Conventional Septic Systems in North Carolina

Rule .1955

15A NCAC 18A .1900

Laws and Rules for Sewage Treatment and Disposal Systems

The typical septic system consists of:

1. **Collection Lines** – carries sewage from facility to septic tank
2. **Septic Tank** - separates, stores, and begins to treat solid wastes
3. **Distribution System** - carries effluent from the tank to the drain field
4. **Drain Field** or Nitrification Field or Soil Absorption System - generally a series of perforated drainpipes in aggregate buried in the ground

Collection Lines
Sewer Lines/Building Sewer

Purpose: To convey raw (untreated) sewage from the house to the septic tank

Requirements: Based on ASTM standards in accordance with NC Plumbing Code

Sewer Lines/Building Sewer

Requirements:

- Scour Velocity

  2 ft/sec (half full pipe)

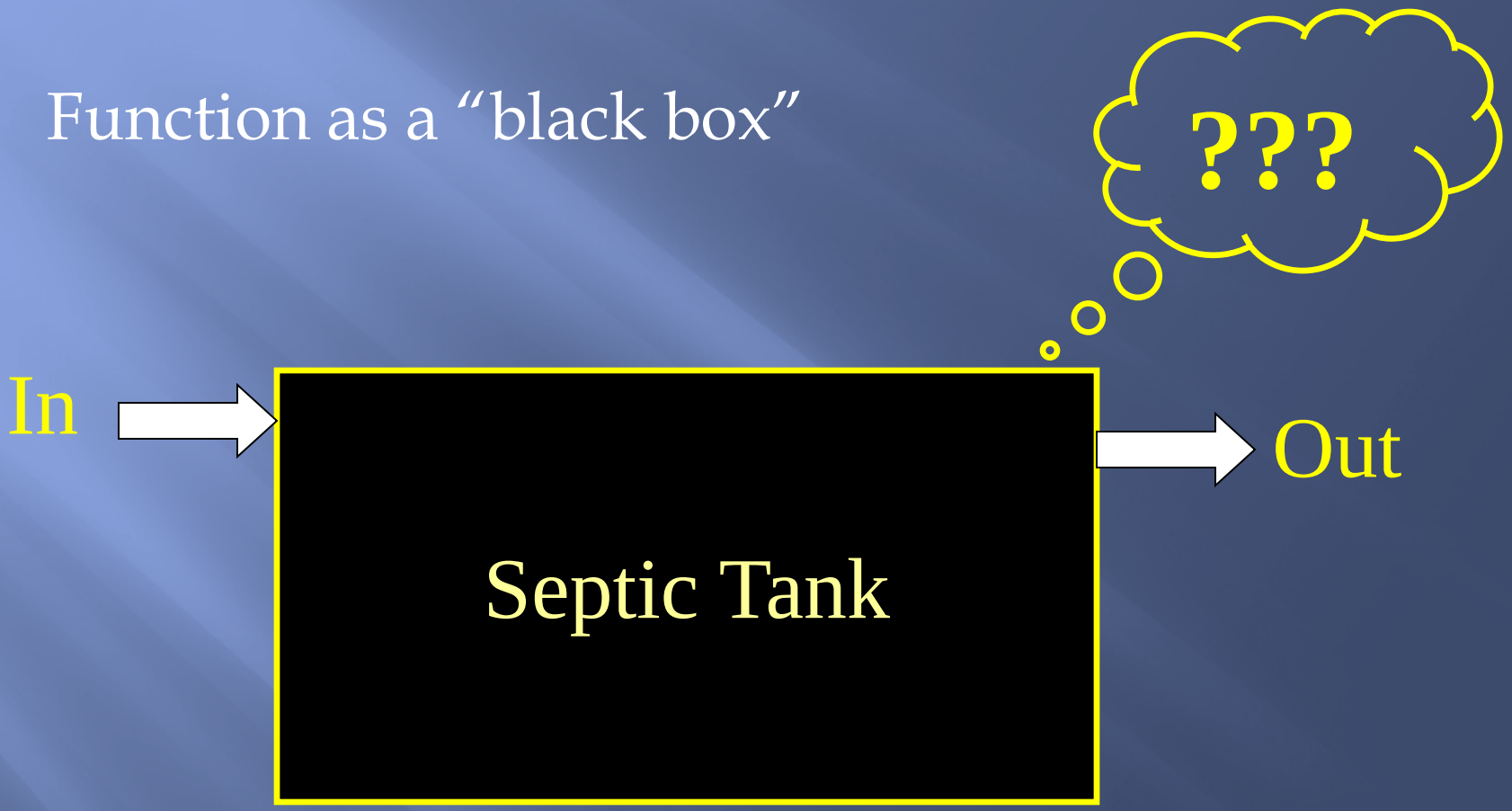
  1 ft/sec (full pipe)

  Typically 1/8" per foot of fall for raw sewage

- Cleanouts every 50' and for bends >45 degrees (4" sewer lines)

Septic Tank

Function as a “black box”



Septic Tank

Historical Perspective:

"A mysterious contrivance consisting of a vault hermetically closed by a hydraulic seal…it rapidly transforms all the excrementitious matter it receives into a homogeneous fluid…"

Louis Mouras, 1881

Septic Tank

Factors influencing biological activity:

- Composition of wastewater
- Flow quantity and variability
- Temperature

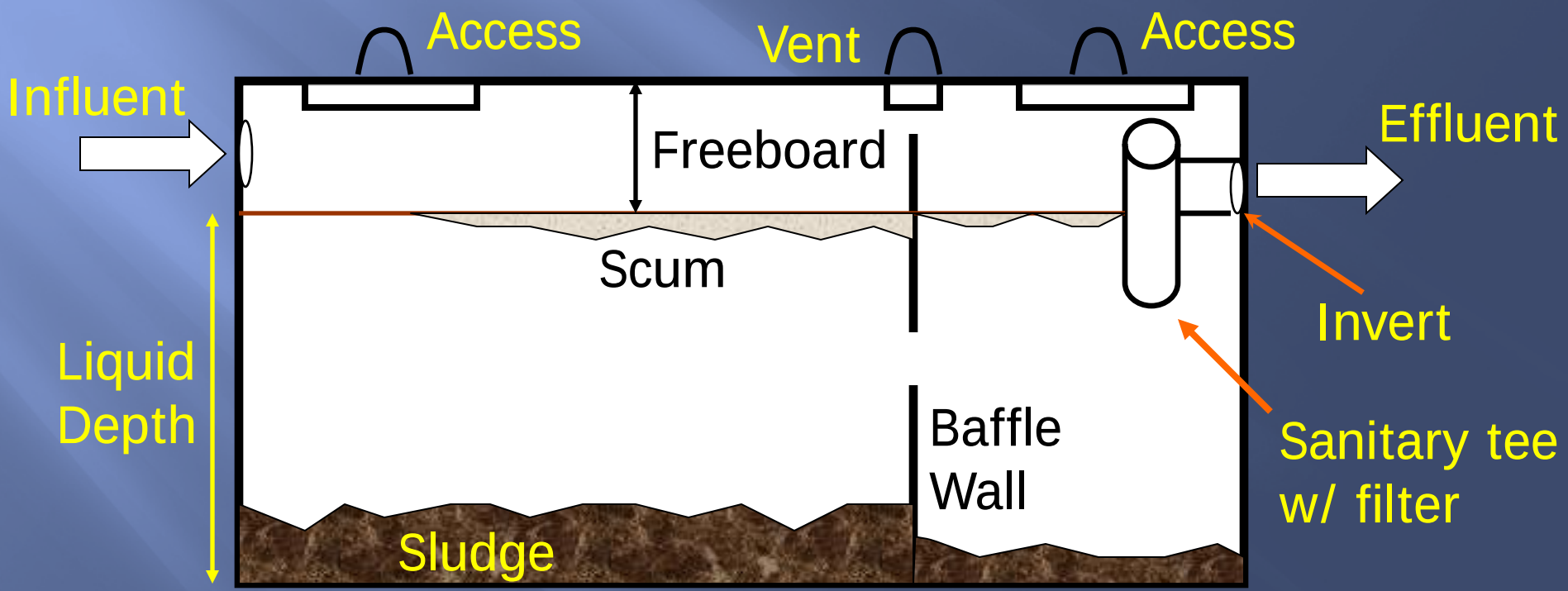
Septic Tank

Purpose:

- **Primary Treatment**: Solids removal as a function of quiescence and retention time
- Secondary Treatment: Limited anaerobic decomposition
- Storage of accumulated solids

Septic Tank Terminology

2 compartment tank (required in NC)



Effluent Filter

Effluent Filters

What are septic tank effluent filters?

