

Onsite Wastewater Treatment

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Overview

- ⦿ What is an On Site Sewage Facility (OSSF)?
- ⦿ Why are we concerned about wastewater?
- ⦿ Evolution of onsite wastewater treatment
- ⦿ Operation and maintenance of septic systems
- ⦿ How to live with a septic system
- ⦿ Extension education & outreach



Onsite wastewater treatment



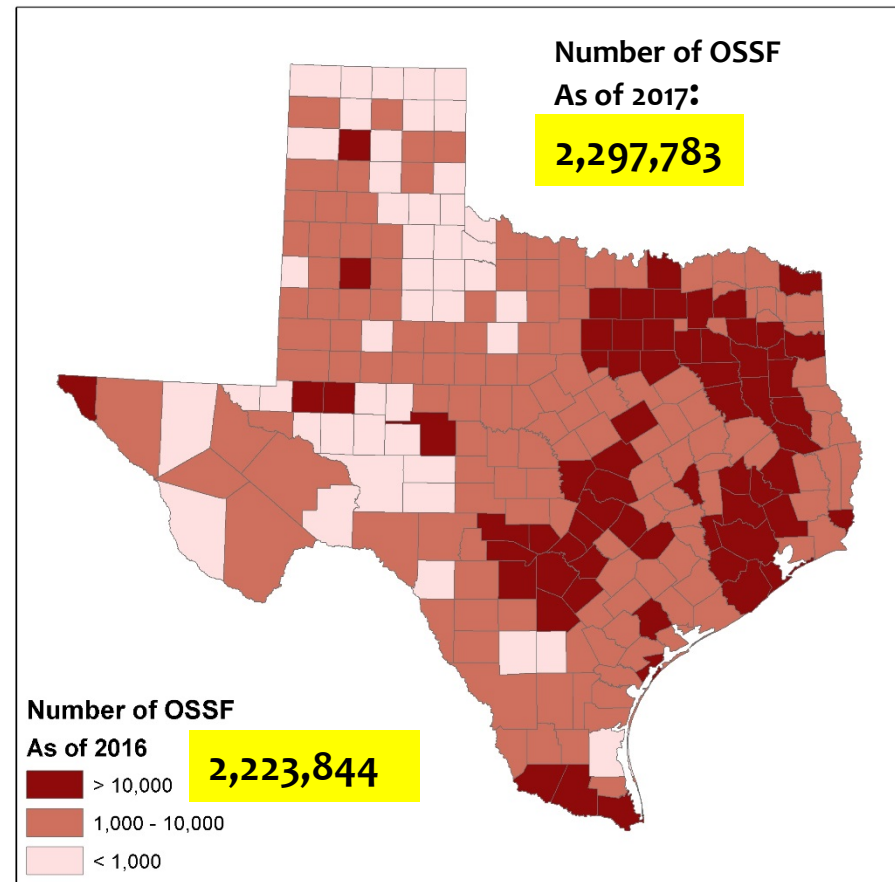
Onsite wastewater treatment systems?

- Rural and Exurban wastewater infrastructure
- Water Quality Protection
- 20 - 40%, Wastewater Infrastructure
- What is the system called?
 - OWTS – Onsite Wastewater Treatment System; Nationally
 - OSSF – On-Site Sewage Facility; Texas
 - Septic System



On-Site Sewage Facilities in Texas

- More than 2,200,000 property owners use OSSF in Texas; and TCEQ permitting agents issue more than 25,000 new permits for OSSFs per year;
- When “*responsibly managed*,” OSSFs offer a permanent, low-cost, and a sustainable option for wastewater treatment – USEPA 1997;
- Number of licensed professionals:
 - Site evaluator/designers (891);
 - Installers (>1,500);
 - Service providers (>1,000).
- Installed aerobic systems:
 - Since 1999: >40%
 - 2015-2021: >50%



Permitting Wastewater Treatment Systems in Texas

- Texas Commission on Environmental Quality (TCEQ), Chapter 285, 5000 gallons per day or less
 - Local Authorized Agent – Usually local Health Department
 - Authorized Agents collect data, issue permits, compliance and can set more stringent rules (10-acres rule, owner maintenance)
 - TCEQ Regional Office
- TCEQ, Chapter 217, Greater than 5000 gallons per day.

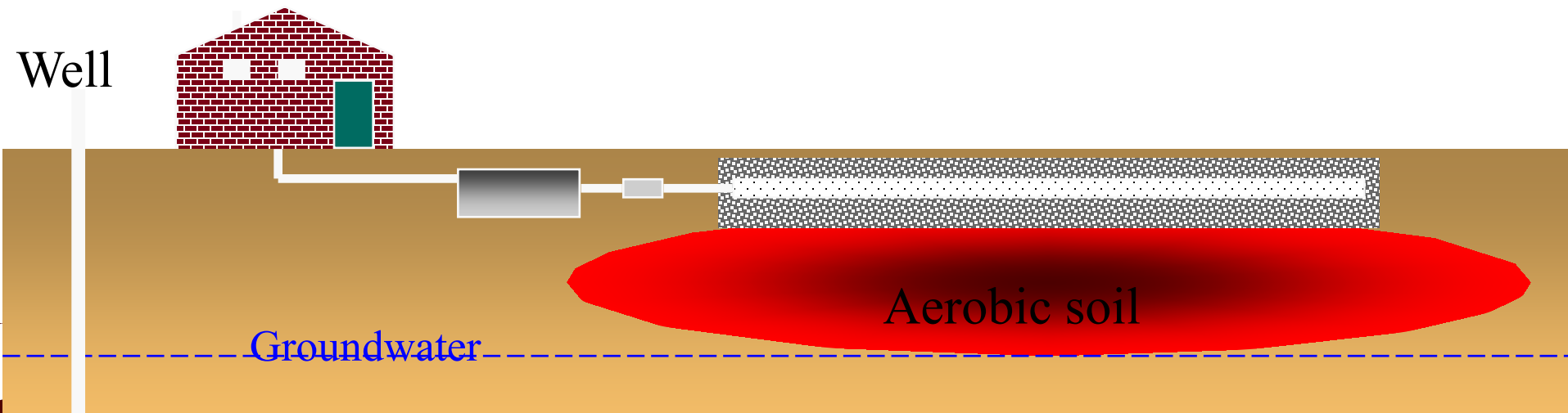


Malfunctioning Onsite System



Evolution of wastewater management

- ◉ Evolving goal:
 - ◉ Disposal: effluent goes away versus treatment
 - ◉ Dispersal: TREATMENT
- ◉ Public health AND environmental issues addressed
- ◉ Management:
 - ◉ Disposal: often no management at all
 - ◉ Dispersal: system management is critical



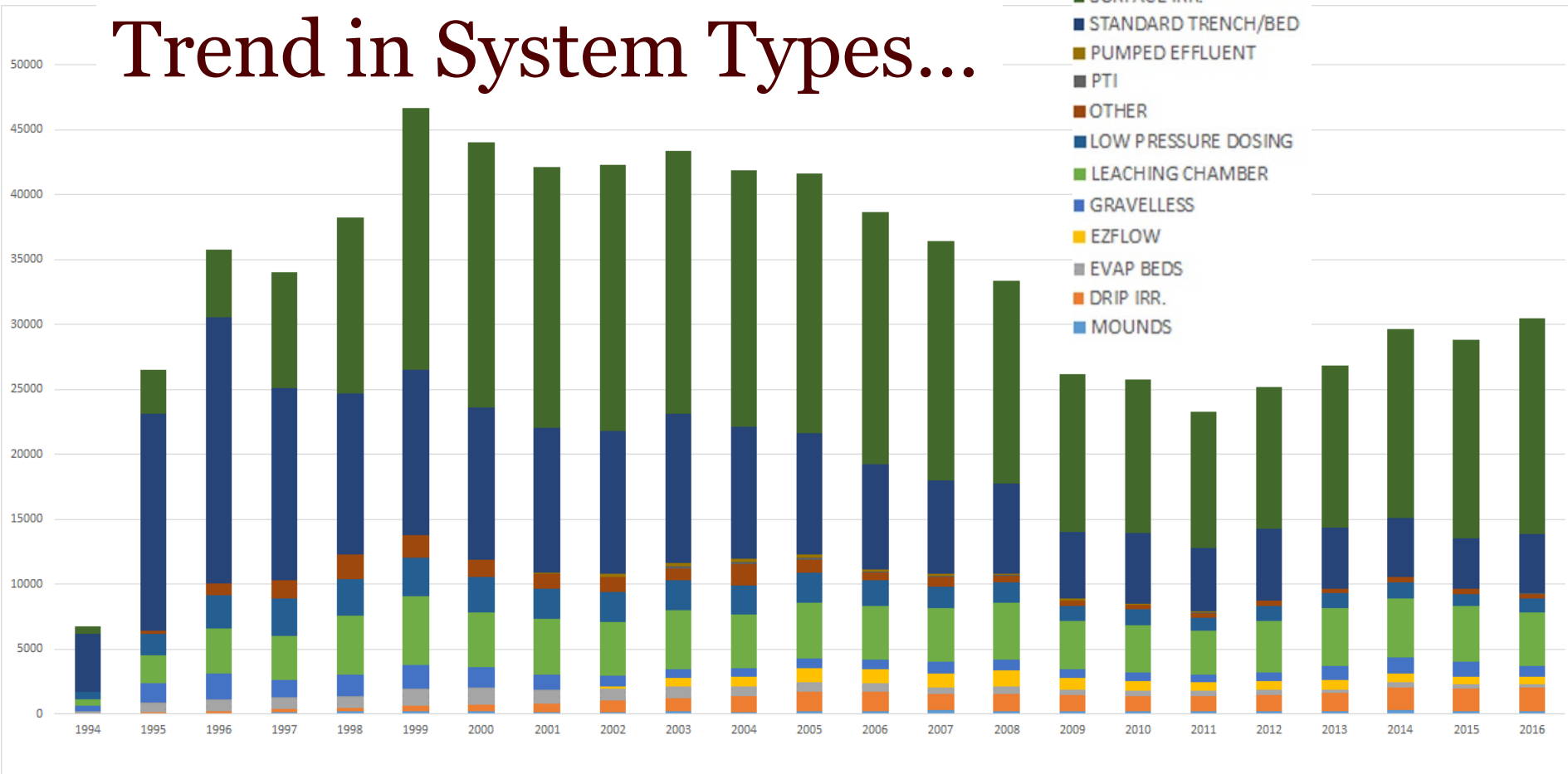
Evolution of wastewater management in Texas

