Orenco Residential Treatment

What's the difference?

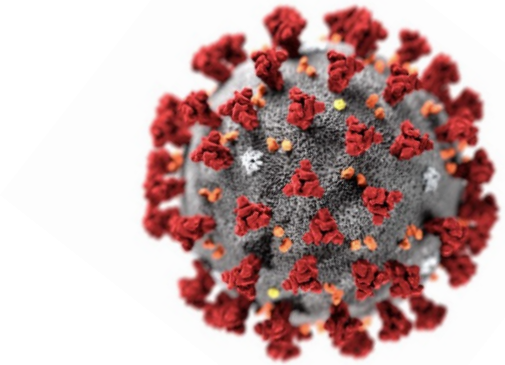
AdvanTex® Design Module Outline

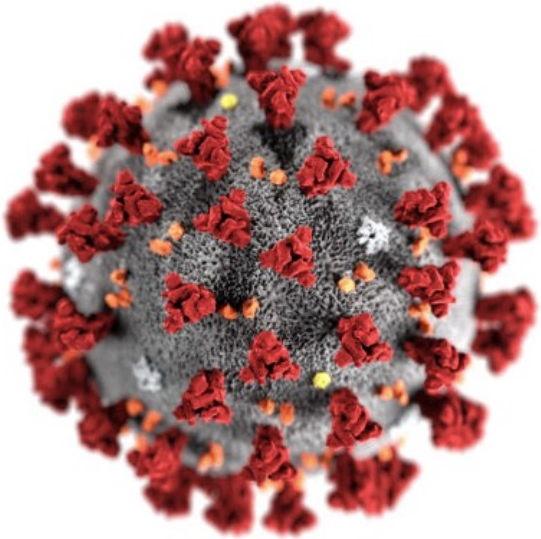
- Introduction to treatment processes/types
- Pros/Cons of each type
- Residential Advantex models
- Performance data
- Processing tank requirements
- System settings
- Disinfection
- Siting considerations
- Effluent reuse

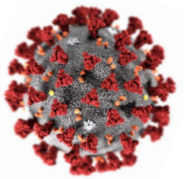
What is Wastewater Treatment?

WWT Removes These Constituents

- Biodegradable organics
- Total suspended solids
- Nutrients
- Pathogens
- Inorganics







Constituents are Removed Through …

- Biological processes
- Chemical processes
- Physical processes

Factors Affecting Removal

- Organic loading
- Hydraulic loading
- Hydraulic retention time
- Flow configuration

Factors Affecting Removal (cont.)

- Temperature
- pH
- Venting
- Grease and oil
- Inorganic solids (kitty litter, etc.)
- Toxins (cleaners, poisons)
- Medications/antibiotics

Most Common Onsite Treatment Processes

- Suspended growth, extended aeration (ATUs)
- Attached growth, packed bed filters (sand, peat, textile filters)

Suspended Growth, Extended Aeration

- Microorganisms are suspended in liquid
- Microorganisms metabolize organic matter to CO_2, H_2O, and cell mass
- Process generates activated sludge

Suspended Growth Technology

Municipal Plants

- Complex design parameters
- Complex control system to manage these parameters
- 24-hour control
- Operation-intensive and maintenance-intensive

Suspended Growth Technology

Residential Applications

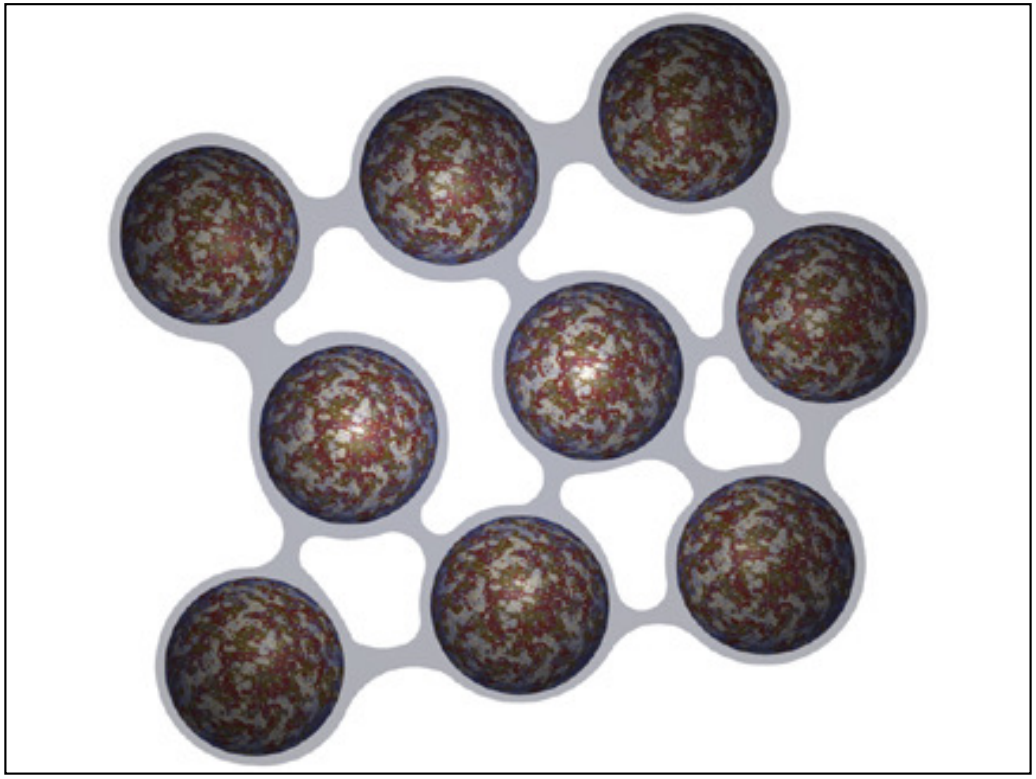
- Usually called “ATUs”
- “Scaled down” municipal treatment plant technology
- Lack the necessary operators or controls
- No surge control or flow monitoring
- Sludge “washout” during hydraulic overloads
- Unreliable performance

Typical ATU Power Cost

- 115 watt blowers* = $20.16/mo.
  (at national average of 23 cents/kWh)
- 1/4 hp blower = $46/mo.
  (2.42 amps, 23 cents/kWh)
- 1/3 hp blower = $77.85/mo.
  (3.8 amps, 23 cents/kWh)

Attached Growth

- Aerobic microbes attach and grow to inert media
- Wastewater flows across a zoogleal film created by microbes
- Microbes extract and digest soluble organic matter from the wastewater



Packed Bed Filter Treatment Technology

- Uses a fixed film medium (textile, sand, peat)
- Operates in an unsaturated condition (not submerged)
- Employs intermittent timed-dosing
- Uses filtration and biological/chemical reduction

Textile Treatment Media

Packed Bed Filters Are …

- Economical
  - Low power consumption (less than $8/month)
- Reliable
  - Consistent, high quality effluent
  - No release of untreated sewage
- Sustainable
  - Low maintenance
  - Long lifespan

The “Secret” to Great System Performance

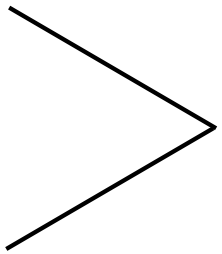
- Appropriate tank sizing
- Dosing frequencies
  - Evenly distributed dosing, 24 hours a day
- Control panel optimizes the treatment process

Appropriate Tankage and Programmable Timers Allow …

Surge control

Flow modulation

Flow monitoring



Optimization of treatment process

ATUs vs Packed Bed Filters

	ATU	PBF
Power Costs	High	Low
Maintenance	High	Low
Life-cycle costs	High	Lower
Effluent quality	Inconsistent	Reliable
Untreated effluent release	Possible	Prevented

What is AdvanTex®?

- A packed bed filter ...
- That uses an engineered textile material ...
- Plus appropriate tankage and timed dosing ...
- And comes in a complete, premanufactured package

AdvanTex® Treatment Systems

- Economical
  - Both initial and lifetime costs
- Reliable
  - All the benefits of PBF performance, but higher treatment capacity and longer lifetime
- Sustainable
  - Much easier to maintain than other PBFs
  - Outstanding effluent quality allows for water reuse
  - Protects the environment

Sustainability

"Advanced onsite wastewater treatment systems are a permanent part of the nations infrastructure and must be managed as such."

Albert Rubin – Professor Emeritus, NC State University

Filter Type
AX20

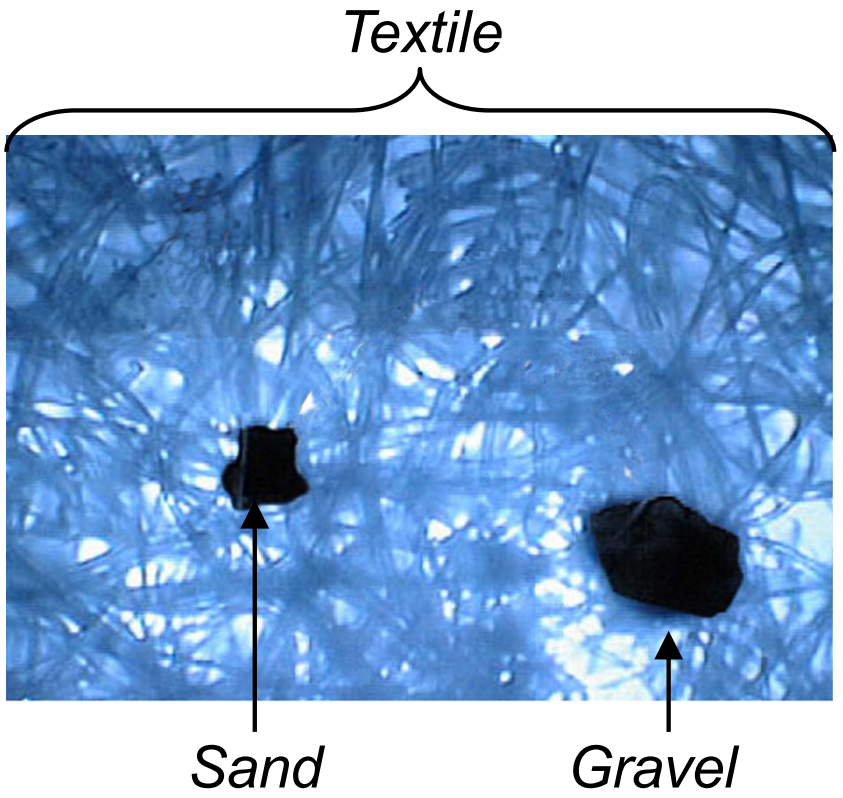
- Physical specifications
  - 7.5' x 3' x 2.5'
  - Footprint: ~23 sq. ft.
  - Dry weight: ~300 lb.