- Mechanical filters
- Constructed of corrosion-proof material
- Replaces the outlet "T" of the septic tank

Why use effluent filters?

- Improve quality of effluent discharged from septic tanks
- Extend life of soil absorption system
- Required by North Carolina General Statutes

Supply Line

Purpose:

- Conveys effluent from septic tank to distribution device (if applicable) and to drainlines

Specifications:

- 3” or 4” PVC (poly vinyl chloride), PE (polyethylene) or ABS (acrylonitrile-butadiene-styrene) pipe
- May substitute corrugated PE pipe (w/proper bedding)
- Minimum fall 1/8” per foot

Distribution Device – Equal

Purpose:

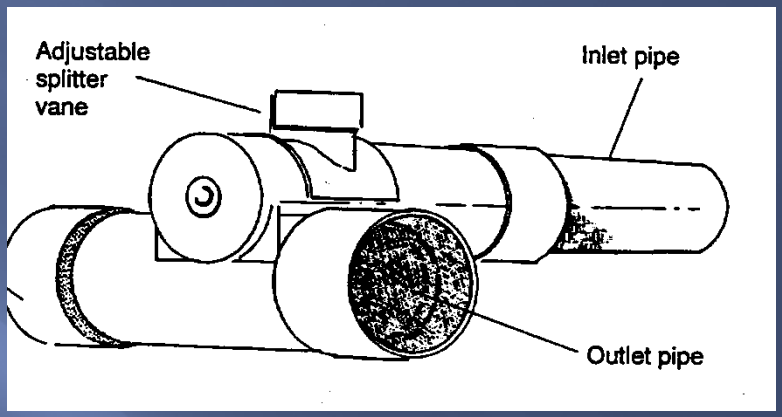
- To convey an equal portion of effluent from the supply line to each individual drainline

Types: D-Box or Divider Tee

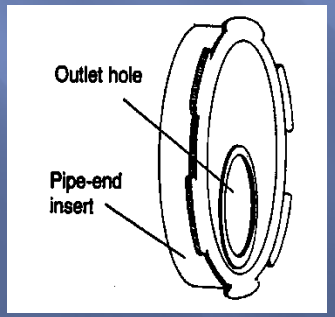
Equal distribution requires equal length trenches!

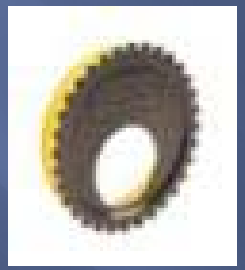
Distribution Device – Equal

D-Box



Flow Divider

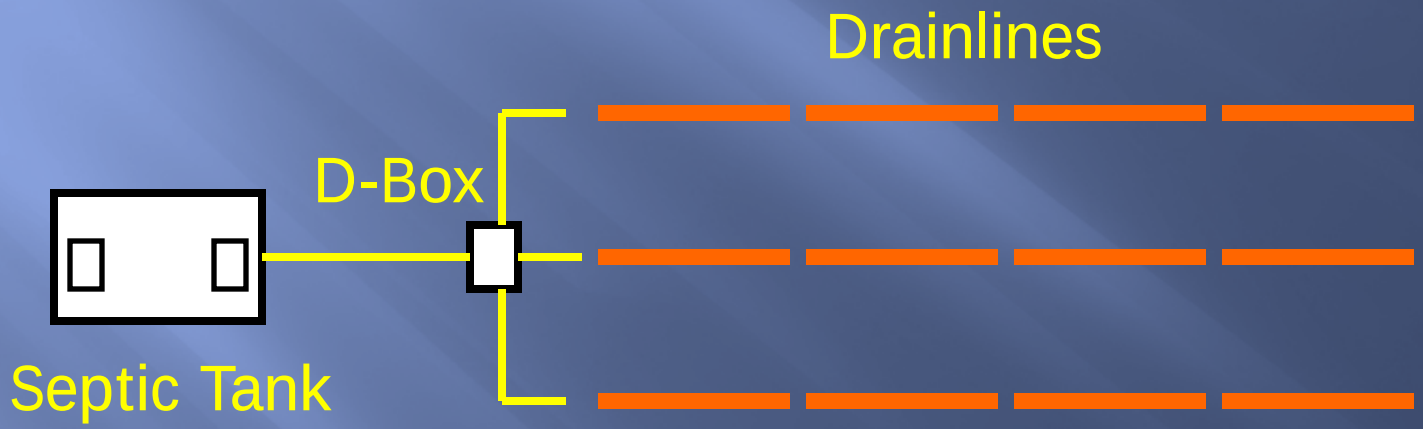




Leveling Devices

Equal Distribution

Plan View:



Distribution Device – Serial

Purpose:

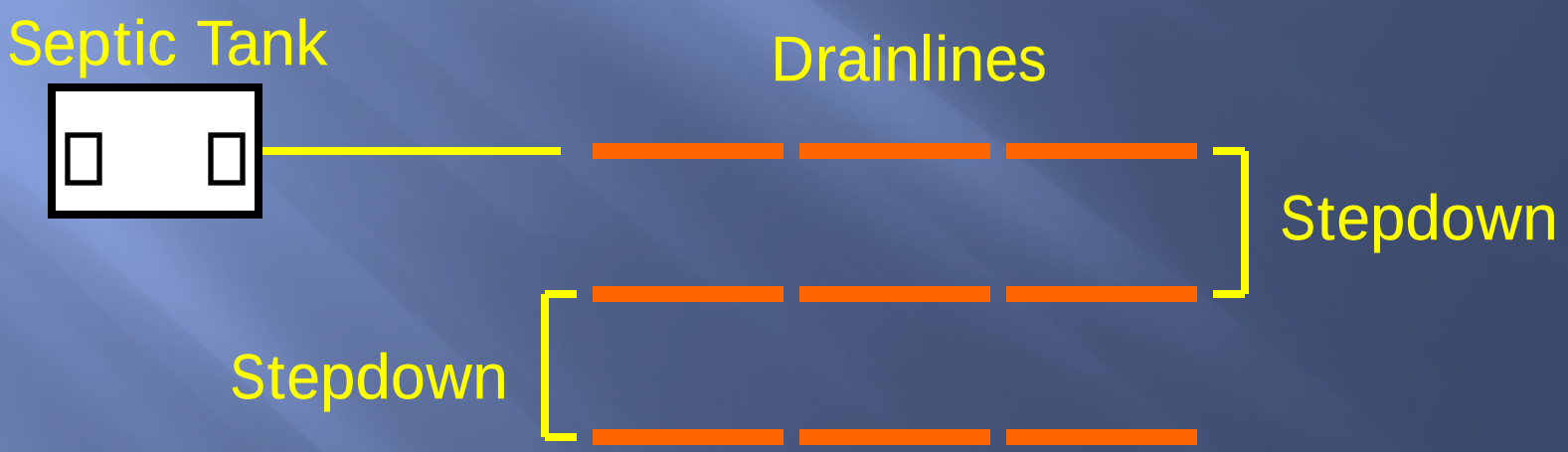
- To fully utilize each individual drainline prior to distributing effluent to remaining line(s)

Types: Drop Box or Step Down

Serial distribution does not require equal length trenches!

