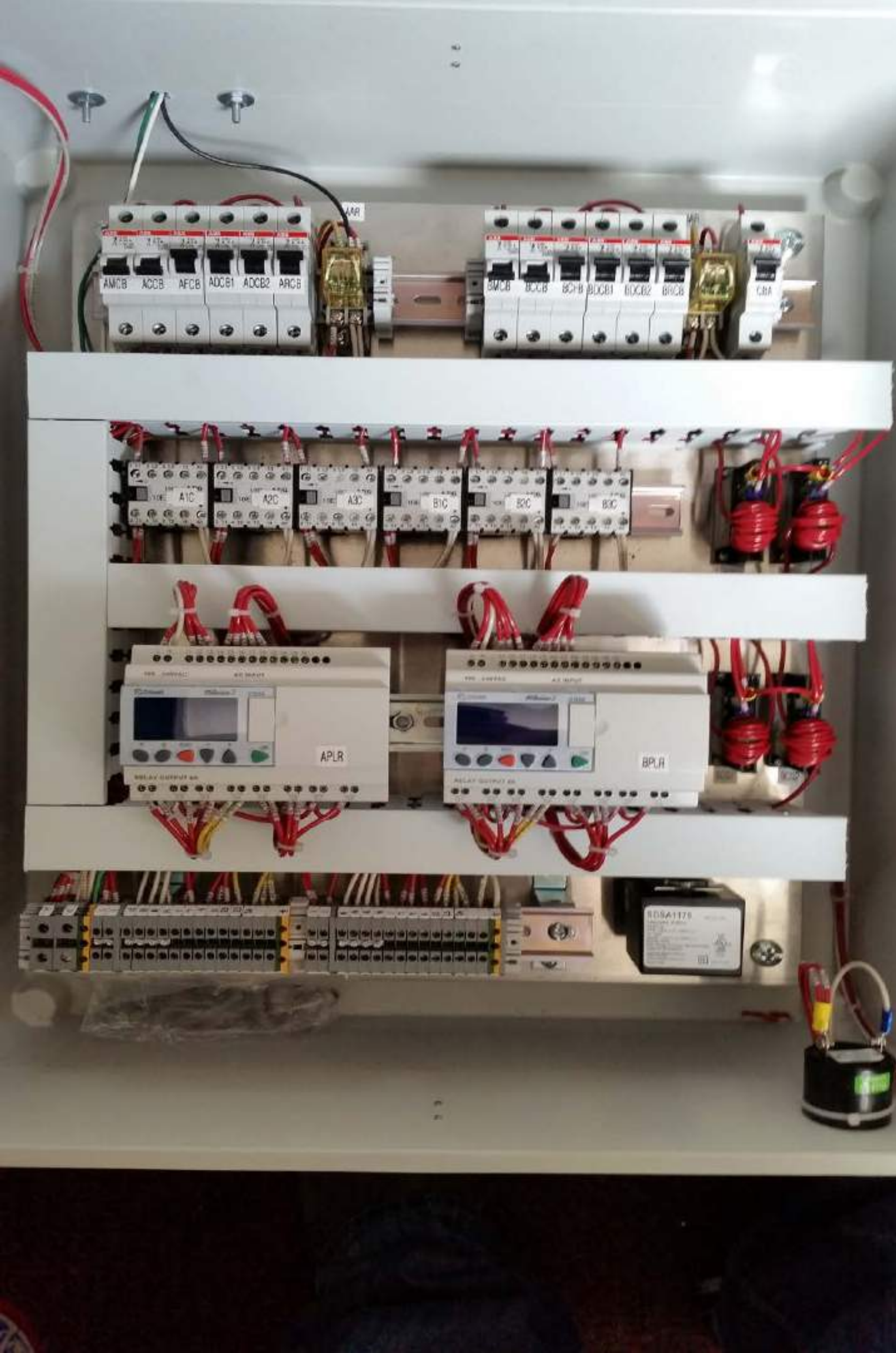


Bioclere Control Panel

Programmable
Logic
Relay

Single Stage / Duplex Pump

- Hand - Off - Auto
- Adjust Dosing & Recycle timers
- Run time meters
- Alarm log
- Energy Save
- Alarm silence



Bioclere Dual Stage Commercial PLR Panel

Bioclere Models, Capacities & Energy Use

BIOCLERE™

Bioclere Model	Dose Pump HP	Full Load Amps (Dosing)	Recycle Pump HP	Full Load Amps (Recycle)	Fan CFM	Voltage	Electrical Usage (KwHrs/Mo)	Max Capacity (gpd)*
16/12-SS	0.33	3	0.33	3	57	115	103	500
16/12-LS	0.33	3	0.33	3	57	115	103	750
16/15	0.33	3	0.33	3	57	115	103	1,000
16/19	0.33	3	0.33	3	57	115	186	1,500
16/25	0.33	3	0.33	3	57	115	186	2,500
24/20/950	0.75	5.00	0.5	8.5	106	115	368	5,000
24/20/1600	0.75	5.00	0.5	8.5	106	115	368	5,000
24/24/950	0.75	5.00	0.5	8.5	106	115	368	5,000
24/24/1600	0.75	5.00	0.5	8.5	106	115	368	7,000
24/30/950	0.75	5.00	0.5	8.5	106	115	368	5,000
24/30/1600	0.75	5.00	0.5	8.5	106	115	368	9,000
30/24	0.5	8	0.5	9	159	115	600	11,000
30/32	0.5	8	0.5	9	159	115	600	13,500
36/24	1	5	1	5.5	238	230	750	17,500
36/30	1	5	1	5.5	238	230	750	20,000

AQUAPOINT

US EPA Reuse Pilot Study – Mobile, AL
20,000 gpd – Secondary treatment

Energy Cost

Comparison

Bioclere Packed Bed Trickling Filter $2.08/day

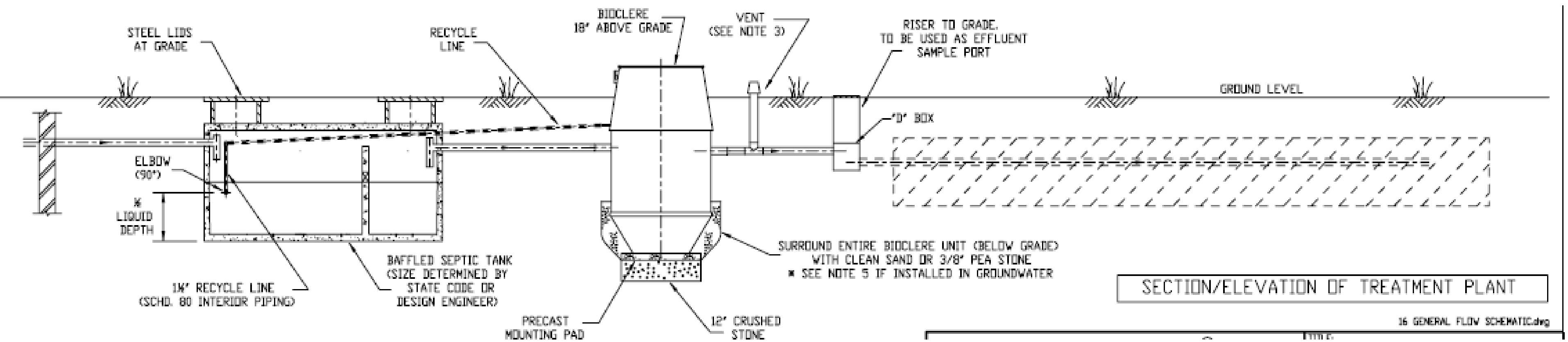
Suspended growth Aerobic Treatment Unit: $6.34/day

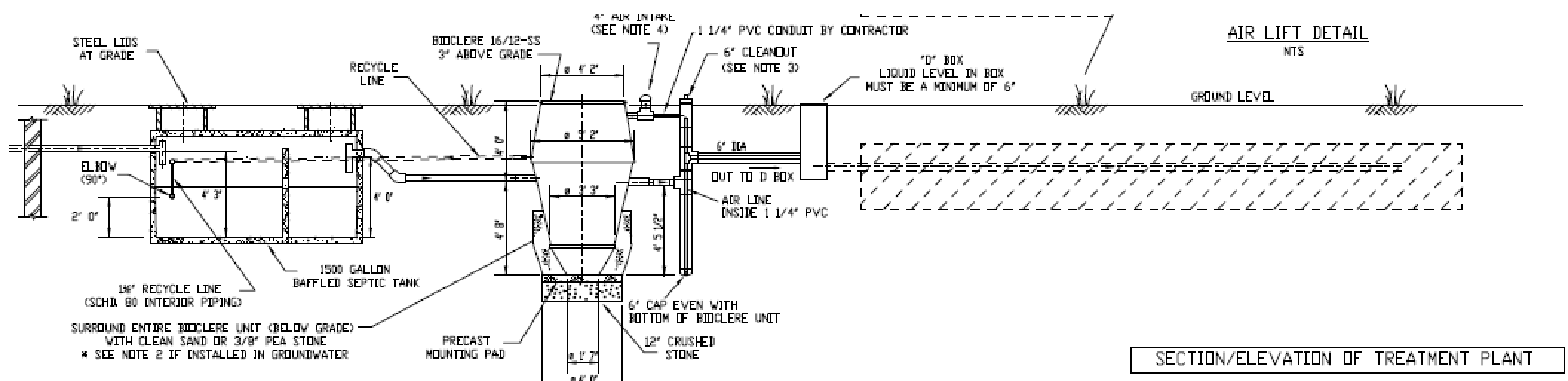
Submerged packed bed media filter
$7.60/day

Compact footprint - Low odor

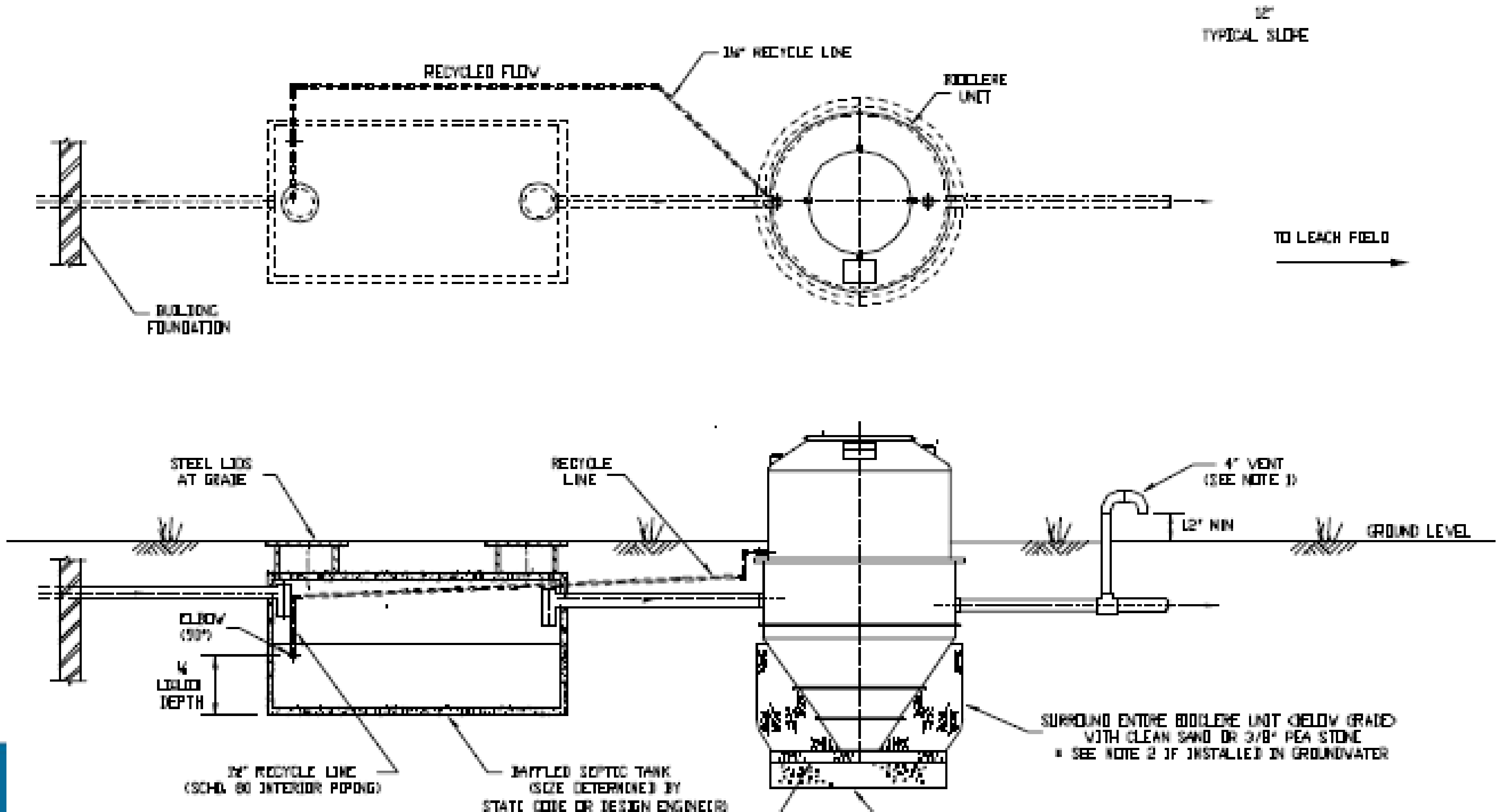
Modular & Scalable

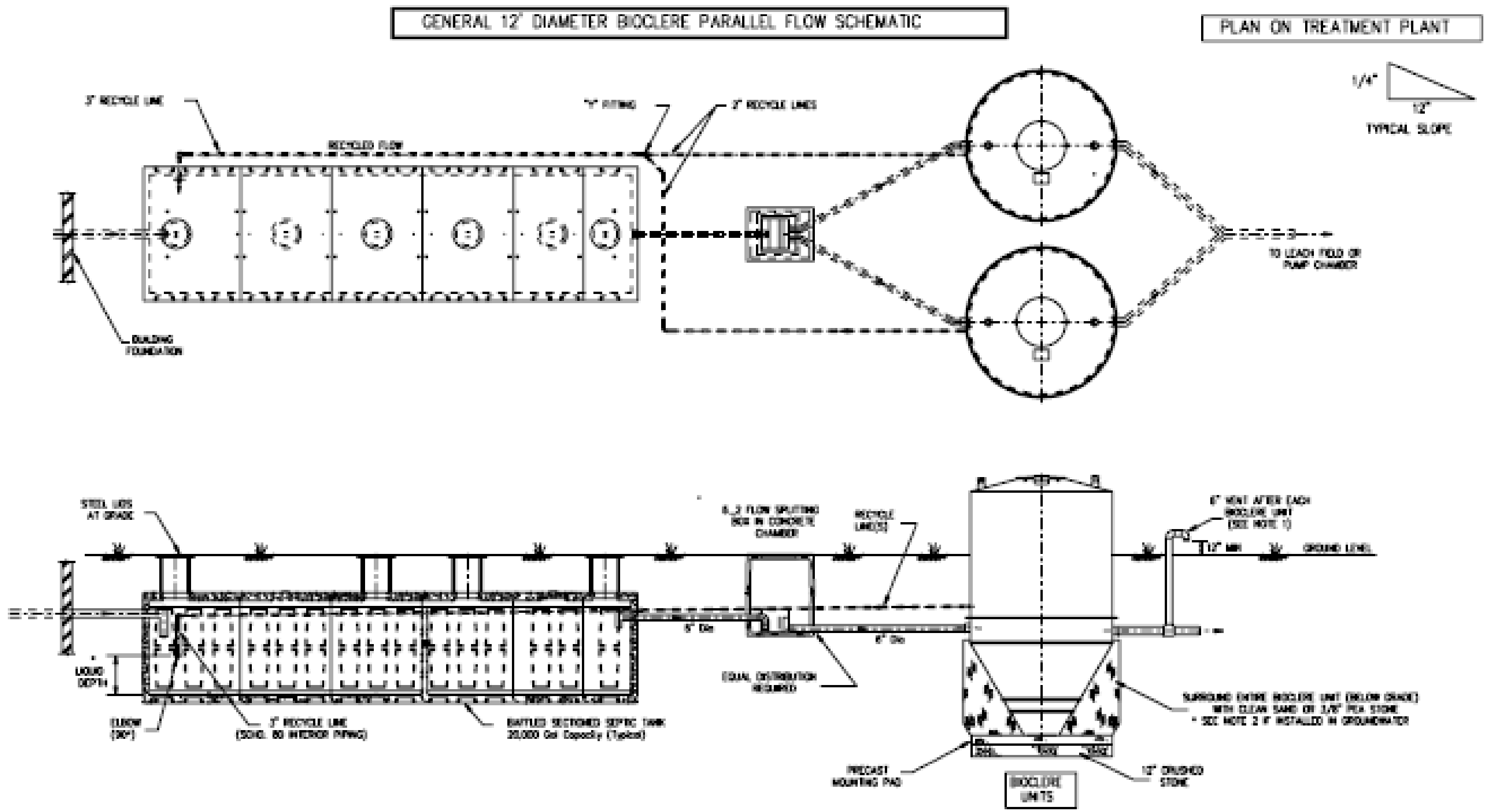
Single family Bioclere





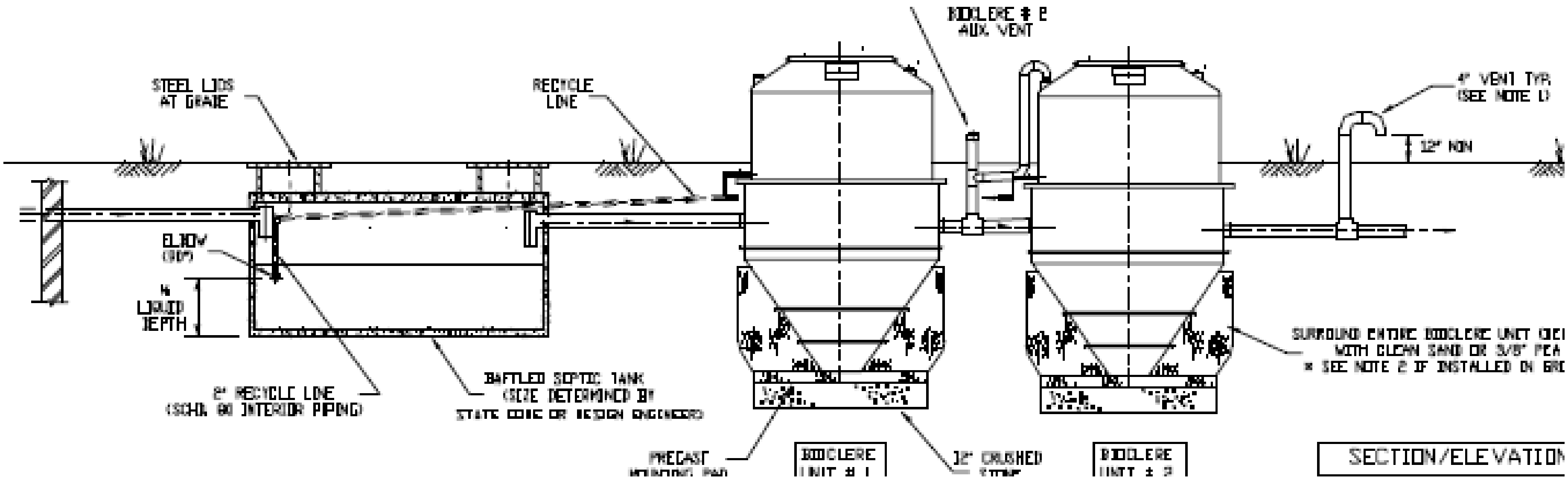
Single Stage Schematic



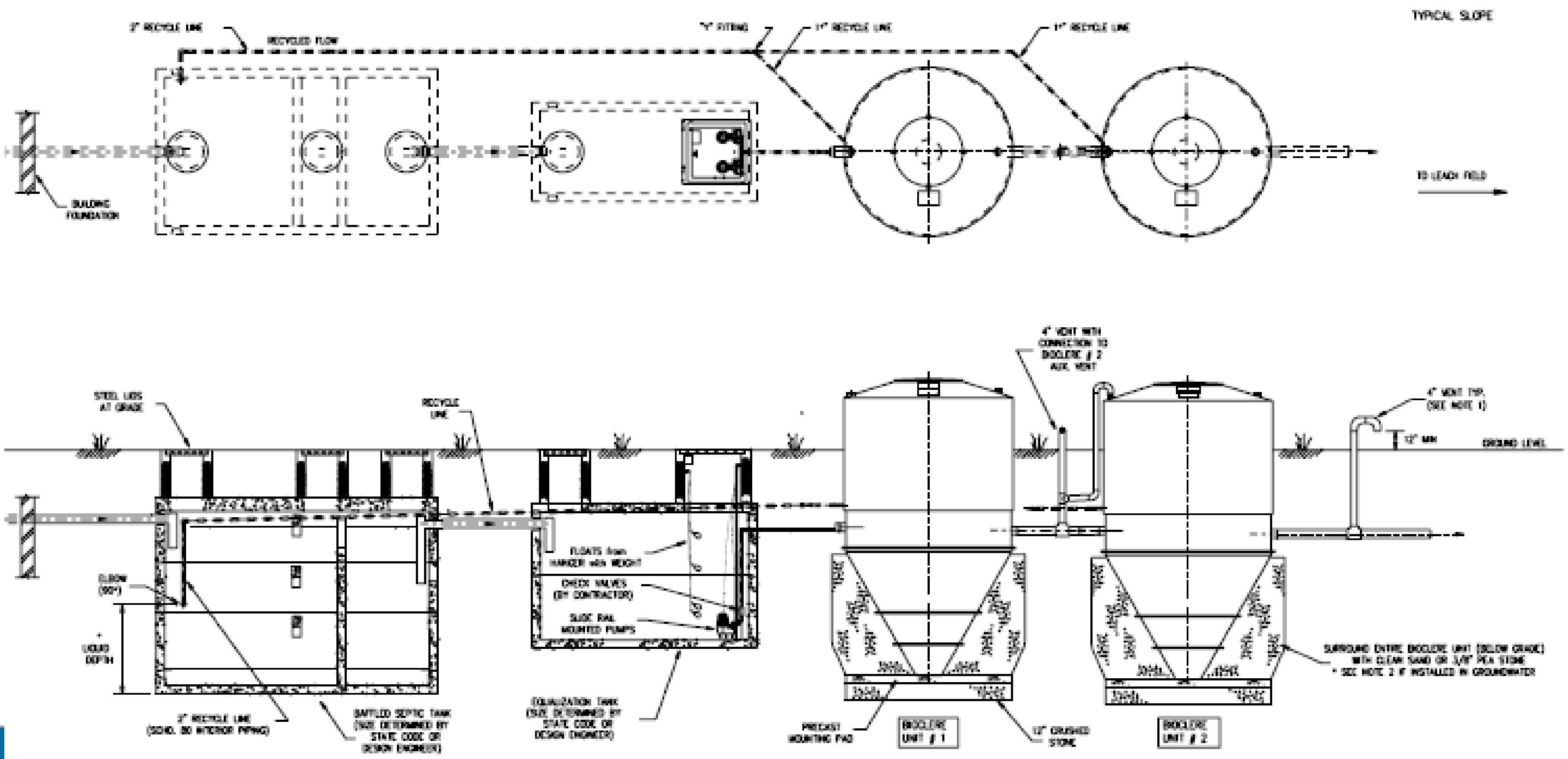

GENERAL 12' DIAMETER BIOCLERE PARALLEL FLOW SCHEMATIC
PLAN ON TREATMENT PLANT
1/4"
12"
TYPICAL SLOPE
3" RECYCLE LINE
"Y" FITTING
2" RECYCLE LINES
RECYCLED FLOW
BUILDING FOUNDATION
TO LEACH FIELD OR PUMP CHAMBER
STEEL LIDS AT GRADE
LIQUID DEPTH
ELBOW (90°)
3" RECYCLE LINE (SCHD. 80 INTERIOR PIPING)
BAFFLED SECTIONED SEPTIC TANK 20,000 Gal Capacity (Typical)
6" Dia
FLOW SPLITTING BOX IN CONCRETE CHAMBER
RECYCLE LINE(S)
EQUAL DISTRIBUTION REQUIRED
6" VENT AFTER EACH BIOCLERE UNIT (SEE NOTE 1)
12" MIN
GROUND LEVEL
SURROUND ENTIRE BIOCLERE UNIT (BELOW GRADE) WITH CLEAN SAND OR 3/8" PEA STONE
* SEE NOTE 2 IF INSTALLED IN GROUNDWATER
PRECAST MOUNTING PAD
12" CRUSHED STONE
BIOCLERE UNITS

26 Homes TN < 25 ppm

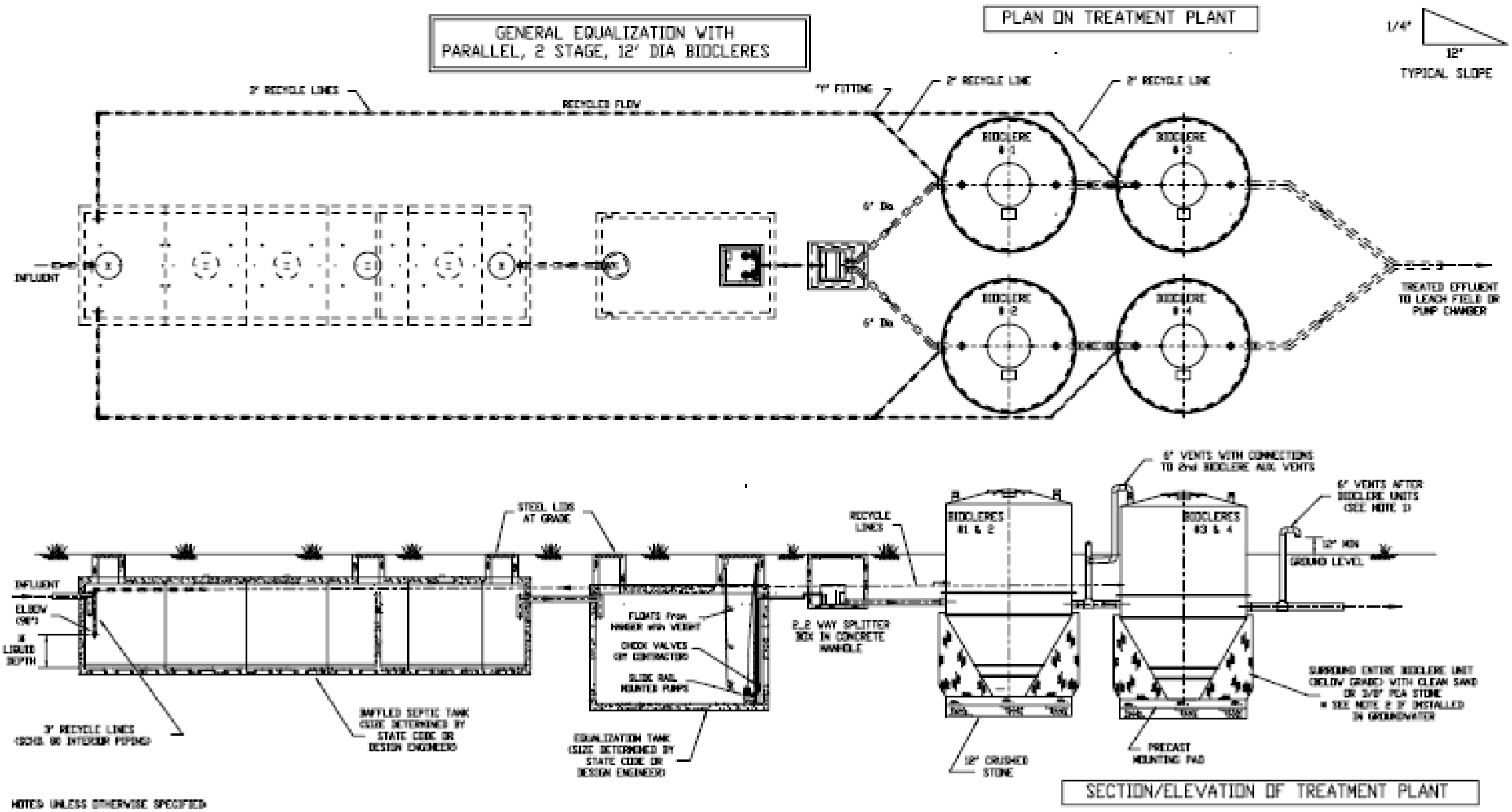
Dual Stage – High Strength &/or Nitrification



Dual Stage w/ flow Equalization



20,000 gpd

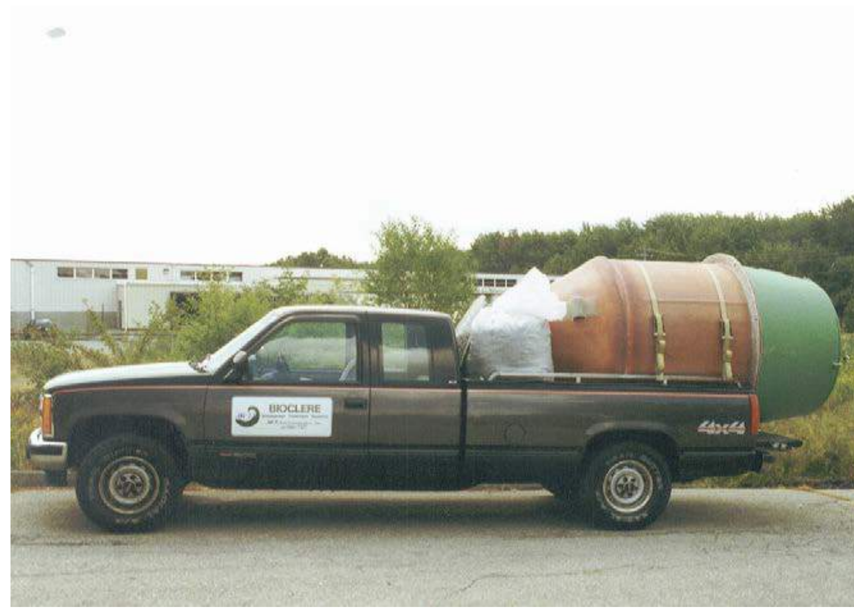

GENERAL EQUALIZATION WITH
PARALLEL, 2 STAGE, 12' DIA BIOCLERES
PLAN ON TREATMENT PLANT
TYPICAL SLOPE
RECYCLED FLOW
INFLUENT
BIOCLERE #1
BIOCLERE #2
BIOCLERE #3
BIOCLERE #4
TREATED EFFLUENT TO LEACH FIELD OR PUMP CHAMBER
STEEL LIDS AT GRADE
RECYCLE LINES
BIOCLERES #1 & 2
BIOCLERES #3 & 4
GROUND LEVEL
FLOATS from HANGER with WEIGHT
CHECK VALVES (BY CONTRACTOR)
SLIDE RAIL MOUNTED PUMPS
2,2 WAY SPLITTER BOX IN CONCRETE MANHOLE
BAFFLED SEPTIC TANK (SIZE DETERMINED BY STATE CODE OR DESIGN ENGINEER)
EQUALIZATION TANK (SIZE DETERMINED BY STATE CODE OR DESIGN ENGINEER)
PRECAST MOUNTING PAD
12" CRUSHED STONE
SECTION/ELEVATION OF TREATMENT PLANT
NOTES: UNLESS OTHERWISE SPECIFIED


20,000 gpd
Mixed Use Commercial Shopping plaza

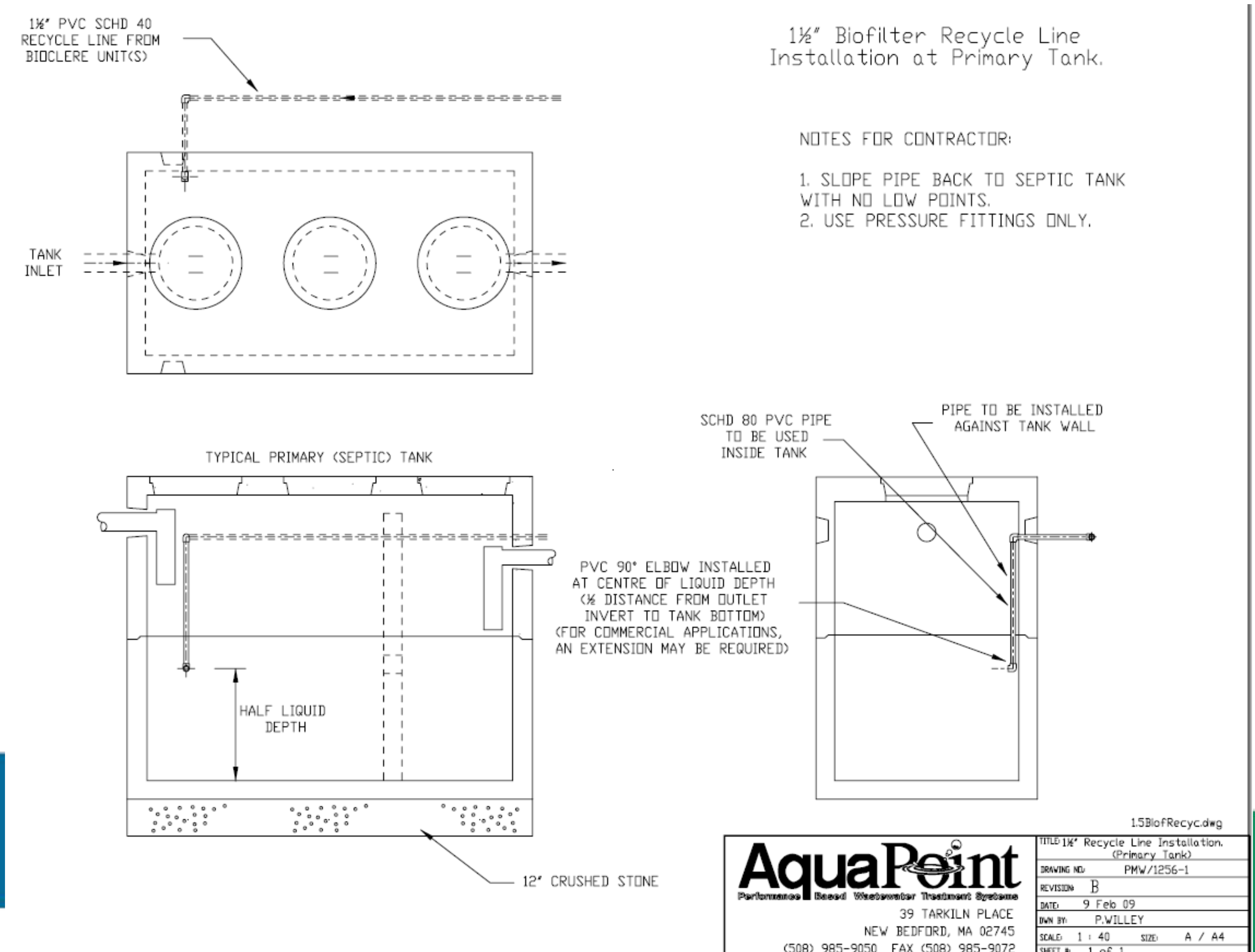
45,000 gpd Apartment complex

Scalable – 100,000 gpd GTMO Complex

Easy to Install


BIOCLERE

Recycle line detail




Link-Belt


Maintenance

BIOCLERE™

BIOLOGICAL WASTEWATER TREATMENT SYSTEM

OPERATION & MAINTENANCE MANUAL

BIOCLERE MODELS:
16/12-SS, 16/12-LS, 16/15 & 16/19

AQUAPOINT
AN OBEN COMPANY
39 Tarkiln Place New Bedford, MA 02745 | Tel 508.985.9050 | Fax 508.985.9072 | Email sales@aquapoint.com
www.aquapoint.com

TABLE OF CONTENTS

This Technical Manual is supplied for the benefit of the user and is not applicable to any other customer. Aquapoint 3 LLC is not responsible for any other equipment used in conjunction with this installation. Please refer to contractor or other suppliers for information and use of their equipment.