AX Series

- Uses hanging textile sheets
- Can withstand occasional abnormally high loading conditions
- Has outstanding serviceability

Textile Offers Greater Surface Area

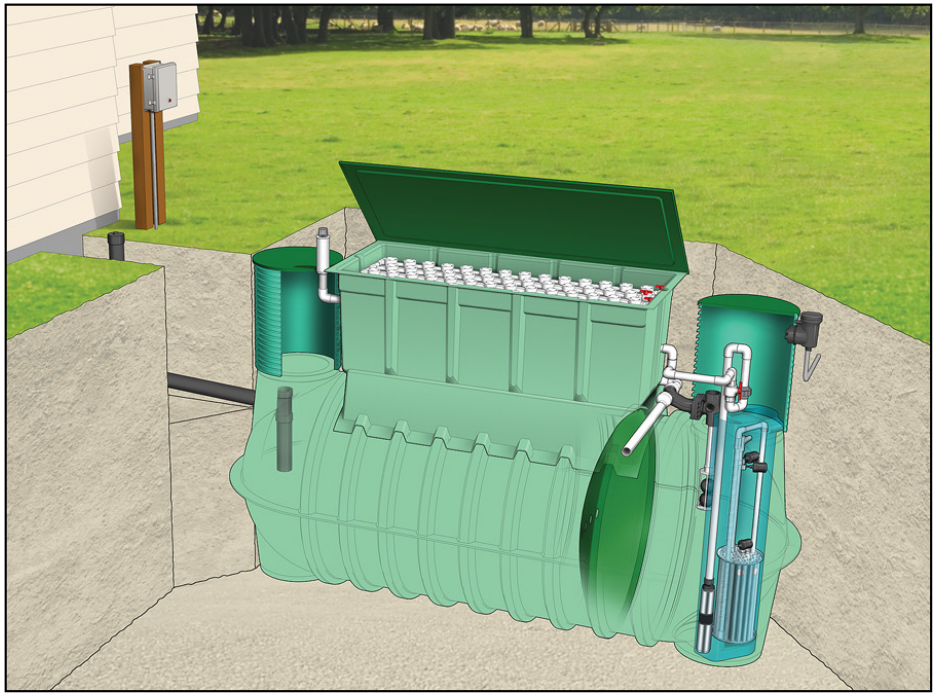
- Specifically engineered for WWT
- 5-20 times more surface area than sand (ft^2 per ft^3 of material)
- The more surface area, the more area for bacterial colonization
- Allows for much higher loading rates than sand filters



AdvanTex® Overview

Main Components

- Control panel
- Processing tank
- Biotube® pump package
- AdvanTex filter with vent
- Recirculating splitter valve



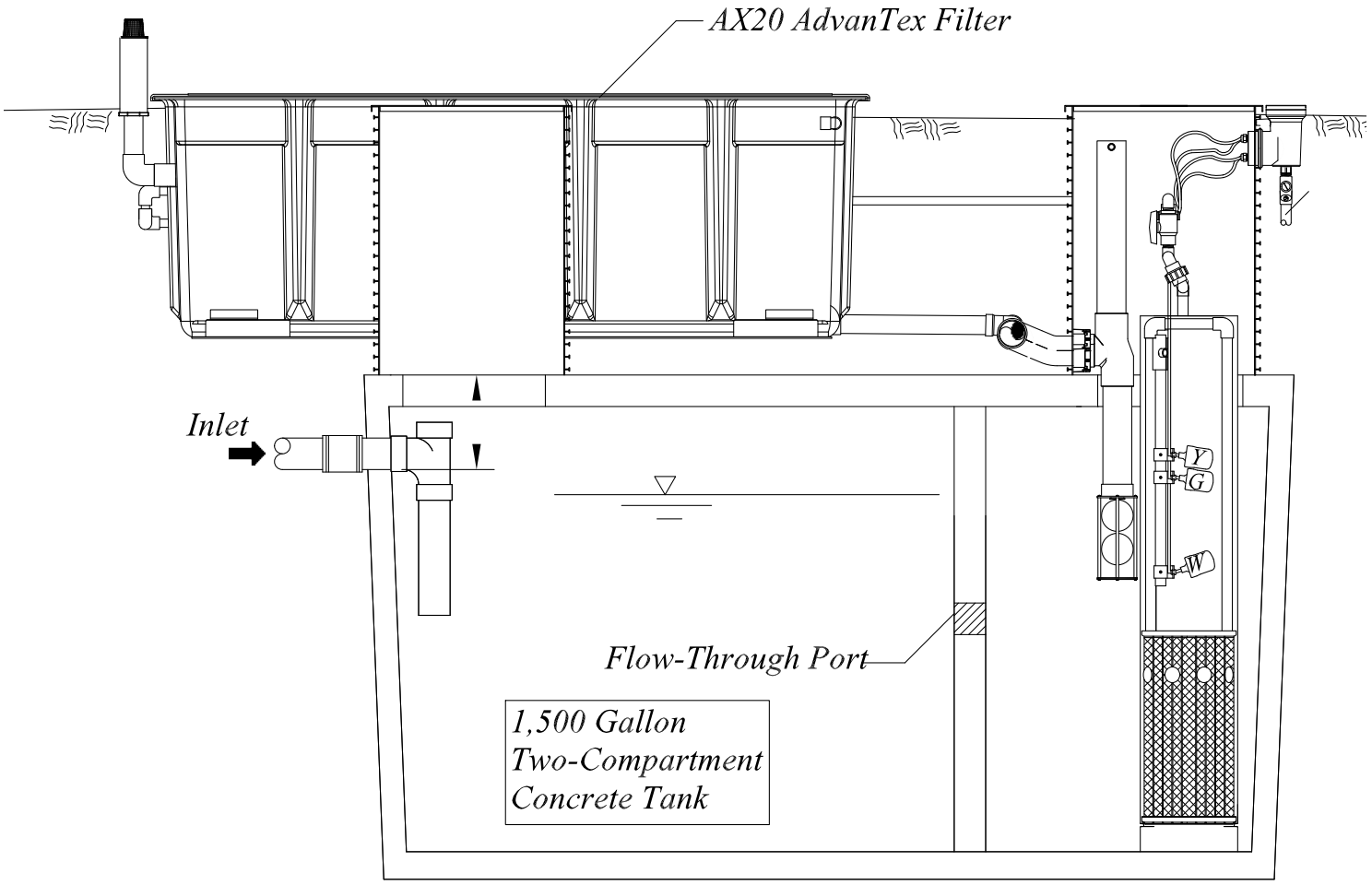
AdvanTex® Filter Installation

- Processing tank
- Filter
- Passive vent
- Treated effluent basin

Modes of Operation

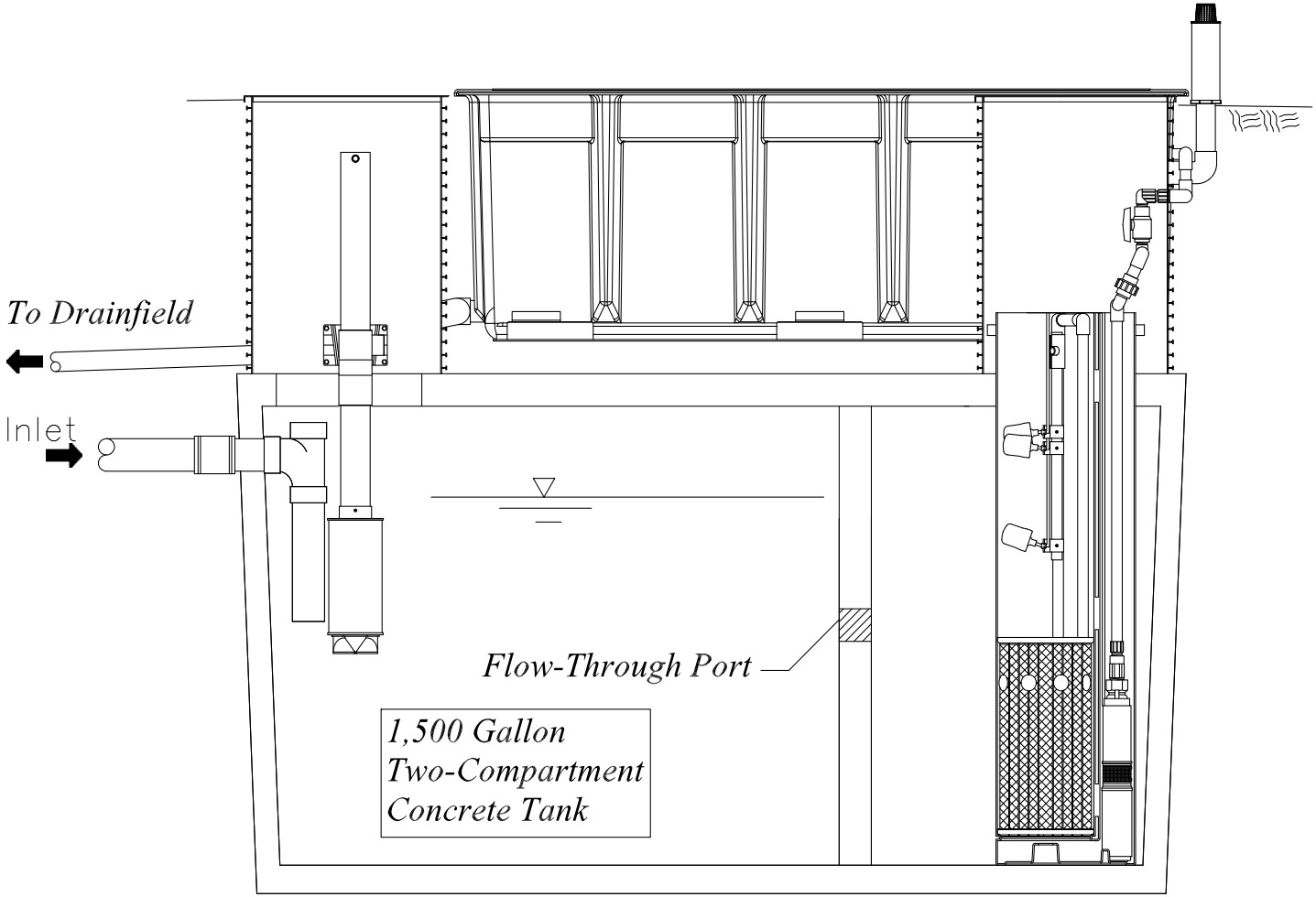
- AdvanTex® Treatment Systems available in two different modes
  - Mode 1: BOD_5 and TSS the primary concern
  - Mode 3: Nitrogen reduction maximized
- Mode determined by local and state regulations

Mode 1: Standard Configuration – AX20



Recirculates through 2nd chamber: Filtrate discharge.