- ⦿ Prior to 1989 – no statewide guidance for installing OSSFs
- ⦿ 1997 – Rules for site evaluation and wastewater treatment
- ⦿ 2008 – Maintenance of advanced treatment units



Trend in System Types...

- SURFACE IRR.
- STANDARD TRENCH/BED
- PUMPED EFFLUENT
- PTI
- OTHER
- LOW PRESSURE DOSING
- LEACHING CHAMBER
- GRAVELLESS
- EZFLOW
- EVAP BEDS
- DRIP IRR.
- MOUNDS



This information was compiled from OARS data from TCEQ.

How do we make the OSSF work?



- ⦿ Evaluate the wastewater source:
 - ⦿ Hydraulic and organic loading
- ⦿ Evaluate site
 - ⦿ Wastewater treatment
 - ⦿ Wastewater acceptance
- ⦿ Choose a final treatment and dispersal component
- ⦿ Choose the appropriate pretreatment system
- ⦿ Operation and maintenance

Roles with septic system management

- Site evaluation
- Design
- Installation
- Startup
- Inspection
- Operation
- Maintenance
- Monitoring
- Pumping



Site evaluation

- Comprehensive evaluation of soil and site conditions for a given land use.
 - Wastewater treatment
 - Wastewater acceptance

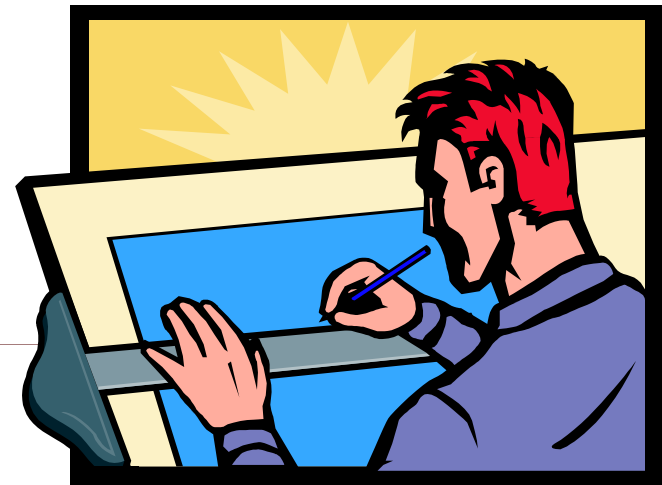
- ***Licensed OSSF Site Evaluator***
- ***Professional Engineer***



Design

- The process of selecting, sizing, locating, specifying and configuring treatment train components that match site characteristics and facility use, as well as creating the associated written documentation.
- A design is also the written documentation of size, location, specification, and configuration.
- Challenges – higher strength wastewater, small sites, varying flows

***Professional Engineer,
Registered Sanitarian***



Installation

- The assembly and placement of components of a system, including final grading and establishment of an appropriate cover
- Startup

Licensed OSSF Installer I
or
OSSF Installer II



Inspection

- The evaluation of and reporting on the status of a wastewater treatment system

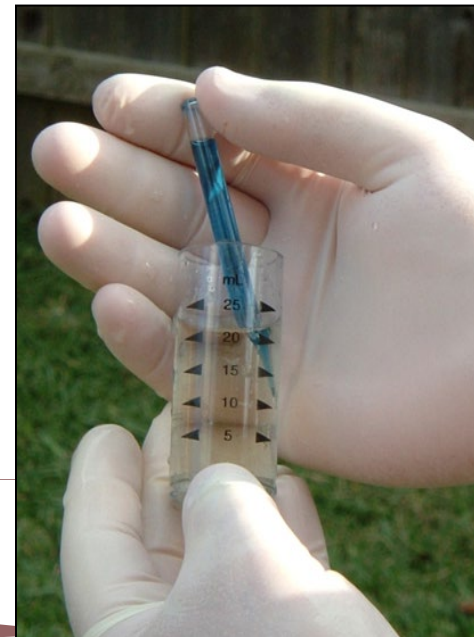
Designated Representative



Operation and maintenance

- Operation
 - Assessing whether each component of the system is functioning properly
- Maintenance
 - taking care of the pieces
- Monitoring
 - verifying performance for a regulatory authority or a manufacturer

Licensed OSSF Maintenance Provider



Pumping

- The action of removing septage from a wastewater treatment system component
- Necessary to prevent accumulated solids from moving into downstream components
 - Drain fields
 - Pumps
- TCEQ Registered Sludge Transporter

Pumper

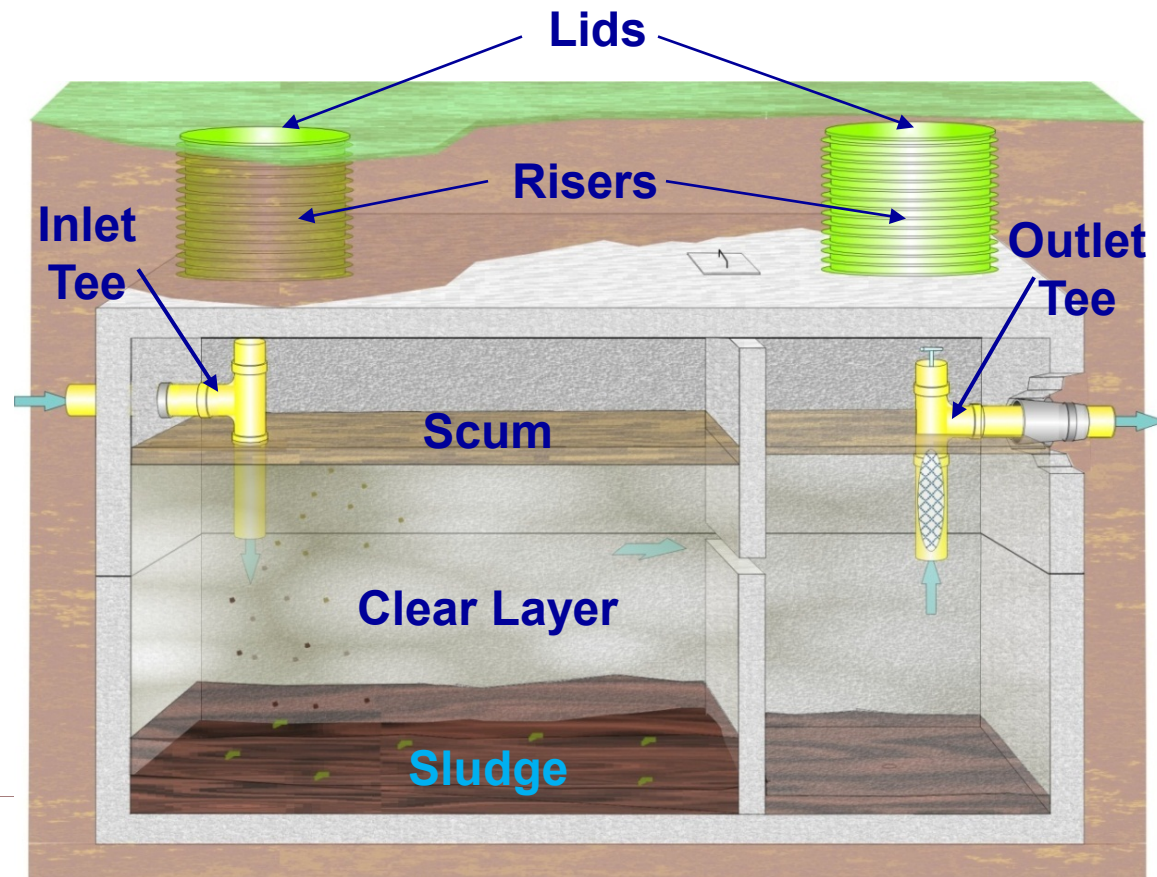


What is a conventional septic system?