MAINTENANCE
BASIC TOOLS FOR BIOCLERE SERVICE

- BOTTLE BRUSH
- SAMPLER / BAILER
- AMMETER
- HAND TOOLS – SCREWDRIVER, WIRE CUTTERS, TIE WRAPS, LARGE PLIERS
- RUBBER GLOVES
- DO METER (GWD)
- FIELD NITRATE TEST KIT (GWD)

REFERFENCE & REPORTING FORMS

- TECHNICAL MANUAL OF PROCEDURES
- INSTALLATION & COMMISSIONING REPORTS
- FIELD SERVICE REPORT FORM

Standard Maintenance (Quarterly)

1. Check general condition / appearance of the unit(s)
2. Condition of cover, locks, latches, gasket
3. Check fan box including lock & latch, internal and external wiring, gaskets, etc.
4. Check vent for air flow / odor
5. Check for quiet fan operation
6. Inspect and characterize Biomass (color & thickness)
7. Check dosing pump operation, timing, alternation
8. Check recycle pump operation, timing
9. Check general condition of spray assembly, spray pattern & coverage. Clean nozzles and adjust spray pattern as needed
10. Check control panel logs, switches, timers & alarms
11. Check effluent clarity

Biofilm Characteristics

Spray nozzle cleaning


Model 16 - Single Family Spray Array

Bioclere Model 16 Dosing Array

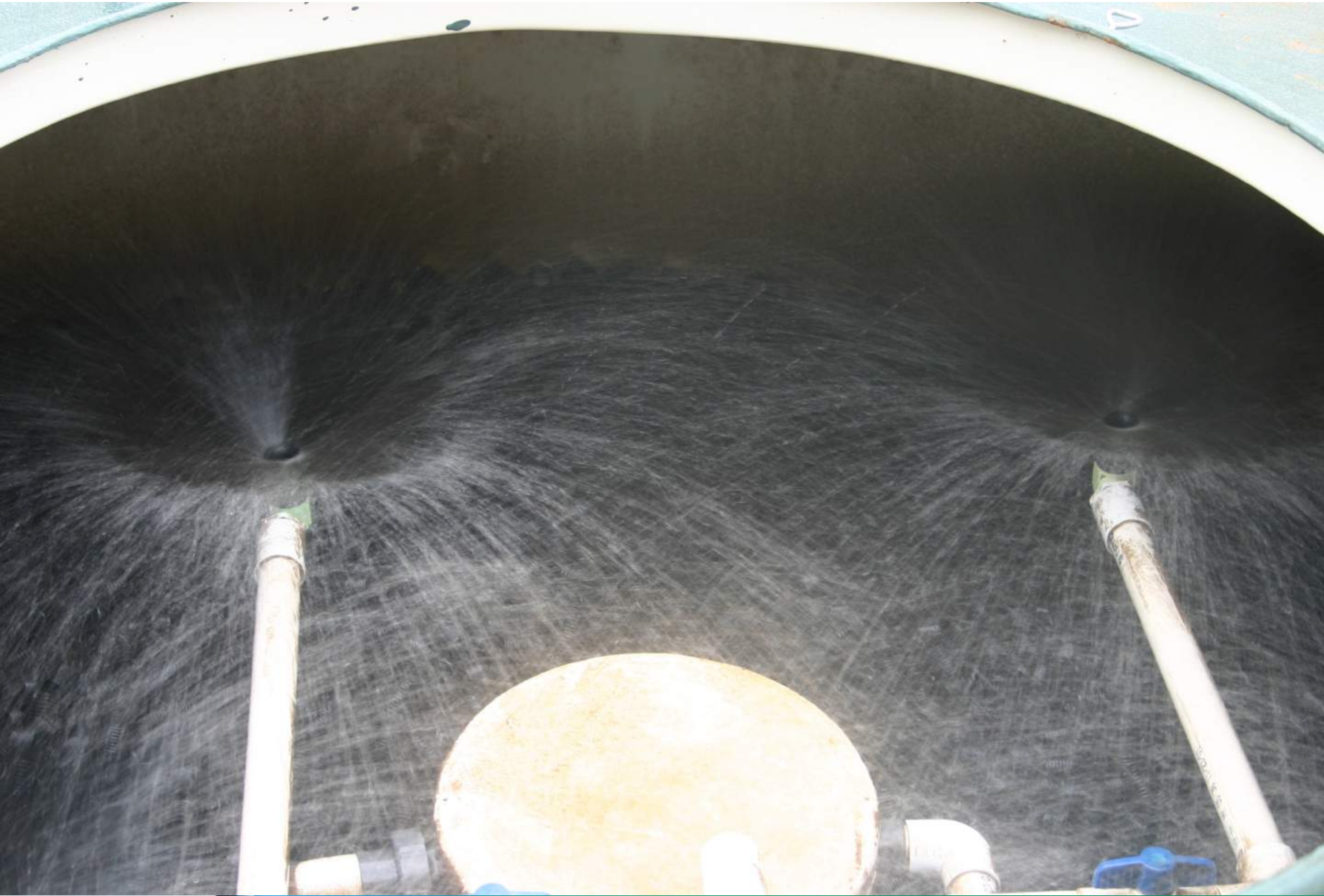
Bioclere 16 series – Dual stage

Low Flow - High strength commercial food processor

1st Stage - Roughing

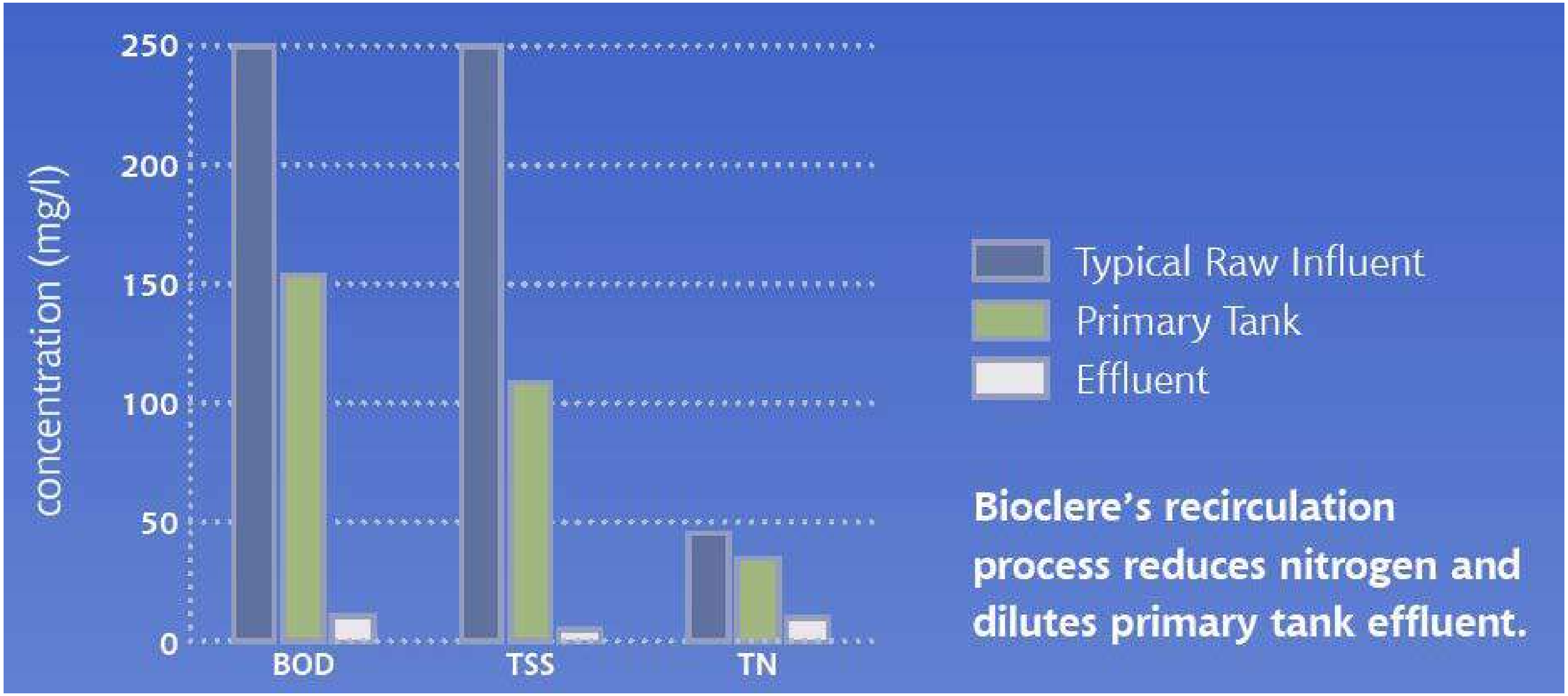
2nd Stage – Polishing / Nitrification

Nitrifying Biomass



PERFORMANCE

Bioclere Removal Rates



- Bioclere Effluent Achieves Reduction % up to:
- 90% for BOD & TSS
- 80% for TN

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

NSF International

ETV Joint Verification Statement

TECHNOLOGY TYPE:	BIOLOGICAL WASTEWATER TREATMENT – NITRIFICATION AND DENITRIFICATION FOR NITROGEN REDUCTION
APPLICATION:	REDUCTION OF NITROGEN IN DOMESTIC WASTEWATER FROM INDIVDUAL RESIDENTIAL HOMES
TECHNOLOGY NAME:	BIOCLERE™ MODEL 16/12
COMPANY:	AQUAPOINT, INC.
ADDRESS:	241 DUCHAINE BLVD. NEW BEDFORD, MA 02745 PHONE: (508) 998-7577 FAX: (508) 998-7177
WEB SITE:	http://www.aquapoint.com
EMAIL:	Aquapoint@aquapoint.com

Table 2. Nitrogen Data Summary

	TKN (mg/L)		Ammonia (mg/L)		Total Nitrogen (mg/L)		Nitrate (mg/L)	Nitrite (mg/L)	Temperature (°C)
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Effluent	Effluent	Effluent
Samples	53	53	53	53	53	53	53	53	51
Average	37	10	23	6.2	37	16	5.2	0.45	15
Median	38	6.3	23	2.8	38	14	4.4	0.34	15
Maximum	46	35	27	22	46	36	14	1.5	23
Minimum	24	1.9	18	0.7	24	6.2	<0.1	0.07	7.4
Std. Dev.	4.4	10	2.1	7.0	4.4	8.4	3.5	0.26	4.9

Samples = Number of samples used in the calculations

Aquapoint.3, LLC — Bioclere 16 Series — 1/14/2013

Single Family Residential Performance Data Summary

Site Number	Bioclere Model	Operator	Design Flow	Owner	TKN (mg/l)	TN Average (mg/l)	TN Adjusted[1]	CBOD Average	CBOD Adjusted[1]	TSS Average	TSS Adjusted[1]
001	16/12	Rooney	770	Sherwood				3.9	3.9	5	5
002	16/15	Bray	880	Rick Jones	13.4	16.2	16.2	31.2	31.2	22.8	22.8
003	16/12	Various	330	Franklin Prop	4.7	14.4	14.4	8	8	4.5	4.5
004	16/12	Various	330	Franklin Prop	5.7	17.5	16.2	15.4	9.6	9.1	9.1
005	16/12	Vancour	330	Fitzmaurice	13.9	19.9	19.9	6.1	6.1	6	6
006	16/15	Quinn	660	Hatch	4.9	7.1	7.1	12.8	6.4	9.2	6.9
007	16/12	Quinn	550	Collins	4.3	11.2	11.2	4.5	4.5	4.8	4.8
008	16/12	Quinn	220	Vitek	10.7	18.4	18.4	8.4	8.4	16.4	9
009	16/12	Palmatier	330	Hearn	5.5	12.4	12.4	3.1	3.1	2.9	2.9
010	16/12	Palmatier	330	Salamones	3.9	7.9	7.9	5.9	5.9	5	5
011	16/12	Palmatier	330	Hayes	5.5	11.7	11.7	4.5	4.5	8.4	8.4
012	16/12	Palmatier	220	Cortese	7.5	15.8	15.8	5.9	5.9	6.6	6.6
013	16/12	Palmatier	550	Sparkman	4.3	10.5	10.5	16	9.6	5.7	5.7
014	16/12 & 15	Palmatier	500	Davenport	5.7	12.5	12.5	7.6	3.5	10.7	6.2
015	16/12	Palmatier	220	Williamson	3.2	12.2	12.2	4.4	4.4	10.7	10.7
017	16/12	Bray	440	Mallet	13.9	15.5		31.2	5.4	17.8	7.8
018	16/12	Quinn	550	Oberman	3.8	10.8	10.8	4.3	4.3	8.1	8.1
019	16/12	McCahill	330	Turner	11.4	11.4	11.4	6.3	6.3	4.6	4.6
020	16/12	Quinn	220	McDonough	11.4	20.9	20.9	6.4	6.4	6.7	6.7
	Average of Raw Data				7.43	13.68		9.7842105		8.68421053	
	Average W/O upsets						13.5		7.4		8

Note [1]

The average results have been adjusted to account for Non Detect (ND) values below the detection threshold of the lab analysis. Rather than assign a zero value, ND results were replaced with a numeric value at 1/2 of the detection level of the analytical procedure.

Major Independent Third Party Study Results *(See Appendix)*	TN Average	CBOD Average	TSS Average
NSF 40 Test results / EPA Environmental Technology Verification (ETV)	16	14	16
NSF 40 (Outliers and Stress test data eliminated) *Refer to Appendices for data*	12	10	10
Pinelands Study	11.3		

Aquapoint.3,LLC
39 Tarkiln Place, New Bedford, MA 02745
508 985 9050

Performance

NJ Pinelands Commission Summary

Objective: Single Family Nitrogen Effluent TN< 14 mg/L

Performance Comparison

Median performance:		*Mean (Average) Performance:*	
Bioclere	**11.2 mg/L**	**Bioclere**	**11.76 mg/L**
Amphidrome	11.9 mg/L	Amphidrome	15.69 mg/L
FAST	27.6 mg/L	FAST	28.49 mg/L
Cromaglass	31.5 mg/L	Cromaglass	32.18 mg/L

Performance & Cost

Pinelands Commission Summary

5 Year Cost Comparison
Equipment, Installation & Operations

Bioclere	**$ 29,561**
Cromaglass	$ 35,265
Amphidrome	$ 32,433
FAST	$ 30,191

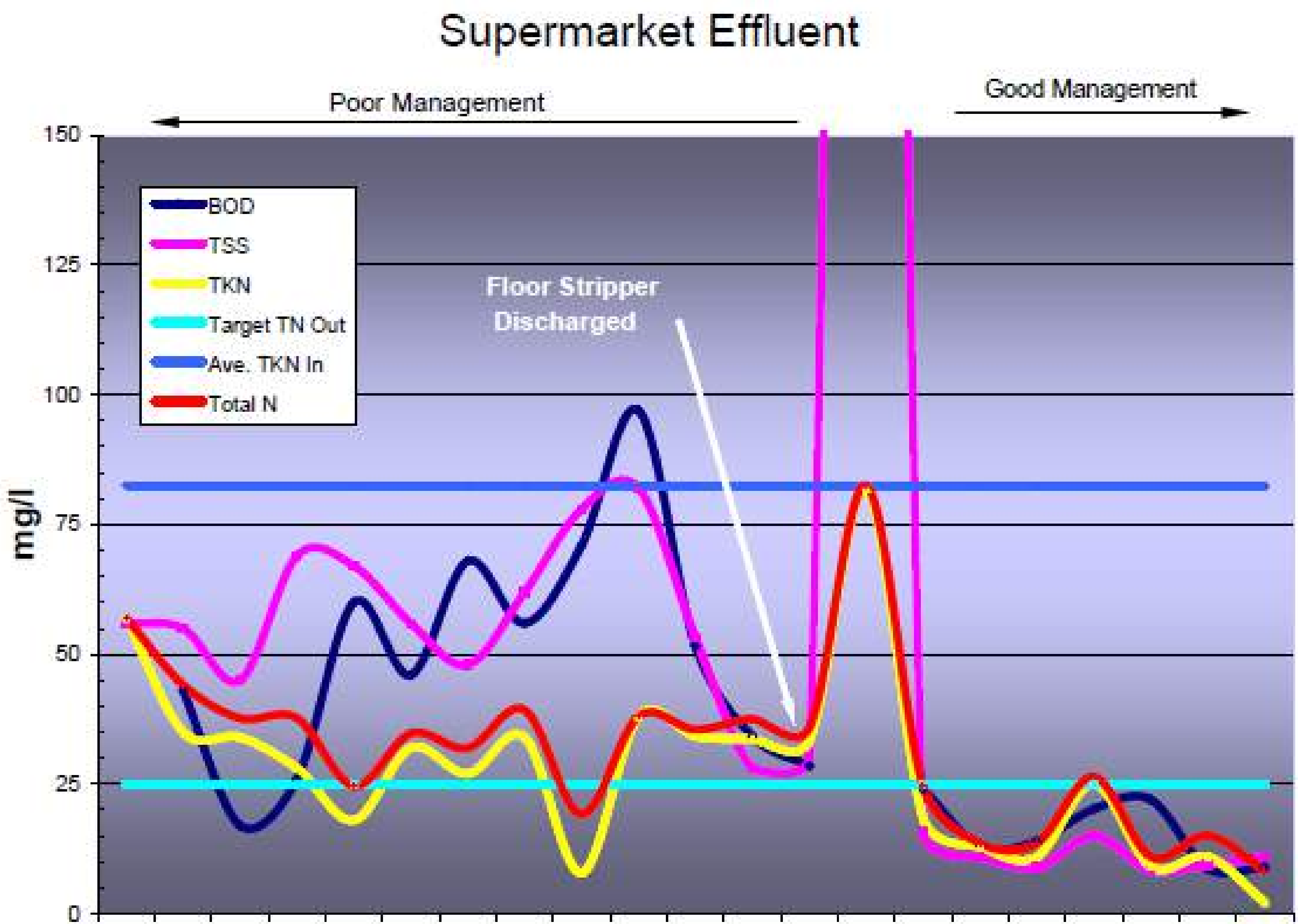
Energy costs increase the Bioclere cost advantage

Addressing the Issues of Nitrogen Removal, Operations and Maintenance

Equipment Application & Design:

Understand the Unique characteristics of On-site & decentralized systems:

- Non-homogeneous wastewater
- Increased strength
- Treatability
  - Toxicity
  - Temperature
  - Bio-chemical constituents
    - pH
    - BOD
    - COD
    - alkalinity
    - carbon
    - O&G


Supermarket Effluent
Poor Management
Good Management
150
125
100
75
50
25
0
mg/l
BOD
TSS
TKN
Target TN Out
Ave. TKN In
Total N
Floor Stripper
Discharged

Bioclere - The High Points

- Simple & adjustable
- Quiet
- Energy Efficient
- Low odor
- Flexible - Modular & Scalable
- Easy to Install- light weight modular units
- Easy to Maintain
- Proven Performance
- Direct to Manufacturer Service & Support
- Robust: > 50 years service life

Thank You

AQUAPOINT
AN OBEH COMPANY

Aquapoint.3 LLC
39 Tarkiln Place
New Bedford, MA 02745
help@aquapoint.com

Decision Maker Wastewater Workshop

Operating and Maintaining Large Denitrifying Septic Systems: What Operators Need to Know to Optimize Service and Performance

Michael McGrath, PLS**,** P.E. - Holmes & McGrath, Inc.

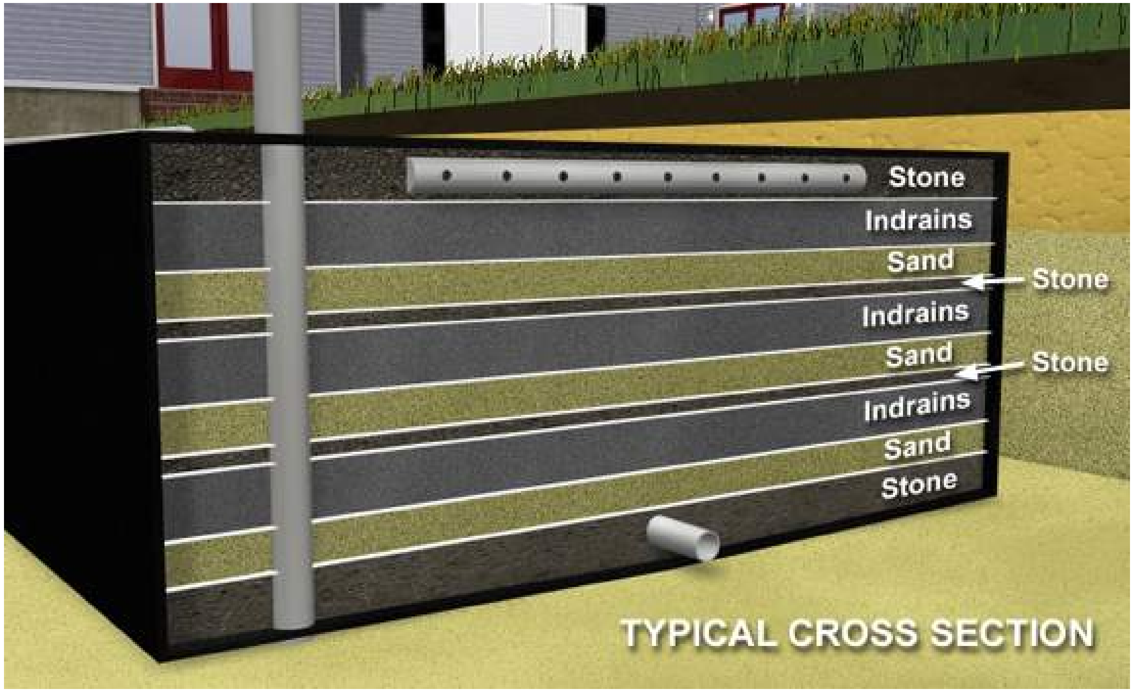
Who am I?

- MICHAEL B. McGRATH, P.E., P.L.S is the managing principal partner at Holmes and McGrath, Inc., a land surveying and civil engineering firm in Falmouth, MA.
- Mr. McGrath graduated from Northeastern University in Boston, Massachusetts with a Bachelor of Science in Civil Engineering.
- In 1984, Mr. McGrath and his partners designed, permitted, built and operated the first innovative alternative denitrifying residential septic system, a RUCK system in Massachusetts.
- Mr. McGrath was a co-founder of Environmental Operating Solutions, Inc. ("EOS"), the manufacturer of MicroC®.
- Mr. McGrath has three patents, one active, on soil based wastewater treatment.
- Mr. McGrath and his partners have further refined RUCK Filter systems.
- Mr. McGrath and his partners has developed the GPC™ system that further treats already treated wastewater and reduces Contaminants of Emerging Concern.

What am I going to tell you

- Basis of how a Ruck system worked.
- A Ruck Filter is a stratified sand filter designed to mimic natural soil formation.
- We now pressure dose Ruck Filters.
- In the following I will describe what treatment occurs when water passes through a RUCK filter.
- I then will describe how we cause denitrification.
- I will describe the GPC filter and describe disinfection.

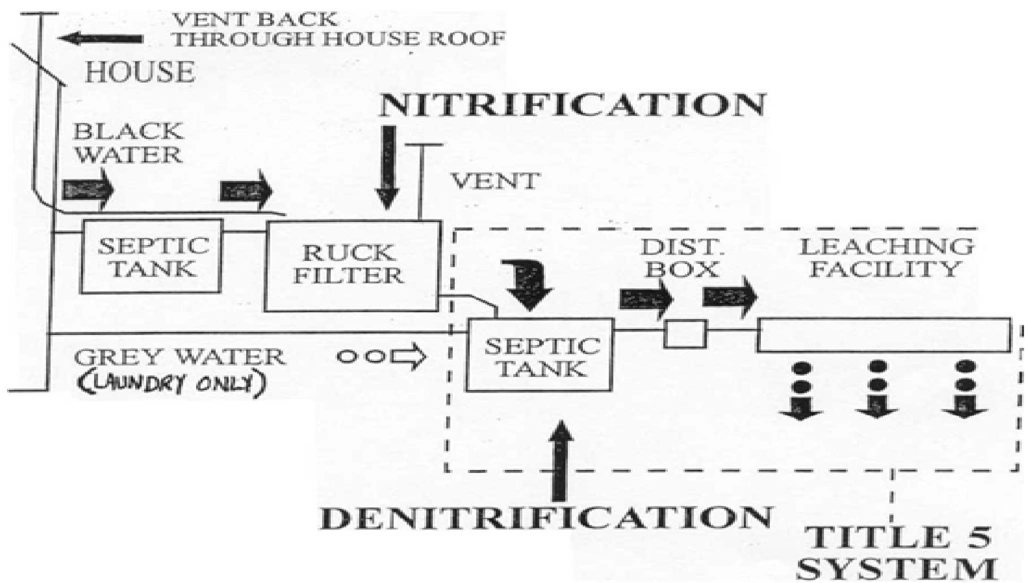
A cross Section of a RUCK® Filter



What treatment occurs when water passes through a RUCK filter.

- We pressure dosed Ruck Filters.
- The Ruck filter effluent will have completely nitrified fluid or all nitrate and nitrite compounds. If mature, the concentration of TKN will be Below Detection Level ("BDL"). It takes about 21 days for nitrification to start.
- There will be BDL concentration of 5 Day Biochemical Oxygen Demand ("BOD_5").
- There will be BDL concentration of Total Suspended Solids ("TSS").
- There will be very few bacteria present.
- There will be a loss of 40% of TN in the filter.

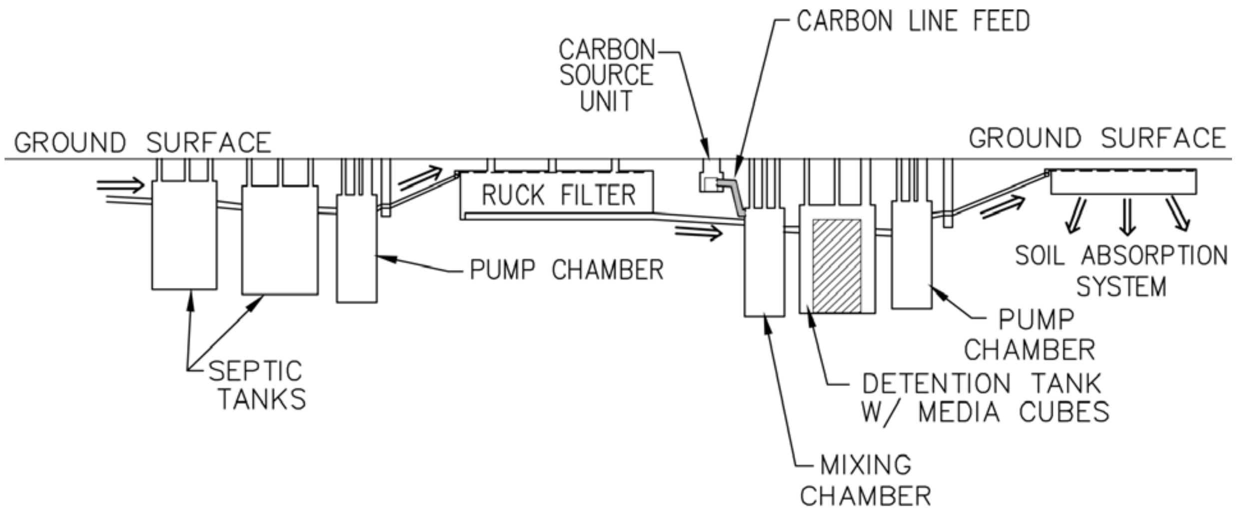
We started with the Residential RUCK system



Issues

- The original 1995 Residential Ruck system was not robust.
- We did not pressure dose the Ruck Filter.
- The concept behind the design that the Black water would be nitrified and denitrification would occur in the gray water tank. The carbon source was in the detergents.
- When Laak invented the Residential Ruck system, household wastewater was much weaker than today,
- Residential Wastewater is now much stronger than when Laak invented the system.
- In our detailed analysis of residential systems, we found that a liquid detergent that when Laak tested it in the 1970’s had minimal dissolved Total Nitrogen now, in the 1990’s had concentrations of 22 mg/l of TKN.
- Reduction of TN then varied too much so we changed to the RUCK CFT system for all flows.