Mode 3: Maximizing Nitrogen Reduction - AX20



Recirculates through both chambers: Filtrate discharge

Performance Data

Definition of Design Flow

- The maximum daily flow a residence is expected to produce
  - Allows for a safety margin and reserve capacity during periods of heavy use

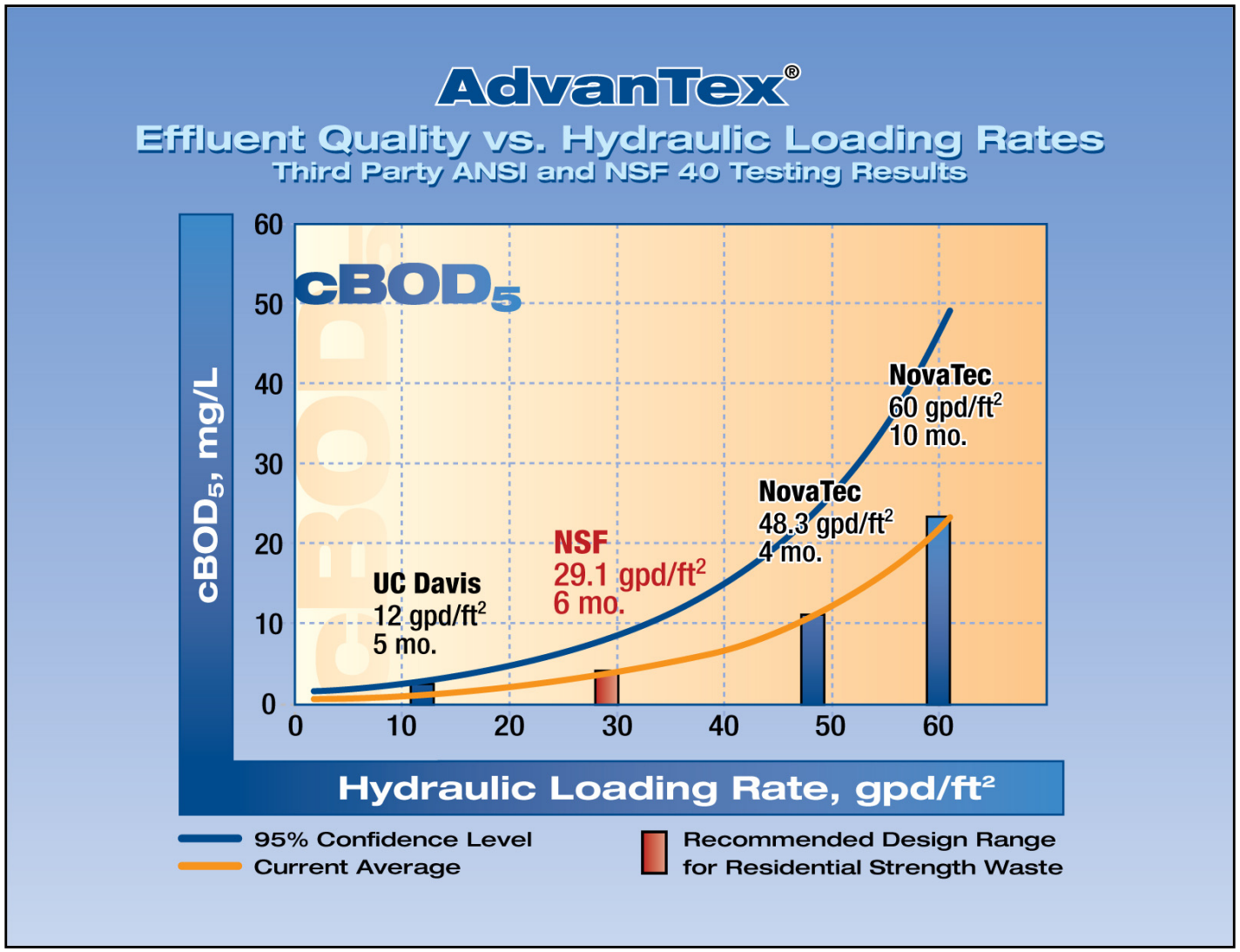
Determine Waste Strength

Screened Residential Effluent*

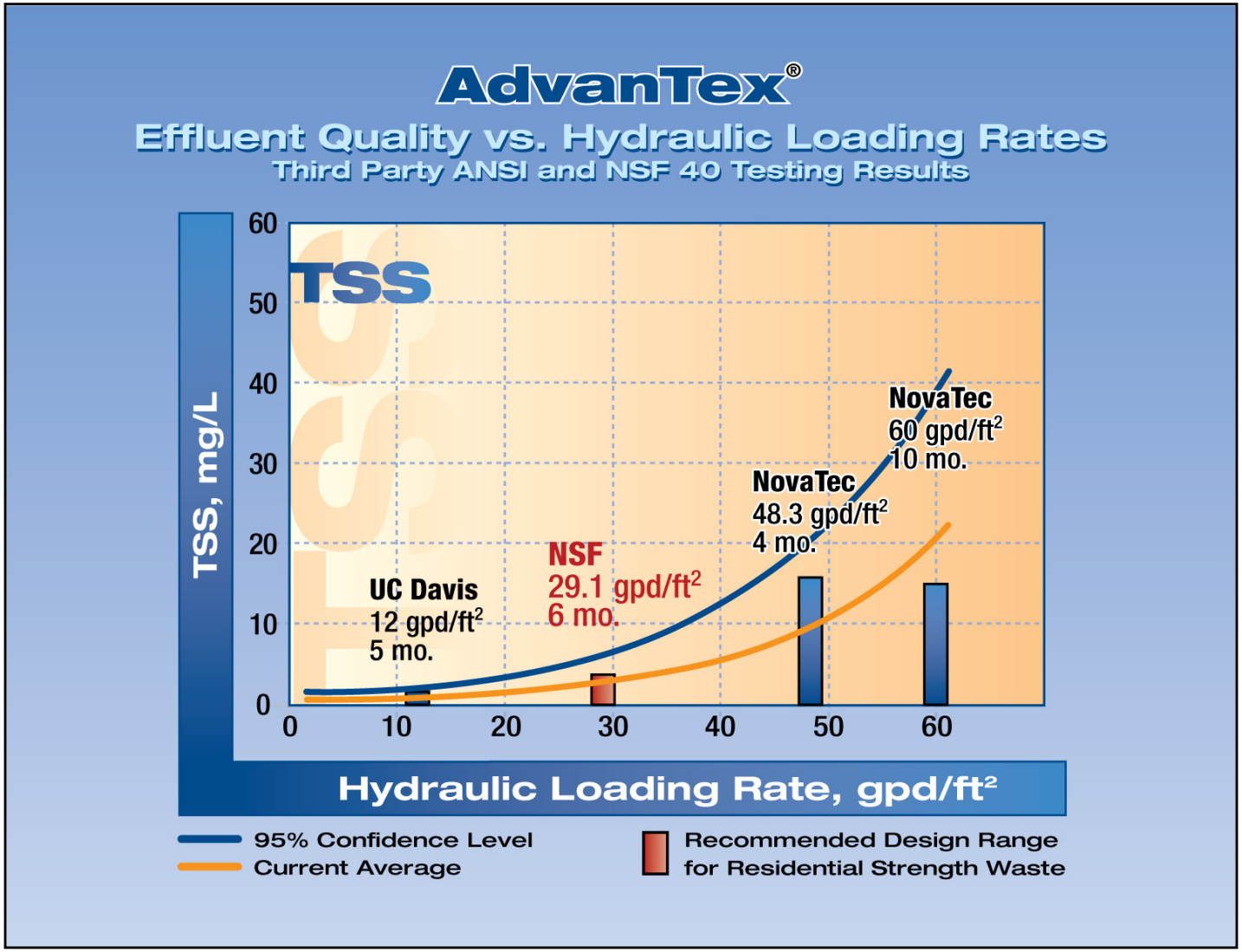
	Average *mg/L*	Weekly Peak *mg/L*	Rarely Exceed *mg/L*
$cBOD_5$	**150**	200	300
TSS	**40**	60	150
TKN	**65**	75	150
G&O	**20**	25	25