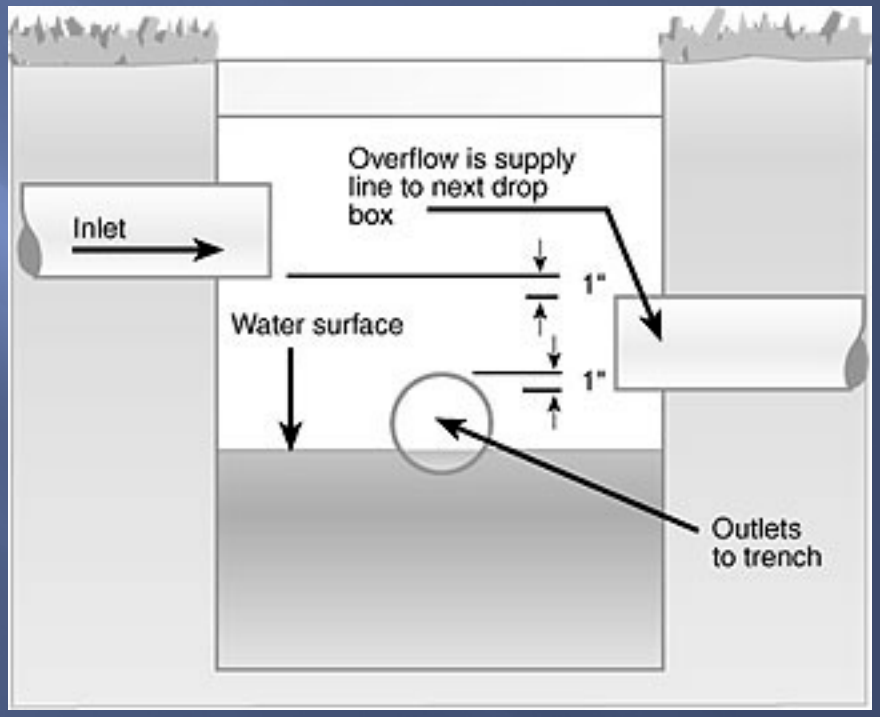
Serial Distribution

Plan View: Stepdowns



Distribution Device - Serial

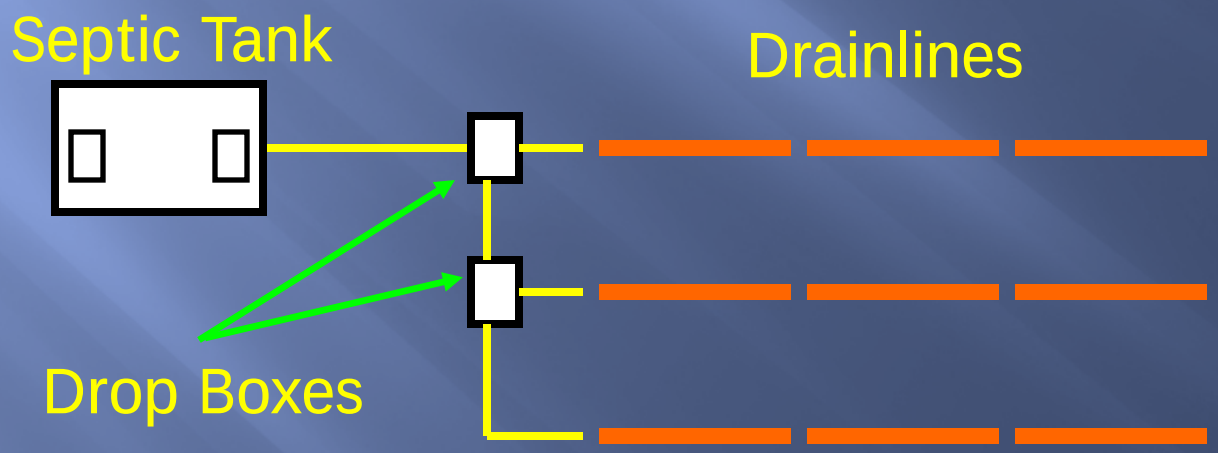
Drop Box



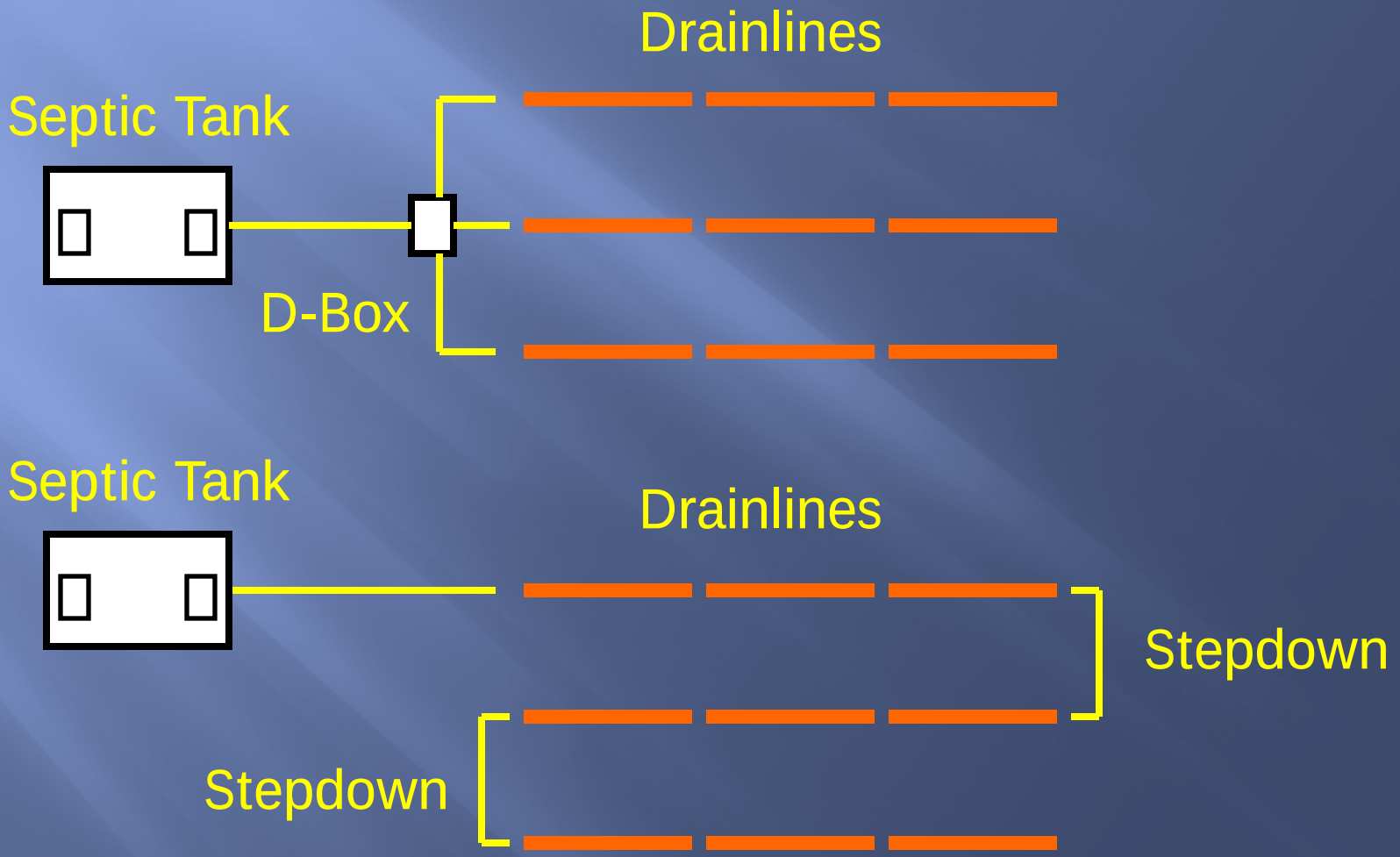
Serial distribution does not require equal length trenches!