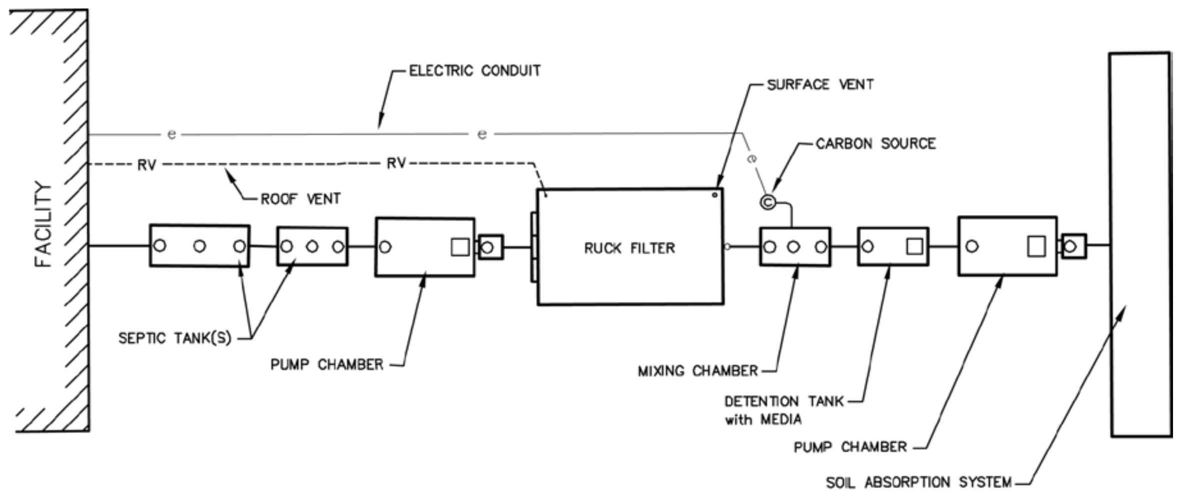
RUCK CFT



<u>PROFILE OF TYPICAL RUCK CFT SYSTEM</u>

NOT TO SCALE

Schematic Layout



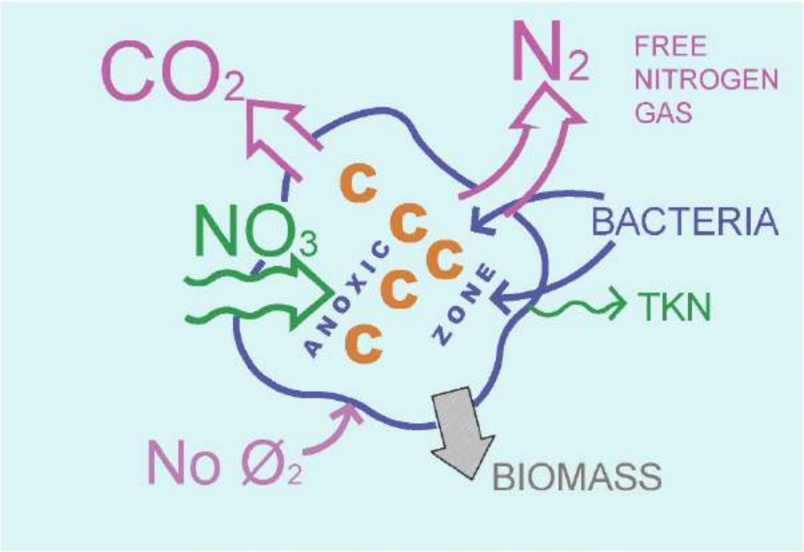
TYPICAL RUCK CFT LAYOUT

NOT TO SCALE

Denitrification in the RUCK CFT system

- Nitrified RUCK filter effluent flows into a mixing tank where a carbon is added
- We specify MicroC to be added as a carbon source.
- With sufficient carbon, bacteria, time and correct temperature, denitrification will be complete.
- So, I show an illustration of denitrification

Denitrification



DENITRIFICATION

What do we need for Denitrification

- Denitrification is a microbial process that requires

1. Water with dissolved nitrate
2. Dissolved carbon that is labile or available to the bacteria.
3. Sufficient bacteria
4. Enough time for the water to go anaerobic
5. Sufficient temperature
6. pH near 7

When denitrification is complete the denitrified fluid has BDL concentrations of nitrate and low concentrations of TKN from the bacteria and from enzymes in the effluent.

Carbon Source

- During the development of RUCK CFT systems, we originally used a specially formulated detergent.
- I and two others formed EOS, Inc, to develop an innocuous carbon for denitrification.
- The amount of the carbon feed is controlled by a timer that is started when a pump on line is tripped. The calibrated volume is set by measuring the actual pumped volume of MicroC in a certain time and then adjusting the Time pumped.
- Formerly, methanol was the usual carbon source for denitrification but it is:
  - Poisonous, you can not touch it
  - You can not breathe it.
  - It burns without a visible flame
  - It is explosive.
  - It is most likely a co-carcinogen
  - If you spill it into the ground, it is a reportable discharge.

  - Methanol is now diluted to reduce dangerous conditions

Denitrification tank effluent

- The denitrification tank effluent meets the requirements for a Groundwater Discharge Permit.
- From seven grab samples of water leaving the denitrification tanks:
- Average BOD_5= 26.2 mg/l
- Average TKN = 6.2 mg/l
- Average NO_3 = 0.8 mg/l
- Average TN = 7.1 mg/l
- Average TSS = 6.1 mg/l

- However, it does not meet the criteria for the maximum count of fecal coliform.
- If disinfection is required, we add a filter before disinfection.
- The filter we design is a GPC Filter.

What is a GPC Filter?

This is a model of a stratified GPC™ filter.

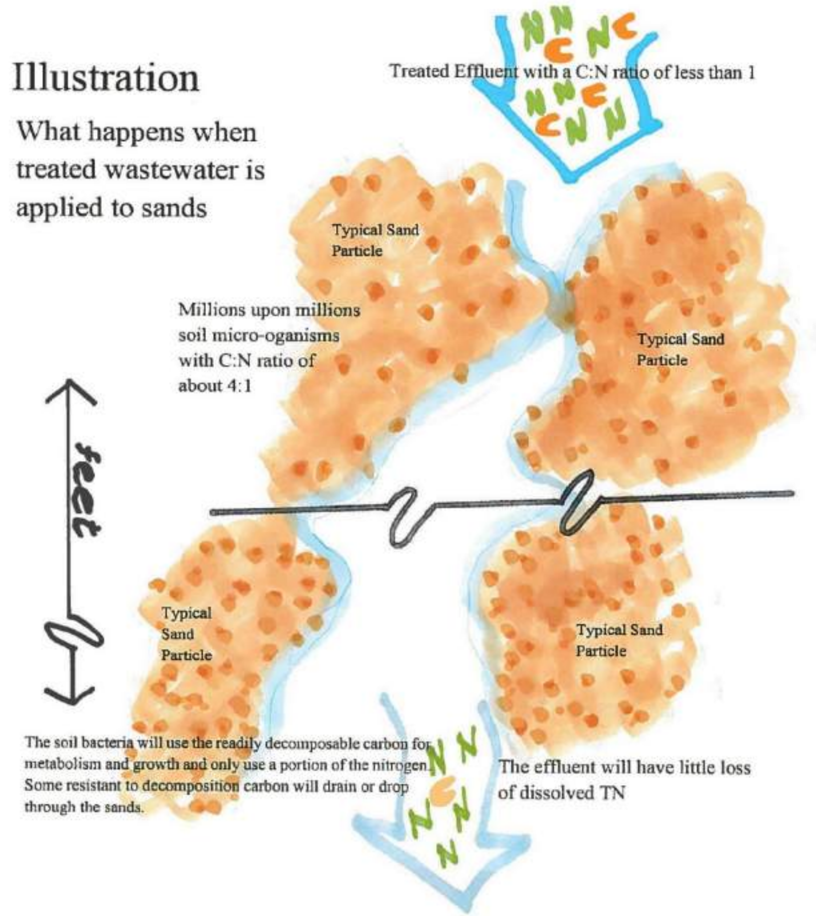
The sand layers are install on crushed stone layers.

The stratifications are designed to improve performance.

Results of small scale testing of GPC filter

- When we dosed the denitrified fluid to a test GPC filter, we often found strange results. Inexplicably while the filter did reduce Total Suspended Solids and 5 Day Biochemical Oxygen Demand, the reduction of TN was inconsistent. At times, the concentration of TN increased. The increase was in the range of 20% but only some of the time.
- While we originally attributed the increase in TN to the lag in time in the water passing through the GPC filter, we think now that there is most likely microbial action that fixed nitrogen from the air.

Is this an Ideal Fluid to dose to a sand filter?

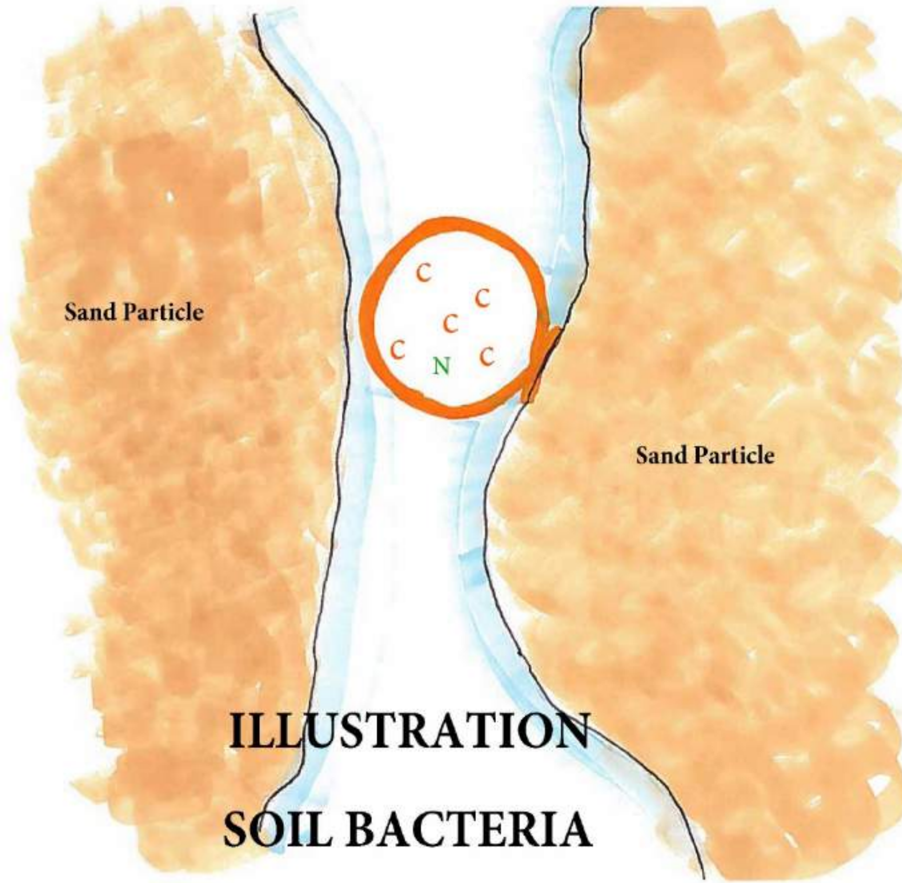


Is this fluid ideal for the soil micro-organisms? **NO!**

- To understand what happens to this fluid in the sand filter, we should consider what the soil micro-organisms will do to this fluid.
- What matters to the micro-organisms is; "What is there to eat?"
- When we look at the denitrified fluid, we should ask: "What is the mass of carbon to nitrogen ratio in the fluid?"
- Is this C:N ration enough for the soil micro-organisms to treat the fluid in the vadose zone?
- We do not know the true carbon expressed as TOC in this fluid.
- What is the relationship of TOC to BOD_5? According to Crites and Tchobanoglous (1998), The ratio of TOC/BOD_5 in treated wastewater varies between 0.2 and 0.5.

What are the general overall makeup of soil bacteria expressed in Carbon and Nitrogen?

The micro-organisms in the soils have carbon to nitrogen ratios in the range of 3:1 to 5:1 according to Paul and Clark (1996).



The GPC process

- To test this hypothesis, we add carbon to the denitrified fluid and dose the fluid onto a stratified filter.
- Here, we add GPC carbon, a proprietary recipe, to treated wastewater and dose the mixture onto a stratified modified Sand Filter called the GPC filter.
- The results from an analysis of tests of the influent water quality compared to the effluent water quality have been surprising.

Final Effluent Testing Results

	BOD$_5$			TSS		TN		NO_3
	mg/l			mg/l		mg/l		mg/l
Average	3.1			2.3		5.1		4.5
TESTS	181			181		181		181
	0			3		13		7
Detected	6			23		n/a		n/a
MRL	3			3				
Total BDL	175			158				
Percent Compliant	100%			98%		92%		96%
Median	3.0			1.5		4.2		3.5
High	13.7			14.0		23.1		22.2
Low	3.0			1.5		0.8		0.4

Composite samples taken at Mill Pond Village, West Yarmouth, MA.
May 13, 2011 to October 31, 2014 (3 years, 5 months)
The denitrified fluid has passed through the GPC process. The final GPC effluent passed through ultraviolet light

Discussion of effluent tests

- Of 181 final effluent composite BOD_5 samples, 175 samples had values below the detection level of 3 mg/l. The highest measured concentration of the BOD_5 was 13.7 mg/l.
- Of 181 final effluent TSS composite samples, 158 samples had values below the detection level of 1.5 mg/l. The highest concentration of TSS was 14.0 mg/l.
- Of 181 final effluent composite samples, 158 samples conformed to the permit level of 10 mg/l TN. The highest concentration of TN was 23.1 mg/l. In this time period, the median TN concentration was 4.2 mg/l. The non-conformities occurred when the upstream treatment system did not denitrify the water completely

Analysis of GPC Filter performance

- This full size GPC Filter removed virtually all detectable BOD_5 concentrations
- This full size GPC Filter removed virtually almost all detectable TSS concentrations.
- The dissolved TN concentrations were reduced by an average of 53%.
- The final effluent TN concentration varied from 3 mg/l to 3.6 mg/l.

Limitations

- The GPC Filter process does have an operating limitation.
- When dissolved carbon is available as an electron donor in soils and in sands, there are electron acceptors that are available in a particular order: Nitrate reducing, Manganese reducing, Iron reducing, Sulfate reducing and Methane reducing.
- If the filter water in the filter sands becomes highly anaerobic, and denitrification is complete, then ferric iron, FE (III) will be released from the sands or from the water.
- The dissolved ferric iron will travel in the filter water. When the filter water with the dissolved ferric ion reaches an aerobic zone, the ferric ion will be oxidized to ferrous iron, FE (II).
- Rust will result forming a relatively impermeable layer at the bottom of a sand filter at the top of the vented layers. The rust layer will have much slower permeability.
- To prevent this condition, the influent water has to have low concentrations of dissolved iron in the water or the GPC Filter will fail.

We discovered that the GPC Process reduced Contaminates of Emerging Concern

- Pharmaceuticals
- 14 detected in influent, 15 detected in effluent
- The GPC Filter reduced nine pharmaceutical chemicals to Below Detection Levels.
- Two chemicals, Atenolol and Lopressor, were reduced substantially (over 80% removal)
- Two chemicals, Carbamazepine and Lidocaine, were reduced.
- Butalbital, increased.
- Azithromycin was found in the effluent but not found in the influent.

Reduction in Household Chemicals from a CEC Test

- Twelve household chemicals detected in the influent.
- The GPC Filter reduced four chemicals, 1.7-Dimethylxanthine (a metabolite of caffeine) Cotinine (a metabolite of nicotine), Diuron (a herbicide) and Propylparaben (preservative) to levels below detection.
- The GPC Filter reduced substantially (over 80% removal), two chemicals, Acesulfame-K (an artificial sweetener) and Caffeine.
- Six chemicals, DEET, Sucralose (an artificial sweetener), TCEP, TCPP, TDCPP and Theobromine (a bitter alkaloid of the cacao plant, from chocolate), were reduced.
- DEET is a chemical in insect repellants and it was reduced from 73% to 88%.
- TCEP, TCPP and TDCPP are fire retardants and are normally considered resistant to decomposition.

Discussion of CEC's tests

- The tests report values in nanograms per liter (ng/L) or one part in one trillion (10^{12}).
- The entire round of tests on the GPC Filter influent and effluent should be repeated several times before the range of removal rates can be confirmed.
- The estimated removal rate in comparing the influent concentrations of a particular chemical to the effluent concentrations of the same chemical necessarily assumes that the applied concentration is the same value during the draining of water through the GPC Filter.
- The CEC removal rates then are approximate and require repetitive tests to establish the true removal capacity. But, in any case, the removal rates are impressive.
- The reduction of the organic carbon chemical concentrations appears to be the result of the soil micro-organisms being so numerous that there is selection in the micro-organism population so that some micro-organisms attack and use for metabolism these organic compounds normally considered resistant to decomposition.
- The reduction of several chemicals to No Detect is an unexpected result.

Advantages of the GPC Process

- The GPC Process will reduce non-conformities in the discharge of treated water to the soils.
- The GPC process enlists the capabilities of soil micro-organisms in the filter sands.
- The GPC Filter effluent includes microscopic insoluble material of which a portion is organic carbon, resistant to decomposition.
- This microscopic insoluble carbon will pass through the soils, enter the groundwater and degrade over time. This carbon is more resistant to decomposition and may become slowly available over time and may provide a carbon source for in situ denitrification by soil bacteria in the vadose zone and downstream in the groundwater.
- RECOMMENDATIONS
- Where treated effluent is discharged into soils, we assert that the use of the constituent BOD_5 should be replaced with a measurement of Total Organic Carbon (TOC). The discharge of treated effluent should have a proper C:N ratio to induce treatment in the vadose zone and to help induce in-situ denitrification in the groundwater downstream in sandy coastal outwash plains and alluvial sandy soils.

- Operators should carefully dose the GPC system.
- pH as always is critical.

Contact

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SanTOE™ Technology for Cost Efficient Advanced Treatment of Sanitary Wastewater

Presentation at

Buzzard's Bay Coalition Decision Makers Workshop

New Bedford, MA

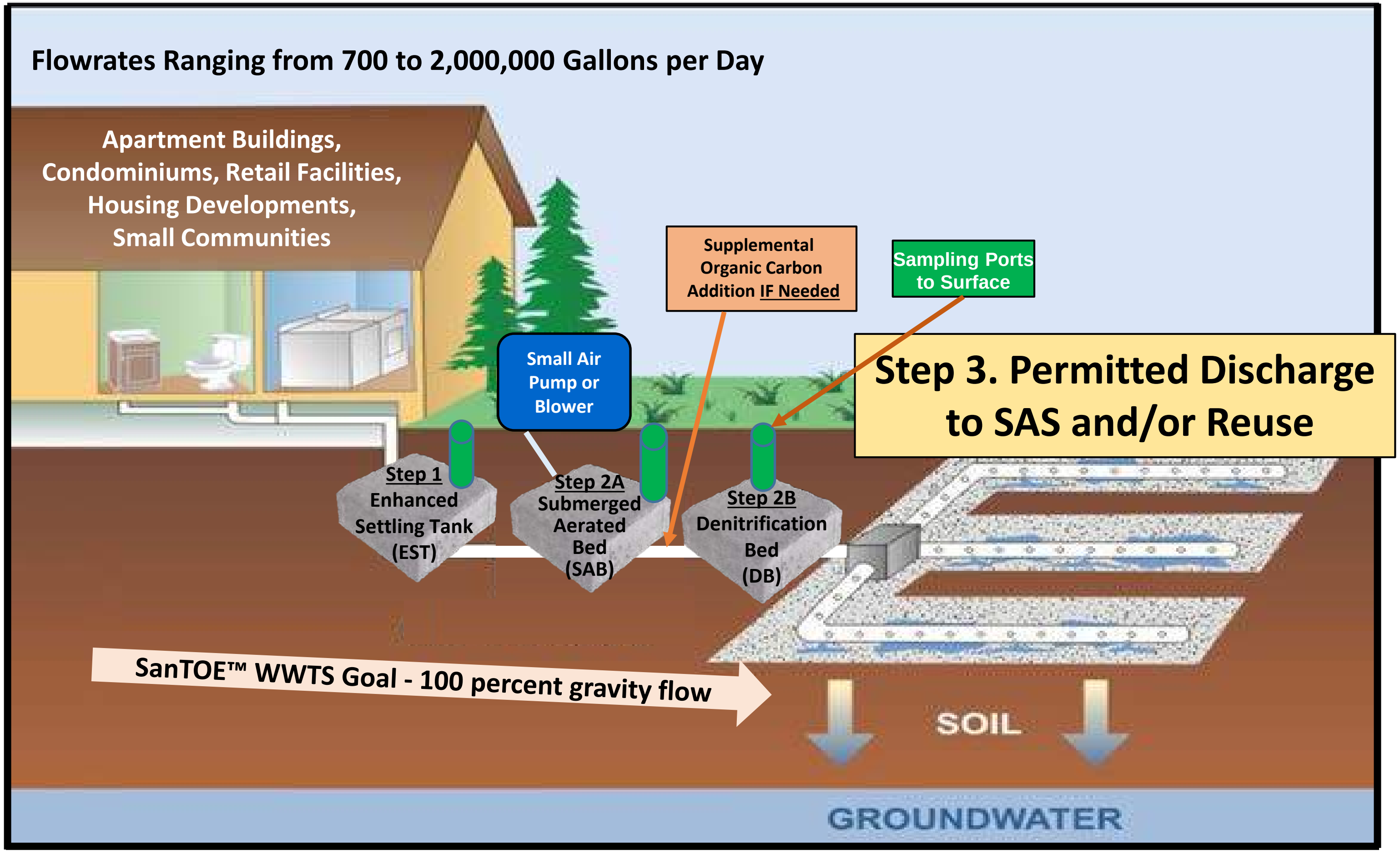
May 2, 2019

Presentation Topics

SanTOE™ WasteWater Treatment System (WWTS)

- Introduction
- MASSTC Demonstration
- Deployment Plan
- Budgetary Costs
- Enabling Decentralized Wastewater Treatment

SanTOE™ WWTS - Innovative Application of Currently Practiced Science & Engineering Design Principles



SanTOE™ WWTS Design Philosophy

- Satisfies and exceeds Title 5 requirements
- Continuous calibration and refinement of design and operating algorithm
  - Bio-kinetic based
  - Enables guaranteed treatment performance
- Straightforward construction and operation – similar to Title 5
  - Common, civil type constriction approaches and materials similar to conventional septic systems
  - Operation and maintenance similar to conventional septic systems
  - Subsurface tanks for landscape type utilization of treatment area
- Low energy use combined with little operation and maintenance effort
  - Gravity flow wherever possible
  - No or little chemical addition
  - No intentional sludge wasting
    - Except for primary sludge removal from Step 1 Enhanced Settling Tank
  - Little mechanical equipment
    - No recirculation pumps or lines
    - Small external air blower with replaceable hose configuration
  - No elaborate control systems or local alarms
    - Remote sensing of few key parameters

Achieves Simplicity of

- **Design**
- **Fabrication**
- **Operation**

Translates to Overall Lower Cost of Installation and Operation

with

Advanced Treatment Consistently Achieved

SanTOE™ WWTS Demonstration at Massachusetts Alternative Septic System Test Center (MASSTC)

Step 1 – EST Treatment

Step 2A – SAB Treatment

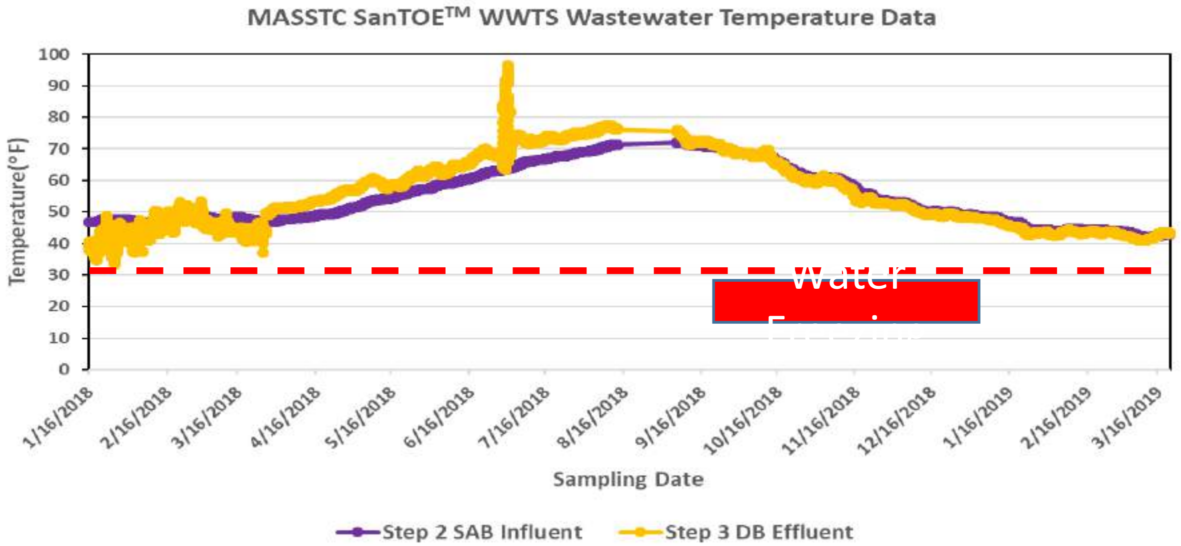
Step 2B – DB Treatment

Total Footprint = 500 ft^2

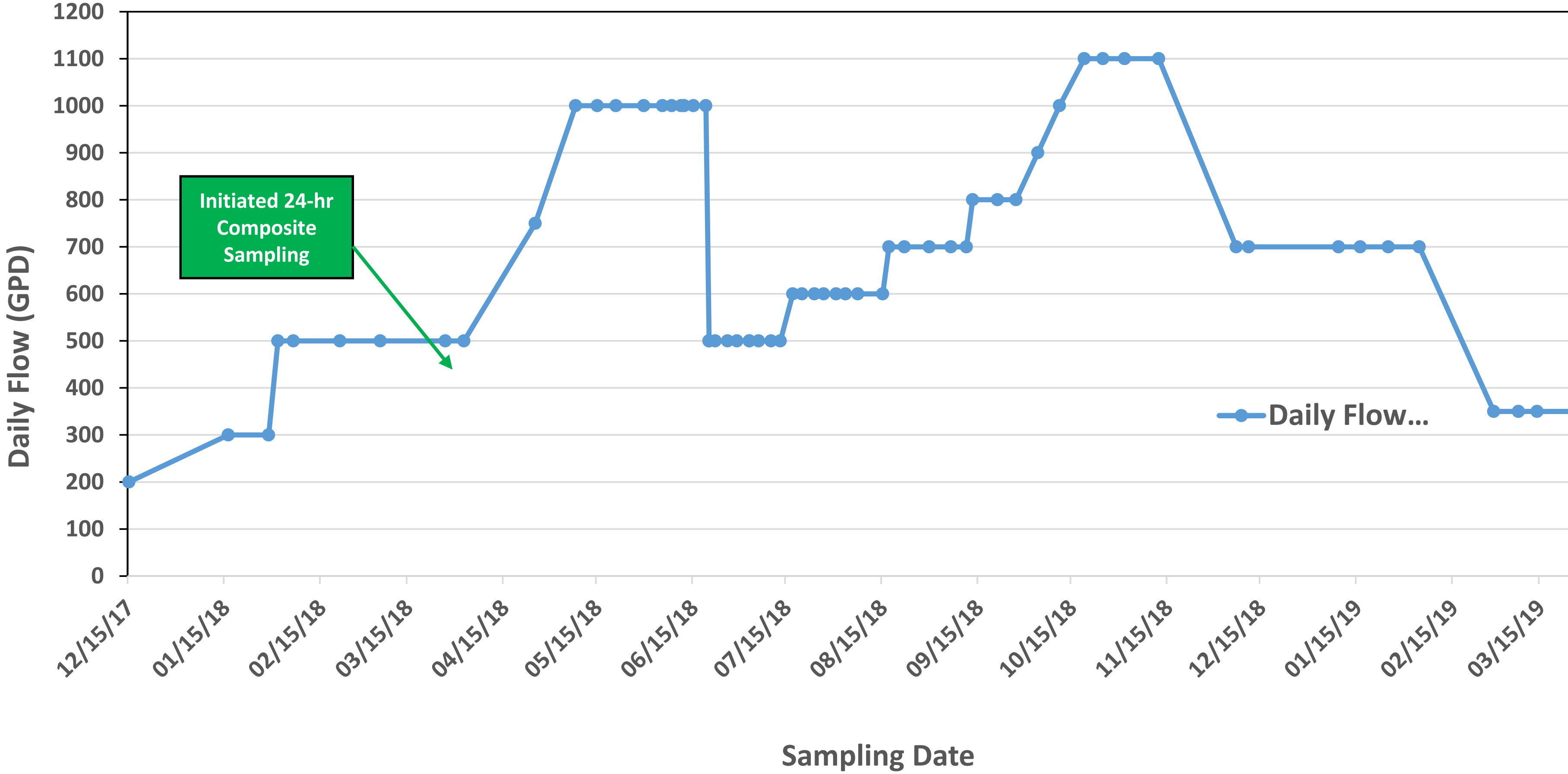
- (0.5 – 1 ft^2/gpd design flow)
- Excluding Step 3 Leach Field

December, 2017 Start-Up with 500 – 1,100 Gallons per Day Operating Flow

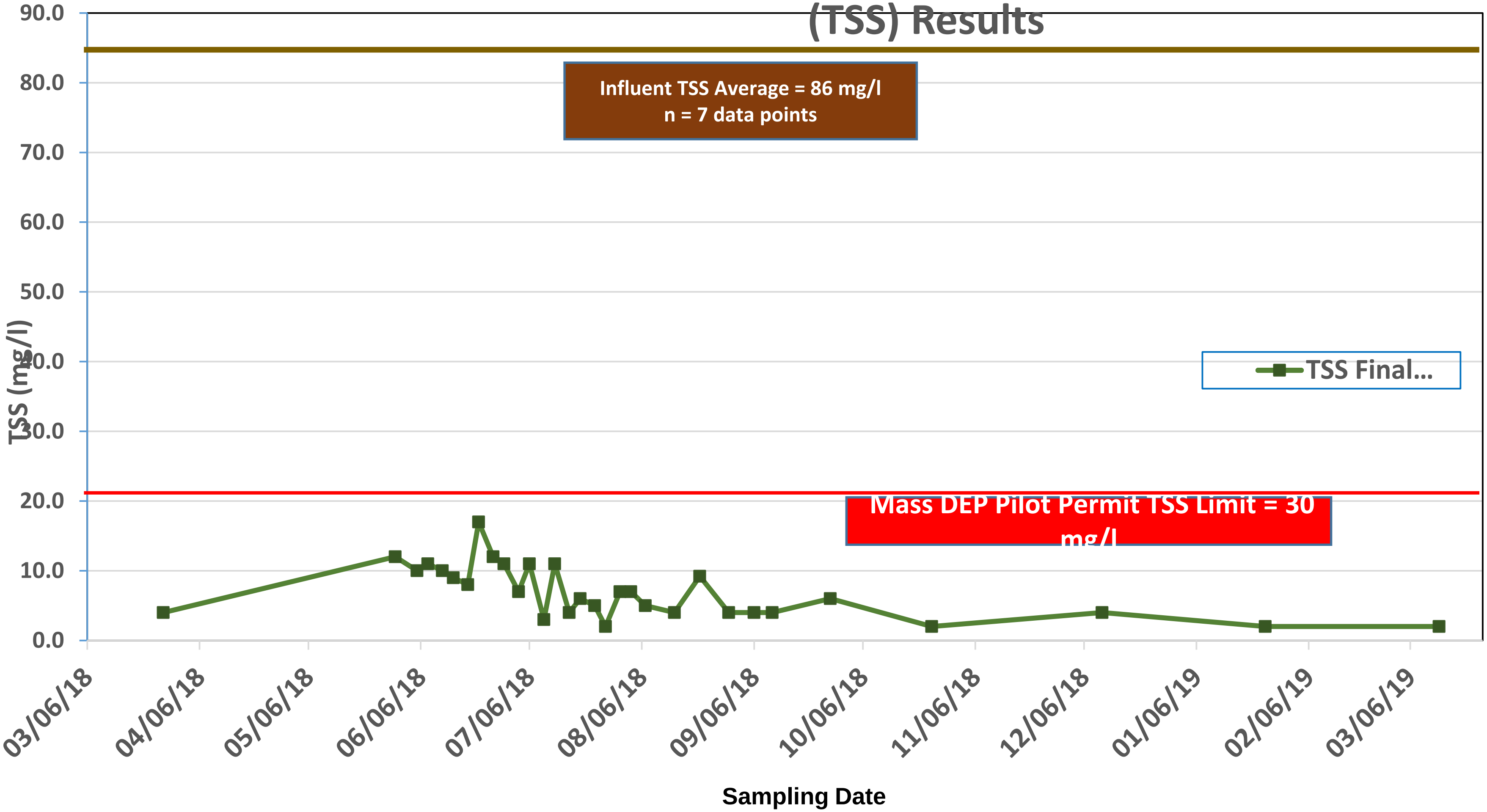
Seasonal Operation of MASSTC SanTOE^{TM} WWTS