** From structurally sound and watertight tanks.*

Performance vs. Loading Rates, $cBOD_5$



Performance vs. Loading Rates, TSS



Performance Data Sources

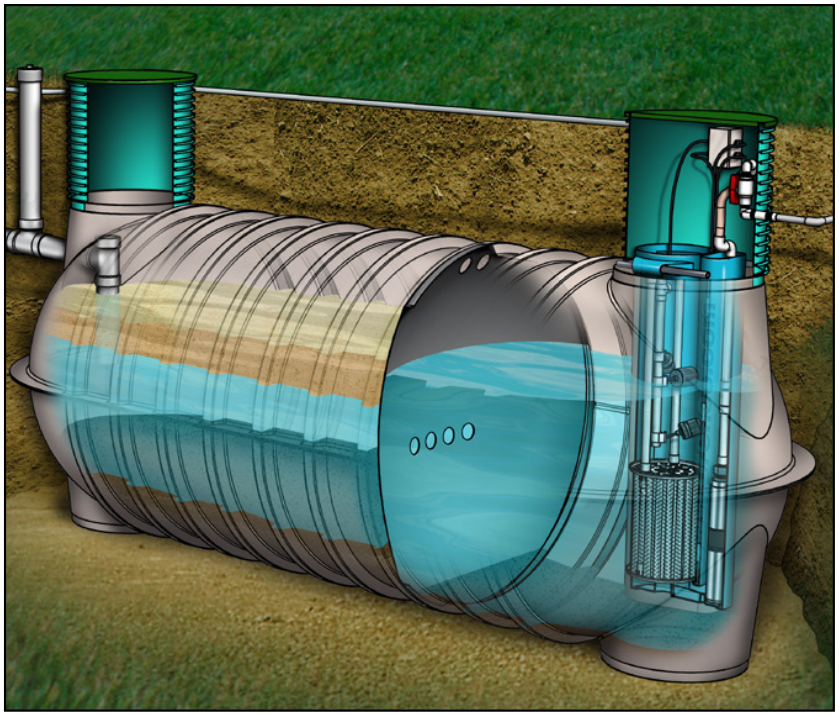
- NSF 40 testing and evaluation to ANSI standards
- NovaTec testing and evaluation to ANSI standards
- EPA national demonstration projects
- State demonstration projects
- University research projects
  - UC Davis, University of MN
- Private installations
  - Throughout U.S., Canada, New Zealand
- Performance summary in real world data

Nitrogen Reduction

- Depends on alkalinity of WW, strength of WW, pH, G&O, etc.
- Mode 1: Typically exceeds 60% reduction; TN of 25 to 35 mg/L
- Mode 3: Typically exceeds 70% reduction

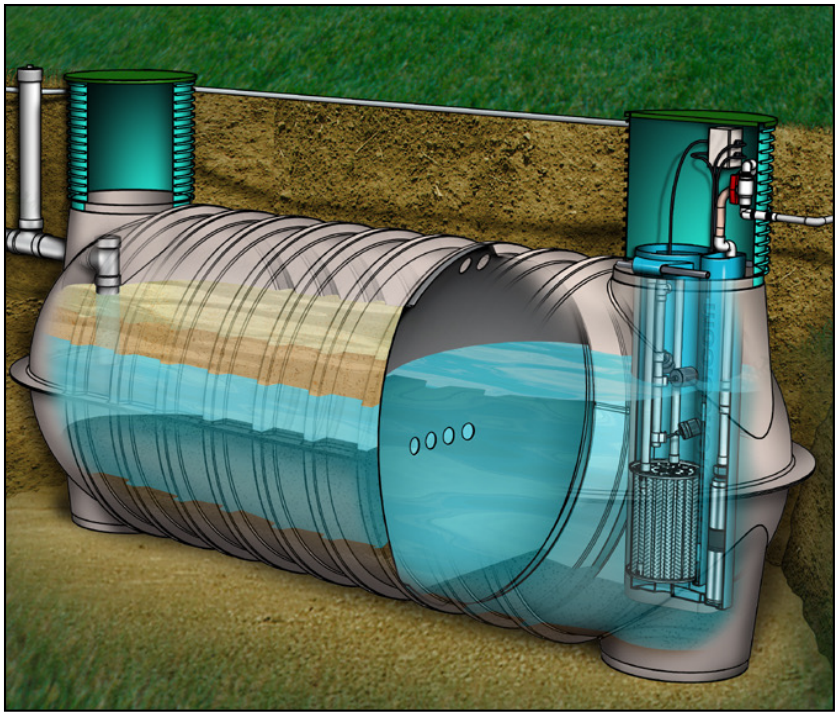
Processing Tank Requirements Residential

- Two-compartment tank with “center pass-through” design
- Must be structurally sound and watertight
- Must be from Orenco-approved tank manufacturer/design



Two-Compartment Processing Tank

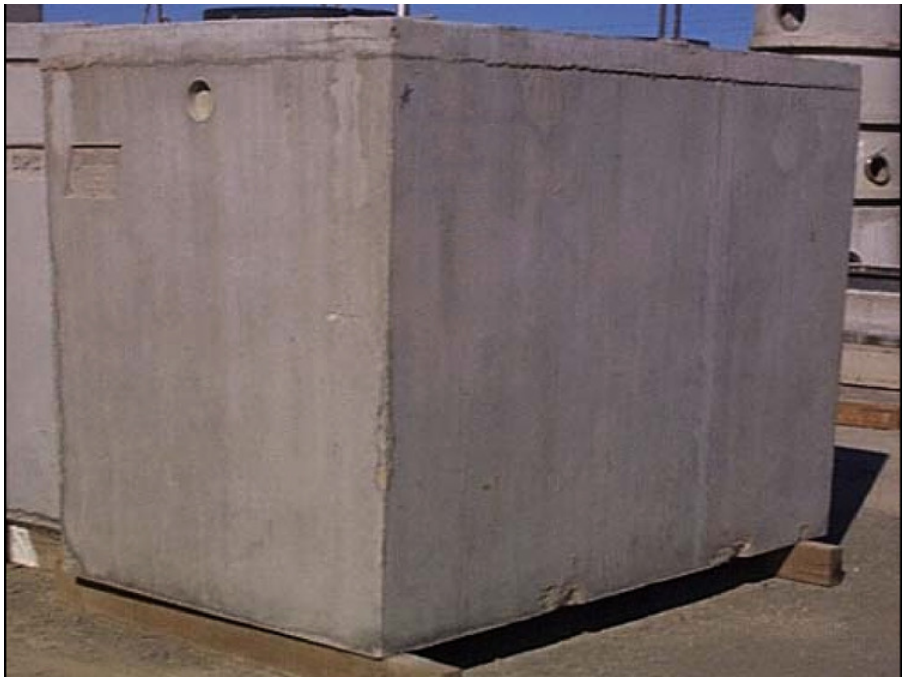
- Minimum 12-square-inch pass-through port in baffle wall
- Port center located at 65 to 75% of minimum liquid level

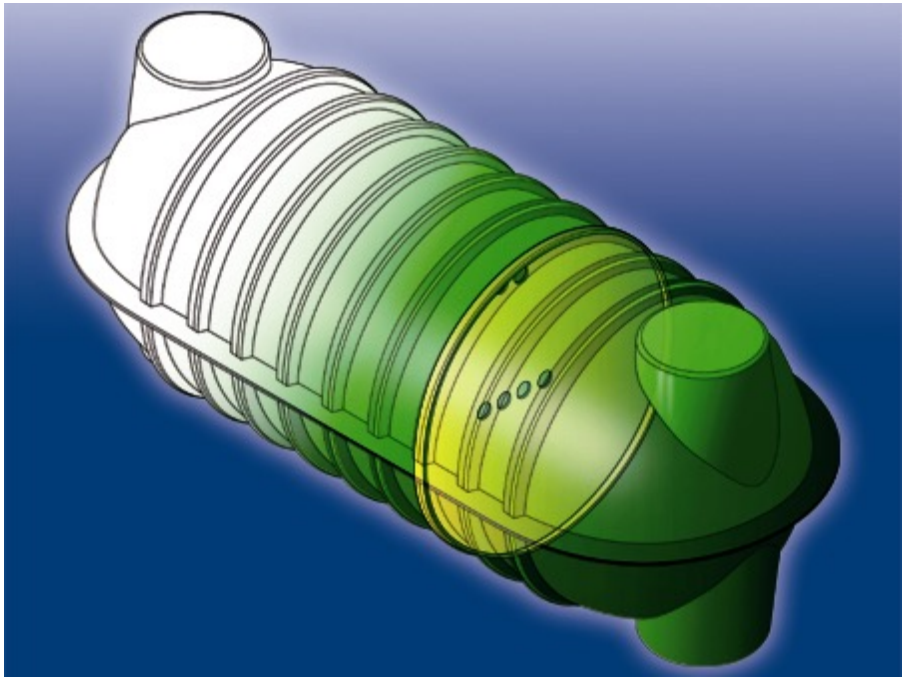


Materials of Tank Construction

Tanks must ...

- Be concrete or fiberglass
- Meet Orenco's General Specifications Guidelines
- Be approved for use with AdvanTex® Treatment Systems





Required Number of Filter Units and Tankage*

Table 2. Required Tankage and Number of Filter Units: Systems Using Single Processing Tank

Number of Bedrooms[1]	Occupants[2] *maximum*	Processing Tank *minimum size, gal. (L)*	AX Units[4] *model*
4 (or fewer)	8	1,500 (5,700)	1 – AX20[5]
5	10	2,500 (9,500)	2 – AX20[5]
6	12	3,000 (11,400)	2 – AX20[5]

Table 3. Recommended Tankage and Number of Filter Units: Systems Using Separate Septic/Recirc Tanks*

Number of Bedrooms[1]	Occupants[2] *maximum*	Septic Tank *minimum size, gal. (L)*	Recirc Tank[3] *minimum size, gal. (L)*	AX Units[4] *model*
4 (or fewer)	8	1,000 (3,800)	1,000 (3,800 L)	1 – AX20[5]
5	10	1,500 (5,700)	1,000 (3,800 L)	2 – AX20[5]
6	12	2,000 (7,600)	1,000 (3,800 L)	2 – AX20[5]