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What is a septic tank?

- Water tight containers
 - Concrete
 - Plastic / Fiberglass
 - NOT Metal
- Detention time
 - Typically 2-3 days
 - Calm conditions
- Gravity separation
 - Heavy sinks
 - Lighter floats
- Anaerobic digestion



HOW A SEPTIC SYSTEM WORKS

For More info

To House

Conventional Septic System Pretreatment

In the pretreatment portion of a septic system, many of the contaminants are removed from the wastewater in order to prepare it for final treatment and discharging into the environment. Contaminants in the wastewater include harmful bacteria that can cause illness, as well as nitrogen and phosphorus that can stimulate algae growth in water bodies.

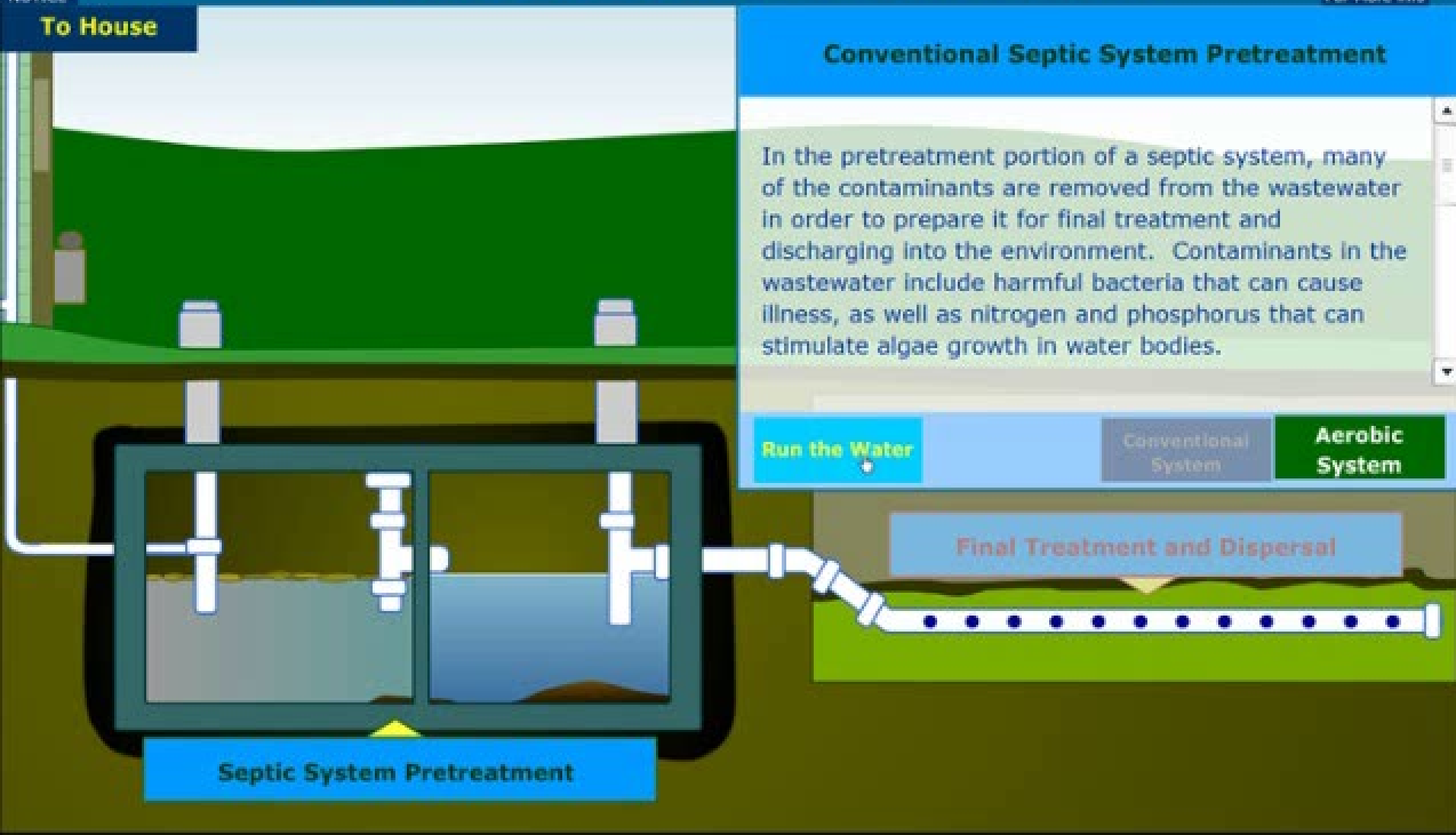
Run the Water

Conventional System

Aerobic System

Final Treatment and Dispersal

Septic System Pretreatment



HOW A SEPTIC SYSTEM WORKS

To House

Conventional Septic System Pretreatment

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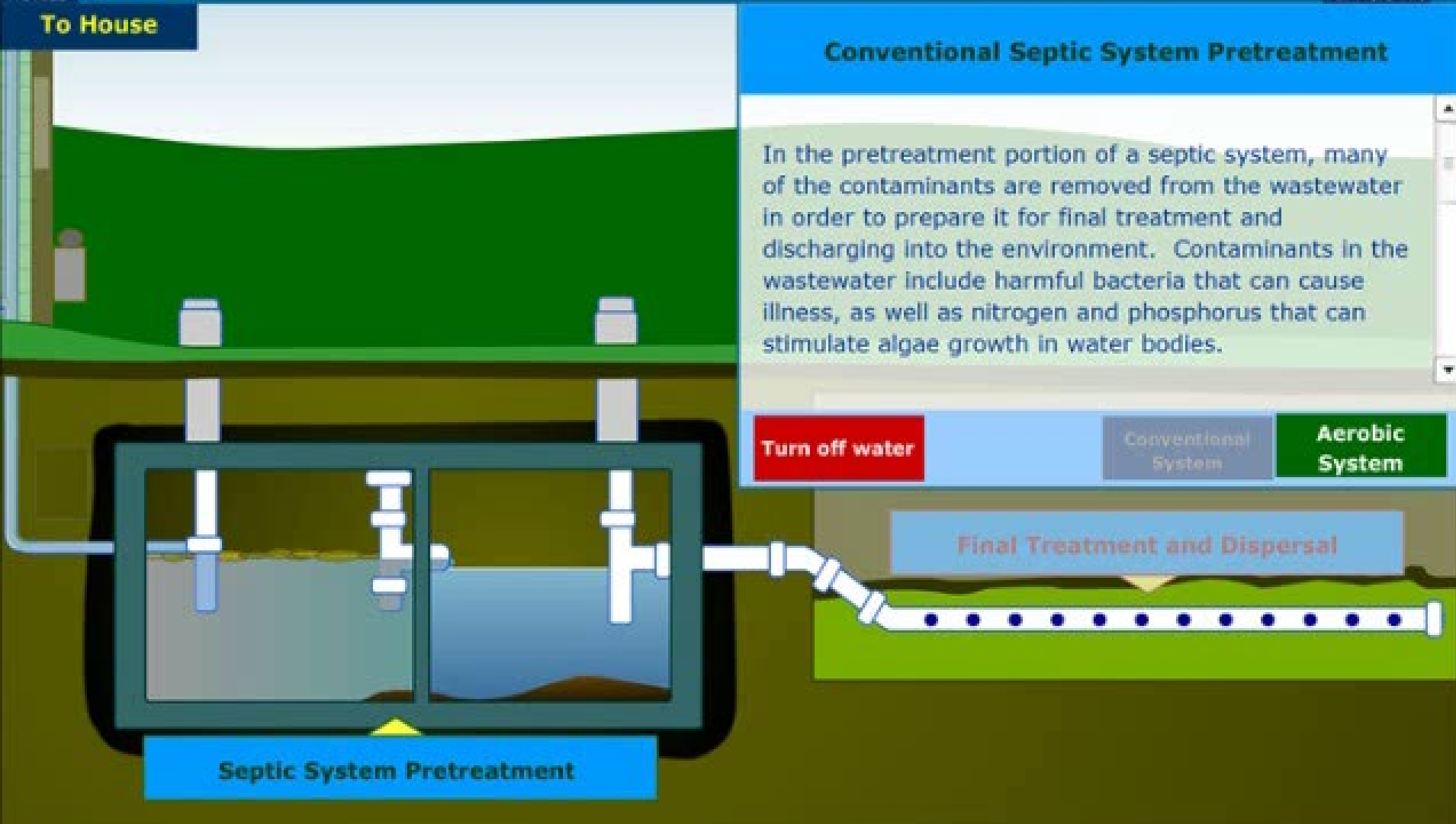
Turn off water