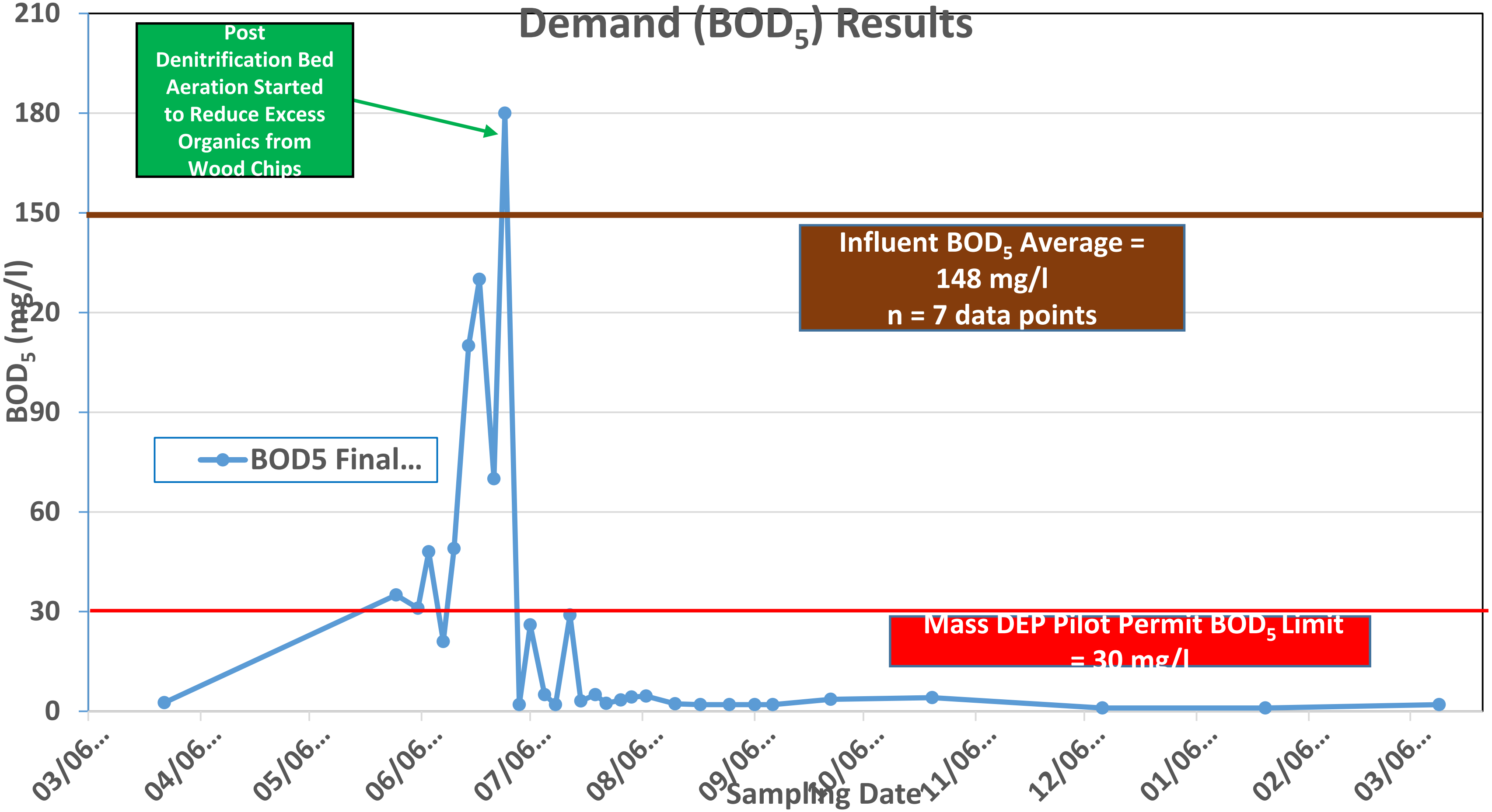
MASSTC SanTOE™ WWTS Daily Wastewater Flowrate (Gallons per Day)



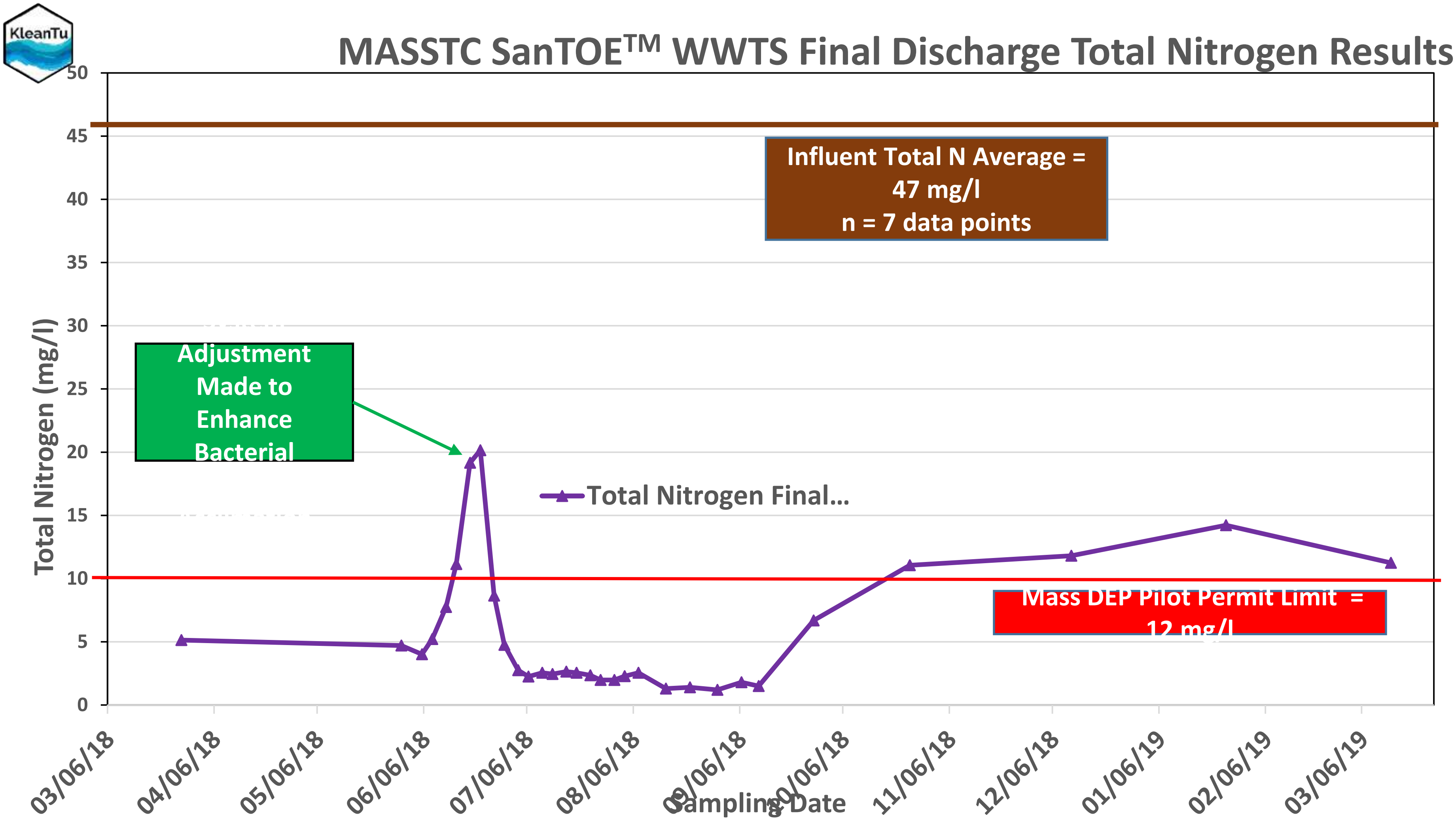
MASSTC SanTOE™ WWTS Final Discharge Total Suspended Solids (TSS) Results



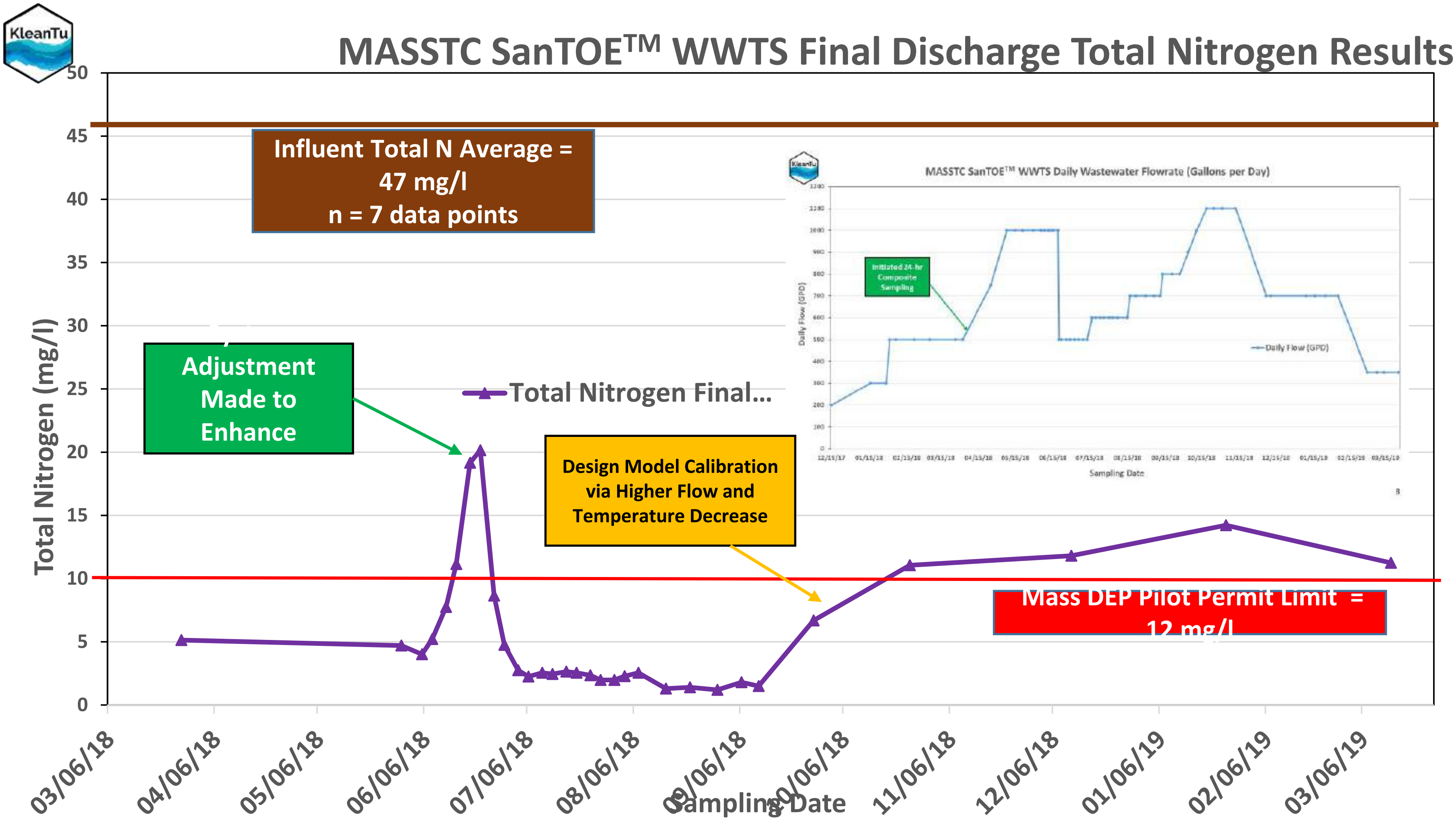
MASSTC SanTOE™ WWTS Final Discharge Biochemical Oxygen Demand (BOD_5) Results



MASSTC SanTOE™ WWTS Final Discharge Total Nitrogen Results



MASSTC SanTOE^{TM} WWTS Final Discharge Total Nitrogen Results



MASSTC SanTOE™ WWTS Performance Summary

(Based on 31 - 24-hour Composite Samplings from March, 2018 – March, 2019)

Final Discharge
(Averages of 31 Sampling Events)

- **pH = 6.7**
- **Total N = 5.6 mg/l (88% removal)**
  - **TKN = 4 mg/l (92% removal)**
  - **Ammonia N = 2 mg/l (93% removal)**
  - **Nitrite N = 0.06 mg/l**
  - **Nitrate N = 1.6 mg/l**
- **Organic C as BOD_5 = 25 mg/l (83% removal)**
- **Total Suspended Solids = 7 mg/l (92% removal)**

All samples analyzed by Mass DEP Certified Lab

SanTOE™ WWTS Continued Development and Optimization

- Remote sensing
- Reduce monitoring costs via alternative analytical methodology
  - Same day results
  - Tisbury POTW is now doing this
- Enhanced removal of pharmaceuticals & personnel care products (PPCPs)
- Enhanced phosphorus removal

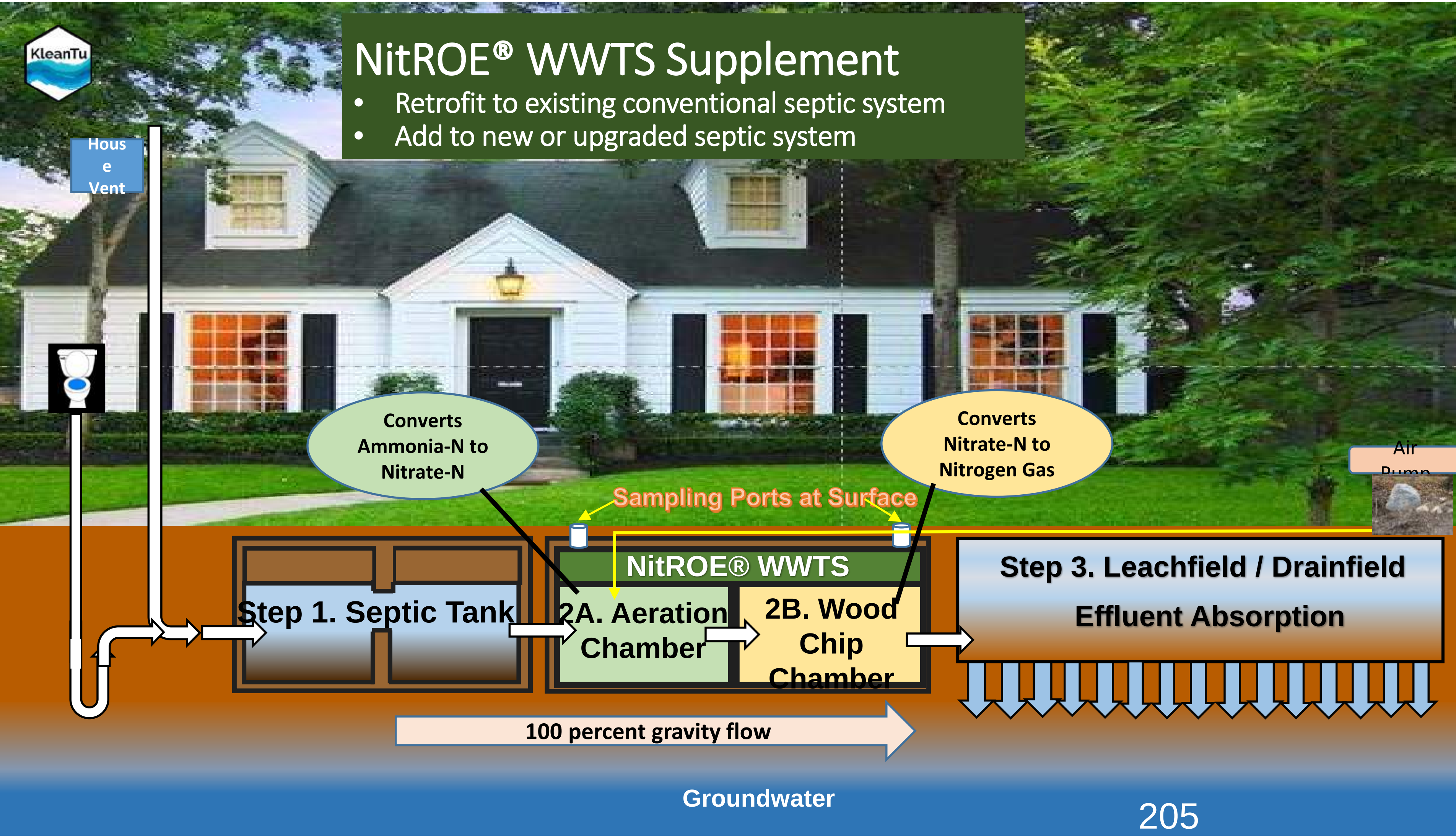
THANK YOU TO

SanTOE™ WWTS Deployment Plan Forward

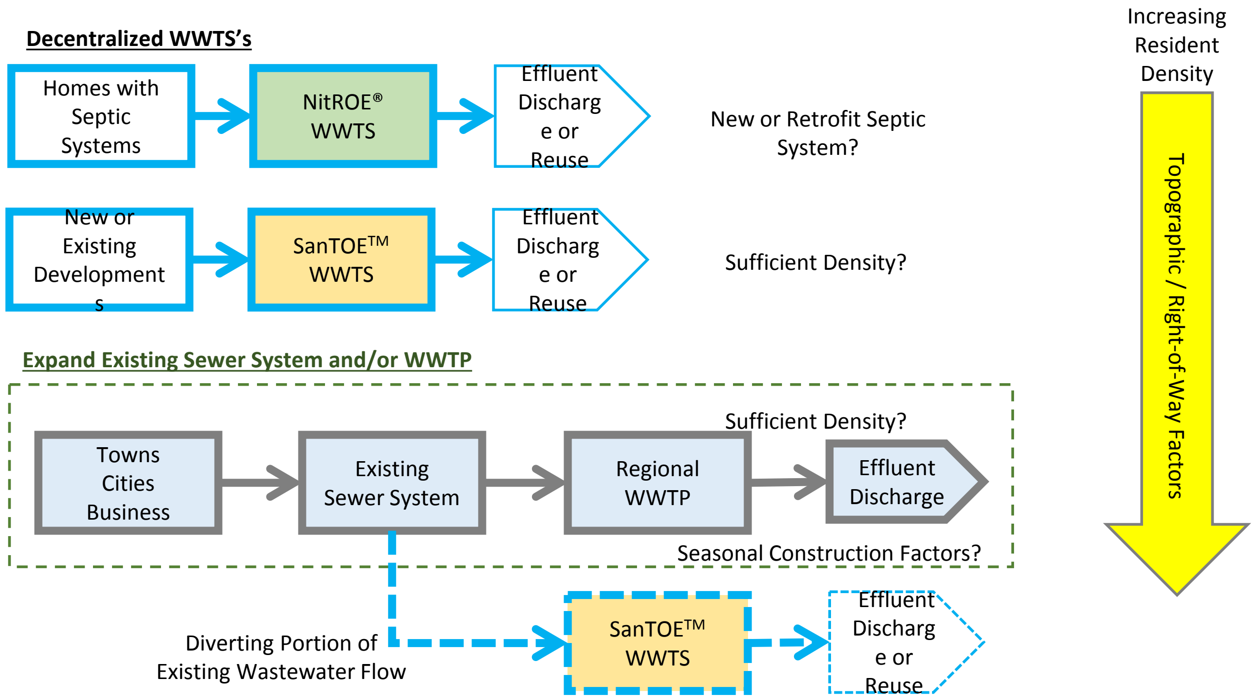
- **Design and Install Two (2) SanTOE™ WWTS's in 2019**
  - **One in Tisbury, MA with design flow = 1,980 gallons per day**
    - **Obtained Mass DEP Pilot Permit**
  - **One in West Falmouth, MA with design flow = 6,000 gallons per day**
- **Guaranteeing Average Values of Treated Effluent**
  - **BOD_5 < 30 mg/l**
  - **Total suspended solids < 30 mg/l**
  - **Total Nitrogen < 10 mg/l**
- **Engaged on additional SanTOE™ WWTS Installations**

SanTOE™ WWTS Budgetary Cost

- Compared to more conventional tank based biological type systems, the SanTOE™ WWTS price is
  - More than 40% lower for installation cost
  - More than 60% lower for yearly O&M cost
- For a 2,000 to 6,000 GPD design flow range, the projected equivalent cost is <$100/lb. N removed
  - Based on 20 years at 5%
  - Influent total N = 60 mg/l with treatment to 10 mg/l
  - Costs of all 3 SanTOE™ WWTS process steps included
- Opportunity for additional cost reduction
  - Reduce size of Step 3 soil absorption system
  - Gravity flow to discharge for design flowrates >2,000 GPD


NitROE® WWTS Supplement
• Retrofit to existing conventional septic system
• Add to new or upgraded septic system
Hous
e
Vent
Converts Ammonia-N to Nitrate-N
Converts Nitrate-N to Nitrogen Gas
Air
Sampling Ports at Surface
NitROE® WWTS
Step 1. Septic Tank
2A. Aeration Chamber
2B. Wood Chip Chamber
Step 3. Leachfield / Drainfield
Effluent Absorption
100 percent gravity flow
Groundwater
205

Role of NitROE® and SanTOE™ WWTS's in Decentralized Wastewater Management



Use of NitROE® and SanTOE™ WWTS is consistent with U.S. EPA decentralized approach

He that will not apply new remedies must expect new evils for *time is the greatest innovator*

Sir Francis Bacon
(1561-1626)

For More Information on SanTOE™ and NitROE® WWTS's

Please Contact:

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john.r.smith@solutions-by-ces.com

J&R Sales and Service, Inc.

Over 20 years in Onsite Wastewater Solutions.

BIO MICROBICS®

BETTER WATER. BETTER WORLD.®

SeptiTech®

Solving Wastewater Problems with Technology

Wastewater Pretreatment Systems

GEOFLOW SUBSURFACE DRIP

Subsurface Wastewater Disposal

About Us…

- J&R established in 1990
- Over 20 years experience in the wastewater treatment market
- We began Piloting in Massachusetts with FAST® and GEOFLOW in 1998 at the Alternative Septic System Test Center
- First FAST® single home installation in 1995; first GEOFLOW in 2000
- BioMicrobics acquired SeptiTech in 2013
- BioBarrier Approval in 2012
- Pioneers in the onsite market throughout New England
- Over 3,000 systems installed – primarily in Massachusetts and Rhode Island
- We maintain greater than 80% of these installations through our service division, Wastewater Treatment Services

Our Products…

- **GEOFLOW Subsurface Drip Dispersal**
  - The first drip system to be approved in New England
  - Superior quality – made in the USA
  - Affordable, alternative option
- **BioMicrobics FAST®**
  - FAST wastewater treatment system
  - Over 3,000 systems installed
- **BioMicrobics BioBarrier ®**
  - Membrane technology for the onsite market
- **BioMicrobics STARR ®**
  - Recently acquired SeptiTech – for a trickling filter treatment option

SeptiTech Wastewater Treatment Systems

Denitrification Units

Residential & Commercial

SeptiTech®
a subsidiary of Bio-Microbics, Inc.

SeptiTech Basics

- Biological Recirculating Trickling Filter
- Aerobic (Pulls Air In)
- No Chemicals Added
- Self Cleaning
- Control Panel Monitors System
- Installed Below Grade
- Added Between 2-Compartment Tank & Disposal Field
- Residential & Commercial Processors

SeptiTech®
a subsidiary of Bio-Microbics, Inc.

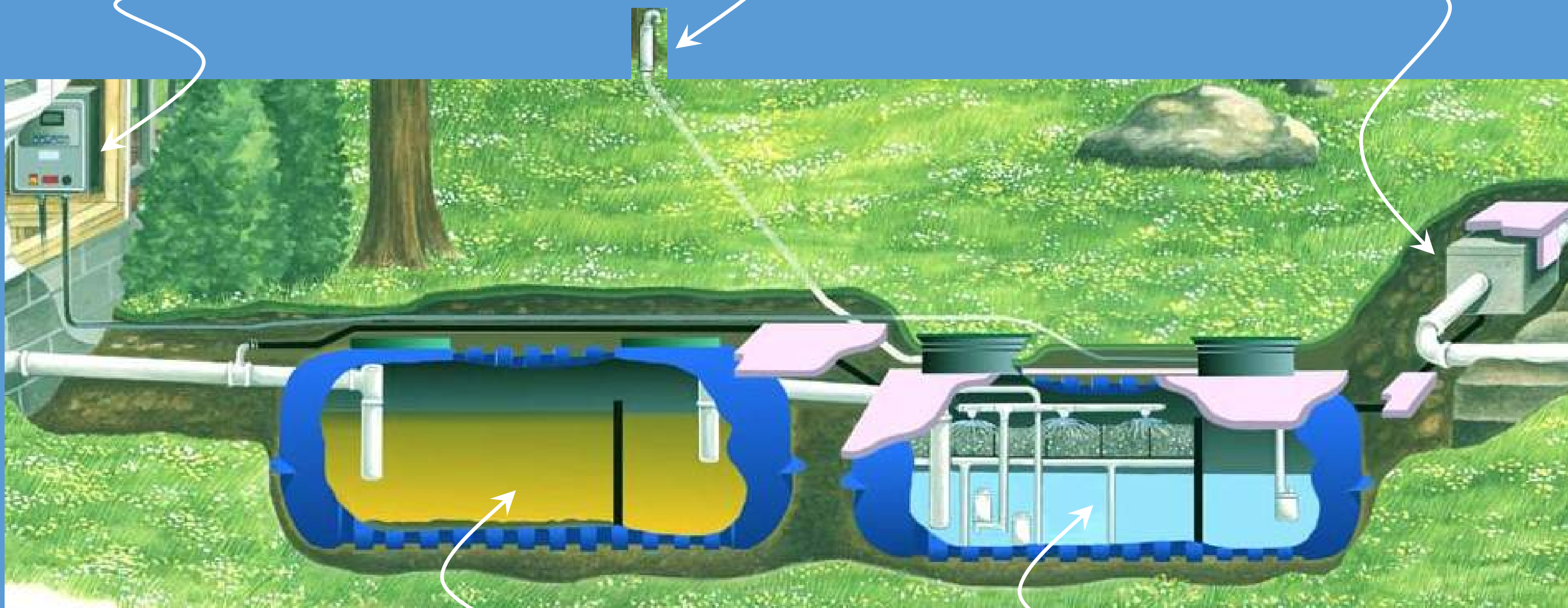
SeptiTech/STAAR Trickling Filter

NSF 40 & 245 Certified – 98% BOD removal – up to 85% TN remov

- Simple and Reliable Process
- Treats High Organic Loads
- Efficient in Removing Ammonia
- Handles and Recovers from Shock Loads
- Relatively Low Power Requirements
- Less Sludge than Suspended Growth Systems
- Moderate Operator Skill Level
- Low Operating Cost
- Equalization and Clarification All in One Tank
- Operating Flexibility and Control
- All Below Grade Components
- No Onsite Concrete Work Required
- No Operations Building Required
- Integrates with Other Technologies

SeptiTech®
a subsidiary of Bio-Microbics, Inc.

SeptiTech Installation



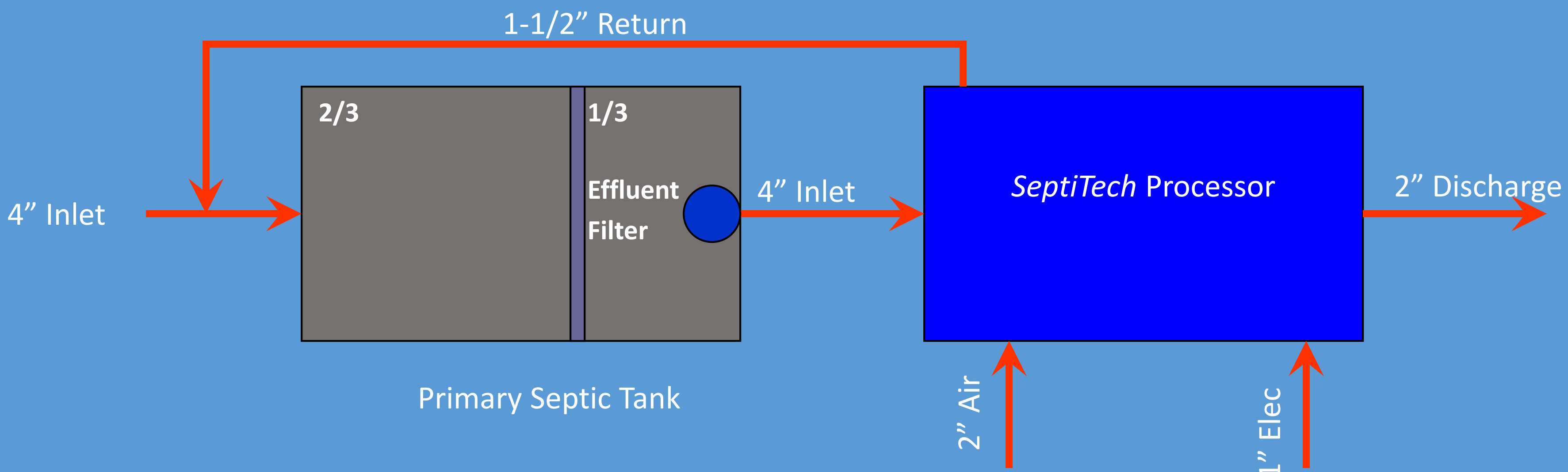
SeptiTech®
a subsidiary of Bio-Microbics, Inc.