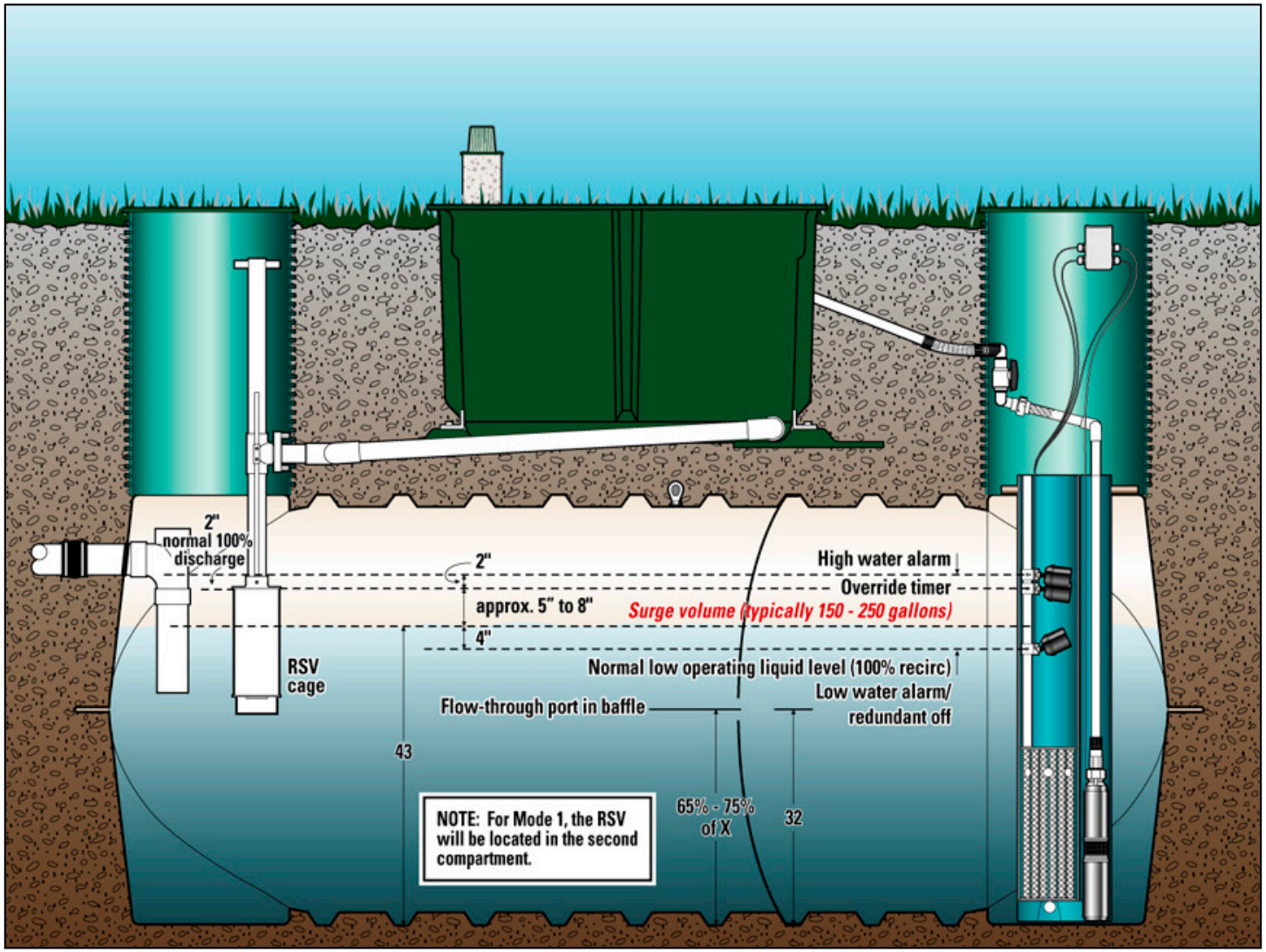
** In jurisdictions which require separate septic and recirc tankage, contact Orenco for options.*

System applications > 6 bedrooms will require a design review by Orenco

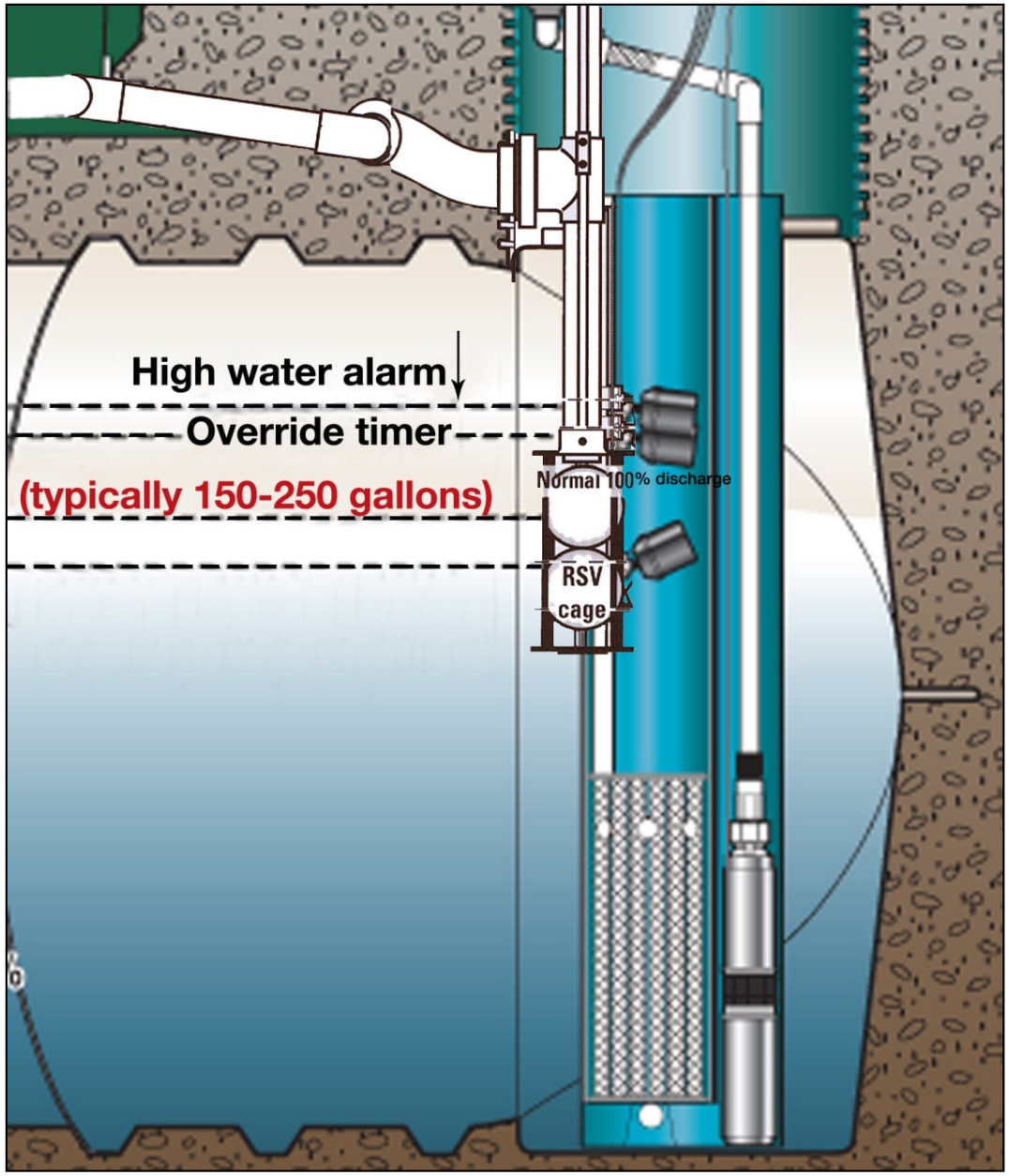
System Settings

- Processing tank liquid levels
- Programmable timer settings

Processing Tank Liquid Level Settings



Mode 1 RSV


High water alarm
Override timer
(typically 150-250 gallons)
Normal 100% discharge
RSV
cage

AX20 Recirculation Ratio

- Initial timer settings based upon expected average daily flows
- Initial recirculation ratio 4:1
- Recommended timer settings
  - Typical “on” time for AX20 is .3 min
  - “off” time varies depending on flow
  - View Vericomm® point data to check actual flows at three-month checkup
  - Reset recirculation ratio, if necessary

Typical Timer Settings

- 72 to 300 cycles per day (typically a 20-minute cycle time)
- Typically 72 cycles per day
  - 0:18 seconds ON
  - 19 minutes and 42 seconds OFF

Ventilation Requirements

- Passive air vent
  - 2" line vent: 20' or less
  - No moving parts
  - No power usage
  - Carbon-impregnated
  - Serviceable

Disinfection

- Orenco UV Disinfection
  - UL Recognized
  - 360º contact zone
  - 99.999% bacteria reduction (5 logs)
  - Ballast in control panel
  - NSF comparative testing meets or exceeds other residential UV units

AXRT

Filter Type AX20

- *Physical specifications*
  - *7.5' x 3' x 2.5'*
  - *Textile: ~ 20ft²*
  - *Dry weight: ~ 300 lb.*

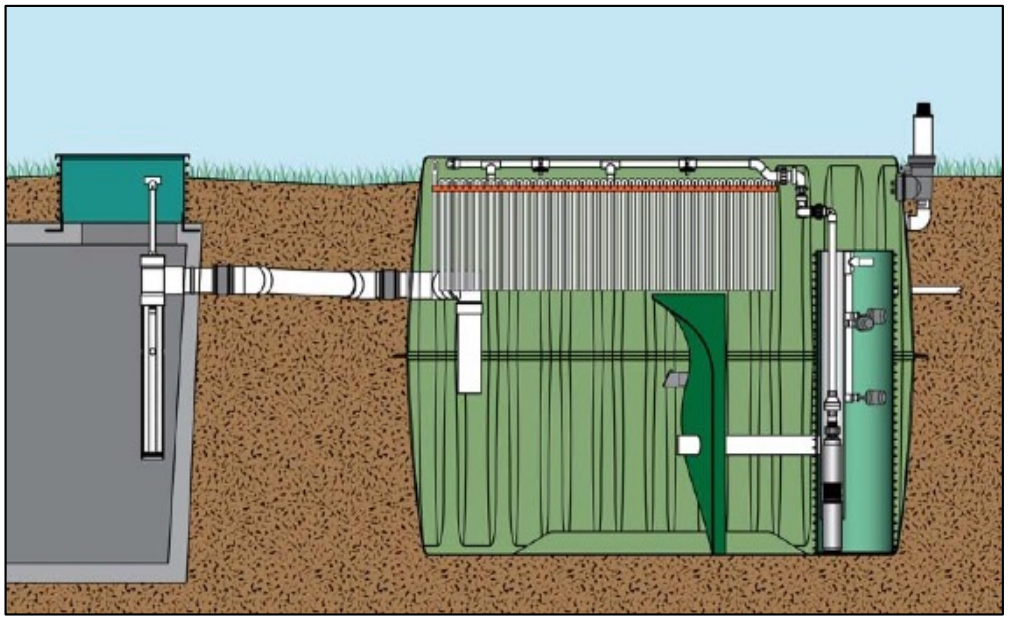
Filter Type AXRT

- *Physical specifications*
  - *8.5’x 5’x 6’*
  - *Textile: 20ft² or 25ft²*
  - *Dry weight*
    - *Gravity Discharge - 900 lbs*
    - *Pump Discharge - 940 lbs*