Conventional System

Aerobic System

Final Treatment and Dispersal

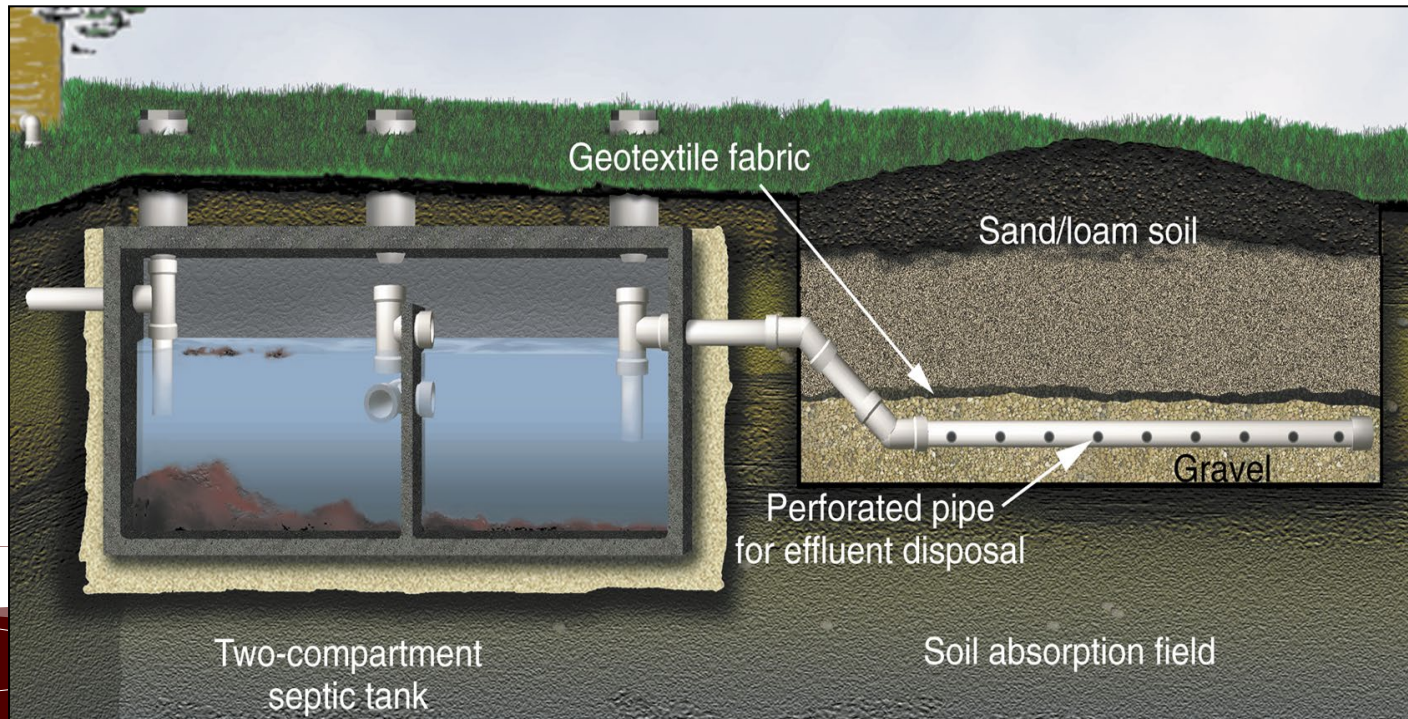
Septic System Pretreatment



What quality do you desire?

Pretreatment

- Primary treatment
 - Gross solids removed
 - Septic Tank / Trash Tank
 - Effluent screen
- A properly operating septic tank can remove
 - 30 - 40% BOD
 - 60 - 70% TSS