Residential System Overview

Primary Septic Tank
- ✓2 Compartment
- ✓Effluent Filter

***SeptiTech* Processor**
- ✓Polystyrene Bead Treatment Media
- ✓Self Cleaning Processor

External Piping
- ✓Inlet / Discharge Line
- ✓Return Line
- ✓Air Intake
- ✓Electrical Conduit



Residential Treatment Media

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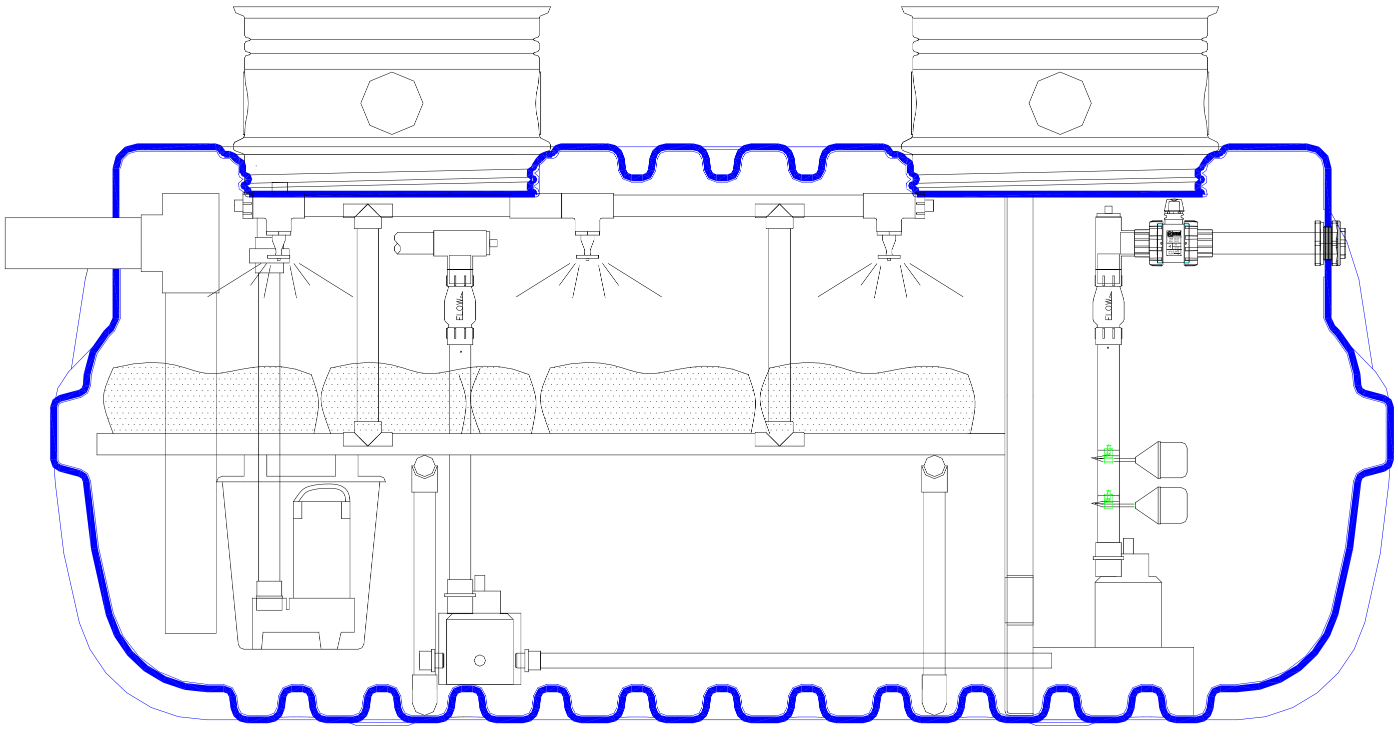
Residential Processor Schematic
Plastic Tank



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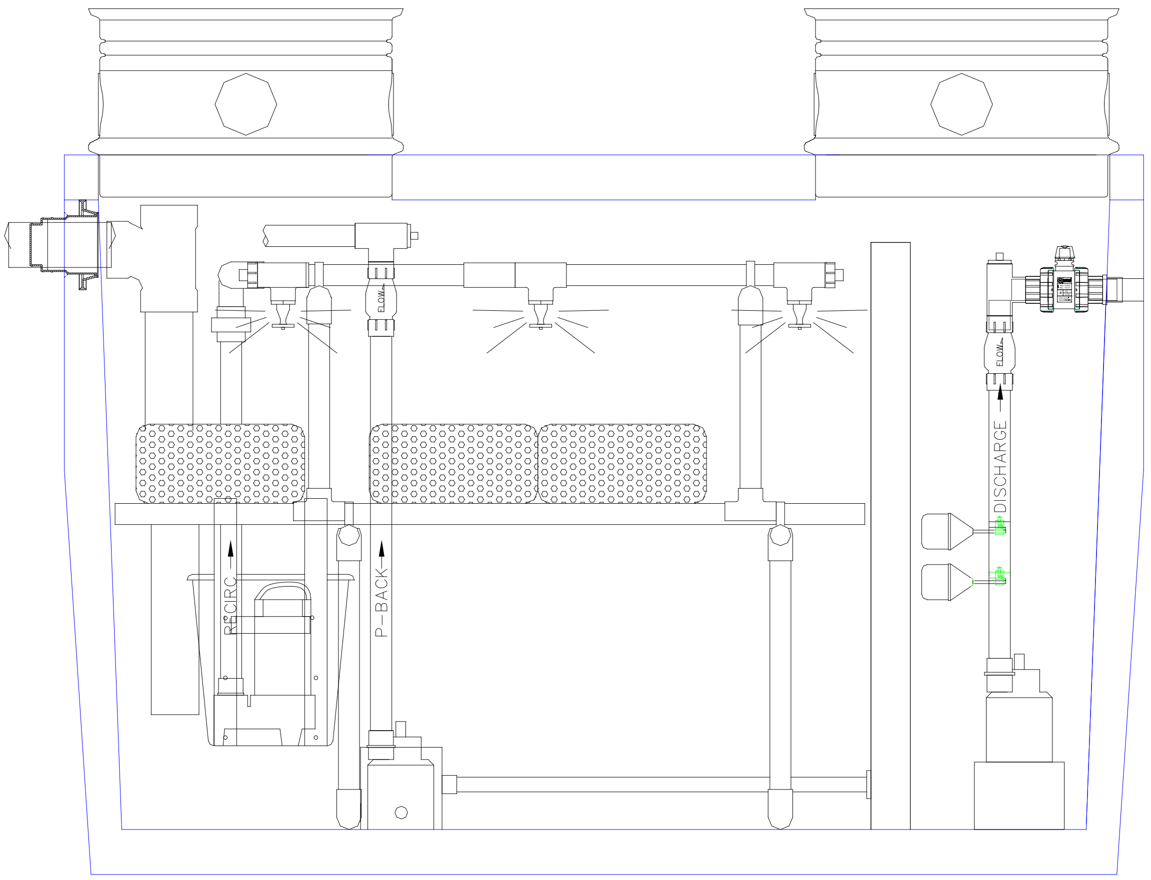
Residential Processor Schematic Concrete Tank



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Residential Control Panel

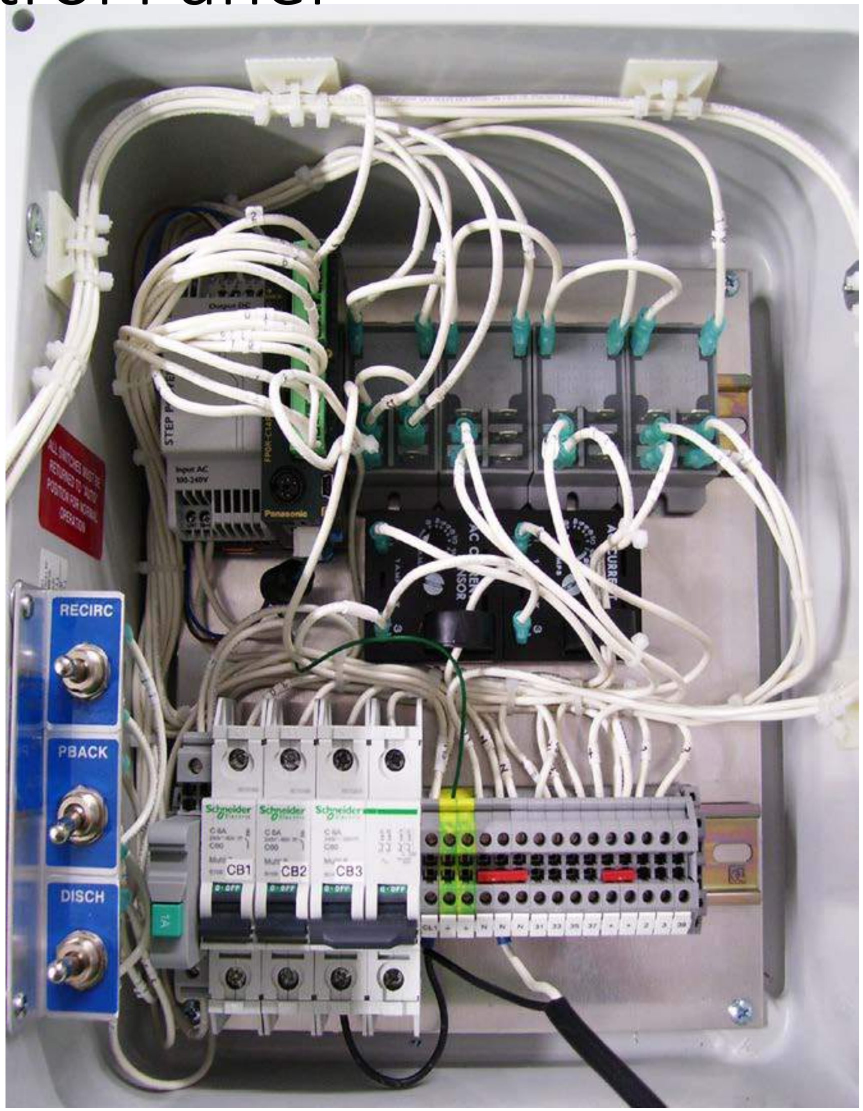
NEMA 4x Enclosure

Audible / Visual Alarm

Hand / Off / Auto Switches

Removable OIT

Built to UL508A Requirements



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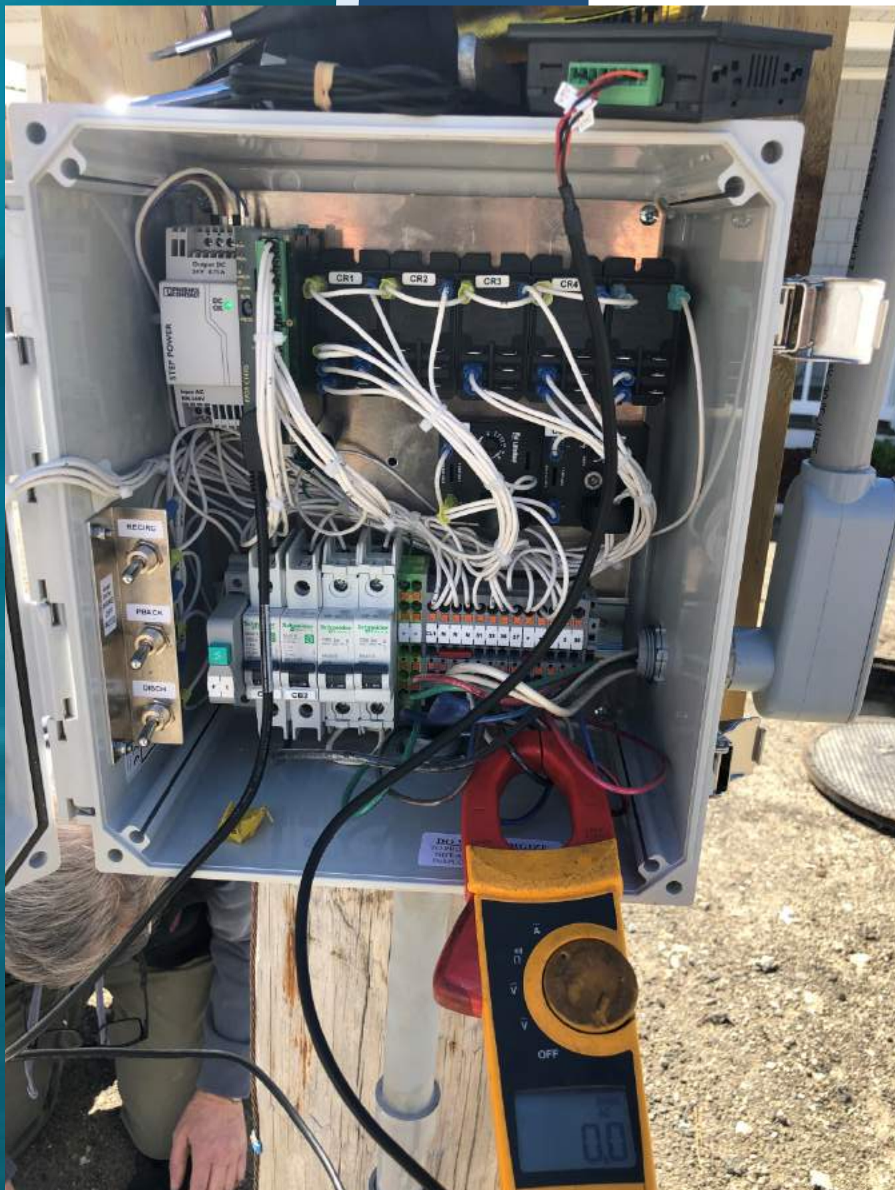
Single Family Home Models



- OIT (Operator Interface Terminal) External PL
- Purchased separately from SeptiTech

Residential Processors

Processor Model	Bedrooms	Tank Capacity
STAAR 0.5	4	1,060 Gallons
STAAR 0.75	6	1,250 Gallons
STAAR 1.0	8	1,500 Gallons

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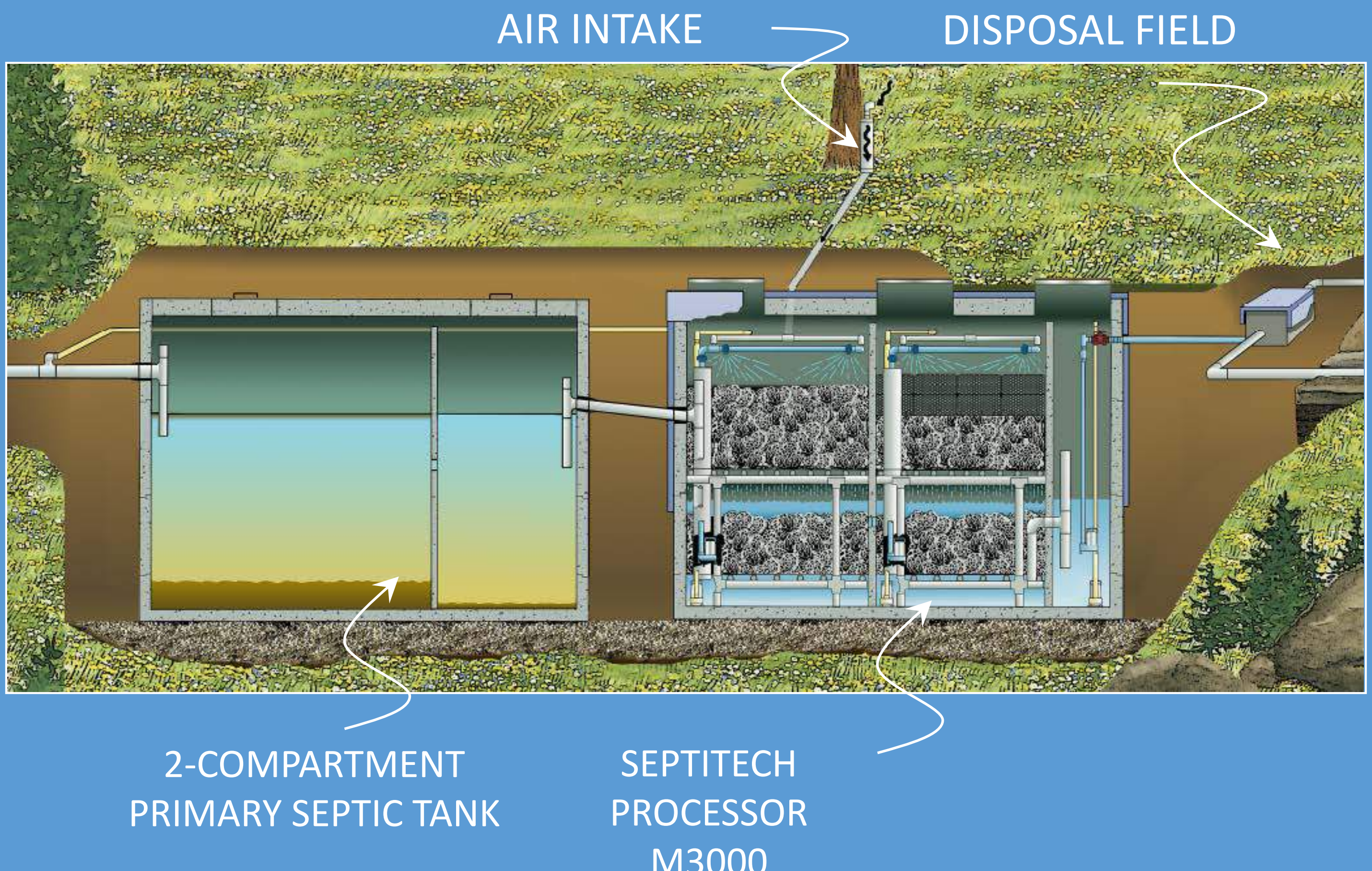
SeptiTech Residential System

SeptiTech®
a subsidiary of Bio-Microbics, Inc.

SeptiTech Commercial Layout



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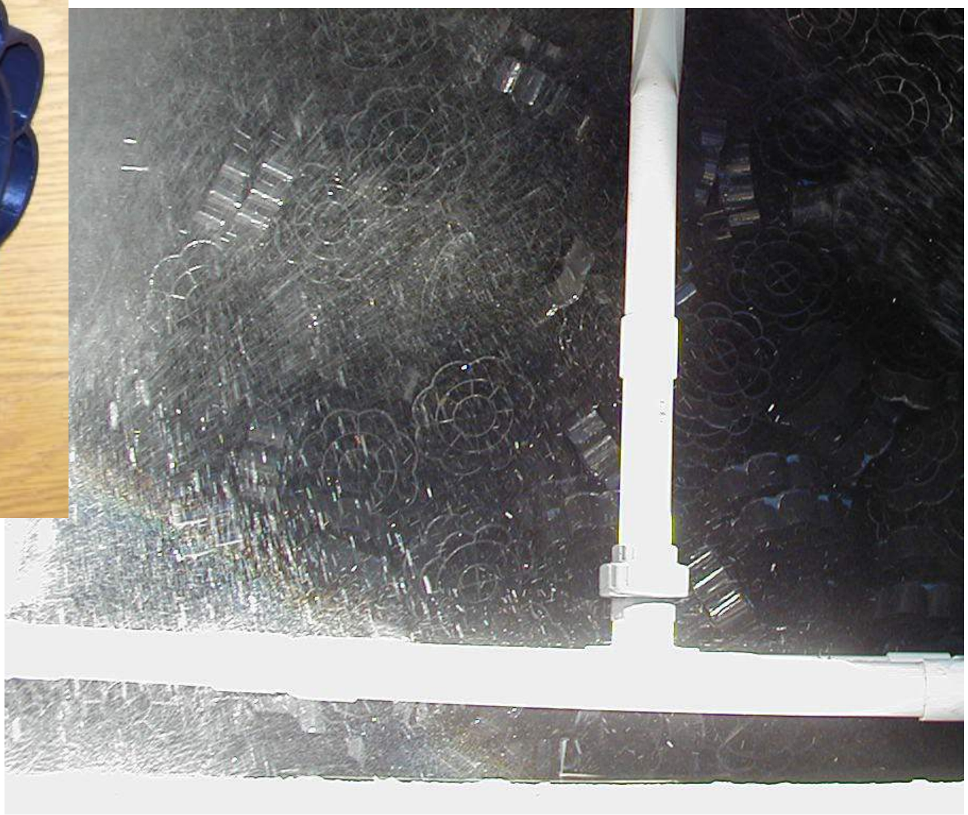
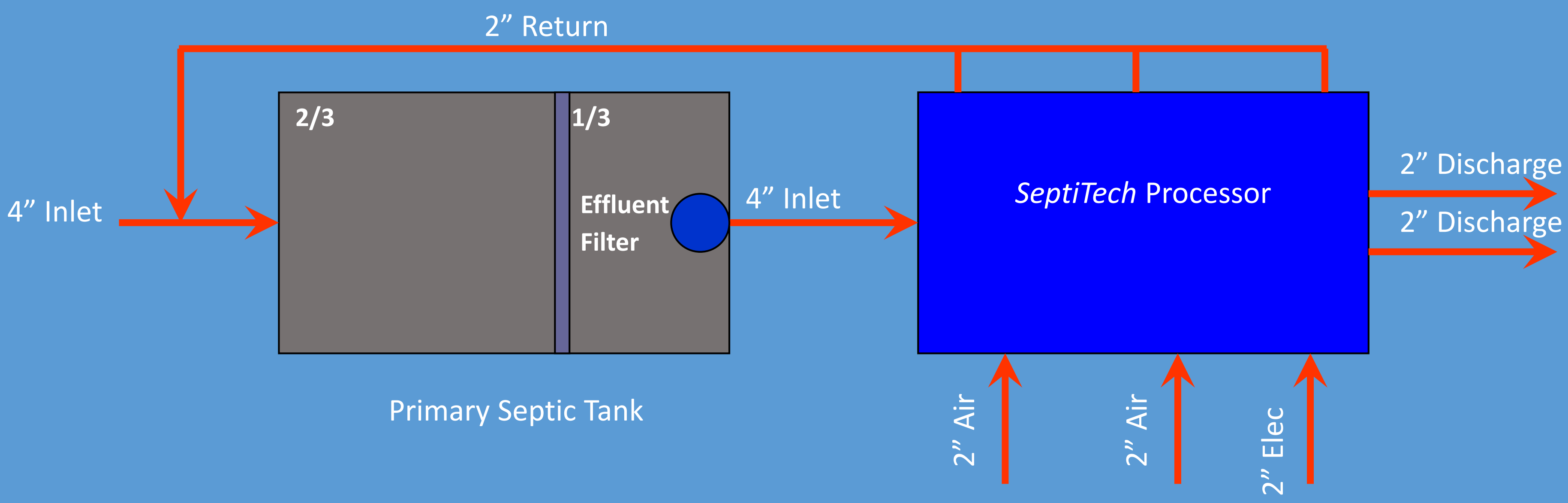
COMMERCIAL TREATMENT MEDIA



Commercial System Overview



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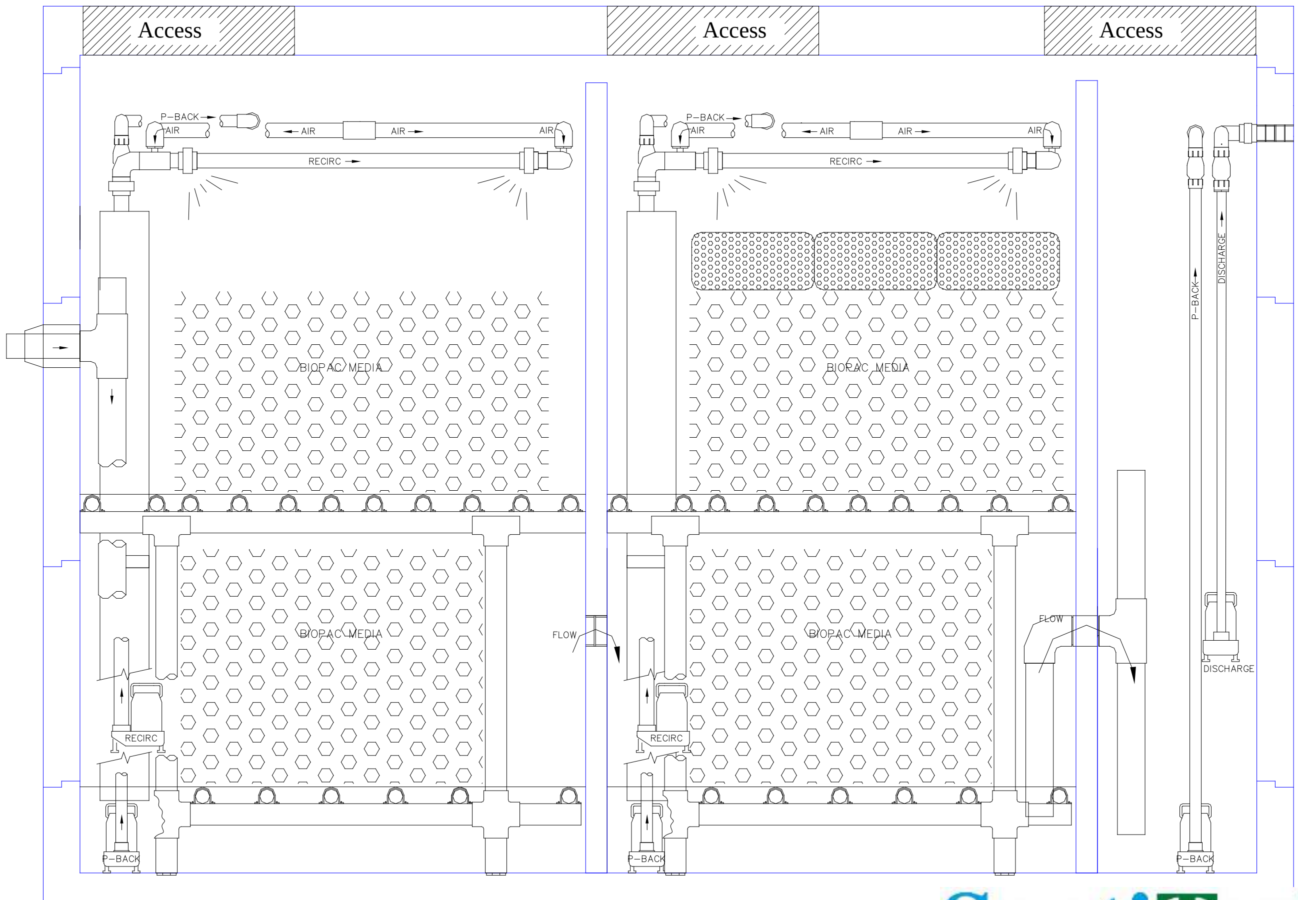
Commercial Processor Schematic



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Commercial Processors

Processor Model	Flow (GPD)	Tank Capacity
STAAR 1.2	1,200	2,000 Gallons
STAAR 1.5	1,500	4,000 Gallons
STAAR 3.0	3,000	6,000 Gallons
STAAR 4.5	4,500	8,000 Gallons
Engineered	100,000 +	Modular

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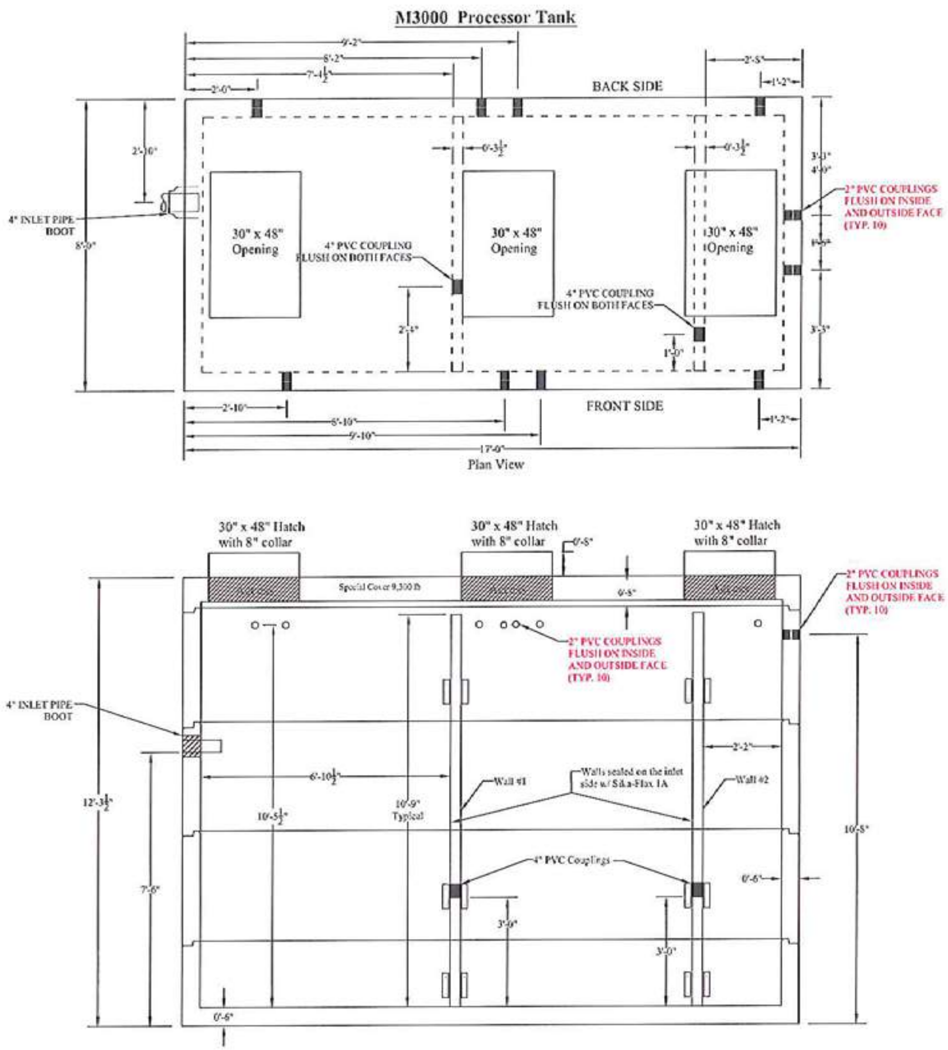
Commercial Systems

Sized based on hydraulics, wastewater strength, and effluent requirements

1. Application (i.e. school, restaurant, subdivision, etc.)
2. Design flow data
3. Discharge flow and pressure (i.e. TDH, pressure, etc.)
4. Effluent quality limits including organics, solids, nutrients and bacterial removals/fecal
5. Available power
6. Water table elevation (for tank selection, if applicable)
7. Features required including, but not limited to: control panel heaters, telemetry, etc.
8. Type of usage (seasonal/year round)

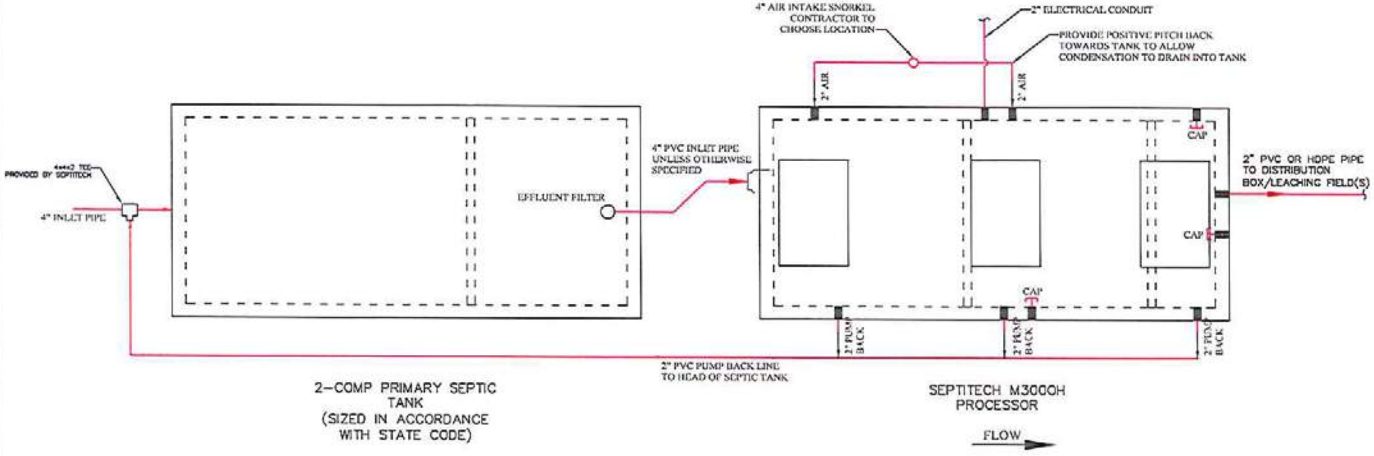
Sizing, Design and Installation Assista



SeptiTech Commercial System STAAR 4.5 (M3000)

- Hydraulic flows up to 4,500 gpd
- Also sized for wastewater strength
- Typically housed in an 8,000 gallon treatment tank
- Septic tank preceding per MA DEP

SeptiTech®
a subsidiary of Bio-Microbics, Inc.