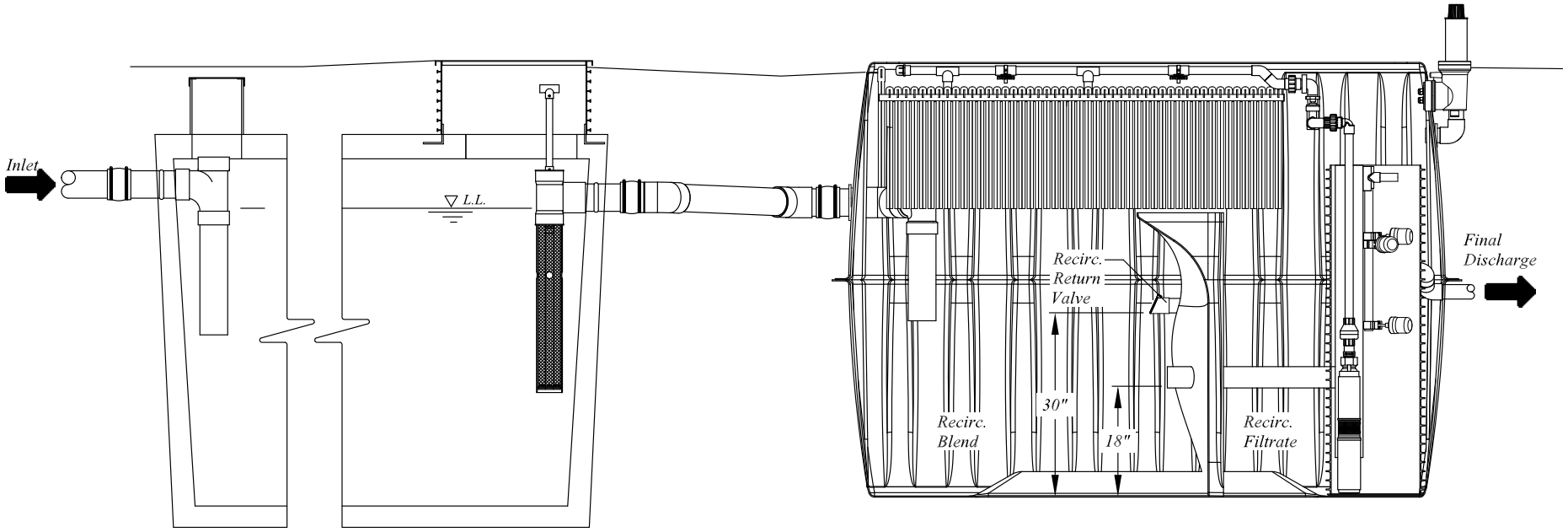
AdvanTex® Overview - AXRT

Main Components

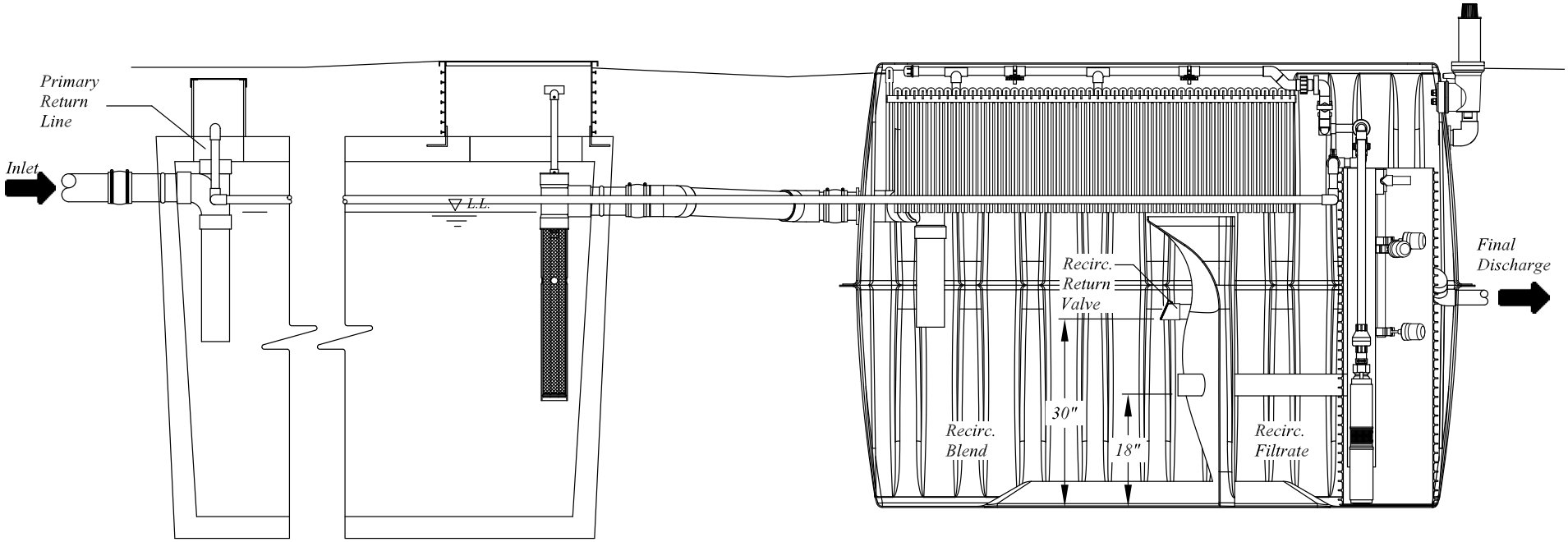
- Control Panel
- Primary Tank
- Vented Effluent Filter
- AdvanTex RT Filter
- Pump System
- Recirc-return valve
- Passive Vent



Mode 1: Standard Configuration - AXRT



Mode 3: Maximizing Nitrogen Reduction - AXRT

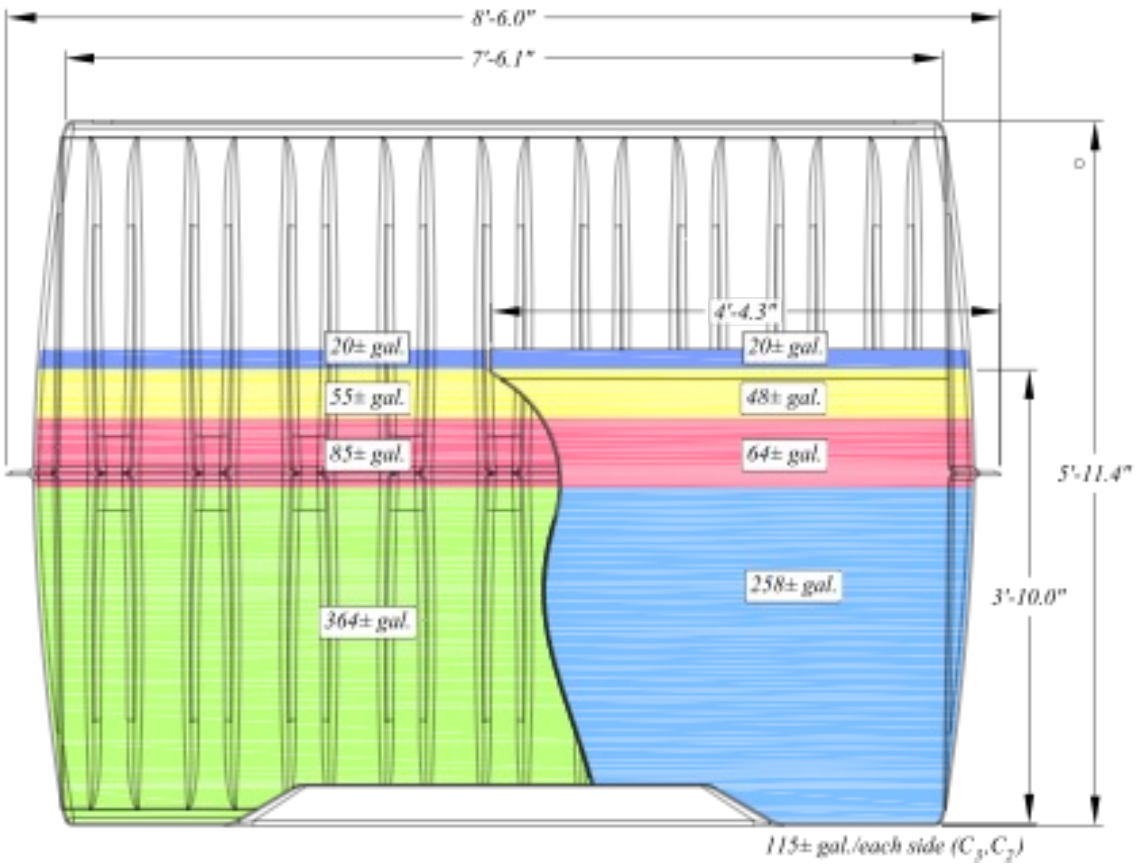


AXRT Processing Tank Requirements Residential

- Tank must…
  - Meets Orenco Minimum Tank Requirements
  - Must have effluent filter
  - Be structurally sound and watertight
  - Be approved for use with AdvanTex®

AXRT Liquid Level Settings

- Pre-set at Factory
- Surge volume 210 gallons total
  - 135 to override float
  - 75 gallons above override
- Total emergency storage 500 gallons