Serial Distribution

Plan View: Drop Boxes



Equal vs. Serial Distribution

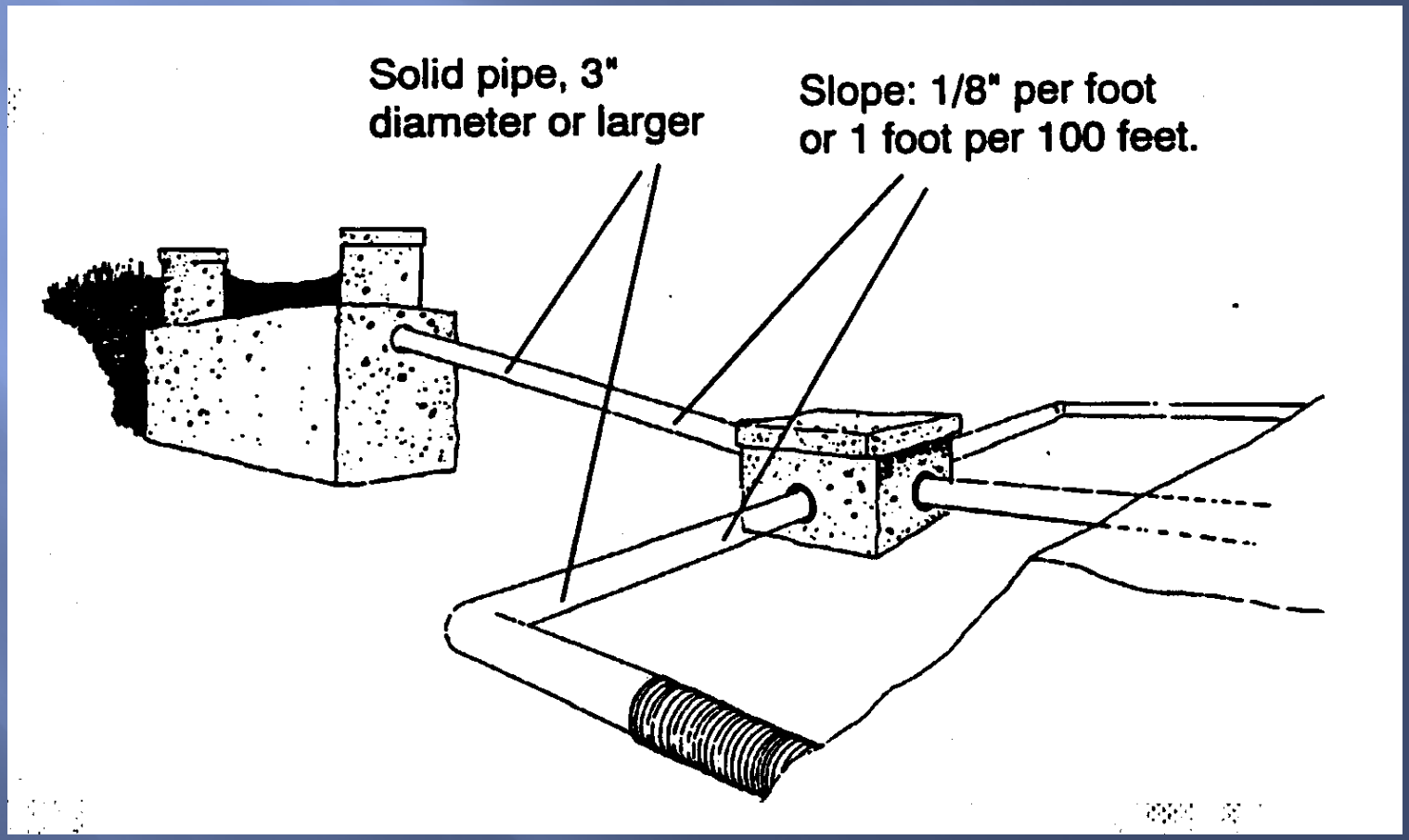


Distribution Device: Equal or Serial

Specifications:

- Leak proof
- 2’ separation to septic tank *and* drainline(s)
- As approved by LHD
- Must be demonstrated by installer to perform as designed

Septic Tank/D-Box/Supply Lines: Overview

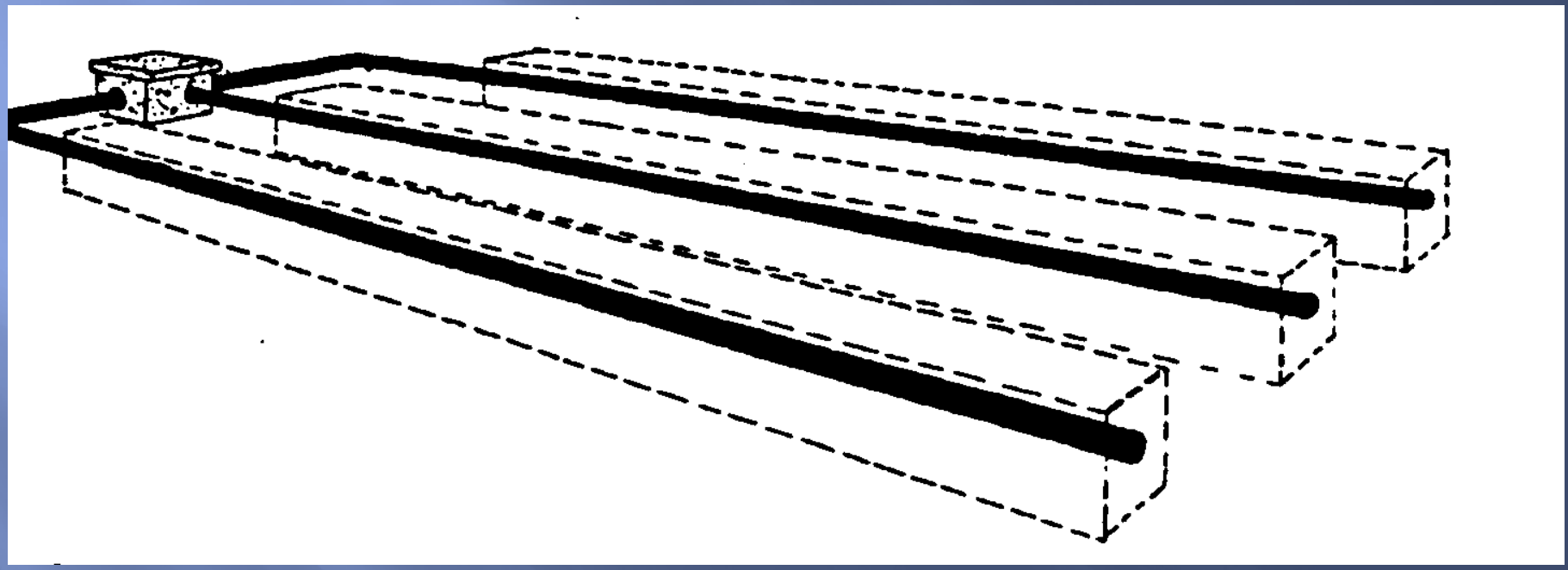


Nitrification Trenches

Purpose:

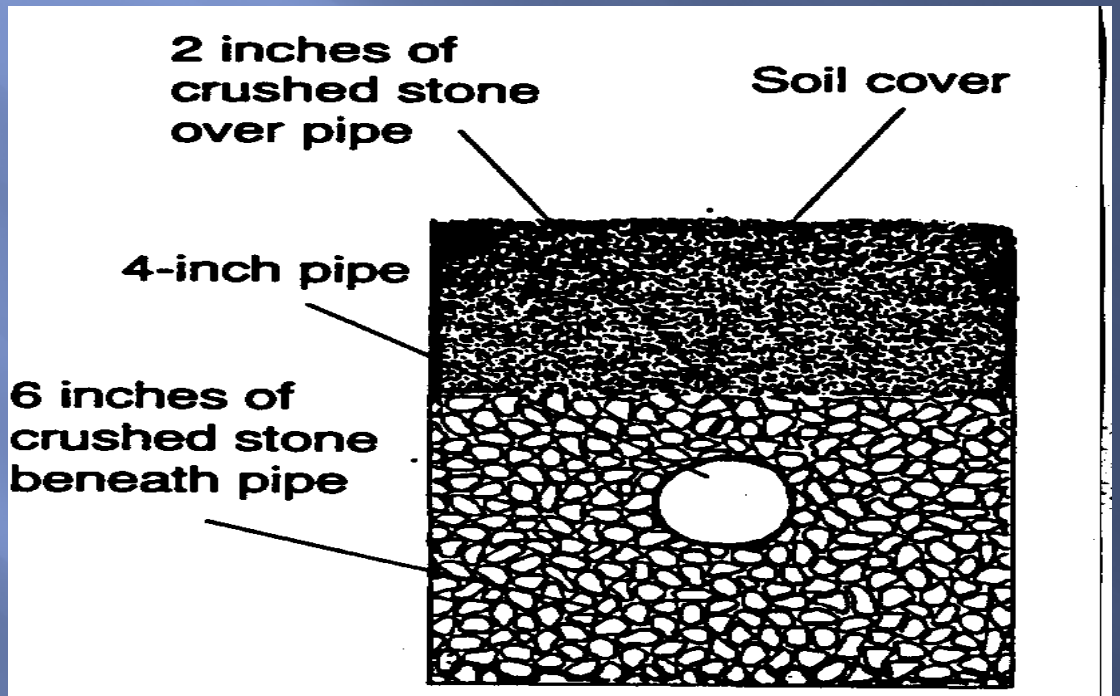
- Provide storage of wastewater until treatment and disposal can occur
- Provide surface area at the soil interface for treatment and disposal

D-Box/Supply Lines/Trenches: Overview



- Trenches level in all directions (maximum fall of 1/4” per 10’).
- Trenches shall follow ground contour if slope > 2% **OR**
- When necessary to maintain trench bottom depth

Cross-section view: Conventional trench



End view of a conventional treatment and disposal trench.