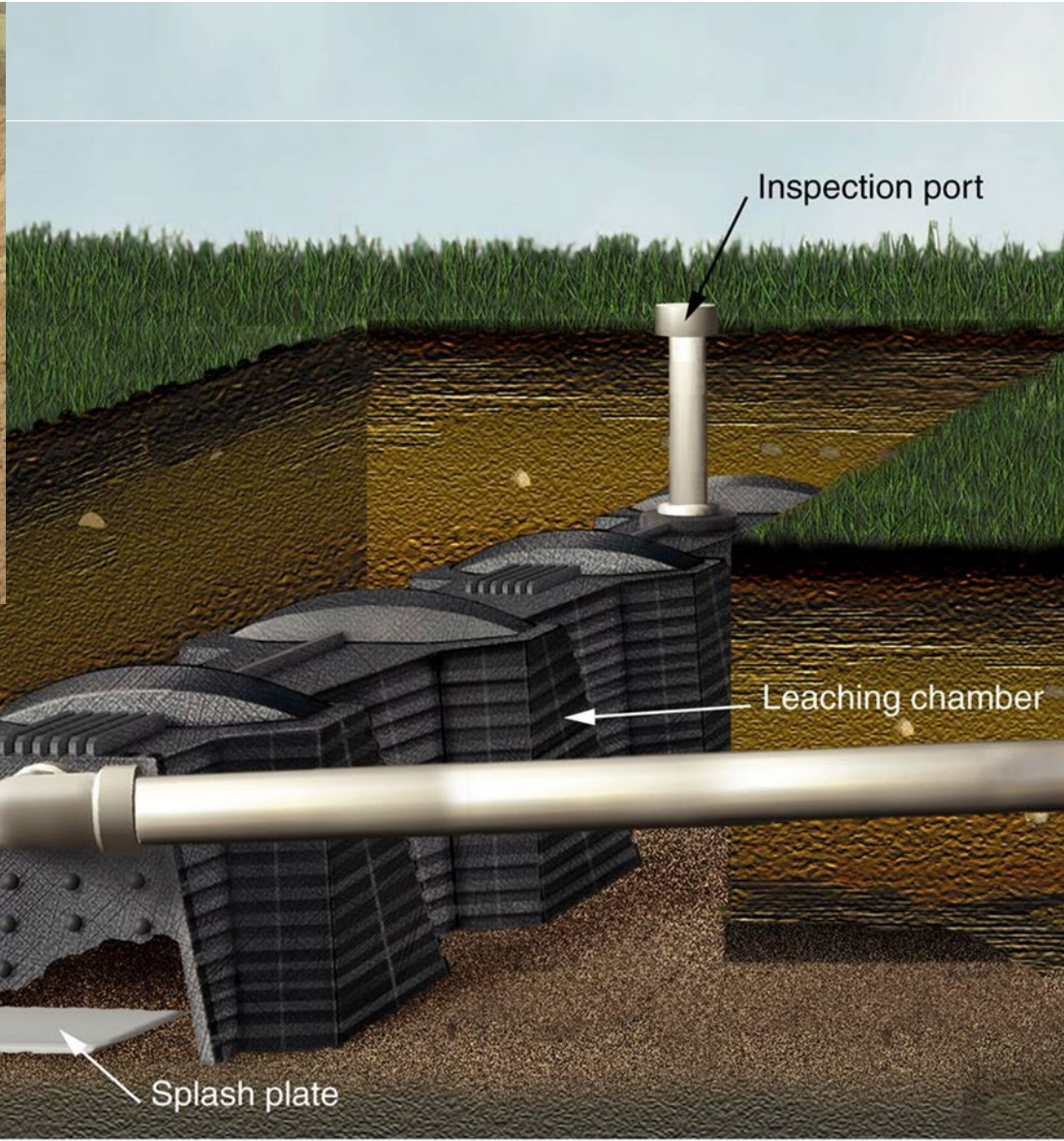


Gravel-less pipe distribution

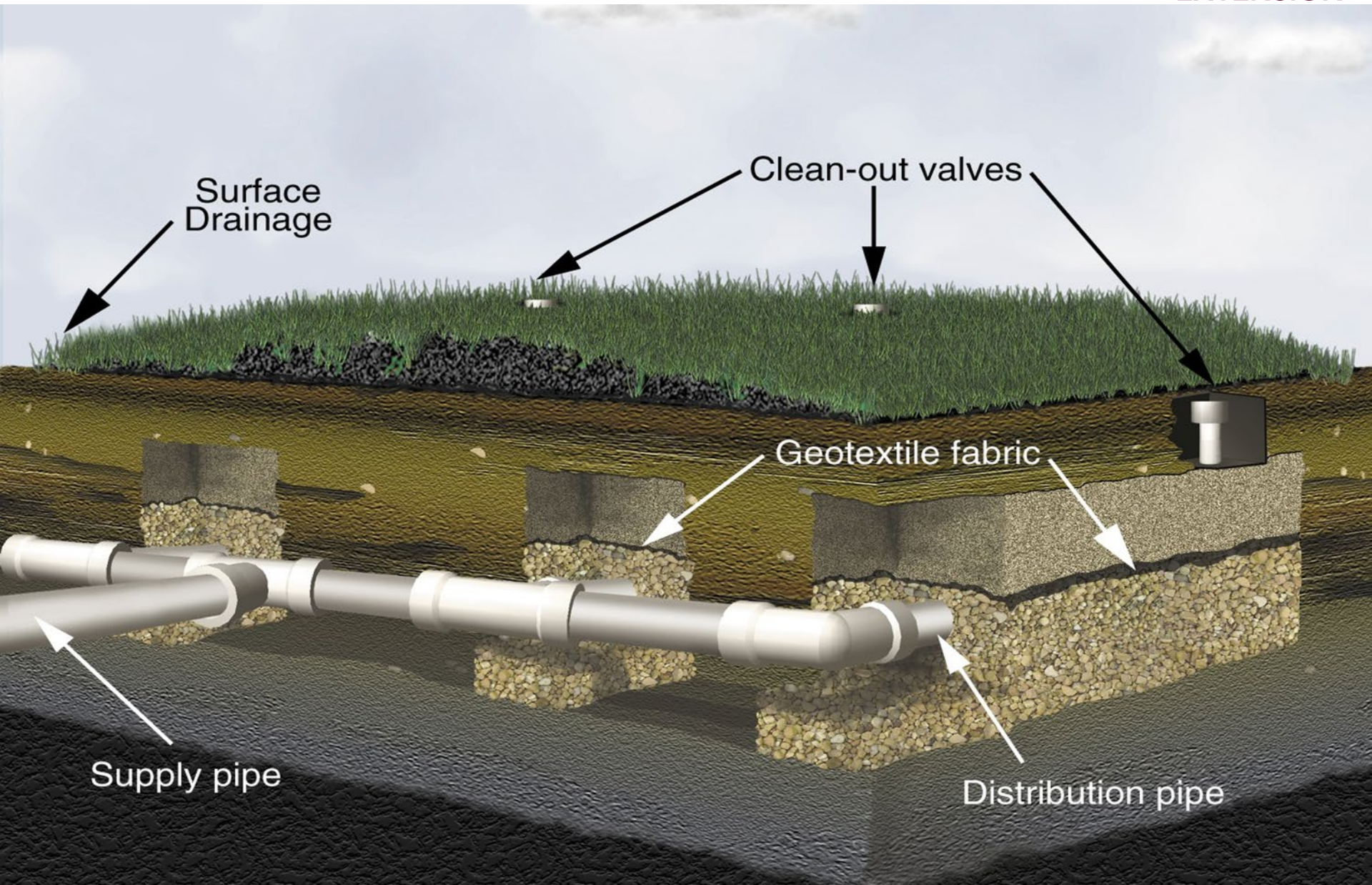


Soil absorption field

Leaching chambers



Low-Pressure Distribution



Mound distribution field



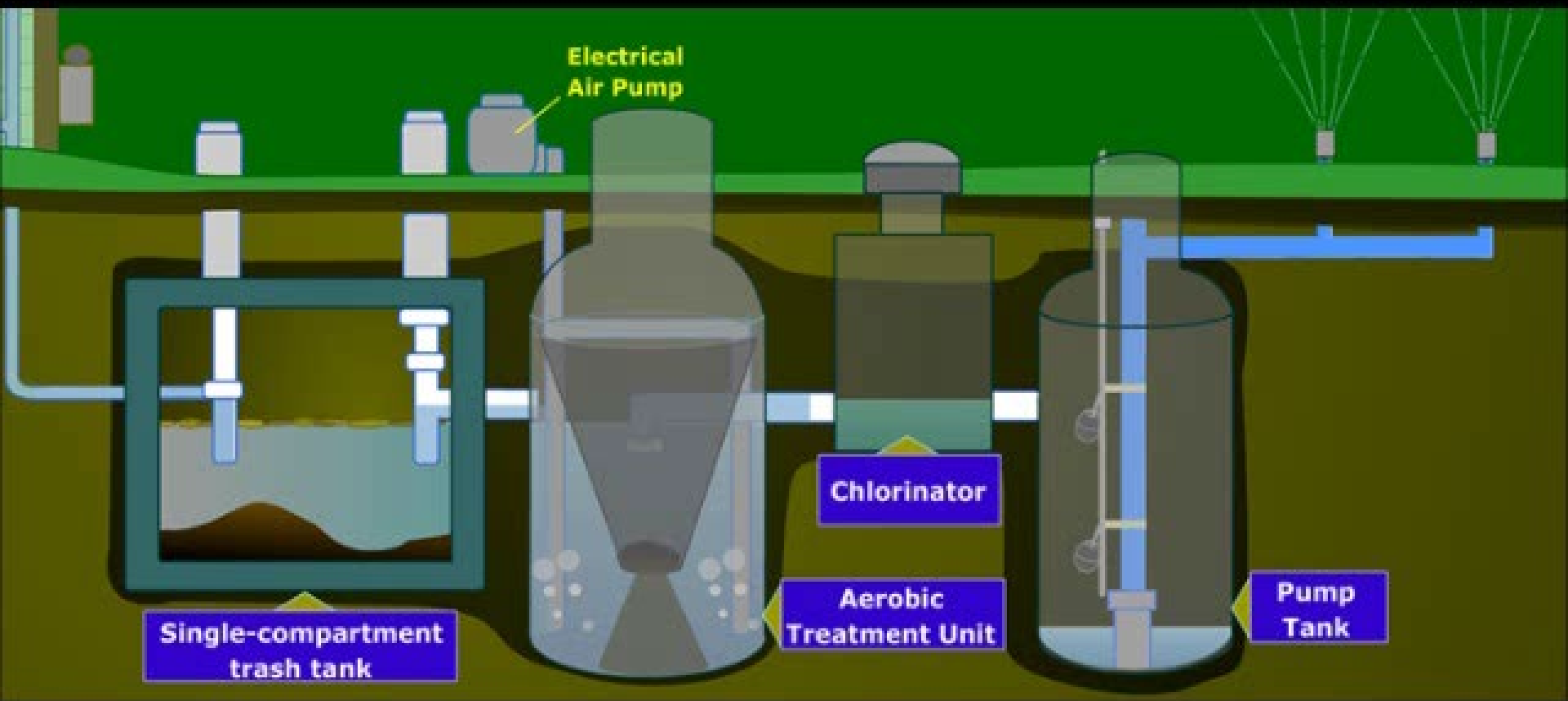
Role of vegetative cover in treatment system

- A healthy cover crop is essential for the system to function properly.
- Plants will:
 - Take up water and nutrients
 - Stabilize the soil & prevent erosion
 - Support beneficial soil organisms
- Do NOT park vehicles on drainfield
- Do NOT construct decks, driveways or buildings over drainfield
- NO woody vegetation over drainfield



What is an aerobic treatment unit?