AX20RT Recirculation Ratio

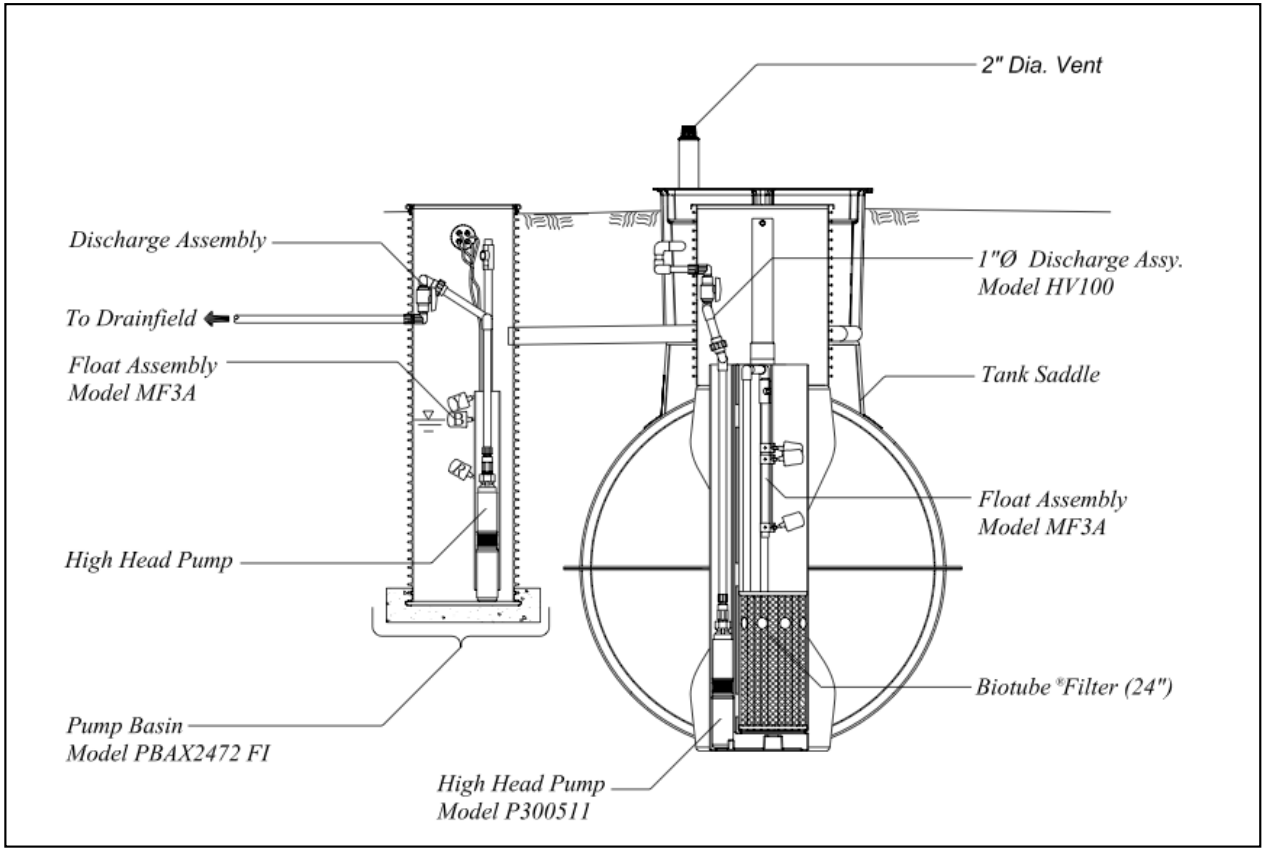
- Initial timer settings based upon expected average daily flows
- Initial recirculation ratio 4:1
- Recommended timer settings
  - Typical “on” time for AX20RT is .8 min
  - “Off” time varies depending on flow
  - View Vericomm® point data to check actual flows at three-month checkup
  - Reset recirculation ratio, if necessary

Discharge Options AX20/AXRT

- Gravity Discharge
- Pump Discharge
  - Pump Basin
  - Dosing Tank
  - Filtrate Blend Chamber (AXRT)

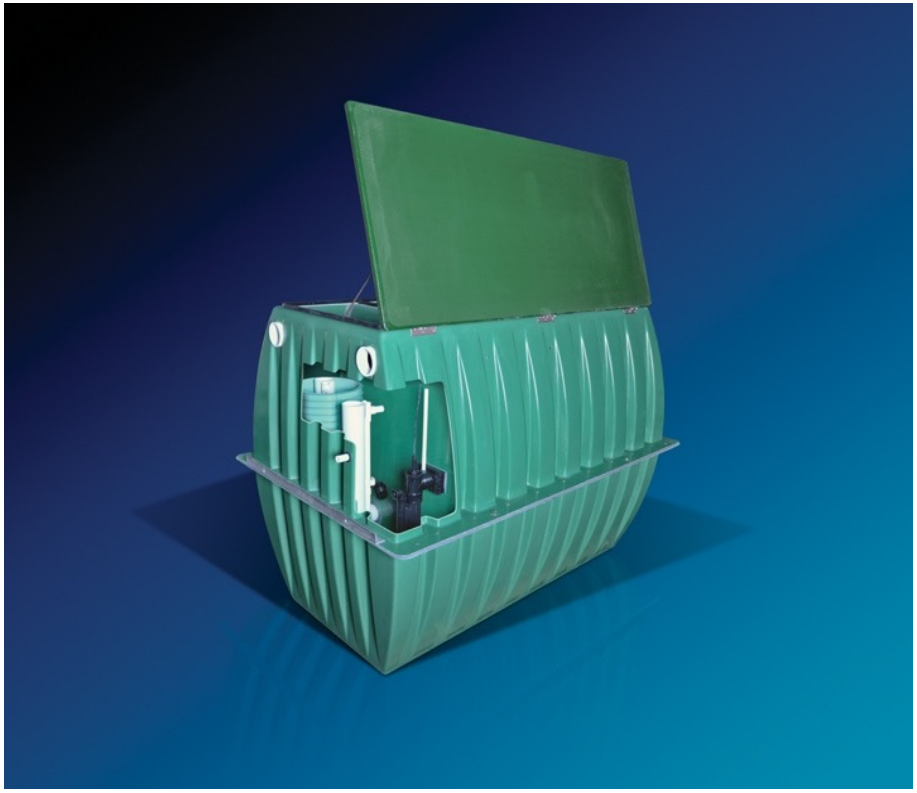
AX20 Discharge Equipment

- Pump Discharge to Final Dispersal
  - 10, 20, 30 and 50 gpm options
  - Pump Basin
  - Pump Tank



AXRT Discharge Equipment

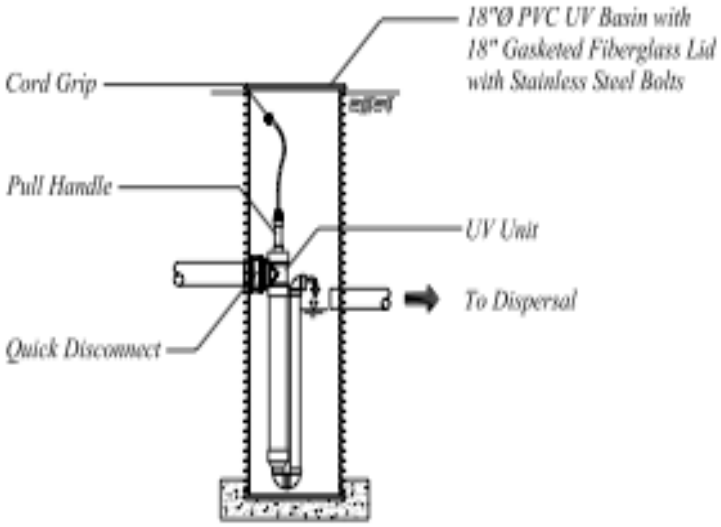
- Pump Discharge to Final Dispersal
  - 10, 20, 30 and 50 gpm options
  - “Off” float is the only float that is adjustable
  - Approximately 8 gal/in



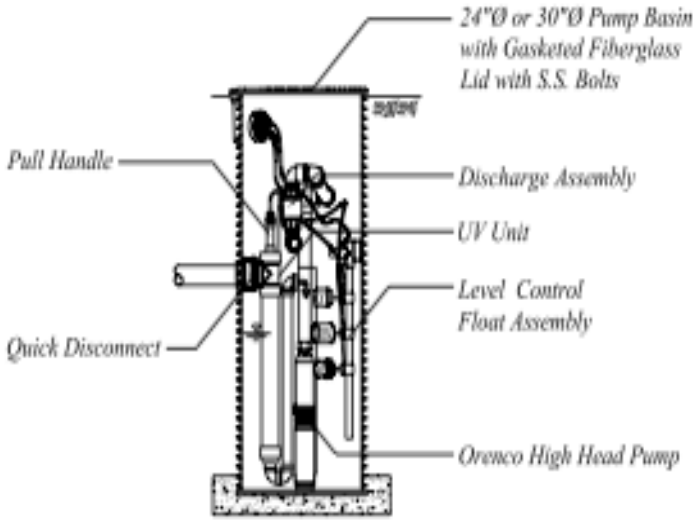
Disinfection

- Orenco UV Disinfection
  - UL Recognized
  - 360º contact zone
  - 99.999% bacteria reduction (5 logs)
  - Ballast in control panel
  - NSF comparative testing meets or exceeds other residential UV units