GENERAL NOTES

- Tank(s) shall not be installed at a depth any greater than 24-inches. Tank installations requiring a depth greather than 24-inches shall do so with prior approval by SeptiTech only. Any risers required to bring the aluminum hatches to grade are the responsibility of the contractor.

- Tank(s) shall be installed with a minimum of 12-inches of compacted crushed stone bedding. Select fill shall be used for backfilling around tanks. Native material may be used if approved by the design engineer.

- Water Testing: Contractor is responsible for water testing the concrete tank(s) once the tank(s) installation has been completed and allowed to set overnight. Water testing shall be conducted in accordance with ASTM C1227.9.2. Installing contractor shall be responsible for providing clean water for the testing, filling the tanks, and pumping the tanks dry once testing is completed.

- Exterior Piping: Contractor is responsible for supplying and installing all exterior piping per SeptiTech installation drawings.

- Air Intake Piping: Air intake snorkel shall be installed within 100 feet of the processor tank. Air intake piping shall be installed such that a positive pitch is provided back towards the processor tank such that any condenstaion build up is free to drain.

- Pipe Insulation: Contractor is responsible for insulating all piping exterior to the SeptiTech processor including the discharge line from the processor to the disposal field.

- Tank Insulation: After concrete tanks have been installed and water testing is completed, contractor shall insulate the top and sides of the processor tank below frost depth (4-feet minimum) down the sides of the tank with 2" rigid foam (blue) board insulation and then complete backfilling. Contractor is also responsible for installing insulation over the top of the forcemain from the SeptiTech system to the disposal field if not buried below frost level in order to prevent freezing.

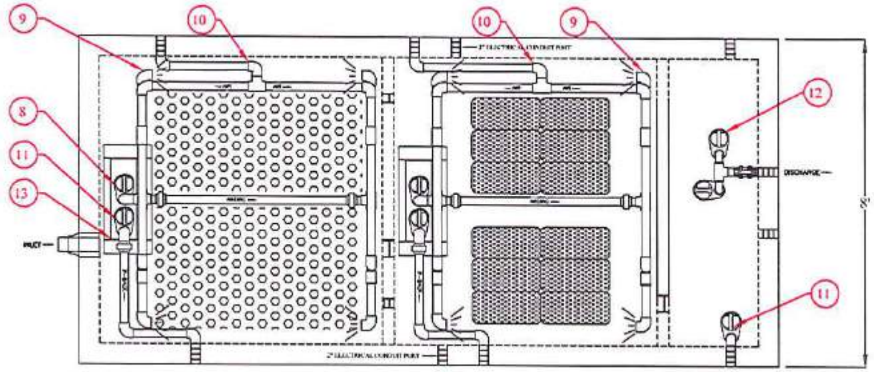
- Electrical: All electrical work is the responsibility of the contractor's licensed electrician and is not provided by SeptiTech. System Controller should be installed in a heated building where an ambient temperature range of 60 to 90 degrees F is maintained. If the control panel must be located outside, please notify SeptiTech, Inc. so a heater may be installed within the enclosure.

  SeptiTech processors can also be built to 3-phase power requirements. If 3-phase is required, please notify SeptiTech at the time of contract signing.

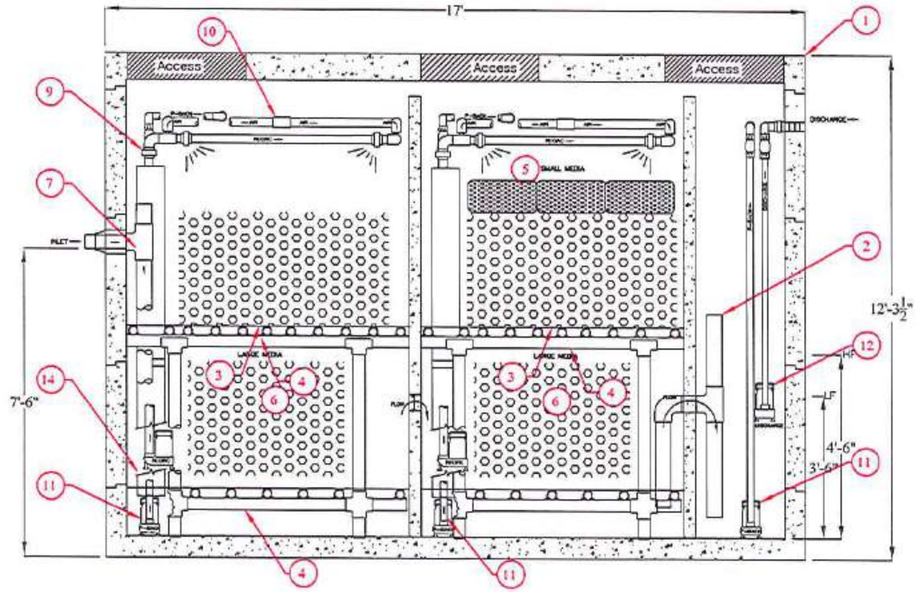
- Phone Line: Contractor is responsible for installing a dedicated analog phone line to the processor control panel for the autodialer/modem. Phone line must be installed and working in order to have any work performed under warranty. Any work performed on the system without the installation of the phone line shall be at the expense of the owner.

SeptiTech	DES.BY: JSC
	DR.BY: JSC
	CK.BY: DRR
	PROJECT NO.:
M3000 PROCESSOR INSTALLATION PLAN	
DATE: 03/16/07	DWG. NO.:
SCALE: 1/4"=1'-0"	REV.: 1

REVISIONS		
DATE	DESCRIPTION	INIT
10/17/06	REMOVED SPRAY NOZZLES, ADDED BLASTER ASSEMBLY FOR BOTH CHAMBERS, REVISED LABELS	JSC



TOP VIEW



ELEVATION VIEW

ITEM	QTY.	PART NO.	DESCRIPTION
14	2	#####	Pump Back Chute Assembly
13	2	#####	Pump Chute Assembly
12	1	#####	Dual Discharge Pump Assembly
11	3	#####	Pump Back Pump
10	2	#####	Blaster Air Header Assembly
9	2	#####	Blaster Assembly
8	2	#####	Recirc Pump
7	1	#####	Inlet Piping Assembly
6	2	#####	Large Media
5	2	#####	Small Media
4	4	#####	Support Structure
3	2	#####	Screening Assembly
2	1	#####	Interior Piping Assembly
1	1	#####	8000 Gal. Concrete Tank

SeptiTech

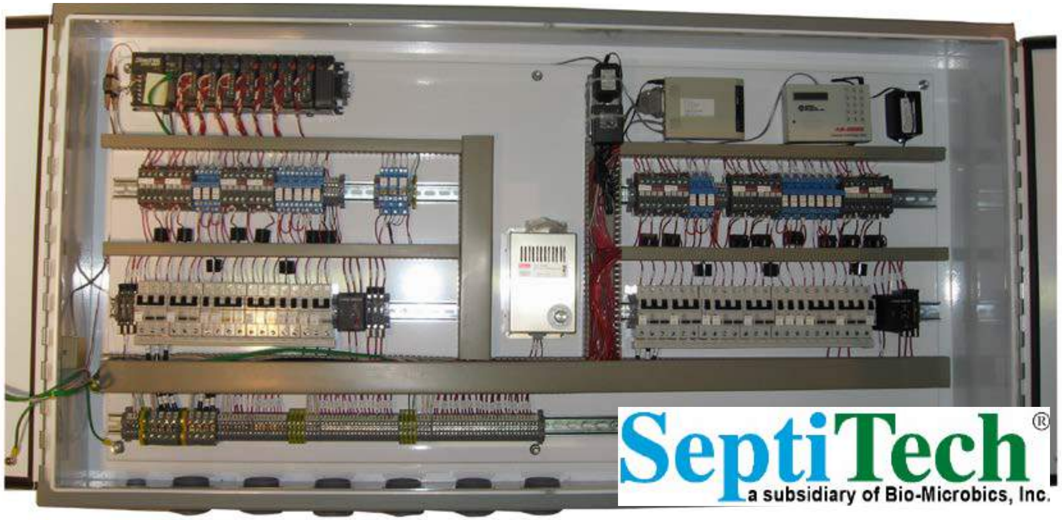
DES.BY:	DRR
DR.BY:	JSC
CK.BY:	WDR

PROJECT NO.:

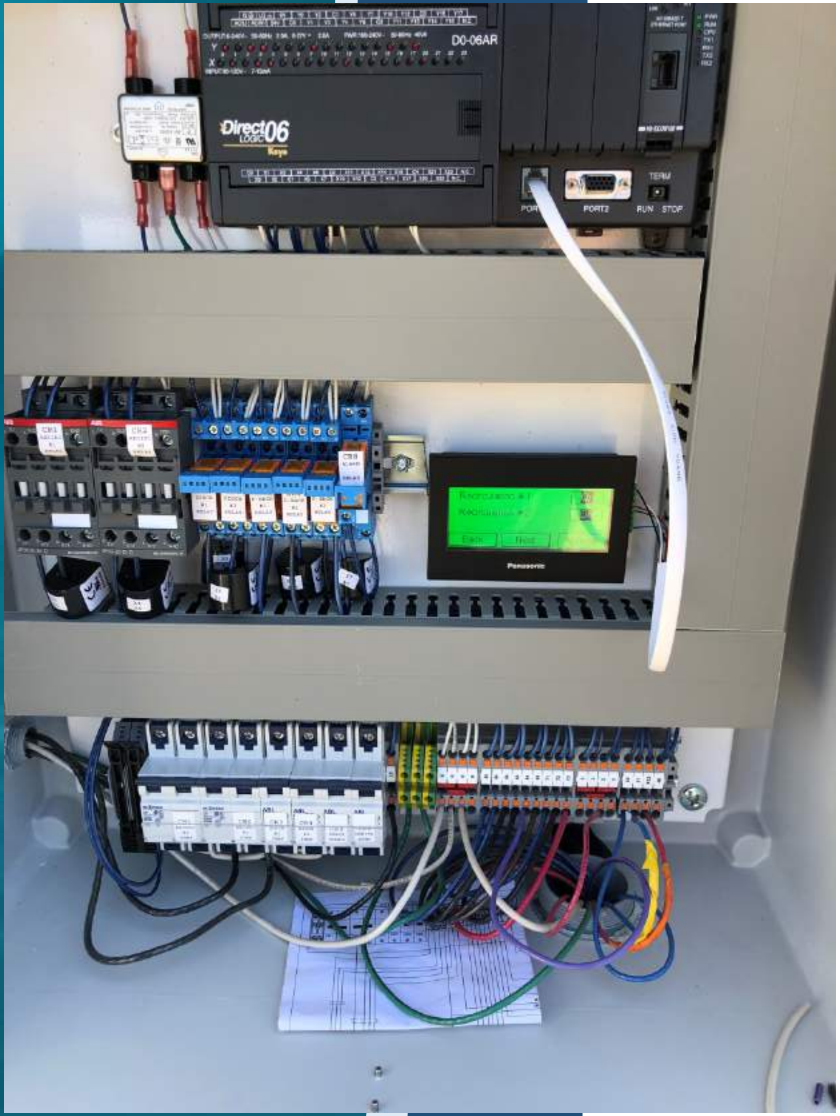
M3000(H)
TOTAL TANK LAYOUT

DATE:	03/04/02	DWG. NO.:	
SCALE:	3/8"=1'-0"	REV.:	1

Commercial System Control Panel

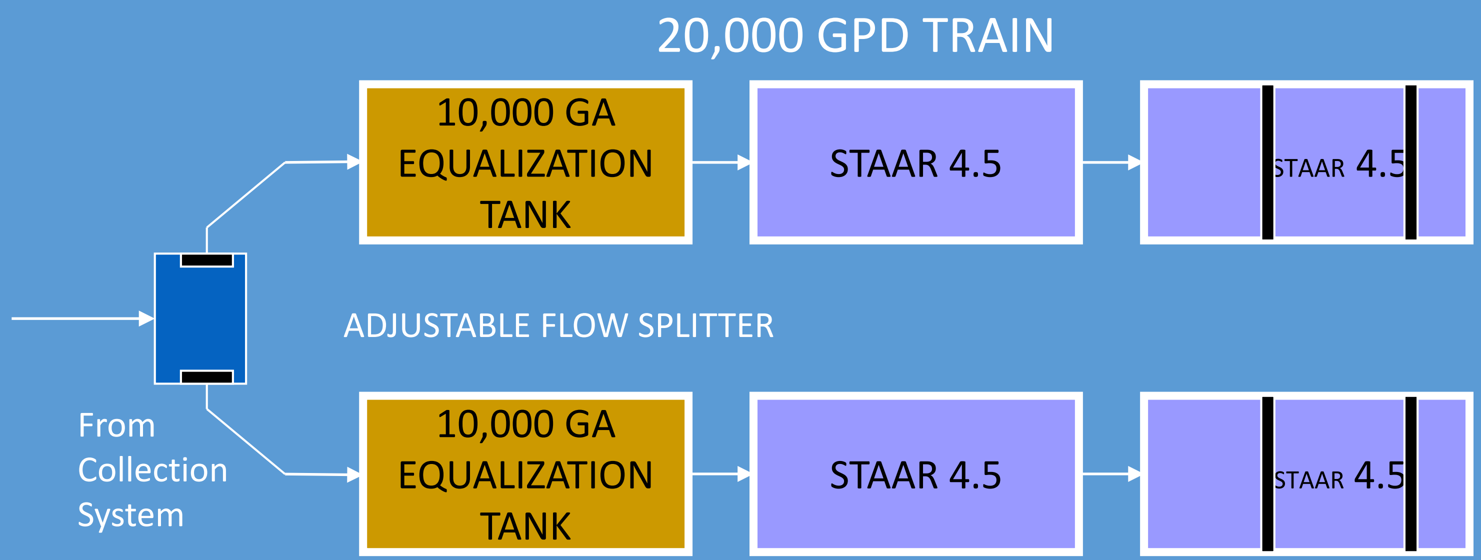


Commercial Control Panel



- Built in programmable/editable PLC
- STAAR 1.2 and larger

Multiple Train Modular Layout



- Equal Flow Splitting is Critical

SeptiTech® a subsidiary of Bio-Microbics, Inc.

Advantages of the *SeptiTech* System

Completely Subsurface

- ✓ H20 Capable
- ✓ Aesthetically Pleasing

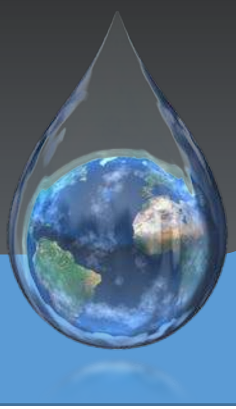
Easy Operation

- ✓PLC Control Panel
- ✓Minimal Components
- ✓Easy Onsite Customization
- ✓Telemetry
- ✓Discharge to SAS

Simple Maintenance

- ✓Self Cleaning Media
- ✓No Extra Pumping
- ✓Mostly Visual Inspection
- ✓PLC data

SeptiTech Prevents Future Failure



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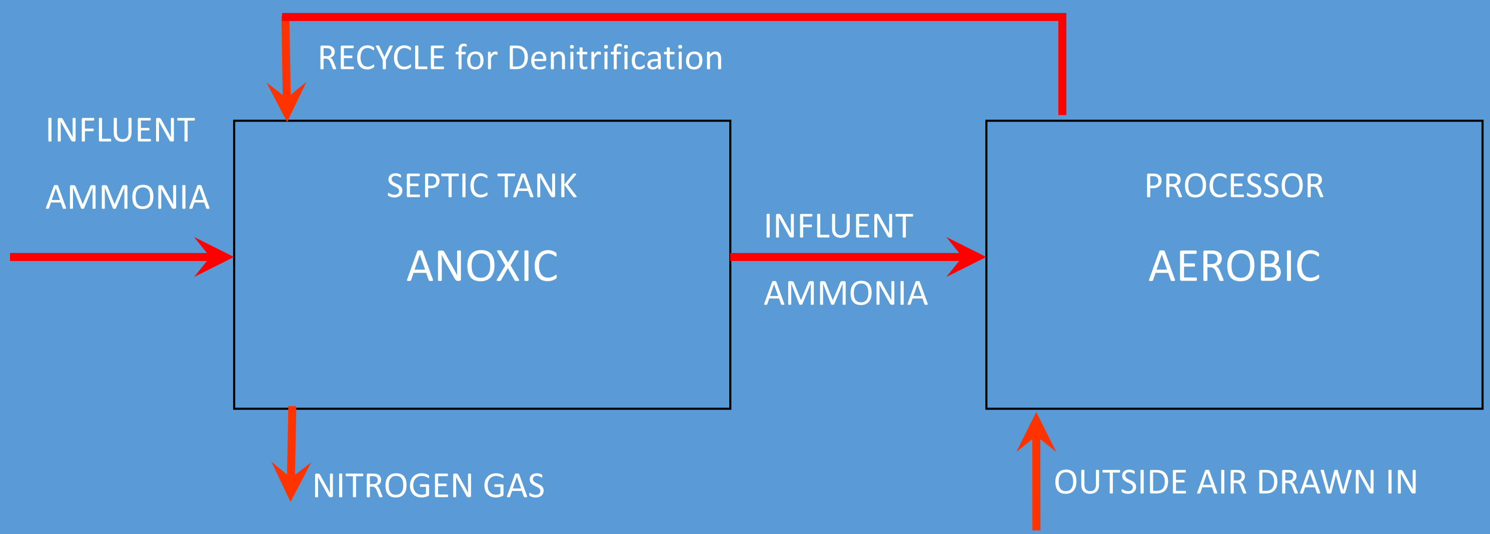
Nitrogen Cycle Simplified

Nitrification — The Conversion of Influent Ammonia to Nitrite & Nitrate

Denitrification — The Conversion of Nitrite to Nitrogen Gas:

Stripping O_2 from NO_3 to Release N_2 (Gas)

"You Must Nitrify Before You Can Denitrify"



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Permitting Requirements

MA DEP Requirements

- SeptiTech® is fully approved with General, Remedial and Provisional Approvals
- Flows up to 10,000 gpd under MA DEP
- Remedial allows for reduction to groundwater or ledge; or a 50% field size reduction
- General allows for a 50% field size reduction
- General Denite and Provisional allow for increased TN loading per acre
  - General Denite Permit awarded in 2018
  - Design Considerations
    - Up to 2,000 gpd
    - Residential flows only
    - Can use in a Zone II DEP Nitrogen Sensitive Area
    - Allows for 660 gpd/acre at 19 mg/L TN; or 550 gpd/acre at 25 mg/L

Operations and Maintenance

SeptiTech Operations & Maintenance

- Onsite Visual Inspection of All System Components
  - Tank, pumps, float switch, control panel, auto-dialer and audio/visual alarm
  - Visual inspection of electrical splices and contacts, check/record amperage and voltage readings
  - Visual inspection of filter media or filtration device(s)
  - Visual observation of spray pattern and “pulsing”
  - Exercise all mechanical valves
- Sensory examination of treated effluent for clarity, odor, oily sheen, foaming or any other unusual characteristics
- Record flow data (volumetric, cycle counter, etc.)

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Operations and Maintenance, things to consider…

- The SeptiTech system is only PART of the whole package
- Proper sizing, installation, operation, and maintenance are essential for success
    1. Pump when recommended; including maintaining grease traps for restaurant applications
    2. Work with owners to determine what can and cannot go down the drain
    3. Proper wastewater chemistry
    4. Monitor hydraulic flows/usage history
- Monitor process to ensure Nitrification is occurring (proper pH, temp, DO, alkalinity, etc.) to ensure ammonia is being oxidized into Nitrite for return to septic tank for denitrification)

Operations & Maintenance Cont….

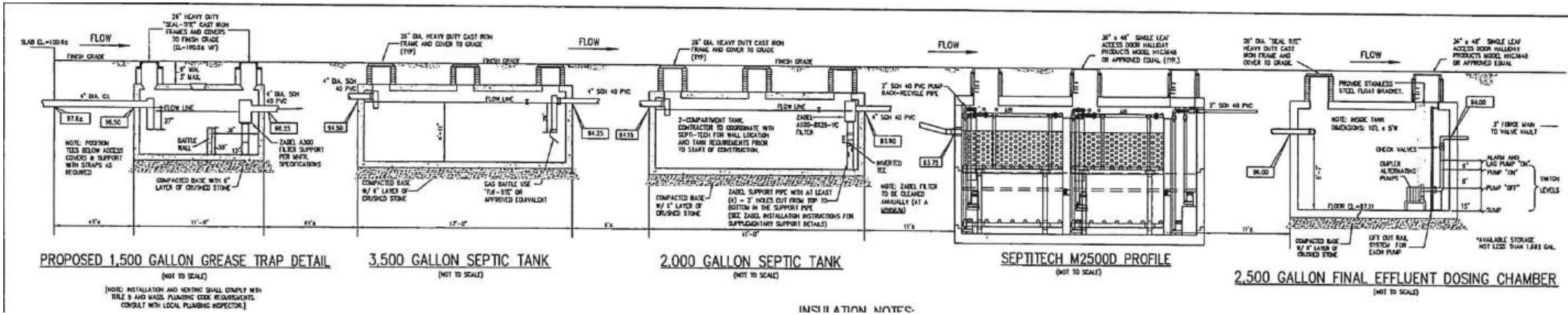
- Chemical augmentation of wastewater influent strength
  - Many applications are new construction, actual influent strength varies
  - Not specific to BioMicrobics Treatment systems, but is true for ALL onsite technologies
- Carbon supplementation: MicroC
- Alkalinity Supplementation: Sodium Bicarbonate
- Metering pump with timer for adjustment during operation

Owner Education

- We encourage all owners to call into our office and learn about the system installed at their property
- We offer onsite meetings to go over their specific system in person
- We have available a list of items that should not be introduced to the system
  - "Do Not Use" items include: liquid fabric softeners, pine oil, drain cleaners, quaternary ammonia cleaners, paint
- Owner education is imperative to maintain a positive and beneficial relationship
- Allows the owner to understand their system and share in the responsibility to keep it functioning as it should
- Any I/A systems ability to affectively treat wastewater is determined by the influent quality and characteristics of the wastewater coming in

SeptiTech Commercial Site

- 484 Station Ave. – South Yarmouth, MA
- STAAR 3.0 (flows approx. 1,700 gpd)
- Installed and Started up in 2014



- Operated by others
- No issues to report
- System modifications made during startup phase with pump run times
- Only material replacements have been floats

Operational Data
2014-2019

- CBOD Average: 3.38 mg/L
- TSS Average: 3.36 mg/L
- TN Average: 8.2 mg/L

SeptiTech Commercial Site

- Bracket's Landing – Eastham, MA
- STAAR 9.0 (flows approx. 9,000 gpd)
- Installed and Started up in 2007

Operational Data

- CBOD Average: 6.5 mg/L
- TSS Average: 6.7 mg/L
- TN Average: 16.3 mg/L

Chases Ocean Grove
Dennisport, MA

- New Installations 2019
- Residential Development, will be phased in over the next year
- Engineer chose to combine cottage flows into several commercial STAAR systems rather than use individual systems

STAAR 1.0

STAAR 1.5

STAAR 3.0

SeptiTech Product Advantages

- Subsurface Installation
  - H20 loading
- Easy to fine tune process
- PLC records historical data
- Self adjusting and cleaning
- Modular design flexibility

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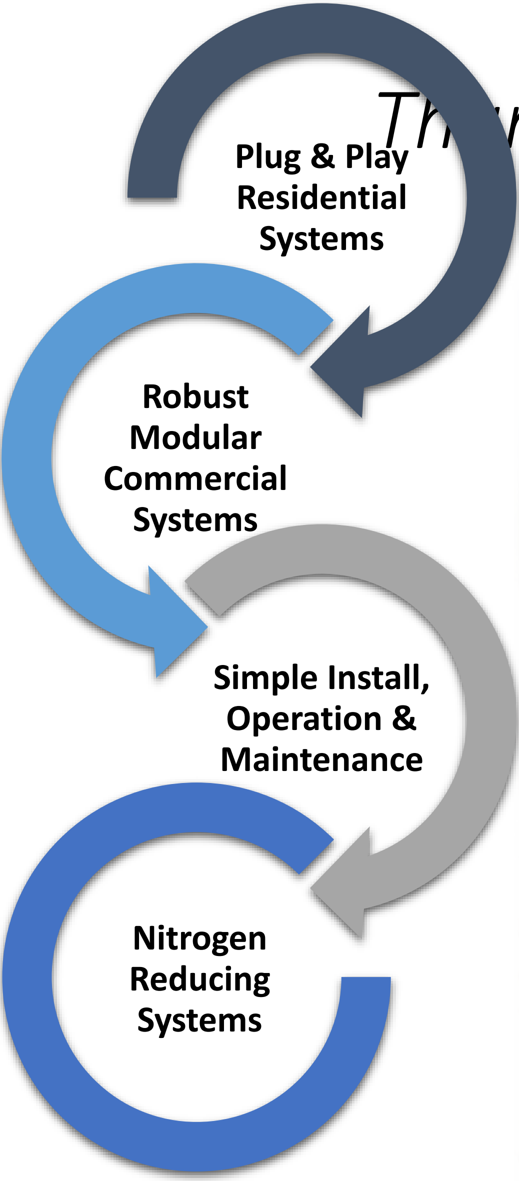
Thank you!



For more information

Visit

www.jrsalesinc.com

www.biomicrobics.com

www.septitech.com

www.geoflow.com

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Agenda & Speakers

Part II.

Small Package Treatment Plants: How to Make Them Work

3:00 p.m. Introduction to Neighborhood-Scale Treatment Plants
Maureen Thomas, BBC & George Heufelder, MASSTC

3:05 p.m. West Island Treatment Plant
Vincent Furtado, Town of Fairhaven

3:35 p.m. Red Brook Community Treatment Plant, Plymouth
Skip Malonson, Weston & Sampson
Daniel Gorczyca, A.D. Makepeace

4:05 p.m. Red Brook Harbor Club & Marina Treatment Plant, Cataumet
Mark Lubbers, Aquapoint 3

4:35 p.m. RUCK CFT & GPC Filter
Michael McGrath, Holmes & McGrath

5:00 p.m. Optional Field Tour to West Island Treatment Plant
141 Fir Street, Fairhaven, MA 02719

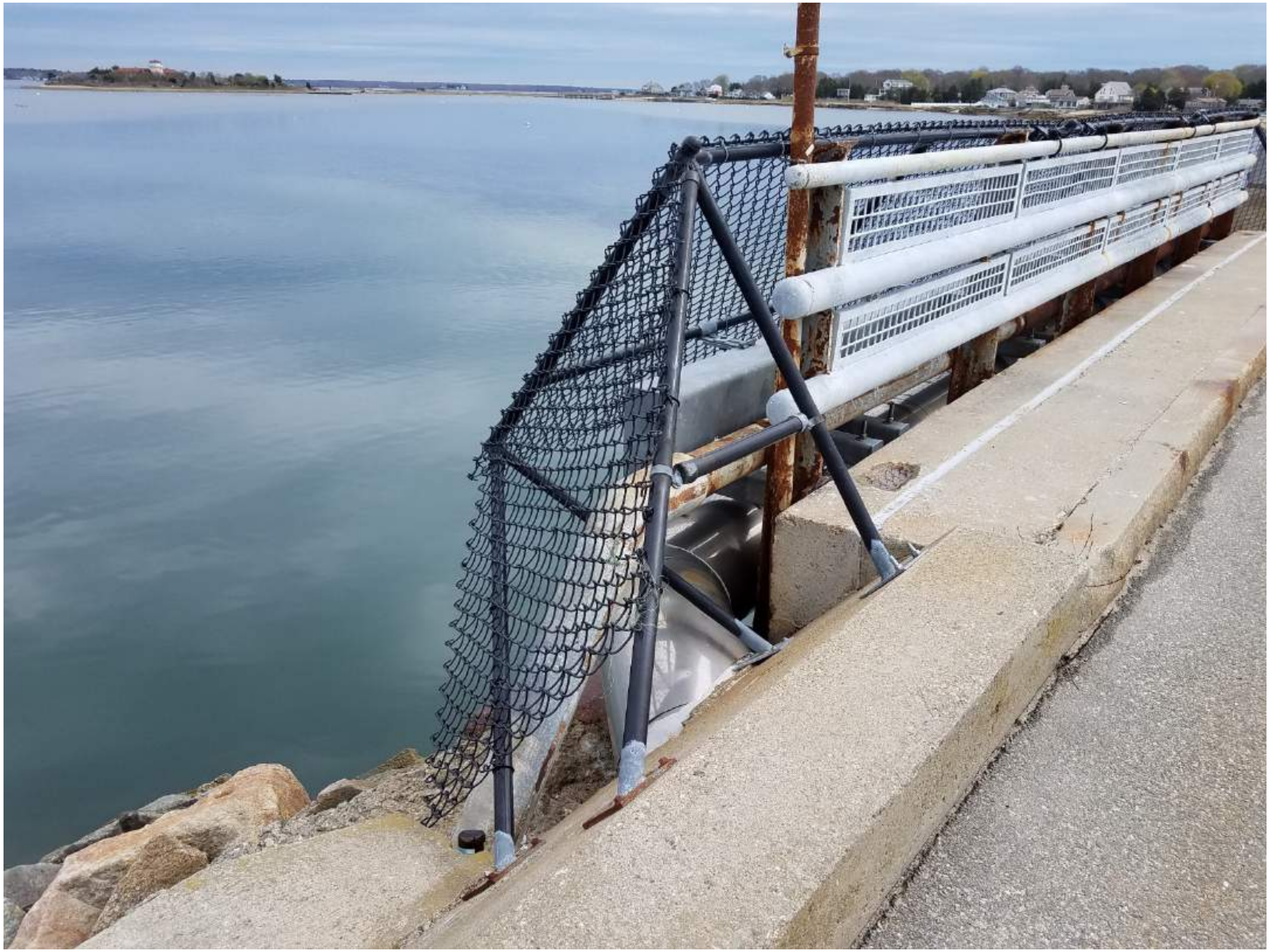
West Island is a small island within the town of Fairhaven that is approximately 535 acres and separated from the mainland by a 0.4 mile causeway

West Island is surrounded by both Buzzards Bay to the south and Nasketucket Bay to its north. Up until recently, most homes on the island were used as summer homes. They were developed on small lots, between 6,000 and 8,000 square feet, with septic systems.

Although the Town was aware of the need to provide a sewer system for the homes on West Island, it didn’t become urgent until Hurricane Bob made landfall in late August of 1991. Fairhaven accumulated $12 million in property damage, the causeway to West Island was nearly washed away and both drinking water wells and septic systems were inundated with water.

After numerous drinking water samples of private wells were collected and analyzed, which revealed elevated bacteria counts, the Town determined that the hurricane compromised island septic tanks which in turn contaminated drinking water wells.

As an initial step to remediate this issue, the Town extended Town water service to the island



The Town next had to decide how to handle the logistics of treating the wastewater – either by running a pipe from the treatment plant on Arsene St or to build a brand new treatment plant right of the island.

Extending the pipe from Fairhaven’s main wastewater treatment facility to all of the homes on West Island would require approximately 7 miles of piping and was deemed cost prohibitive. As a result, it was decided to build a wastewater facility on West Island.