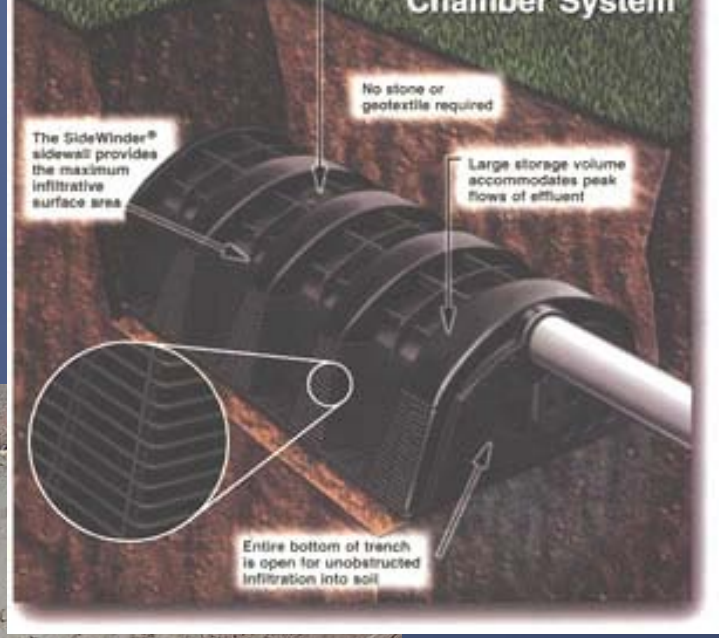
Aggregate

Crushed Stone Sizes #3, #4, #5, #57, #6

Specified by ASTM Standards

PolyStyrene Aggregate

Chambers


Chamber System
No stone or geotextile required
The SideWinder® sidewall provides the maximum infiltrative surface area
Large storage volume accommodates peak flows of effluent
Entire bottom of trench is open for unobstructed infiltration into soil

Large Diameter Pipe (LDP)

Tire Chips

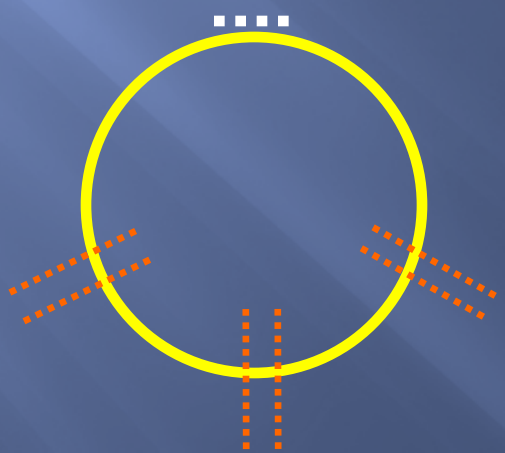
Pipe

Corrugated, perforated PE

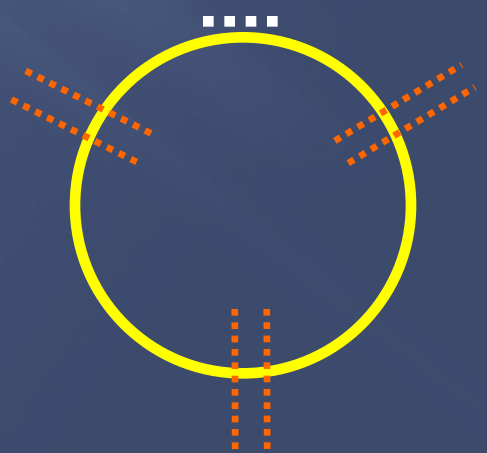
4” or 6” diameter

3 rows of 1/2” to 3/4”

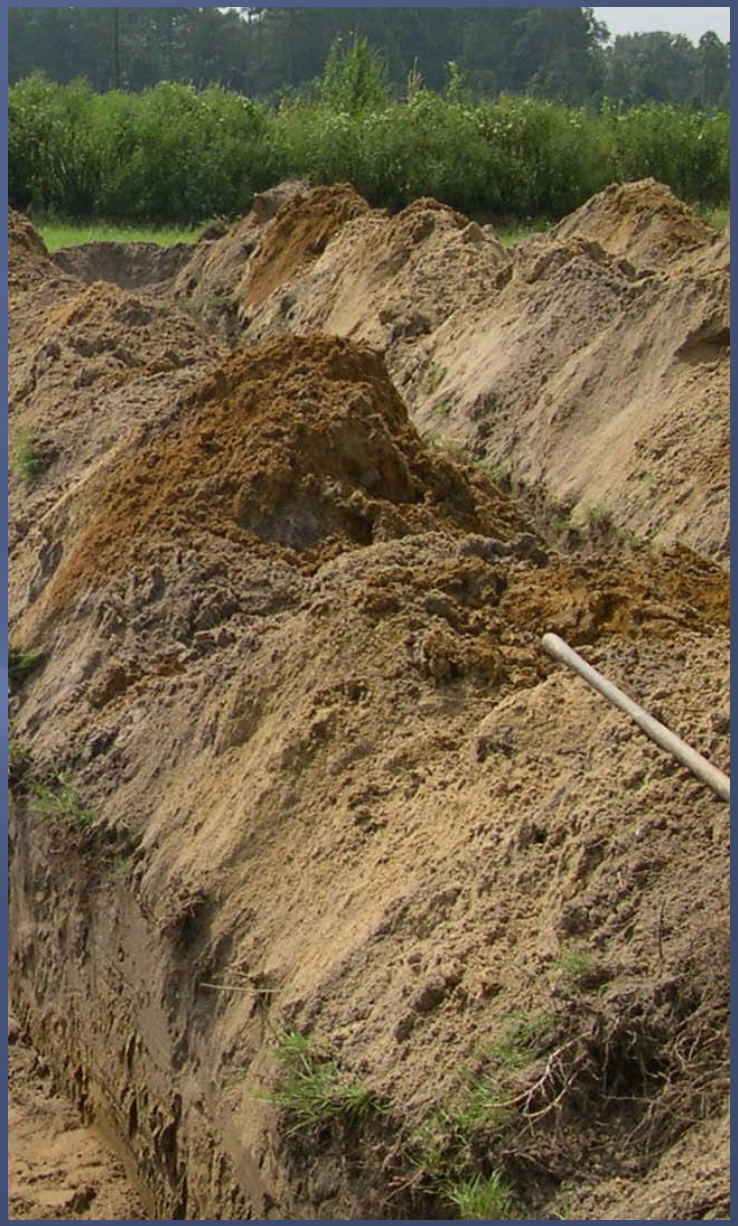
longitudinally ~4” on cer



Orientation of Holes (C/S)



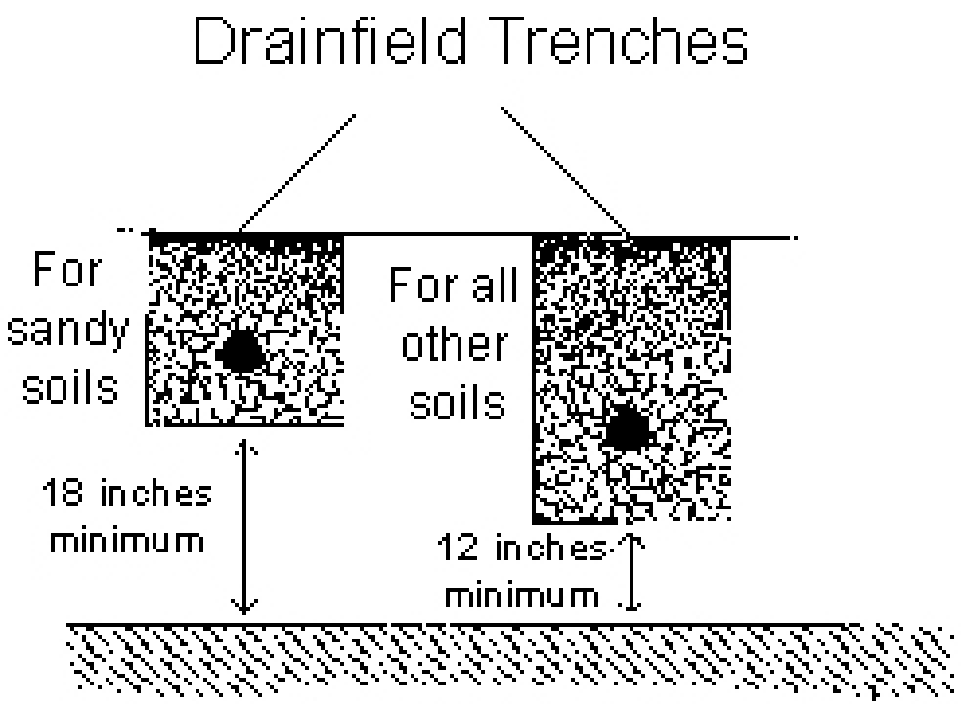
Soil



Purpose:

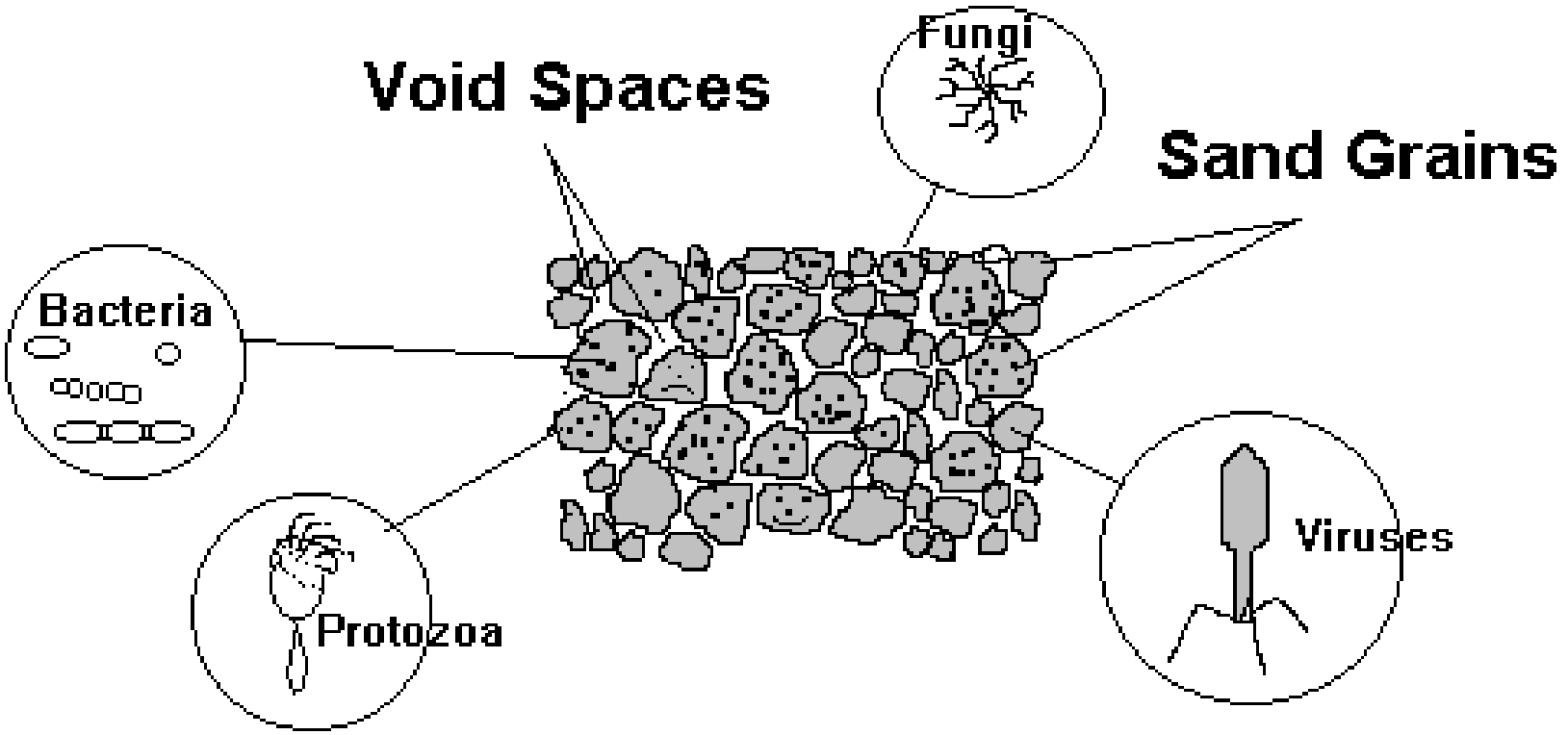
- To absorb and physically filter components from the effluent as well as facilitate chemical and biological remediation of organic and pathogenic materials.

Cross-section view: Conventional trench

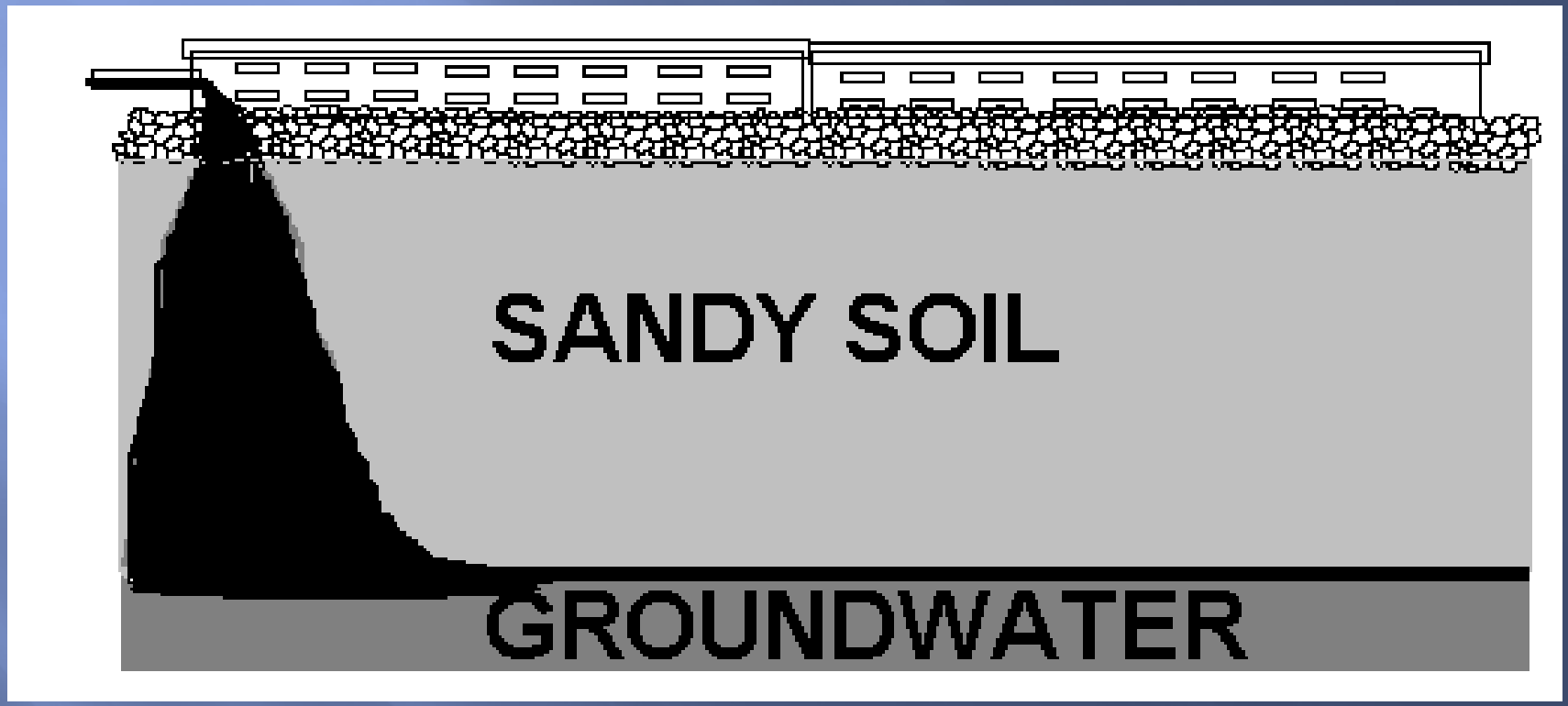


Required distance between bottom of drainfield and groundwater table.