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Electrical Air Pump

Single-compartment trash tank

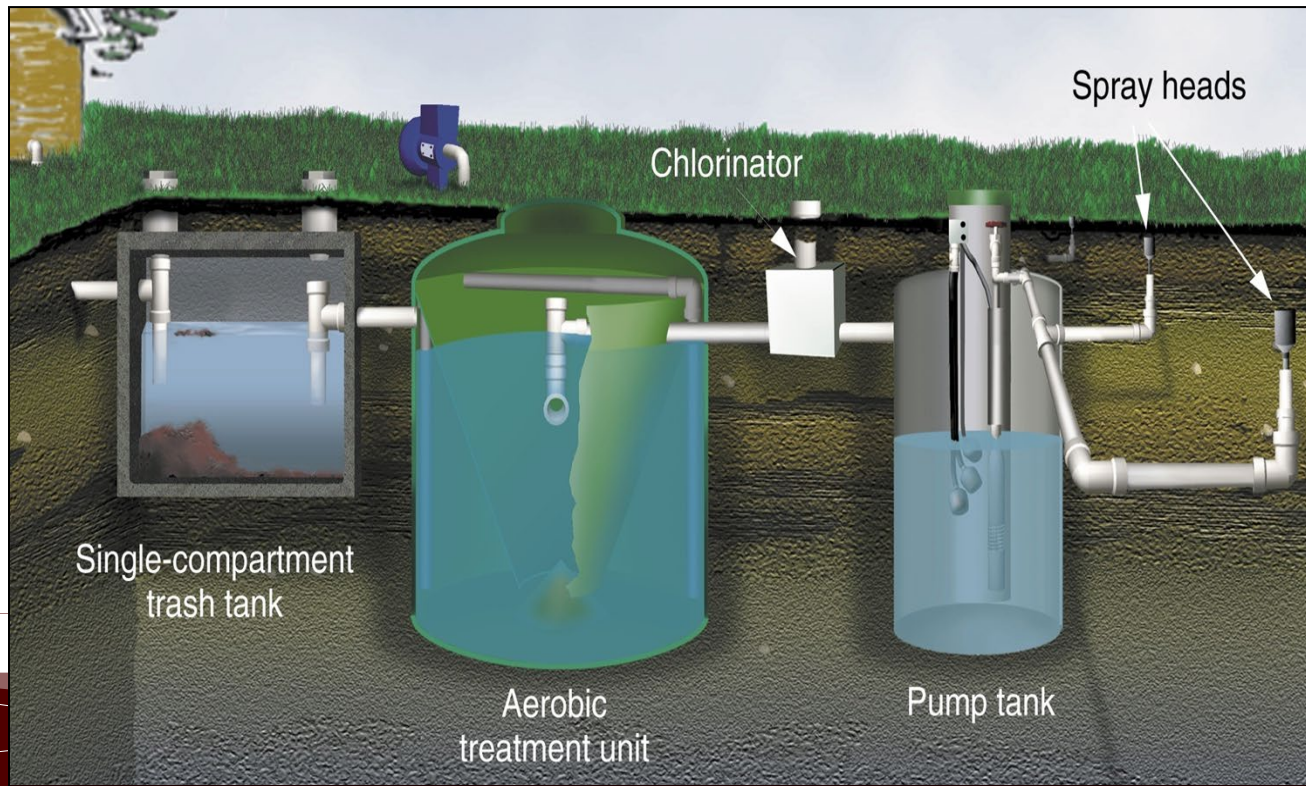
Chlorinator

Aerobic Treatment Unit

Pump Tank

Aerobic Treatment Unit

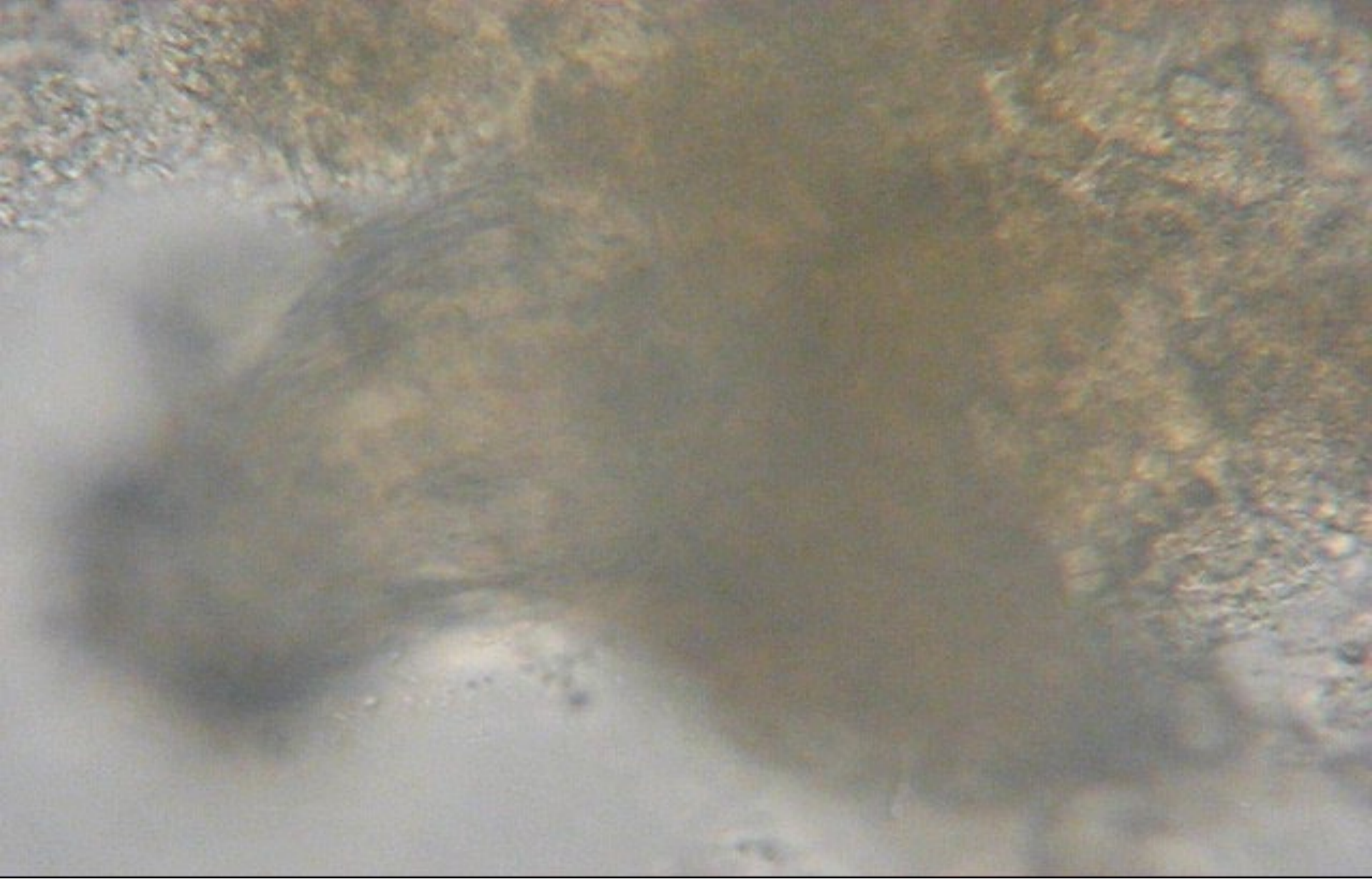
- Secondary treatment
 - Aeration, media filters, sand filter
- Removal of:
 - 85 – 98% BOD
 - 85 – 98% TSS



Aerobic treatment unit

- ⦿ Aerobic Microbes
 - ⦿ Require Oxygen to live and grow
 - ⦿ Consume waste and bacteria
- ⦿ Air supply
 - ⦿ Compressor / Aerator
 - ⦿ Diffusers
 - ⦿ Oxygen transfer to wastewater
 - ⦿ Mixing of food and organisms
- ⦿ Clarifier

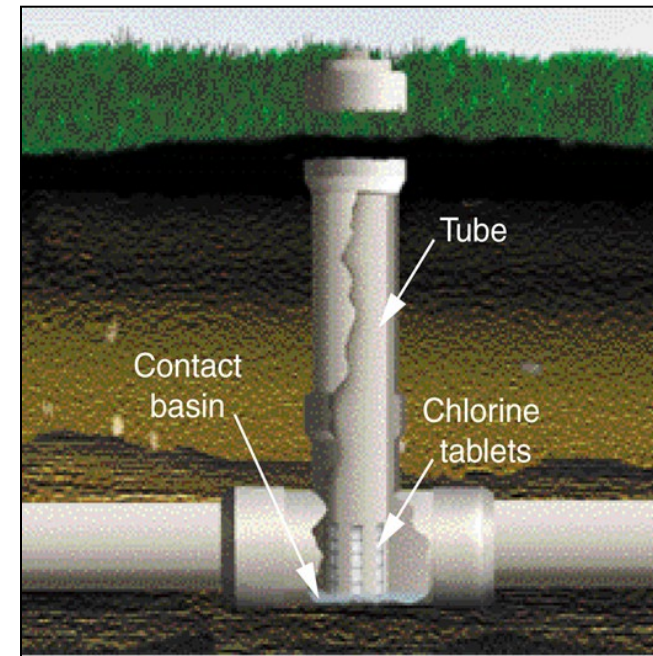




Large rotifers attached to aerobic treatment media feeding on bacteria and organic nutrients pH 6.94, DO 4.54 ppm

Disinfection

- ⦿ Disinfection, **NOT Sterilization!**
- ⦿ Chlorinator
 - ⦿ NOT SWIMMING POOL TABLETS!
- ⦿ UV light



Water Quality – Spray Field

- ⊙ High potential for human contact with water
- ⊙ Secondary Quality Effluent
 - ⊙ Remove 85-98% of solids and organic matter
 - ⊙ Remove pathogens?
- ⊙ Soil microbes are the final treatment!
- ⊙ This is effluent – ***NOT DRINKING WATER!!!!***