Due to the soil conditions, it was decided to discharge the treated effluent into wells versus into a body of surface water. Treated effluent had not been discharged into wells in Massachusetts before, and there was concern that over time the effluent would rise to the surface. As such, there were numerous hydrogeological studies conducted confirming that the water neither rose to the surface nor had a deleterious effect on the bay. As such, after working closely with the Town on these trials, the DEP approved the project

The next obstacle was obtaining a piece of land large enough to both implement this technology. With help the local State delegation, the Town purchased five acres of land from the West Island State Reservation as well as a 20 acre easement around its perimeter, with the stipulation that the facility could not be used for any new developments on West Island and current residences could not add any new dwellings.


NO PARKING

To keep the costs as low as possible for the homeowners, the Town worked with the United States Department of Agricultural Rural Development, which is a federal agency that provides funding to towns and secured a grant totaling $5.2 million, which significantly lowered the betterment fee for homeowners.

The West Island wastewater treatment facility project cost approximately $7 million and services 375 homes, 89 of which are seasonal. Since the establishment of the facility, six new homes have been built on West Island and are on their own Title V septic systems.

The facility and sewer system on West Island consist of two pump stations, a treatment facility that provides both biological and nitrogen removal treatment, holding tanks, and a dispersal field. It was important to blend the facility with the rest of the community, so an old clubhouse on the East side of the Island was refurbished to look like a compact house. All equipment is indoors, besides the holding tanks, which prevents odor issues. The facility was built to handle 100,000 gpd of wastewater but usually averages 16,000. The flows ramp up during the summertime and rainstorms.

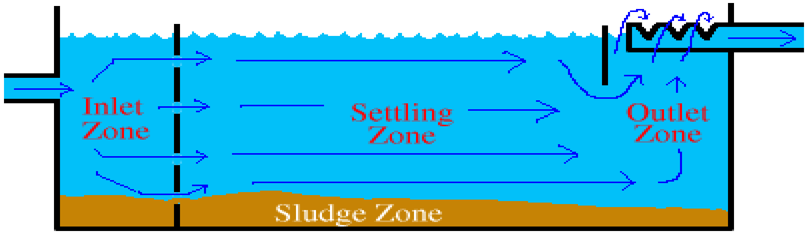
The pump stations deliver the collected wastewater to the facility, and then once treated, it is transported to the wells. Each of the four wells is approximately 30-40 feet deep and 12 inches in diameter with five feet of well screen at the bottom to ensure even dispersal. The wells are designed to be free-flowing with gravity used as the ultimate mechanism dispersing the effluent through the soil.

Once the wastewater makes it way to the treatment system the two main parameters required to be removed are solids and nitrogen. The solids primarily come from bathroom use and the origin of nitrogen is from the ureac acid in urine, which contains a significant amount of nitrogen.

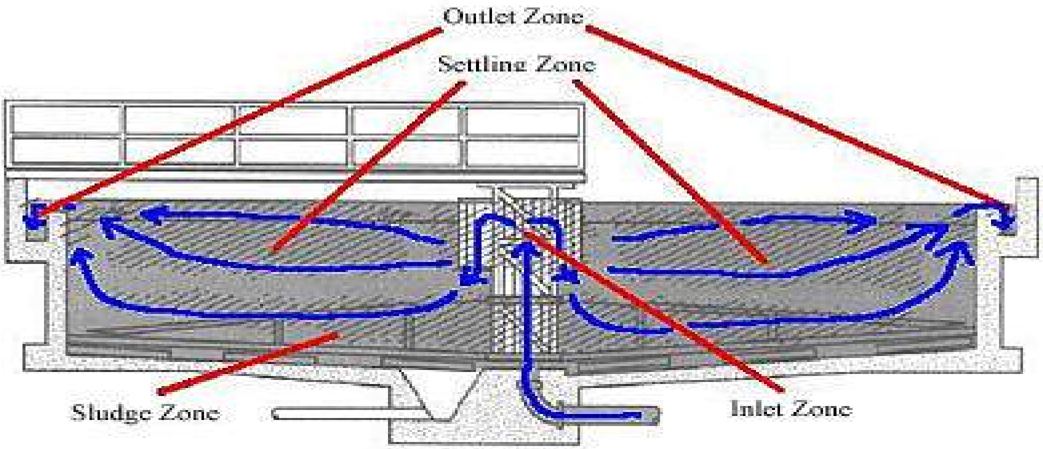
In order to remove the solids, the wastewater goes through two types of processes – a physical separation and a biological separation.

The tank where the physical separation takes place is called a clarifier or settling tank. These structures can either be rectangular or round and have specific treatment zones.

Rectangular Basin Zones



Circular Basin Zones



Expected removal efficiencies for primary clarifiers

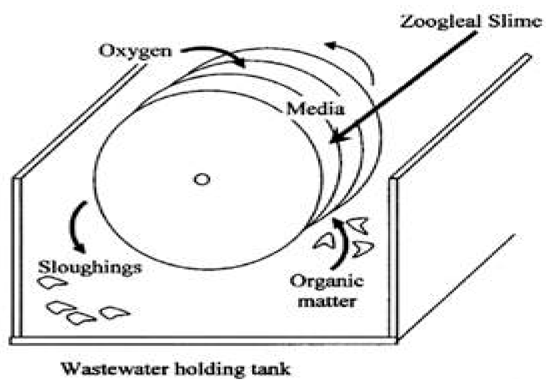
Settleable Solids 90% to 99%
Suspended Solids 40% to 60%

As our discharge permit requires us to remove 85% of the solids, that is where the biological processes come in.

Rotating Biological Contactors

- The **rotating biological contactor** (RBC) is a fixed film biological treatment device. The basic process is that slime sitting on a media, consisting of a series of circular disks mounted side by side on a common shaft is rotated through the wastewater flow.

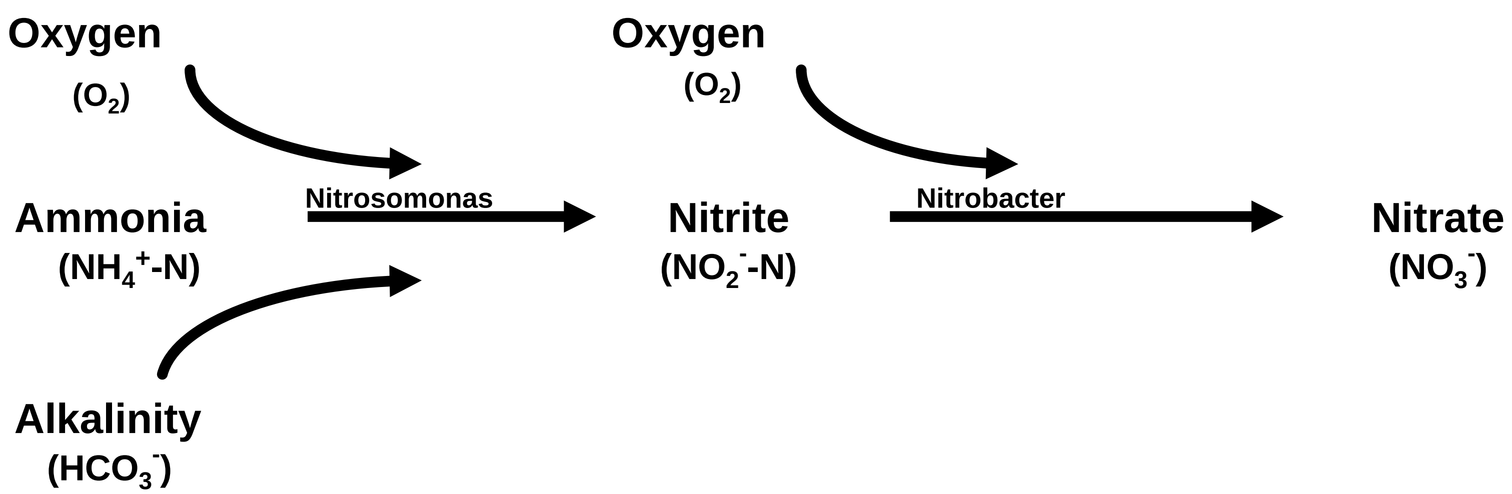
Rotating Biological Contactors



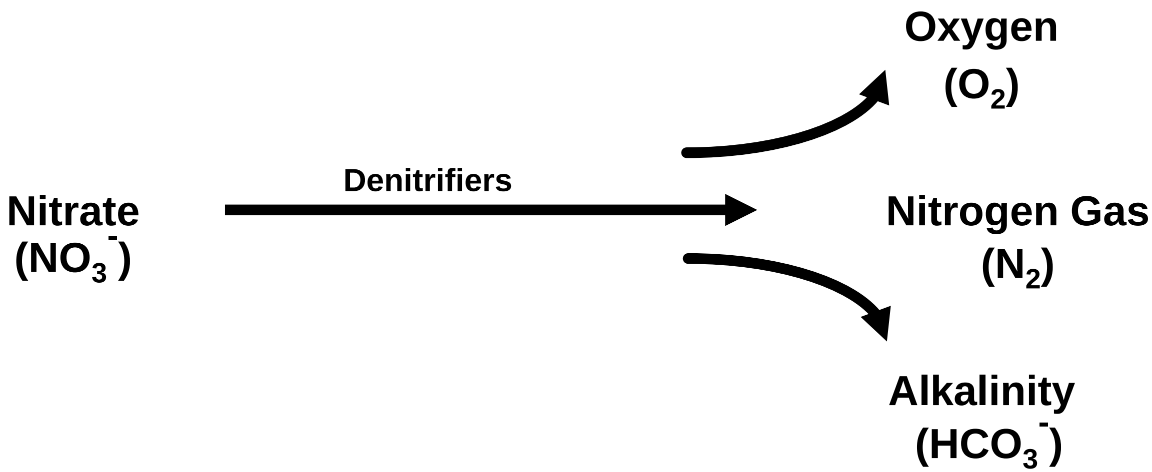
Between the physical separation of the clarifiers and the biological separation of the RBC's, the desired solids removal is achieved.

For nitrogen removal…

Biological Oxidation (Nitrification)



Denitrification



In FY20, the Town has secured funds (1.75M) to upgrade the current plant to ensure many years of sustainability.

welcome

Weston & Sampson

REDBROOK

AN A.D. MAKEPEACE COMMUNITY

Weston & Sampson[SM]

transform your environment

REDBROOK

AN A.D.MAKEPEACE COMMUNITY

Redbrook an A.D. Makepeace Community Wastewater Treatment Facility

Development Overview & Treatment Optimization

May 2, 2019

Buzzards Bay Coalition – New Bedford, MA

Presenters:

Dan Gorczyca (A.D. Makepeace Company)

Skip Malonson (Weston & Sampson)

Weston & Sampson

REDBROOK
AN A.D. MAKEPEACE COMMUNITY

agenda

- Redbrook Project Overview
- Wastewater Treatment Facility
- Treatment Technology
- Facility Performance & Optimization
- Nitrogen Removal
- Q&A

Weston & Sampson

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AN A.D. MAKEPEACE COMMUNITY

Redbrook development - overview

- Located in Plymouth, Massachusetts
- Property owned by A.D. Makepeace Company
- Mixed Use Development
  - Permitted in 2008
  - 1,175 Residential Units
  - Up to 90,000 ft^2 of Commercial
  - Up to 75,000 ft^2 of Recreational
  - Private Water & Wastewater Utilities
  - 1,500 Acre Property, 1/3 to be Developed
- Construction Begin in 2014/2015
- 10-12 Year Development Program
- Nitrogen Net Neutral Project
  - Cranberry Bog Removal
  - Fertilization Restrictions

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Redbrook wwtf – permitting & design

- Weston & Sampson assisted with planning & permitting the collection system and WWTF
- GWDP up to 395,000 gpd (phase 1 up to 100,000 gpd)
- WWTF treatment technology – MBR (bioProcess$H_2$0)
- WWTF designed by Weston & Sampson (Grade 6 facility)

bioprocessH_2O – headquartered in Portsmouth, RI

- Extensive portfolio of advanced biological and membrane filtration systems
- Installed over 100 systems across the US, Canada and the Caribbean
- Installed 12+ MBR/membrane filtrations systems in MA

Redbrook wwtf – construction / O&M

- WWTF Construction through a DBO arrangement with Weston & Sampson
  - Phase 1, treatment up to 100,000 gpd
  - 04/2013 start
  - 07/2015 completed
  - 09/2015 clear water test
  - Phase 2, treatment up to 395,000 gpd (future)
- Tight tank use of pump stations (3) until December 2017 (flows ~ 10,000 gpd), Weston & Sampson O&M
- 12/2017 WWTF Start-up – Weston & Sampson daily O&M
- Current flows ~17,000 gpd

Weston & Sampson

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Redbrook wwtf - treatment

Headworks (from collection system, pump stations)

- Trash tank (1)
- FET (1)
- Screening equipment

Weston & Sampson

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Redbrook wwtf – treatment

- Process trains (2, A & B)
- Process tanks (3/train)
  - Pre-anoxic
  - Aeration
  - Anoxic
- pH, ORP, & DO monitored

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Redbrook wwtf – treatment technology

- Blowers
- Chemical feed systems
  - MicroC
  - Membrane cleaning

Weston & Sampson

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Redbrook wwtf – treatment technology

- BioProcess membrane skids (2)
  - Reduction in Suspended Solids
  - Membrane Type X-Flow Tubular
  - Flow Pattern Inside-Out
  - Membrane Pore Size 0.03 um
  - Module Material PVC

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Redbrook wwtf – treatment technology

- Permeate tank
- UV system
- Process Control
  - QA/QC lab bench

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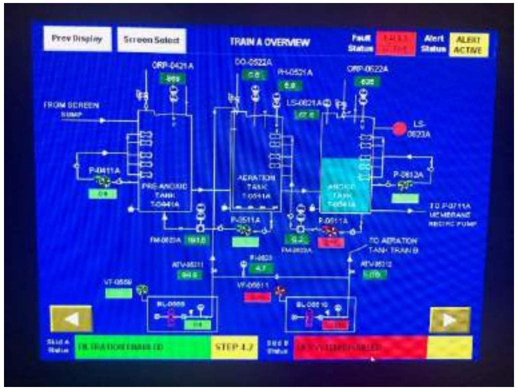
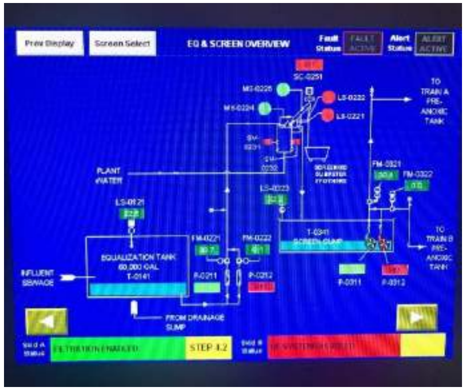
Redbrook wwtf – treatment technology

SCADA system

- Controls
- Alarms
- Remote monitoring & control





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Redbrook wwtf – treatment technology

- Effluent Discharge
- Rapid Infiltration Sand Beds (4)

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Redbrook wwtf – treatment technology

- Onsite stand-by/emergency generator (diesel)
- Electrical service for entire facility
- Equipped with automatic switchgear

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Redbrook wwtf – performance & optimization

Key Highlights to Start Up and Permit Compliance

Plan & Review, Plan & Review, Plan & Review!!

- Seed Sludge from a similar facility is crucial.
- Continuous monitoring (onsite & remotely) of key parameters (flow, temp, pH, DO, others) and process modifications.
- Routine daily process control bench testing for NH_3, NO_3, Alkalinity, solids testing of MLSS %
- Experienced operations staff with knowledge of process relationships and how a single change to the process can and will effect the entire process.
- Communication amongst plant personnel with respect to process changes.
- Sludge wasting is based on the % solids in the system.

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Redbrook wwtf – performance & optimization

- Listen and look! Get to know the sights and sounds of a treatment process and you can avoid issues.
- Routine maintenance as prescribed by the equipment manufacturers is provided for a reason.
- Membrane cleaning is essential to proper operations. The system self cleans after each cycle with filtrate but will require chemical cleaning to remove both organic and inorganic particulates . These cleanings are based on operational set points and can be preprogrammed once a good baseline is established.

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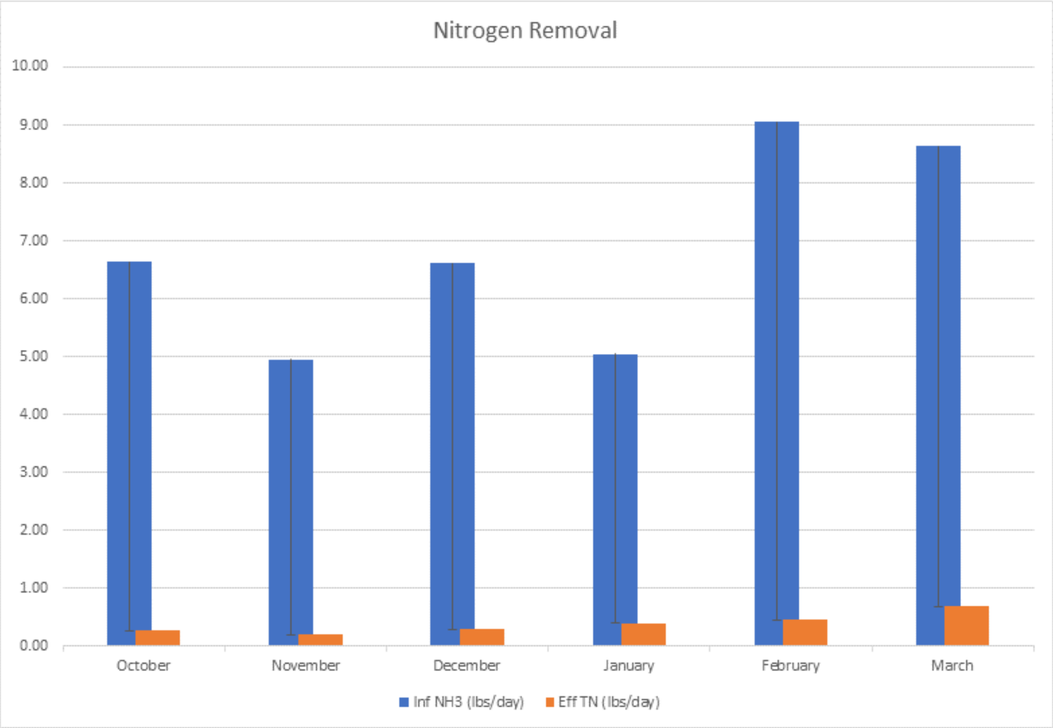
Redbrook wwtf – nitrogen removal



Questions?

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Thank you

westonandsampson.com

admakepeace.com

redbrookplymouth.com

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.01 to 2 MGD Technologies

AQUACELL™

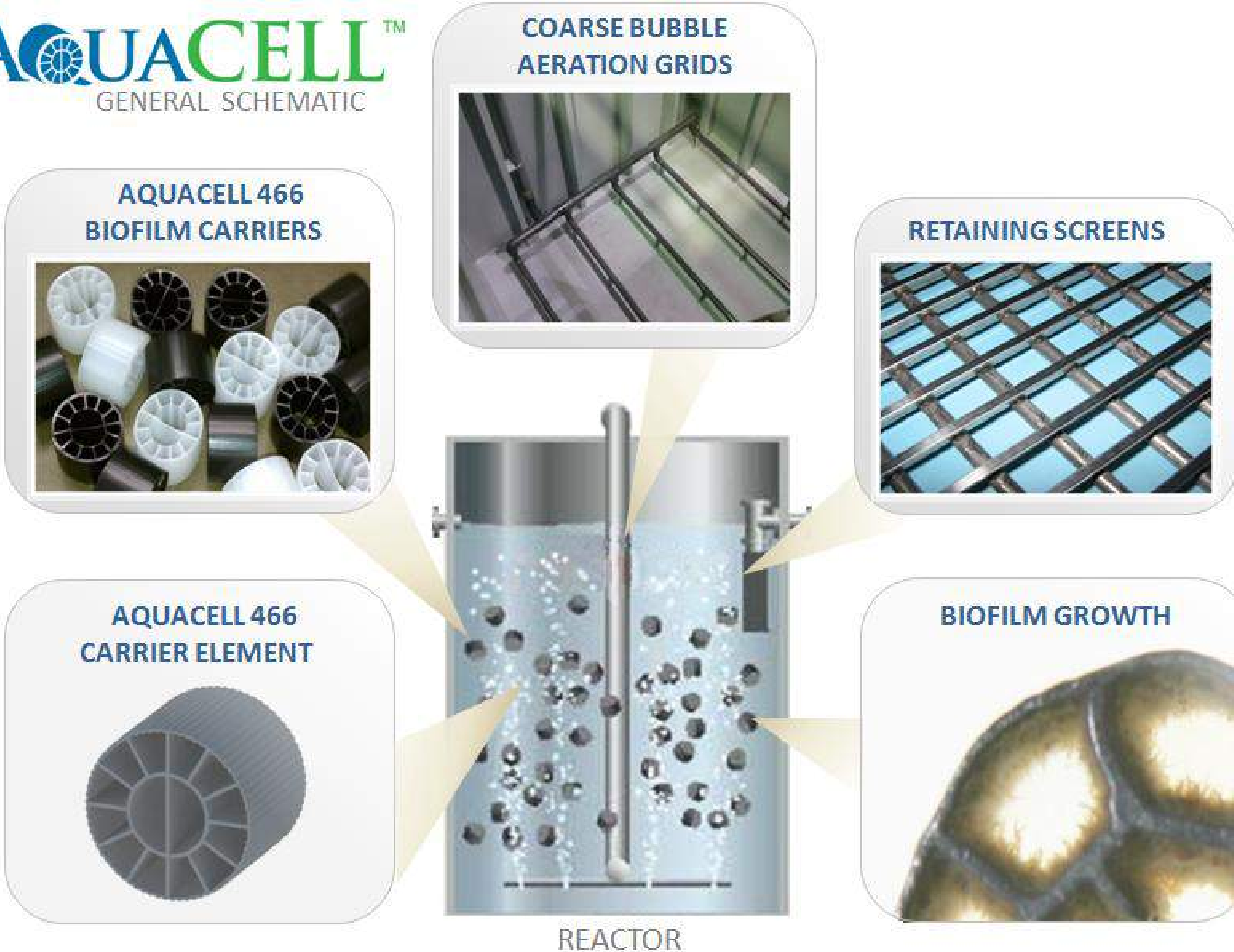
Moving Bed Biofilm Reactor (MBBR)

AQUAFAS™

Integrated Fixed Activated Sludge (IFAS)

AQUACELL™

GENERAL SCHEMATIC



Aquapoint AquaCELL Media

High Active Biomass Density

High SRT on media (20-25 days) enhances performance

2500-4000 mg/l MLSS equivalent in biofilm

Reduced Load On Clarifier

Biomass retained in reactor

Loading to clarifier generally 200 to 300 mg/l TSS

Reduced Hydraulic Retention Time

As little as 2-3 hrs for secondary treatment (30/30)

Typically ¼ the reactor capacity of activated sludge

Utilization of existing basins for enhanced treatment or capacity upgrades

Aquapoint AquaCELL Media

Media Characteristics

Neutrally buoyant, UV Resistant HDPE

466m² / m³ Protected Surface Area

Large aperture size for adequate sloughing & scouring velocities

No sludge bulking

Excellent mixing characteristics

Actual Size = 7/8” x 7/8”

MBBR Aeration Diffusers

Advantages

Coarse, or medium bubble diffusers

Low maintenance

Full floor grid with down welling zones

Complete Mix

Stainless steel or Schedule 80 PVC

Media Retention Screens

Advantages

Robust SS Wedge Wire Design

Low Head loss / Low Maintenance

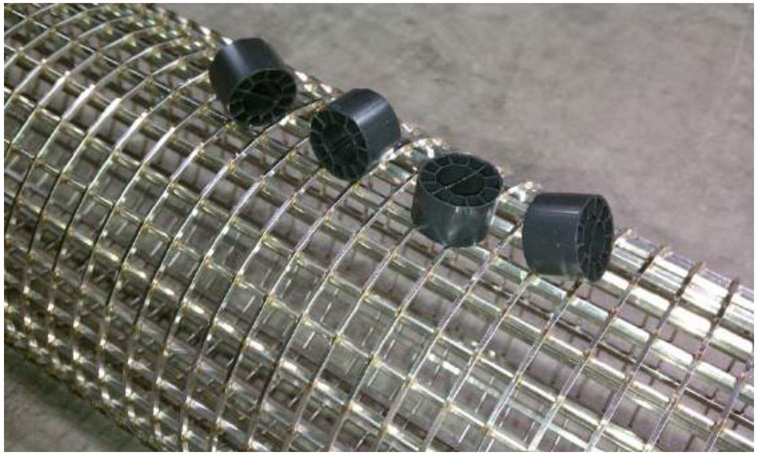
Large aperture (10 mm)

20-30 gal/sq ft

Cylindrical

Flange mount or slide-in

Vertical or horizontal mounting

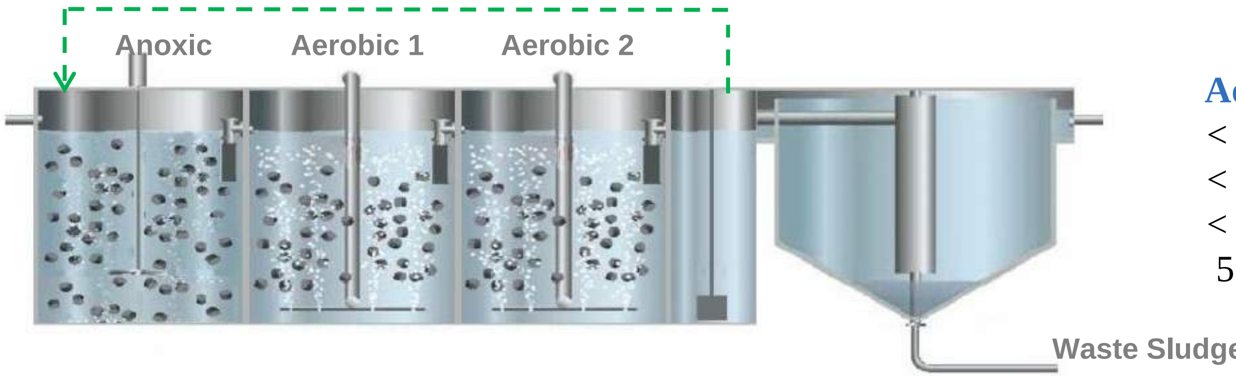


Integrated Control Panel

AQUACELL™

Moving Bed Biofilm Reactor (MBBR) Technology

- Easy to Operate single pass process - No Return Activated Sludge (RAS)
- Biofilm Carriers used in both Anoxic and Aerobic zones

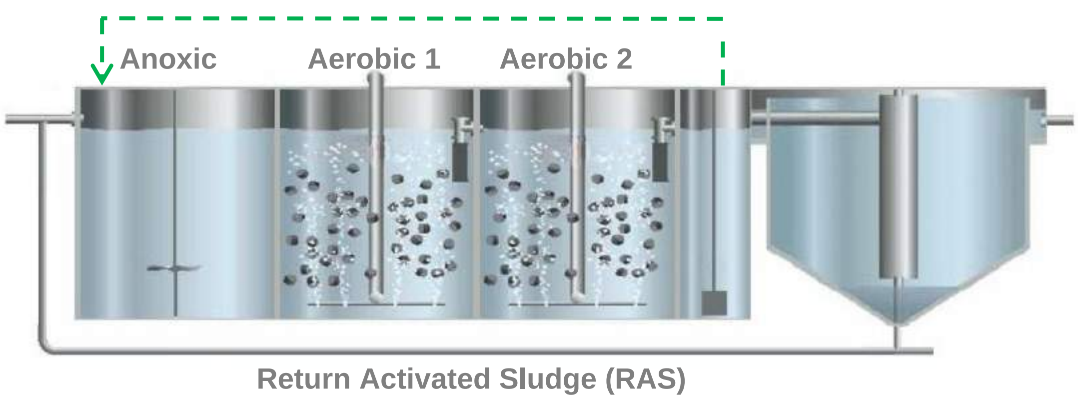


AquaCELL (MLE)
< 20 mg/LBOD
< 20 mg/L TSS
< 0.5 mg/L NH_3-N
5 - 10 mg/L TN

AQUAFAS™

Integrated Fixed Activated Sludge Technology (IFAS)

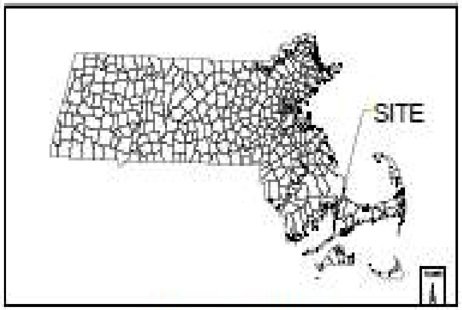
- Incorporates Return Activated Sludge (RAS) ➡ Higher levels of treatment
- Increased operations & management of suspended growth phase
- Biofilm Carriers only used in Aerobic zones (No Media in Anoxic zones)
- Somewhat lower capital cost



AquaFAS (ENR)
< 20 mg/L BOD
< 20 mg/L TSS
< 0.5 mg/L NH_3-N
< 5 mg/L TN

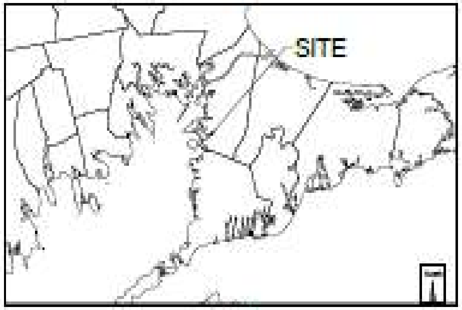
CATAUMET HARBORVIEW HOMES
RESIDENTIAL REDEVELOPMENT
BOURNE, MASSACHUSETTS

Sept. 3, 2013



MASSACHUSETTS

Graphic Scale



TOWN

Graphic Scale

VICINITY MAP

Graphic Scale

1-inch = 1000-feet

Sheet List Table	
Sheet Number	Sheet Title
1	COVER SHEET
2	CONSTRUCTION NOTES
3	EXISTING CONDITIONS
4	EROSION CONTROL PLAN
5	PROPOSED SITE PLAN
6	GRADING & DRAINAGE
7	ROAD PROFILE PLANS
8	UTILITY PLAN
9	WASTEWATER SITE PLAN
10	DETAILS (1)
11	DETAILS (2)
12	DETAILS (3)
13	DETAILS (4)
14	DETAILS (5)
15	DETAILS (6)
16	TREATMENT PLANT DETAILS (1)
17	TREATMENT PLANT DETAILS (2)
18	DISPOSAL DETAILS
19	LANDSCAPE DETAILS
20	LANDSCAPE PLAN - TREES
21	LANDSCAPE PLAN - SHRUBS-PERENNIALS