AX20 UV Discharge Equipment



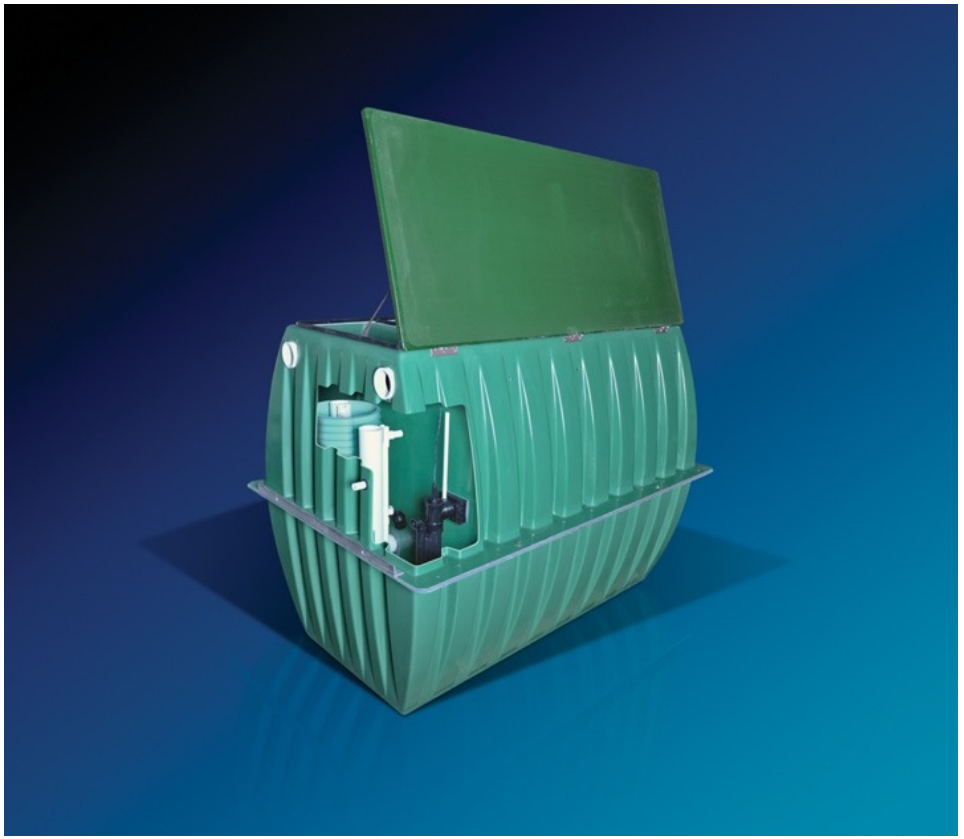
UV Basin: Gravity Discharge Option
Side View



UV Basin: Pump Discharge Option
Side View

AX20RTUV Discharge Equipment

- Orenco UV Disinfection
  - Standard RT body
  - Additional baffle
  - Orenco UV unit
  - Approximately 4 gal/in



Power Consumption

- Recirculation pump
  - Runs approximately 30 to 60 min./day
  - 9 Amps, 115 volts
  - $2.00 to $4.00/month at national average electrical rate of $0.13/kWh

Plumbing Considerations

- Water softener backwash prohibited
- Gravity pipes sloped properly
- No dips or “bellies in any gravity

Compact Install

- Ideal for small sites
- At-grade components
  - Filter pod
  - Access risers
  - Pump basin

Lids Nearly Flush with Lawn

- Lids available in two colors
  - Green (standard)
  - Brown

Landscaped Systems

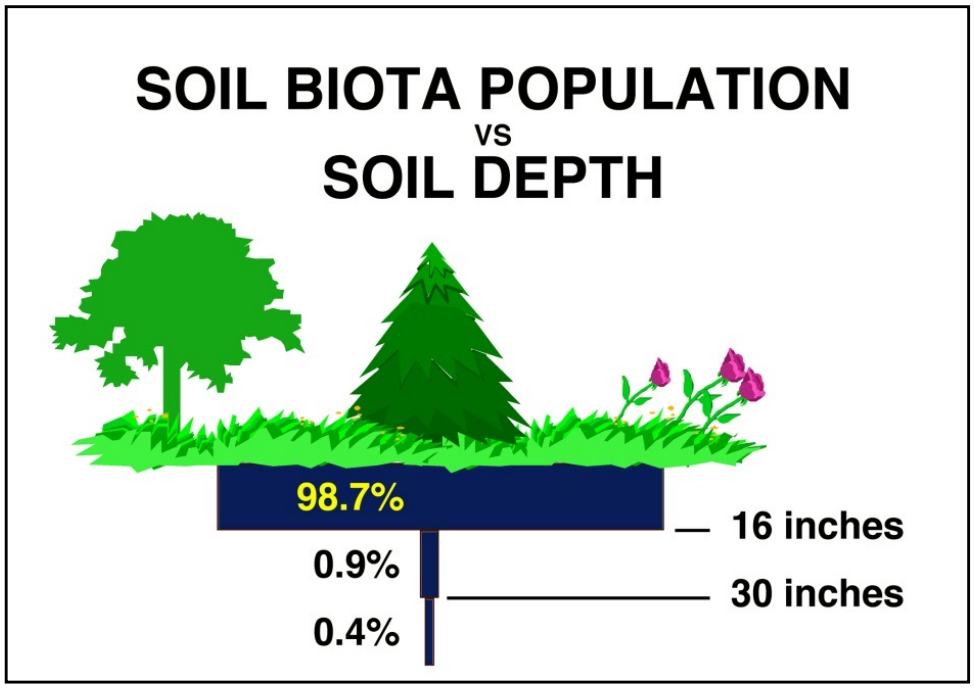
Effluent Reuse

Water Reuse Technologies Using Shallow Soil Distribution

- Shallow effluent dispersal
- Shallow gravelless
- Landscape irrigation
- Conventional drip irrigation

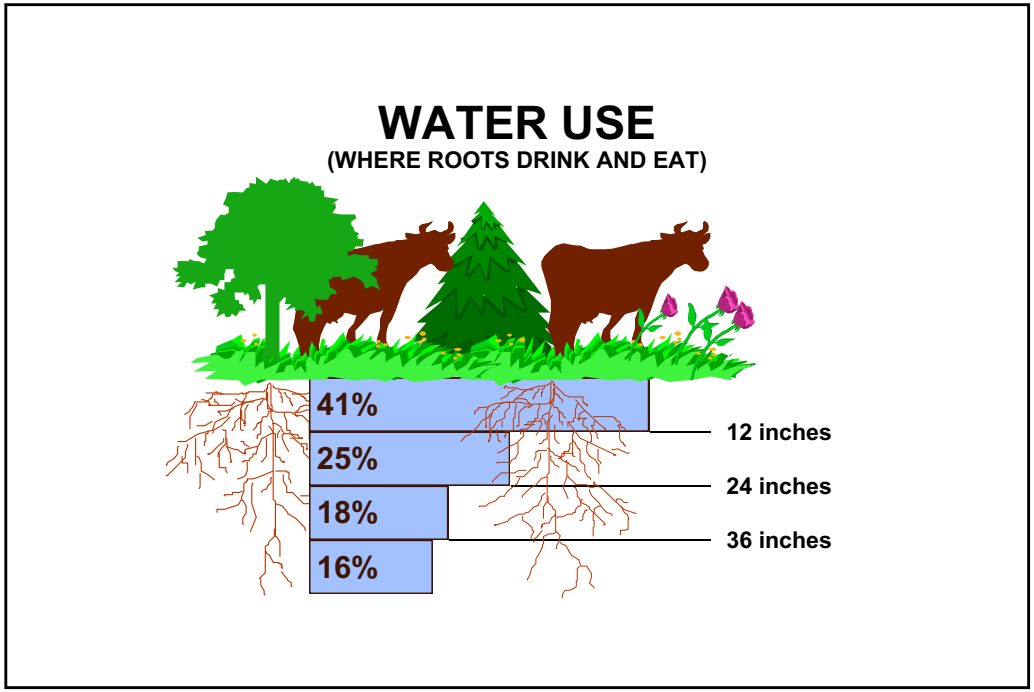
Shallow Effluent Dispersal is Better

Final treatment of effluent takes place in the top 16" of soil, where soil biota and roots are concentrated



Shallow Effluent Dispersal is Better

41% of plant roots are concentrated in the top 12" of soil



Shallow Pressurized Dispersal System

- Improved soil infiltration
- Optimized treatment
- Easy installation
- No rock required
- Less impact to site

Shallow Gravelless Drainfield

Inspection Port

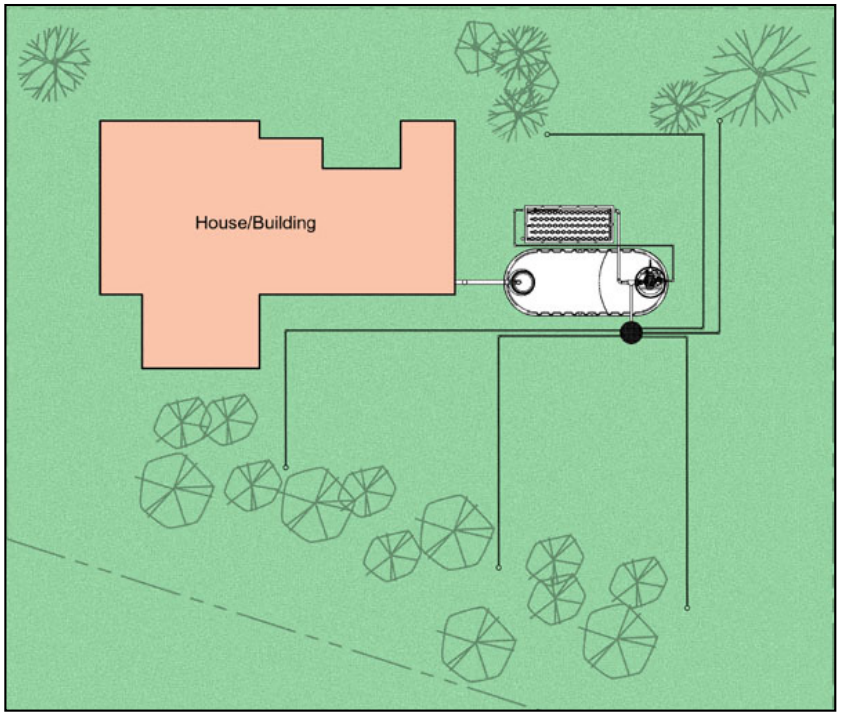
- Note shallowness
- No ponding

Shallow Gravelless Drainfield

- No biomat formation
- Enhanced soil structure

Landscape Irrigation

- Targeted use
- Common components
- Low maintenance



Landscape Irrigation

- Main PVC “transport”
- Spot irrigation “drainfield laterals”

Conventional Drip Irrigation

- Drip tubing for large area or turf irrigation

Questions ?