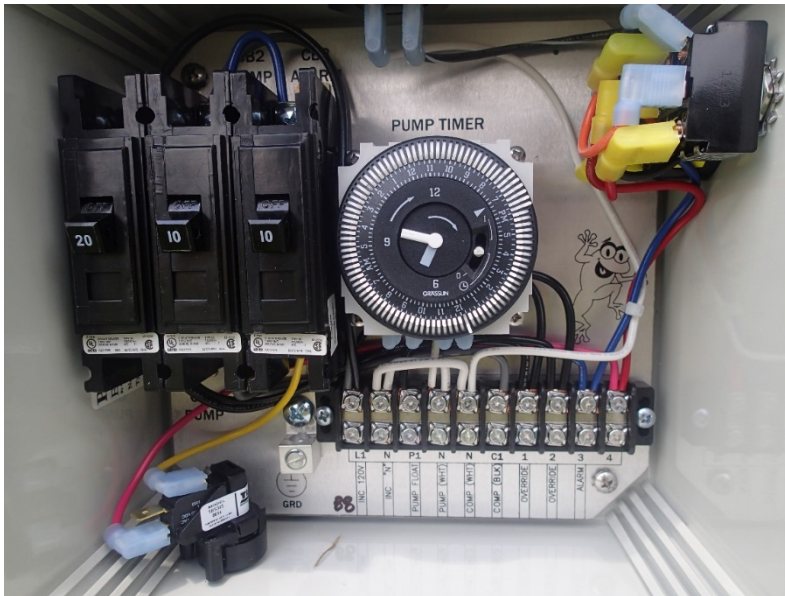


Subsurface drip distribution



Living with an ATU

- ⦿ Hydraulic and organic loading
- ⦿ Flow equalization
- ⦿ Operation and maintenance



Homeowner maintenance exemption

285.7(d)(4)

- At the end of the initial two-year service policy period, the owner of an Aerobic Treatment Unit for a single family residence shall either maintain the system personally or obtain a new maintenance contract.
 - Limitation: An owner may not maintain an OSSF under the provisions of this section for commercial, speculative residential, or multifamily property.
 - Many Authorized Agents require Aerobic Treatment Units to be professionally maintained on a continuous basis
 - Some Authorized Agents allow homeowner maintenance upon completion of an approved course

AgriLife Extension Homeowner Education Programs

- ⦿ Address homeowners' FAQs
 - ⦿ How do you live with an OSSF?
 - ⦿ 1st home with an OSSF?
 - ⦿ Maintenance requirements

- ⦿ Education and outreach
 - ⦿ Workshops
 - ⦿ Online programs
 - ⦿ Website
 - ⦿ Publications, & manuals
 - ⦿ Demonstration sites
 - ⦿ Inspections



Early plumbers

Course Evaluation Results

○ Intro to Septic Systems

- 76% will perform operation and maintenance activities on their septic system
- 75% will pump out their septic tanks as needed
 - 20% had already adopted this practice

○ Homeowner Maintenance of ATUs

- 20% of participants indicated a willingness to hire a professional to maintain their system

6. *Would you recommend this particular activity to others?*

Yes No

7. *Your thoughts on the program (perhaps what you liked most, liked least, additional information you would like, etc.).*

Informative but I don't feel competent to do this on my own. Will be better able to communicate with contractor.

Septic system additives

- ⦿ Not been proven to be beneficial to system performance
- ⦿ Not recommended
- ⦿ Break up particles that are settled at the bottom and make them suspended
- ⦿ Potential solids loading to downstream components



Kitchen

- Dishwasher
 - Hydraulic surges of wastewater
 - Space out loads
 - Organic load
 - Clean/scrape plates
- Garbage Disposal
 - Increases scum by 20%
 - Pumping required 1-2 years sooner
 - Organic matter had not been digested, so it will take longer to break down
 - Small particles take longer to settle



Laundry

- Use should be spread out
 - Returning from vacation
- Liquid soap is recommended
 - Use less
 - Remove risk of fillers in powders
 - Use bleach sparingly
- Consider a high efficiency washer



Toilet

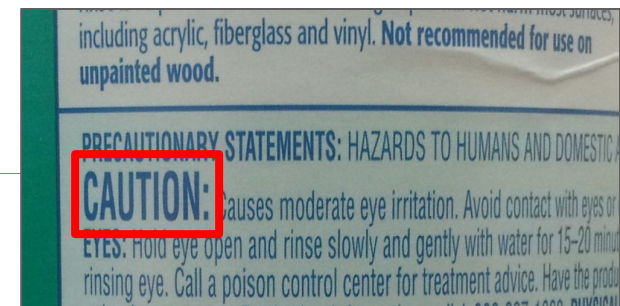
- ⦿ Only urine, feces, soap, toilet paper and limited amounts of cleaner should be going down drain
- ⦿ No feminine products, prophylactics, cigarette butts, etc.
- ⦿ No every-flush toilet bowl sanitizers
- ⦿ No wet wipes

Septic Safe?



Cleaning products

- ⦿ Cumulative effects on system performance
- ⦿ Look at Labels!
 - **DANGER**: Means the chemical will kill the bacteria, and its use should be minimized or eliminated.
 - **WARNING**: Means limited use should have a minimal impact on the system.
 - **CAUTION**: Typically means the product will have little effect.



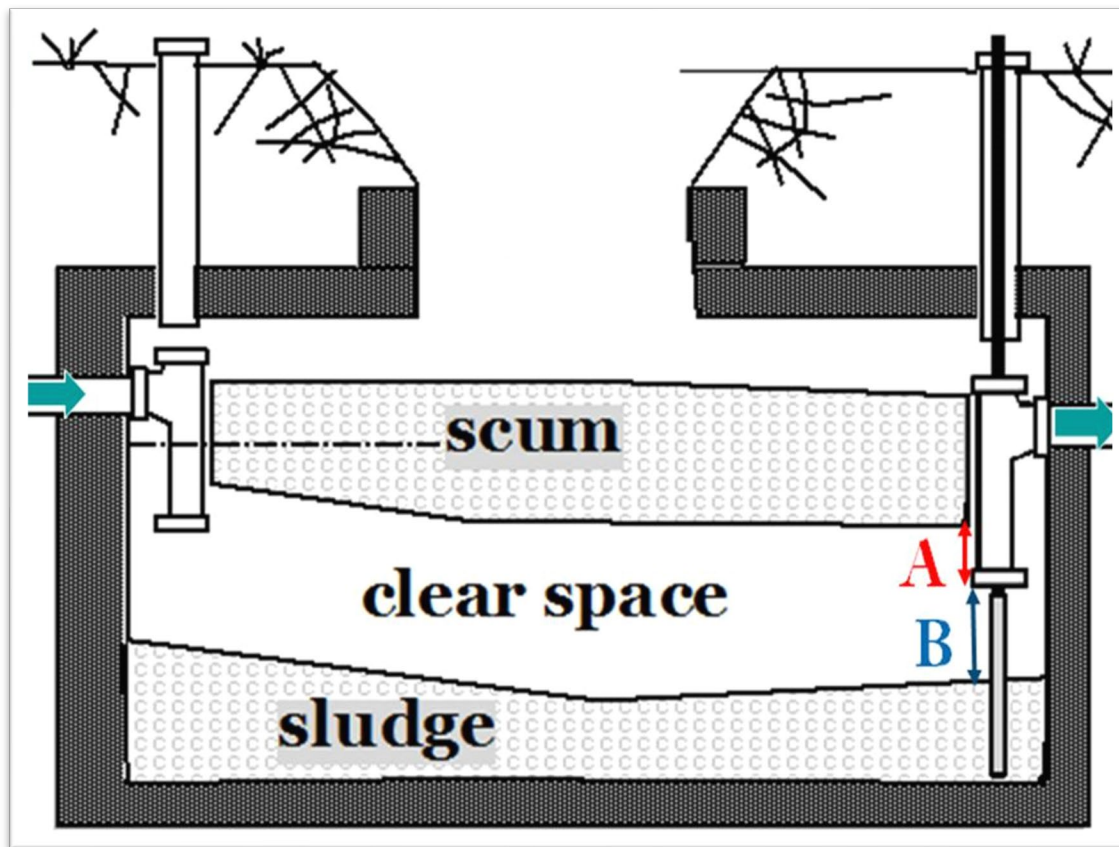
Prescription drugs & antibiotics

- Can kill microbes living in system
 - Won't discriminate against organisms living in the system
- Additional treatment components may be necessary
- Increase maintenance
- Do not pour unused medicines down the drain



Septic tank pumping recommended?

- Should be pumped when total solids reach 25-33% of tank capacity.
- If 'A' is less than 3"
- If 'B' is less than 12"
- Typically required every 3 to 5 years
- Pump during dry seasons to reduce the risk of tank flotation



Measuring solids



Scum Layer

Clear Layer

Sludge Layer



??