CATAUMET HARBORVIEW HOMES
RESIDENTIAL REDEVELOPMENT
BOURNE, MASSACHUSETTS

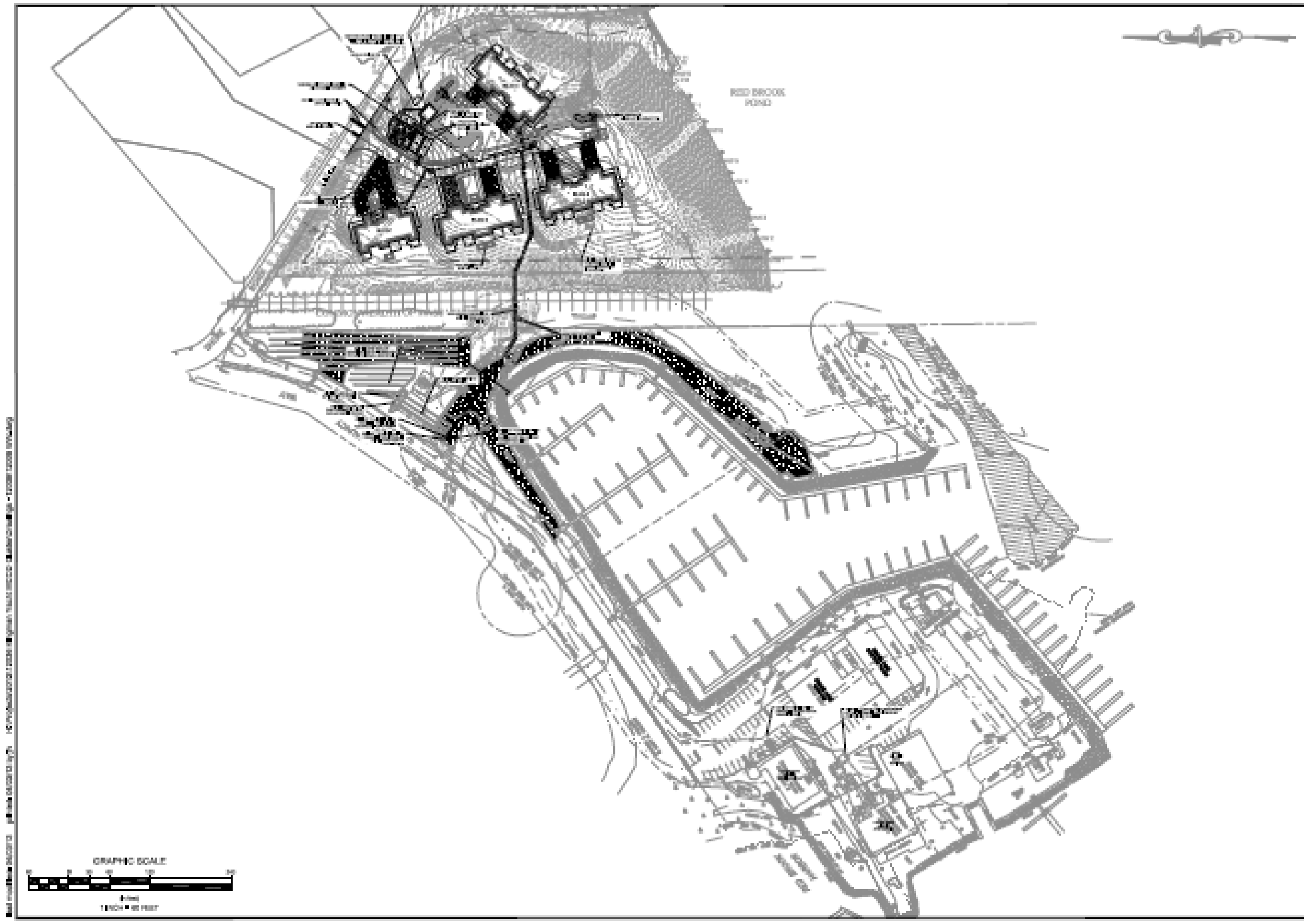
Red Brook Harbor Properties Realty Trust
P.O. Box 408
Cataumet, MA 02534
508 563-7136

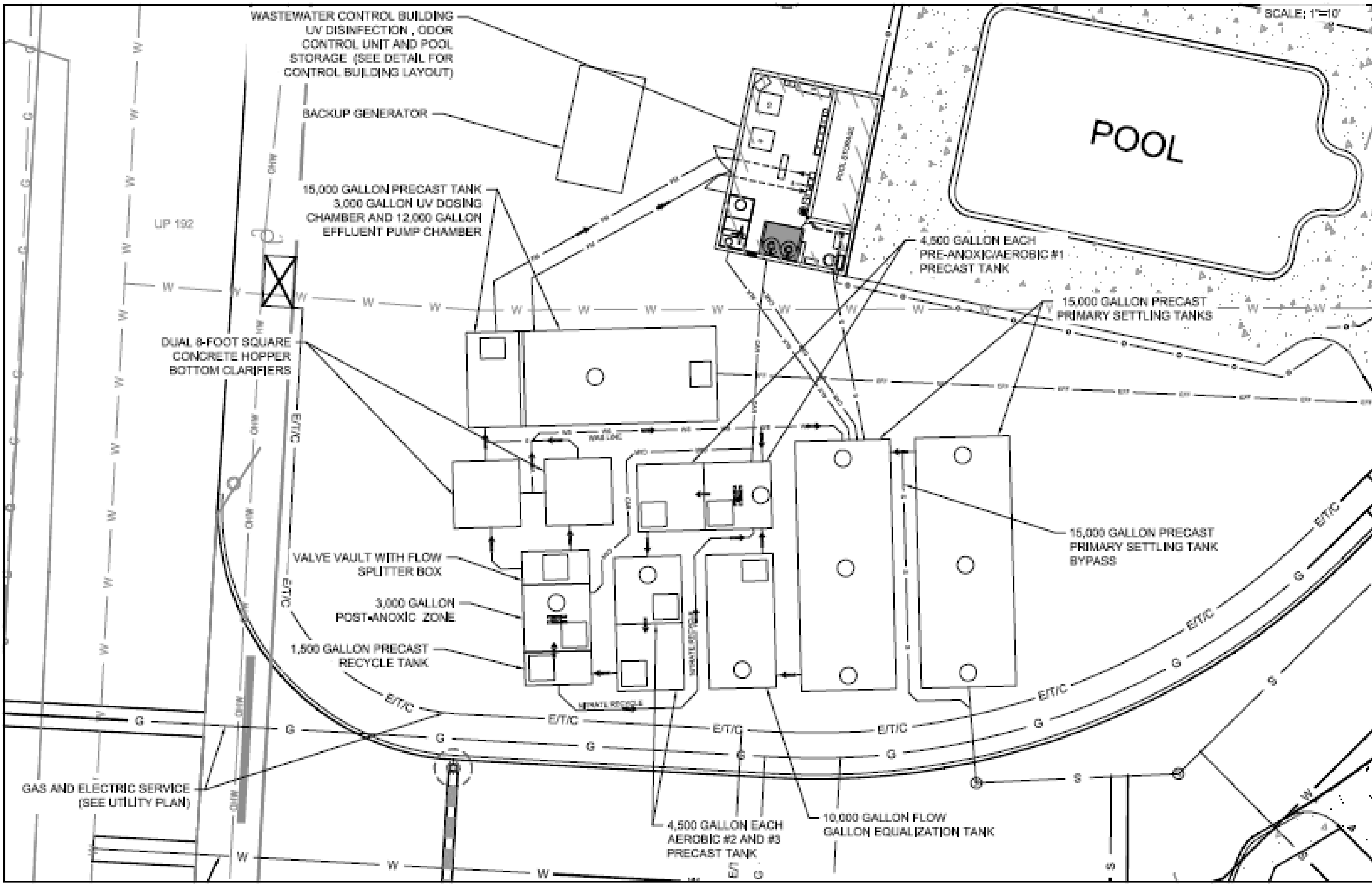
Horsley Witten Group, Inc.
Sustainable Environmental Solutions

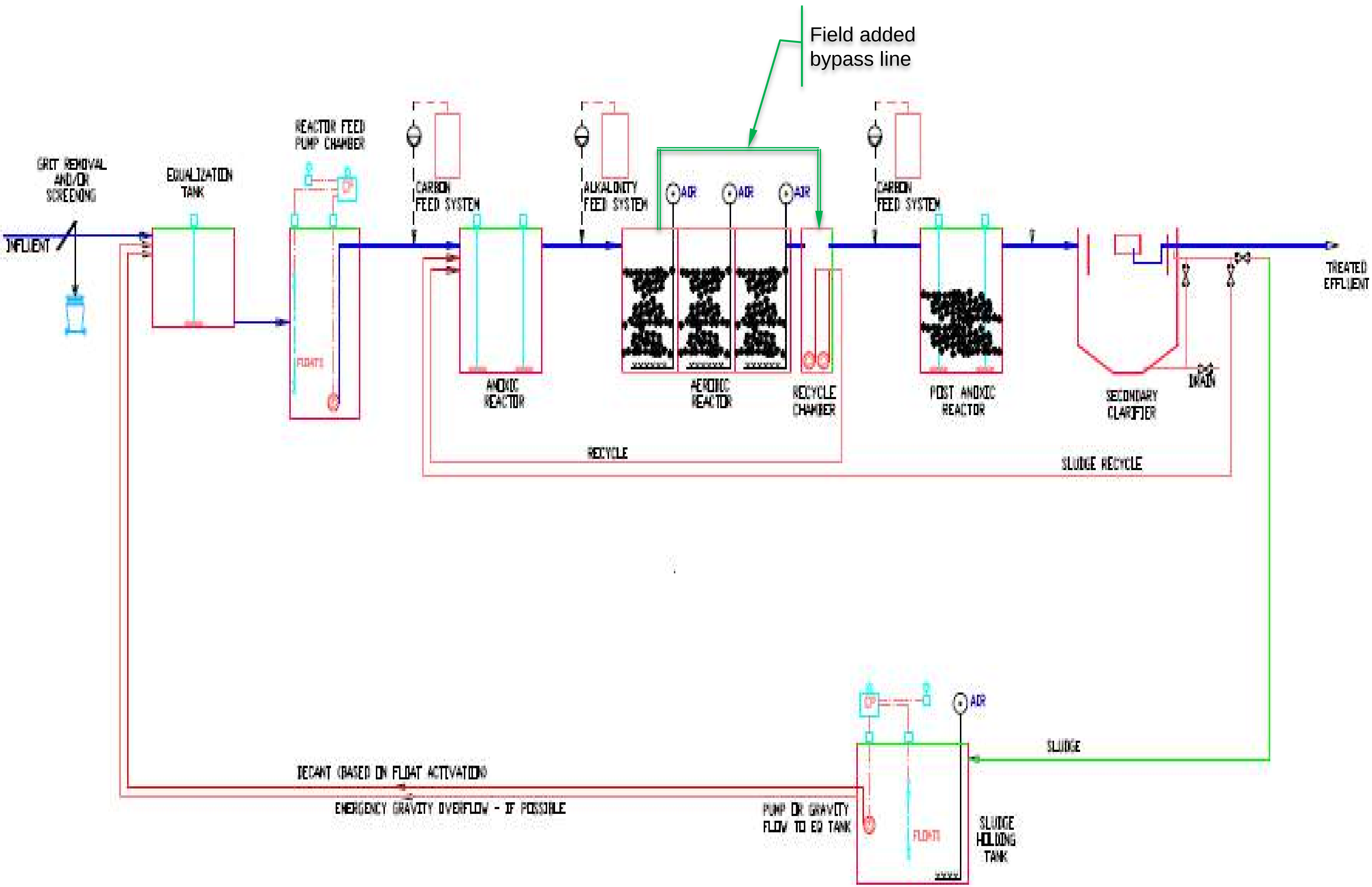
Revisions

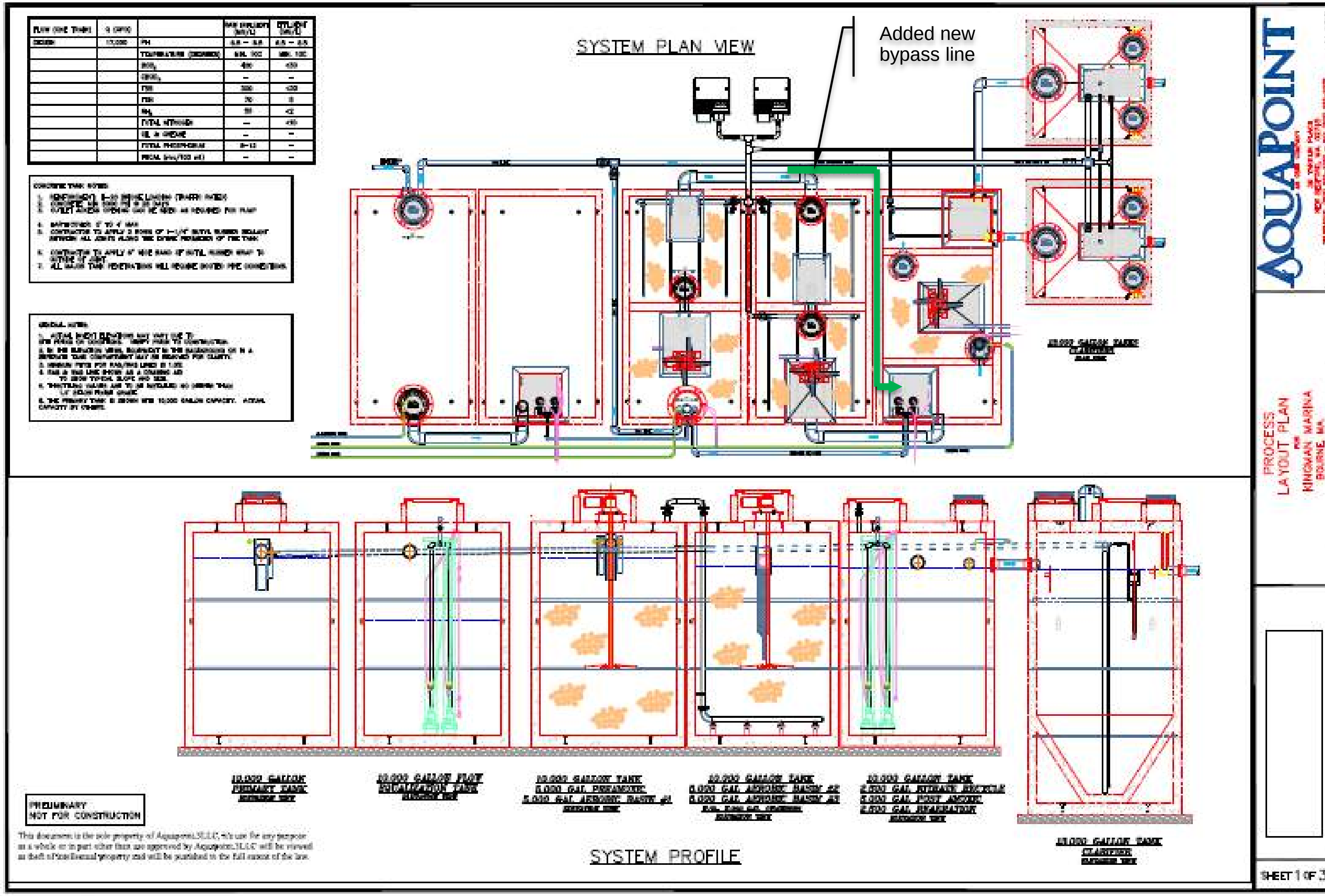
1 of 21

C-1


RED BROOK
POND
GRAPHIC SCALE


SCALE: 1"=10'
POOL
WASTEWATER CONTROL BUILDING UV DISINFECTION , ODOR CONTROL UNIT AND POOL STORAGE (SEE DETAIL FOR CONTROL BUILDING LAYOUT)
BACKUP GENERATOR
15,000 GALLON PRECAST TANK 3,000 GALLON UV DOSING CHAMBER AND 12,000 GALLON EFFLUENT PUMP CHAMBER
UP 192
4,500 GALLON EACH PRE-ANOXIC/AEROBIC #1 PRECAST TANK
15,000 GALLON PRECAST PRIMARY SETTLING TANKS
DUAL 8-FOOT SQUARE CONCRETE HOPPER BOTTOM CLARIFIERS
15,000 GALLON PRECAST PRIMARY SETTLING TANK BYPASS
VALVE VAULT WITH FLOW SPLITTER BOX
3,000 GALLON POST-ANOXIC ZONE
1,500 GALLON PRECAST RECYCLE TANK
GAS AND ELECTRIC SERVICE (SEE UTILITY PLAN)
4,500 GALLON EACH AEROBIC #2 AND #3 PRECAST TANK
10,000 GALLON FLOW GALLON EQUALIZATION TANK
POOL STORAGE
E/T/C


Field added
bypass line
GRIT REMOVAL
AND/OR
SCREENING
INFLUENT
EQUALIZATION
TANK
REACTOR FEED
PUMP CHAMBER
FLOATS
CARBON
FEED SYSTEM
ALKALINITY
FEED SYSTEM
AIR
AIR
AIR
CARBON
FEED SYSTEM
ANOXIC
REACTOR
AEROBIC
REACTOR
RECYCLE
CHAMBER
POST ANOXIC
REACTOR
SECONDARY
CLARIFIER
DRAIN
TREATED
EFFLUENT
RECYCLE
SLUDGE RECYCLE
AIR
SLUDGE
DECANT (BASED ON FLOAT ACTIVATION)
EMERGENCY GRAVITY OVERFLOW - IF POSSIBLE
PUMP OR GRAVITY
FLOW TO EQ TANK
FLOATS
SLUDGE
HOLDING
TANK


SYSTEM PLAN VIEW
Added new bypass line
SYSTEM PROFILE
10,000 GALLON PRIMARY TANK
10,000 GALLON FLOW EQUALIZATION TANK
10,000 GALLON TANK 5,000 GAL PREANOXIC 5,000 GAL AEROBIC BASIN #1
10,000 GALLON TANK 5,000 GAL AEROBIC BASIN #2 5,000 GAL AEROBIC BASIN #3
10,000 GALLON TANK 2,500 GAL NITRATE RECYCLE 5,000 GAL POST ANOXIC 2,500 GAL REAERATION
10,000 GALLON TANK CLARIFIER
PRELIMINARY NOT FOR CONSTRUCTION
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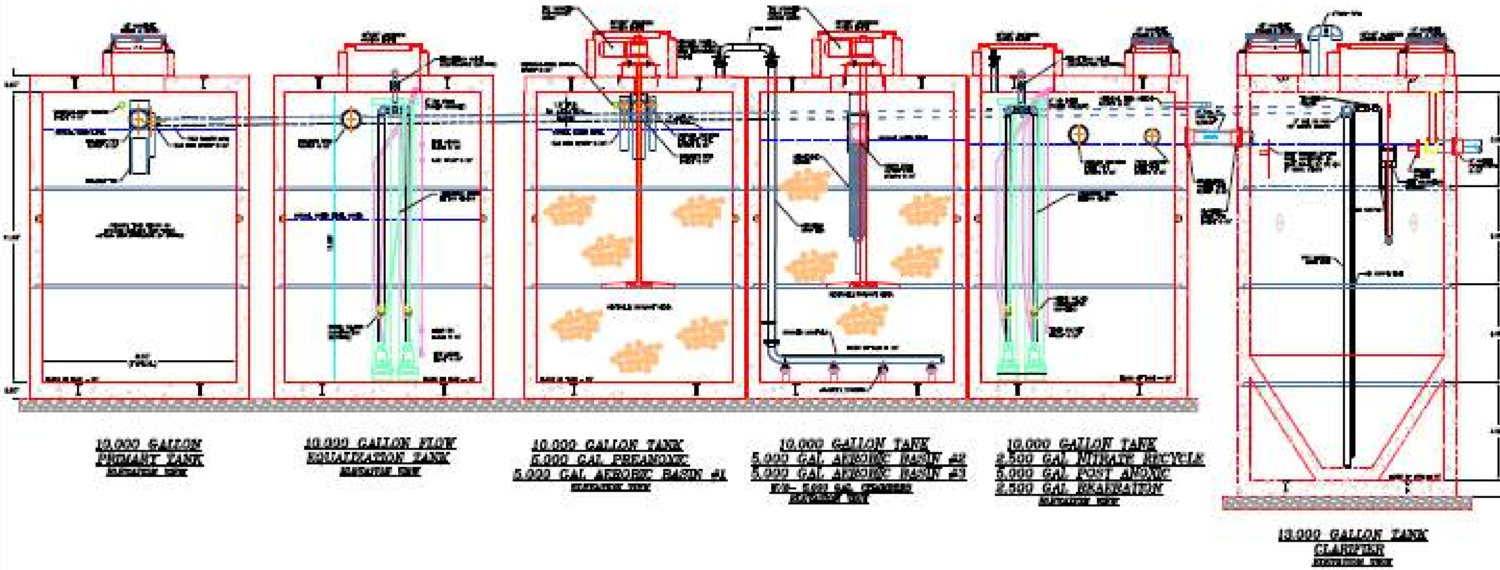
AQUAPOINT
PROCESS LAYOUT PLAN
FOR
KINGMAN MARINA
BOURNE, MA
SHEET 1 OF 3



SYSTEM PROFILE

PRELIMINARY
NOT FOR CONSTRUCTION

AQUAPOINT

PROCESS
LAYOUT PLAN
FOR
KINGMAN MARINA
BOURNE, MA.

SHEET 3 OF 3

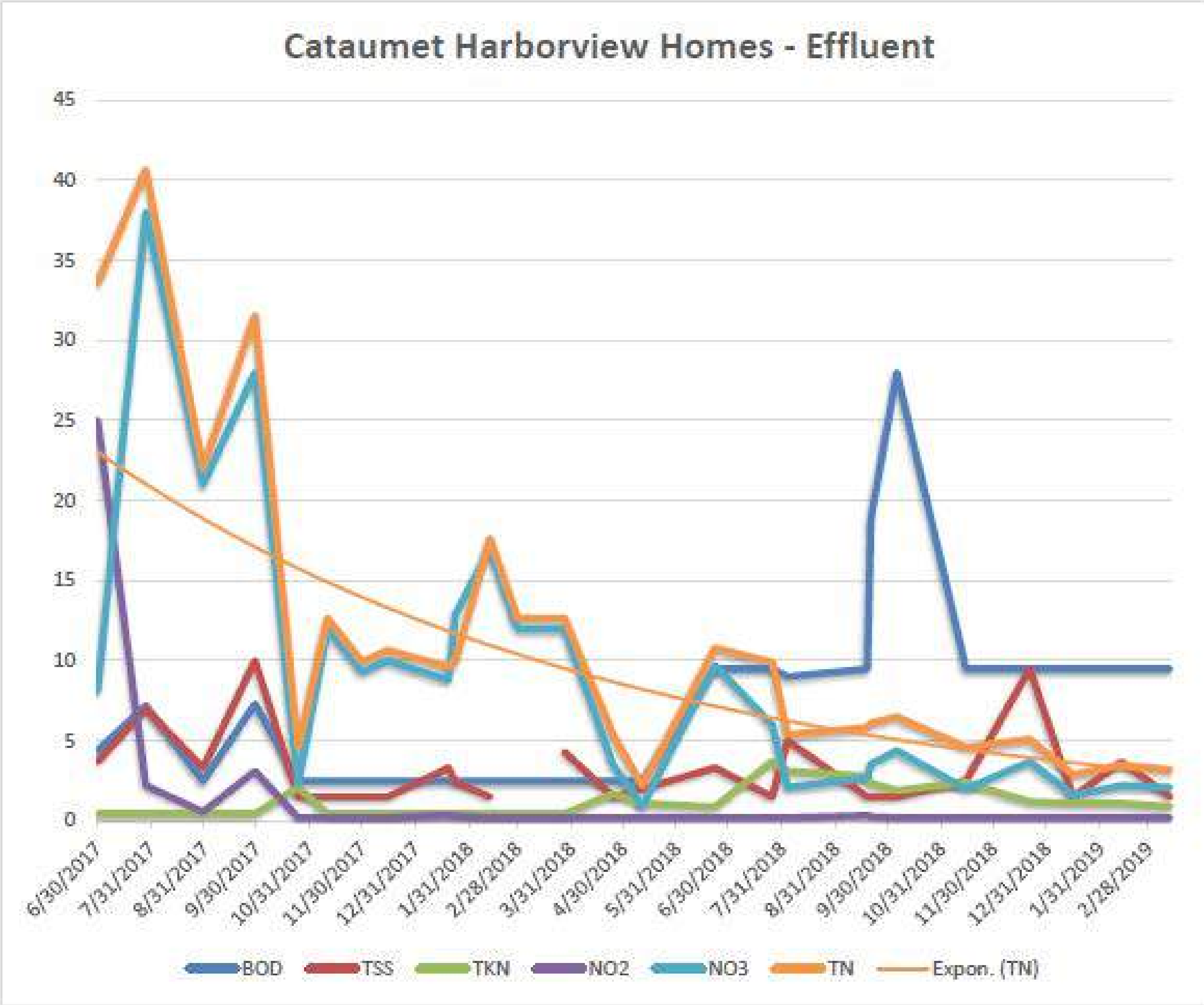
Kingman Marina Proposed WWTP Tanks

Option #1 - Single train WWTP built in One Phase for 34,000 gpd						
Tanks	Function	Nominal Capacity (gal)	Approximate Inside Dimensions (Feet)			
			L	W	SWD	Over all height
# 1	Equalization	10,000	16	8	10	12
# 2*	Pre-Anox & Aeration Reactor # 1	9,000	16	8	10	12
# 3*	Aeration reactors # 2 & #3	9,000	16	8	10	12
# 4*	Post Anoxic	3,000	8	8	10	12
	Re- Aeration	1,000				
# 5	Recycle chamber	1,500	6	6	10	12
# 6	Flow Divider manhole		6	6	NA	6
# 7 & 8	Clarifiers		8	8	14	16
* Tanks are 2 compartment with interior full wall baffle						

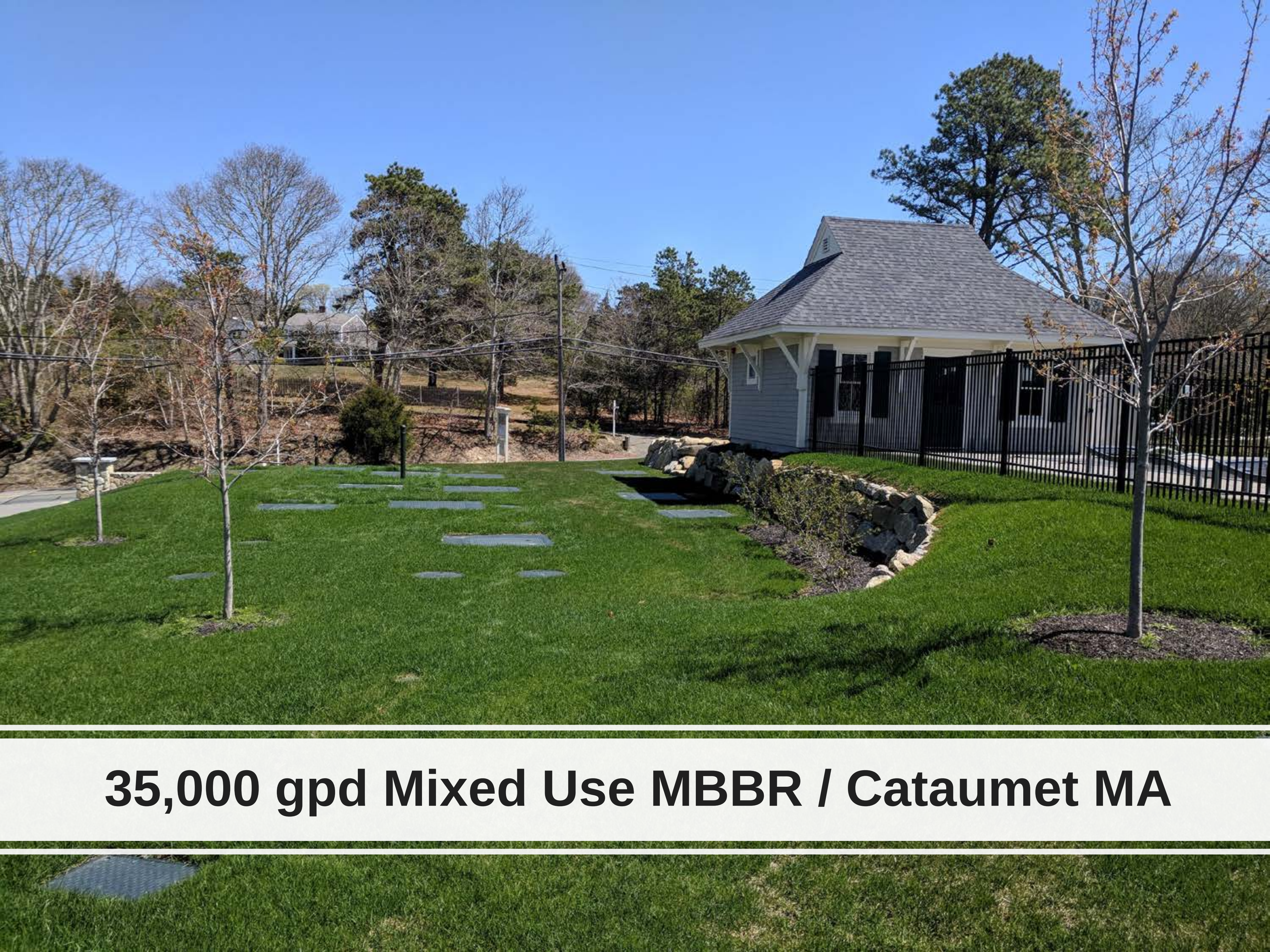
Location: Cataumet Harbor

Effluent

DATE	BOD	TSS	TKN	NO2	NO3	TN	Fecal	O&G	Ortho P	Tot. P	VOC
6/30/2017	4.4	3.7	<0.5	25	8.1	33	2	0.9			
7/28/2017	7.2	7	<0.5	2.2	38	40	6	0.98	12	12	
8/30/2017	<3	3.3	<0.5	0.56	21	22	3	0.7			
9/29/2017	7.3	10	<0.5	3.1	28	31	<10	<0.5			
10/24/2017	<3	<2	2.1	<0.25	2.3	4.4	<10	1.1	7.7	11	
11/10/2017	<3	<2	<0.5	<0.25	12	12	<1	0.8			
11/30/2017			<0.5	<0.25	9.3	9.3					
12/15/2017	<3	<2	<0.5	<0.25	10	10	<1	<0.5			
1/19/2018	<3	3.3	<0.5	0.38	8.8	9.2	TNTC	0.9	3.1	6.2	Chloro: 1.3
1/23/2018							<1				
2/12/2018	<3	<2	<0.5	<0.25	17	17		<0.5			
2/28/2018	<3		<0.5	<0.25	12	12	<2				
3/27/2018	<3	4.3	<0.50	<0.25	12	12	<2	<0.5			
4/24/2018	<3	<2	1.7	<0.25	3.5	5.2	<2	0.5	1.8	4.8	
5/11/2018	<3	2	1.1	<0.25	0.92	2.0	<2	<0.5			
6/22/2018	<10	3.3	0.88	<0.25	9.7	11	<10	0.9			
7/25/2018	<10	<2.0	3.7	<0.25	6	9.7	4	2.3	11	11	
8/3/2018	9	5	3.1	<0.25	2.1	5.2	<10	0.7			
9/18/2018	<10	<2.0	2.8	0.33	2.7	5.8	278	0.8			
9/20/2018							2				
10/5/2018	28	<2.0	1.9	<0.25	4.4	6.3	28	1.4	5.5	10	
11/14/2018	<10	2.5	2.4	<0.25	2	4.4	76	1			
12/21/2018		<10	1.2	<0.25	3.7	4.9		<0.5			
1/15/2019	<10	<2	1.1	<0.25	1.6	2.7	<10	<0.5	5.6	6	ND
2/12/2019	<10	3.7	1.1	<0.25	2.2	3.3	<2	10			
3/12/2019	<10	<2.0	0.90	<0.25	2.1	3.0	<2	0.5			
										5.26	
Permit Limits					30	30			10	10	



Cataumet Harborview Homes - Effluent
45
40
35
30
25
20
15
10
5
0
6/30/2017
7/31/2017
8/31/2017
9/30/2017
10/31/2017
11/30/2017
12/31/2017
1/31/2018
2/28/2018
3/31/2018
4/30/2018
5/31/2018
6/30/2018
7/31/2018
8/31/2018
9/30/2018
10/31/2018
11/30/2018
12/31/2018
1/31/2019
2/28/2019
BOD
TSS
TKN
NO2
NO3
TN
Expon. (TN)


35,000 gpd Mixed Use MBBR / Cataumet MA

Thank You

AQUAPOINT
AN OBEH COMPANY

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New Bedford, MA 02745
help@aquapoint.com

Thank You!
West Island Treatment Plant Tour

141 Fir Street
Fairhaven, MA 02719