Soil Matrix



Effluent Distribution



Ciliates 5-10 micrometers

Single cells:
- grazers
- particle feeders
- scavengers

NEMATODES ~1mm

Roundworms - free living

Also common in activated sludge and septic tanks.

Feed on chunks of bacterial floc.

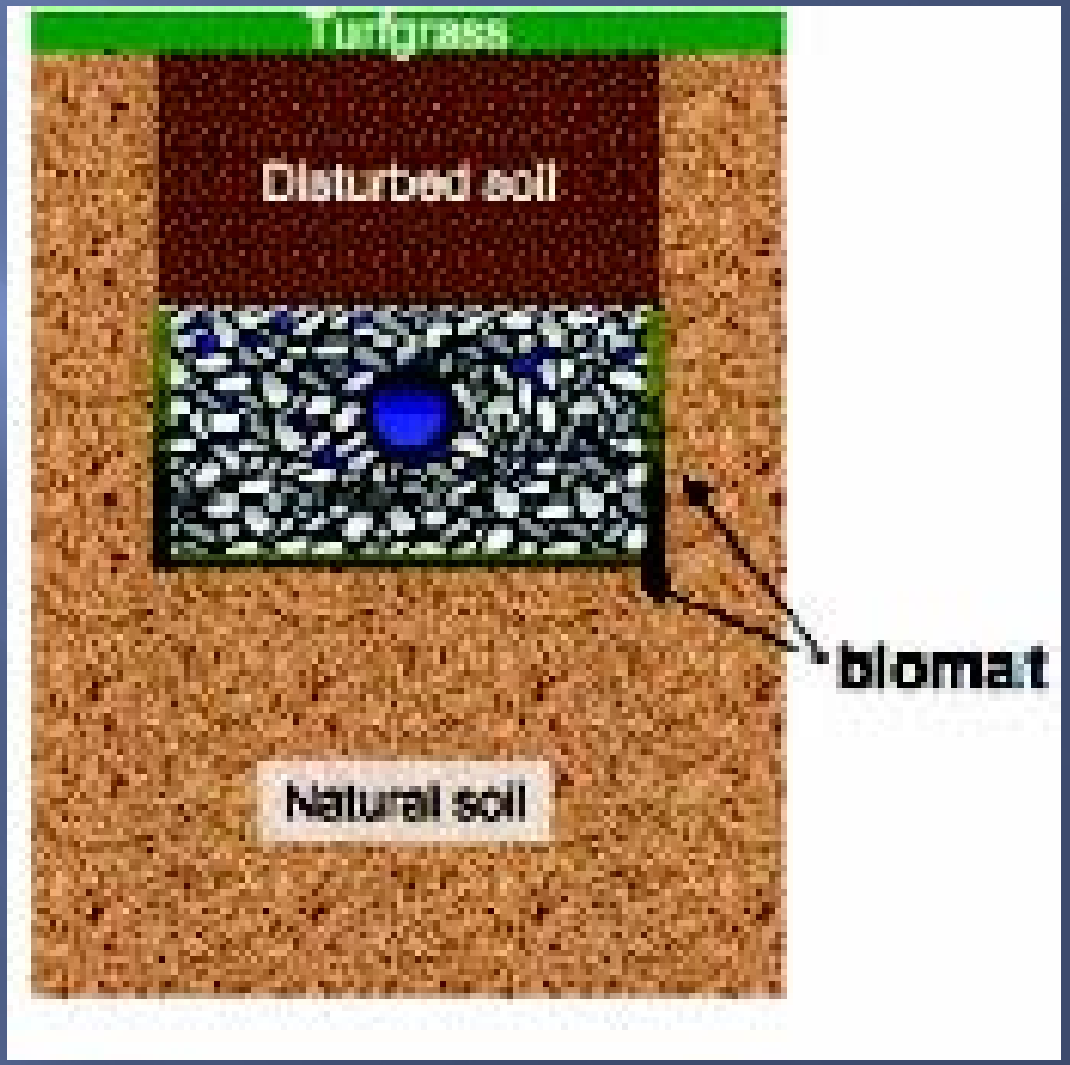
Aerate soil

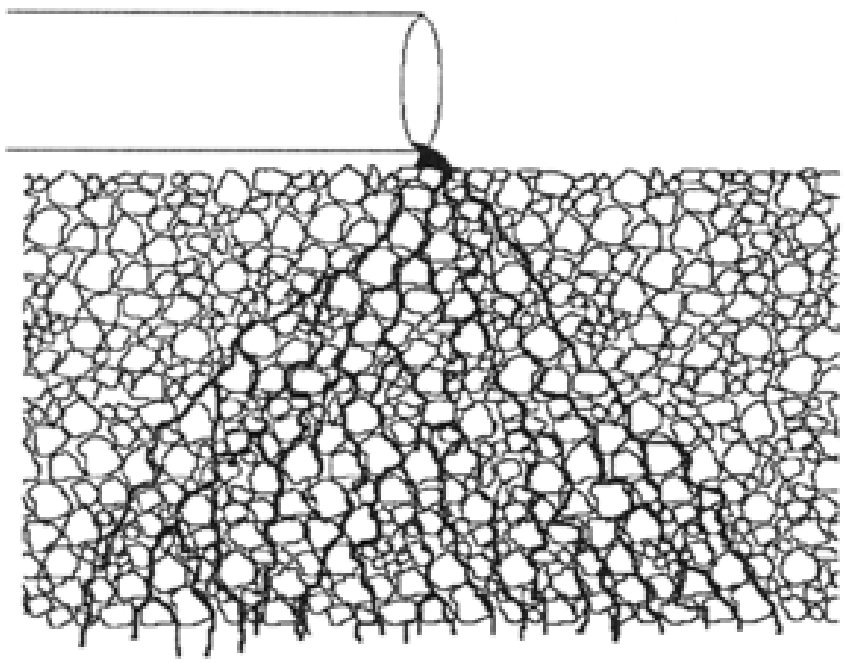
Biomat


1 Surface material : Silicon Urethane
2 Natural Jade (Long Wave Infrared Rays)
3 Double Protected Safety Layer
4 Hyron Cotton Layer (Thermal Insulation Layer)
5 Air Roll Padding Cottons
6 Water Proof Layer
7 Japanese Kurera's Super Fiber
8 First Fiber Glass Layer (The Interception of Water Vein Waves and Harmful Electromagnetic Waves)
9 Japanese Kurera's Super Fiber
10 First Urethane Protector Layer
11 Solid Square Cotton Padding
12 Second Fiber Glass Layer (Prevents Over Heating & Electromagnetic Waves)
13 2000㎳ Semi Conductor Heating Plate
14 Second Urethane Protective Layer
15 Padding-Hyron Silk Cotton Thermal Insulation Layer
16 Concentrated Ceramics Reflects Infrared Rays
17 Bottom : High Quality Silk Cotton Material

Biomat

A relatively dense sewage-digesting community of organisms in the immediate area where the aggregate component of the septic system contacts the soil





Unsaturated Flow - liquid follows a tortuous path around the surface of soil particles and comes into contact with bacteria and protozoa that break down the waste.