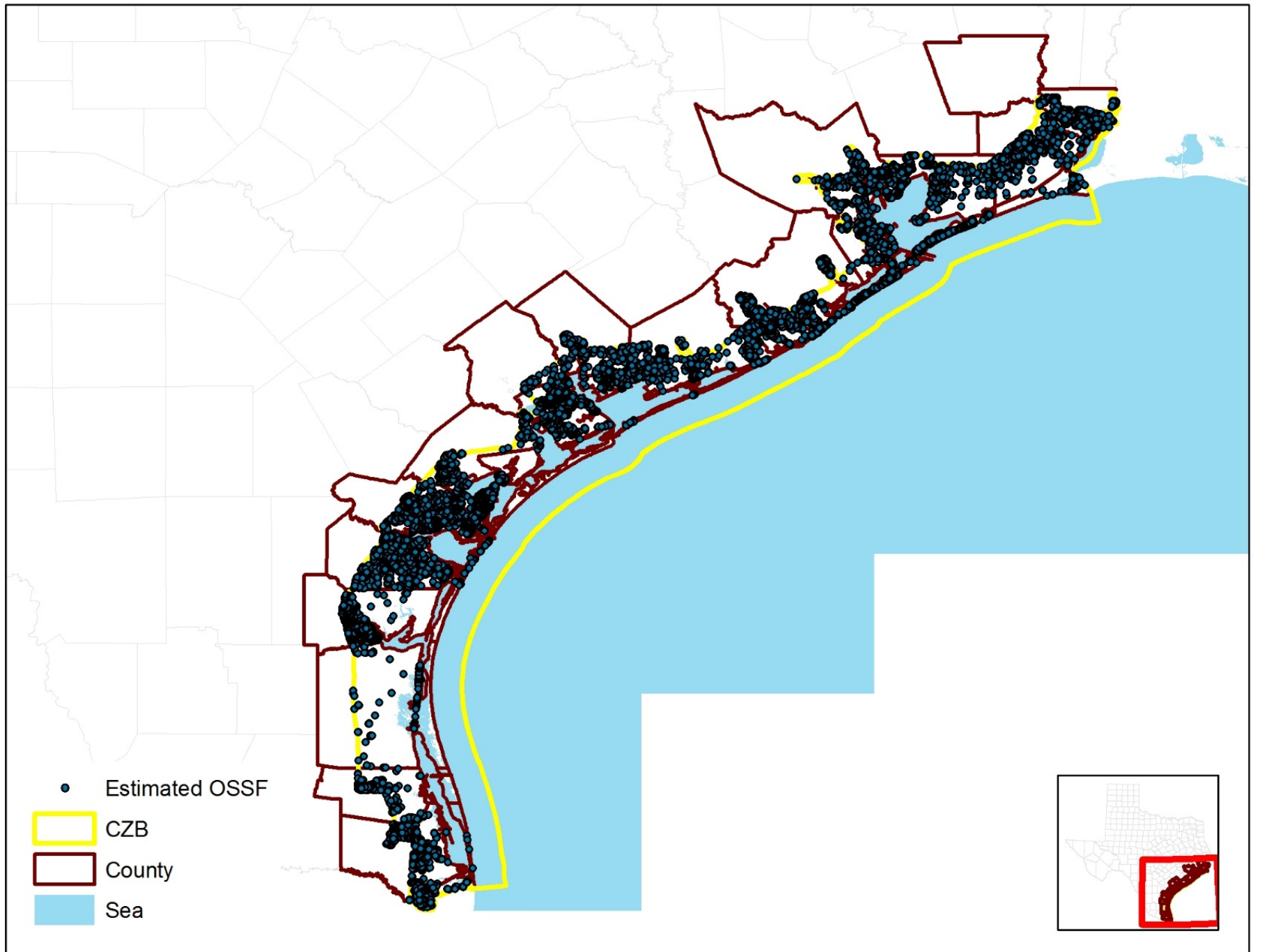
Programs to address and replace failing OSSFs

- ⦿ EPA funding through Section 319 Nonpoint Source Management Program of the Clean Water Act (CWA)
 - ⦿ Texas Commission on Environmental Quality
 - ⦿ Texas State Soil and Water Conservation Board
- ⦿ Supplemental Environmental Projects (SEP)
 - ⦿ Council of Government

Coastal Zone Act Reauthorization Amendments (CZARA)

- Funded through TCEQ 319 grant
- Nonpoint source pollution
- Tasks
 - Outreach
 - OSSF Inspections
 - Establish and maintain an OSSF Inventory





Current OSSF Projects

- San Bernard River in Brazoria County
 - Homeowner education
 - Pumping & inspection of at least 36 OSSFs
- Tres Palacios Watershed (Matagorda County)
 - Homeowner education
 - Voluntary inspection of OSSFs
 - Repair or replacement of at least 10 failing OSSFs



Inspections & Pump-outs

- Voluntary inspections
- 100+ systems inspected
- Participants receive:
 - Free system pump out
 - Visual inspection of the septic tank
 - Report of operational status
 - A better understanding of OSSF operation and maintenance
 - Suggestions to improve system operation



Causes of Failures

- ⦿ Age and deterioration of components
- ⦿ Undersized tanks and drainfields
 - ⦿ Originally weekend homes / fishing camps
 - ⦿ Small lots
 - ⦿ Exceeding design flow
- ⦿ Unsuitable soils
 - ⦿ Clay
 - ⦿ High water table
- ⦿ Owner abuse / neglect
- ⦿ No access for maintenance



Accessibility Issues

Accessibility = ease of maintenance

- Depth of installation
- Inspection ports and risers
- Encroachment



Soil and site conditions





On-Site Water Reuse Research Capacity @ RELLIS campus

Public-Private-Partnership

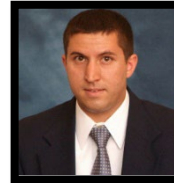




**Innovative On-Site Desalination and Wastewater Reuse Technology
Research and Demonstration on the
Texas A&M University's RELLIS Campus in Bryan, TX.**



**BIOLOGICAL & AGRICULTURAL
ENGINEERING**
TEXAS A & M UNIVERSITY



Anish Jantrania and Ryan Gerlich

TEXAS A&M
AGRI LIFE
RESEARCH | EXTENSION

On-Site Wastewater Treatment Training Center, <http://ossf.tamu.edu/>

Future Plans:

Our goal is to use the funding from Water Seed Grant and REEU program to study performance of the combined MBR and water treatment technologies to determine efficacy of the Onsite Direct Potable Reuse of Wastewater (Fig. 3). We have installed advanced wastewater treatment technology (Membrane Bio-Reactor) as well as water treatment technologies (Capacitive Deionization, Ozone and UV Disinfection, and Reverse Osmosis) for purification of the MBR effluent. We are in the process of adding several new technologies including a high-efficiency distillation technology to treat wastewater and desalinate salty ground water. We are also in the process of field testing an energy efficient Reverse Osmosis (RO) membrane designed to make On-Site desalination affordable. Our proposed innovative on-site water technology has the potential to disrupt conventional centralized water infrastructure approach in a manner similar to use of solar panels on roof of individual houses/buildings for energy production.

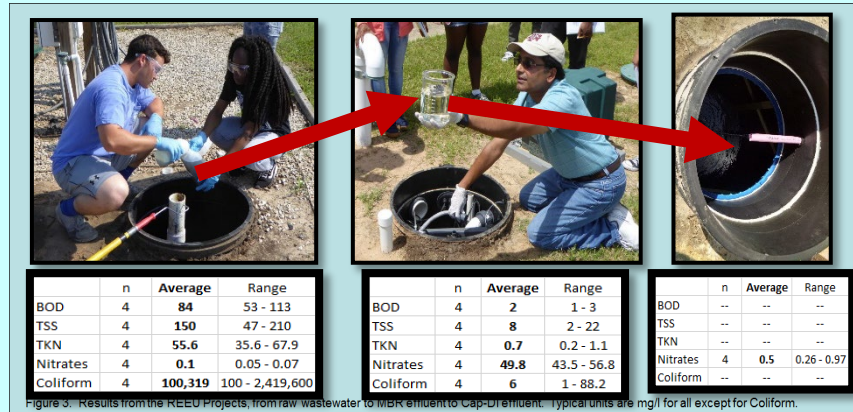


Figure 3. Results from the REEU Projects, from raw wastewater to MBR effluent to Cap-DI effluent. Typical units are mg/l for all except for Coliform.

On-Site Water Reuse Research Capacity @ RELLIS campus



OSSF



ODPR



Preliminary findings by REEU Fellows



Final product NOT yet ready for DPR... More studies and data needed....

Summary

- ⦿ OSSFs will play a vital role in our future infrastructure needs.
- ⦿ Responsible management of OSSF is a MUST
- ⦿ Advanced technologies available for most situations.
- ⦿ TAMU offers Education, Research, and Extension Services related to OSSFs and in future will focus on OSSRFs



Thank you

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On-Site Sewage Facilities (OSSF)

Home OSSF Basics Events Contact Publications

Operation and Maintenance

Onsite Wastewater Treatment and Reuse

Our Mission:

To provide information on the technologies available for managing wastewater so that people can make informed decisions when selecting, operating, and maintaining their onsite wastewater treatment system.

News & Updates

Free Homeowner Maintenance of Septic Systems class in La Marque, TX: March 29, 2012, 6:30pm - 8:30pm

OVERVIEW

- Onsite Wastewater Treatment Systems (OWTS)
 - Wastewater Source (Homeowners)
 - Collection and Storage
 - Pretreatment Components
 - Advanced Pretreatment Components
 - Disinfection
 - Final Treatment and Dispersal
- Selecting and Permitting
- Operation and Maintenance

EDUCATIONAL MATERIALS

ADDITIONAL RESOURCES