THE OBJECTIVE OF A LEACHING FIELD IS TO PROVIDE UNSATURATED FLOW OF EFFLUENT TO THE GROUNDWATER

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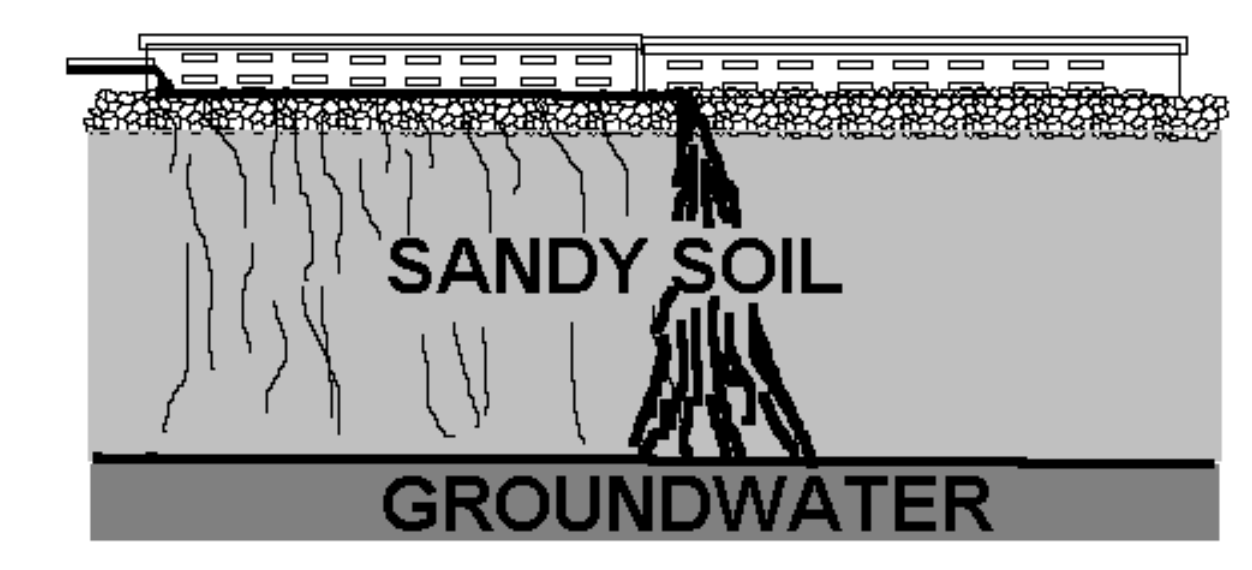
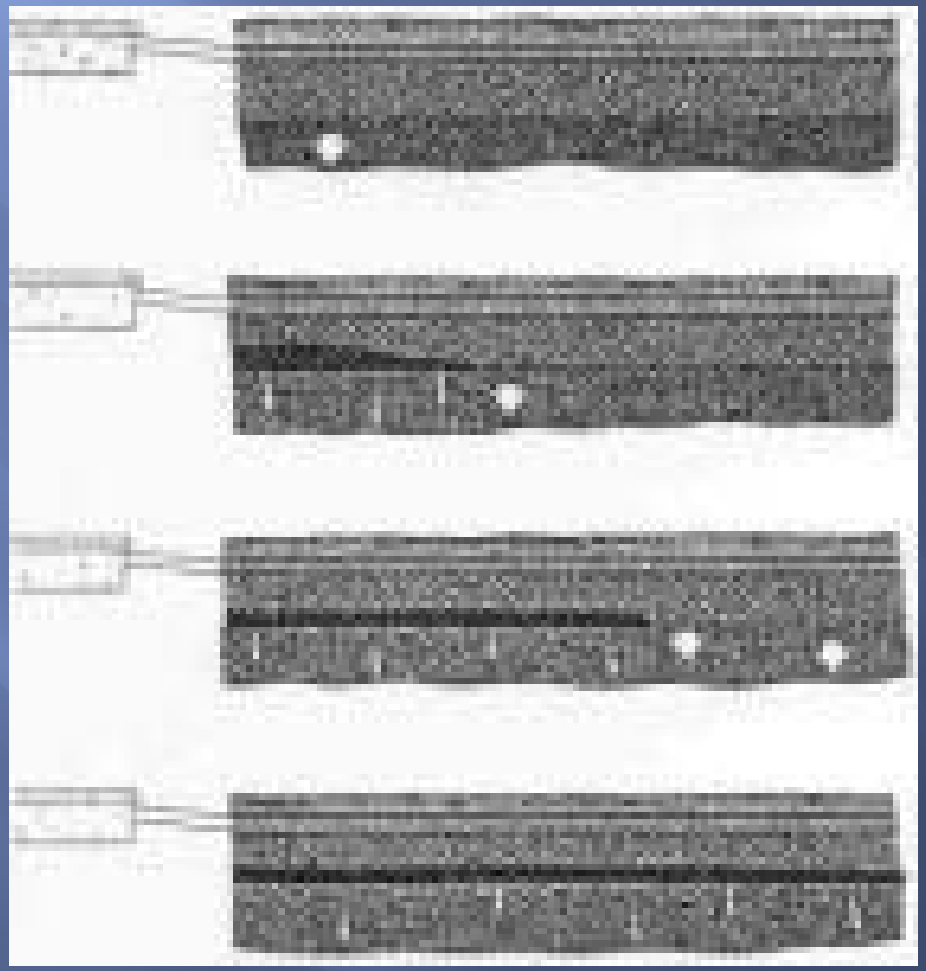
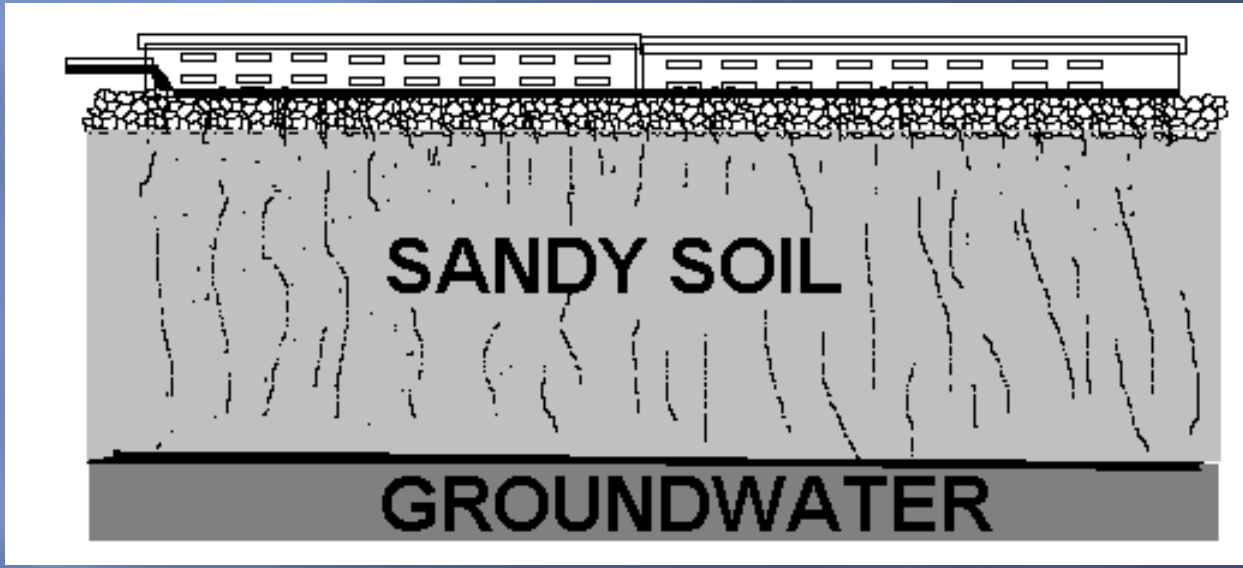
Biomat Formation



Formation of Biomat



Mature Biomat



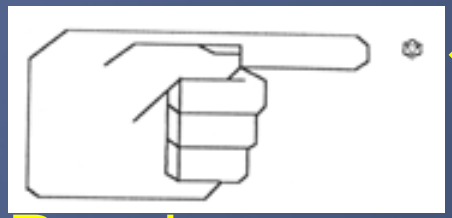
LTAR

LTAR – Long Term Acceptance Rate

Stated in gallons per ft^2 per day (gpd/ft^2)

The amount of effluent that can be applied to the Nitrification field to achieve and maintain aerobic and unsaturated flow.

Viruses



Reovirus 70-75 nanometer (10^{-9} meter)
Enlarged ~57,000 times

Putting viruses in perspective?

If a sand grain 0.5 mm - was similarly enlarged, = ~ 94 feet high !

That nematode = 180'+ long

The pore space between sand grains = 13 feet wide !

- You would be 60 miles tall !

The Early Years of Sanitation

Early Roman Law
(governing chamber pots)
Dejecti Effusive Act

A person shall be fined and pay damages to the injured party for throwing or pouring "missiles of mirth" out an open window and hitting someone.

Note: Law only applied during daylight hours.

Questions?

MANY OF THE STREETS, NEVERTHELESS, WENT ON BEING RECEPTACLES AND RESERVOIRS FOR THE CONTENTS OF THE CHAMBER-POT AND THE SLOP PAIL.