Media Filter Operational Process

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Residential & Commercial
Denitrification Units

What are Media Filters?

- Other names: attached growth, fixed film, packed bed, biofilter or trickling filter
- Use natural (e.g. gravel, sand, peat, coir) or man-made (textile, open cell and closed cell foams, polypropylene fiber, synthetic sand or polystyrene bead) media
- single pass or recirculating configurations

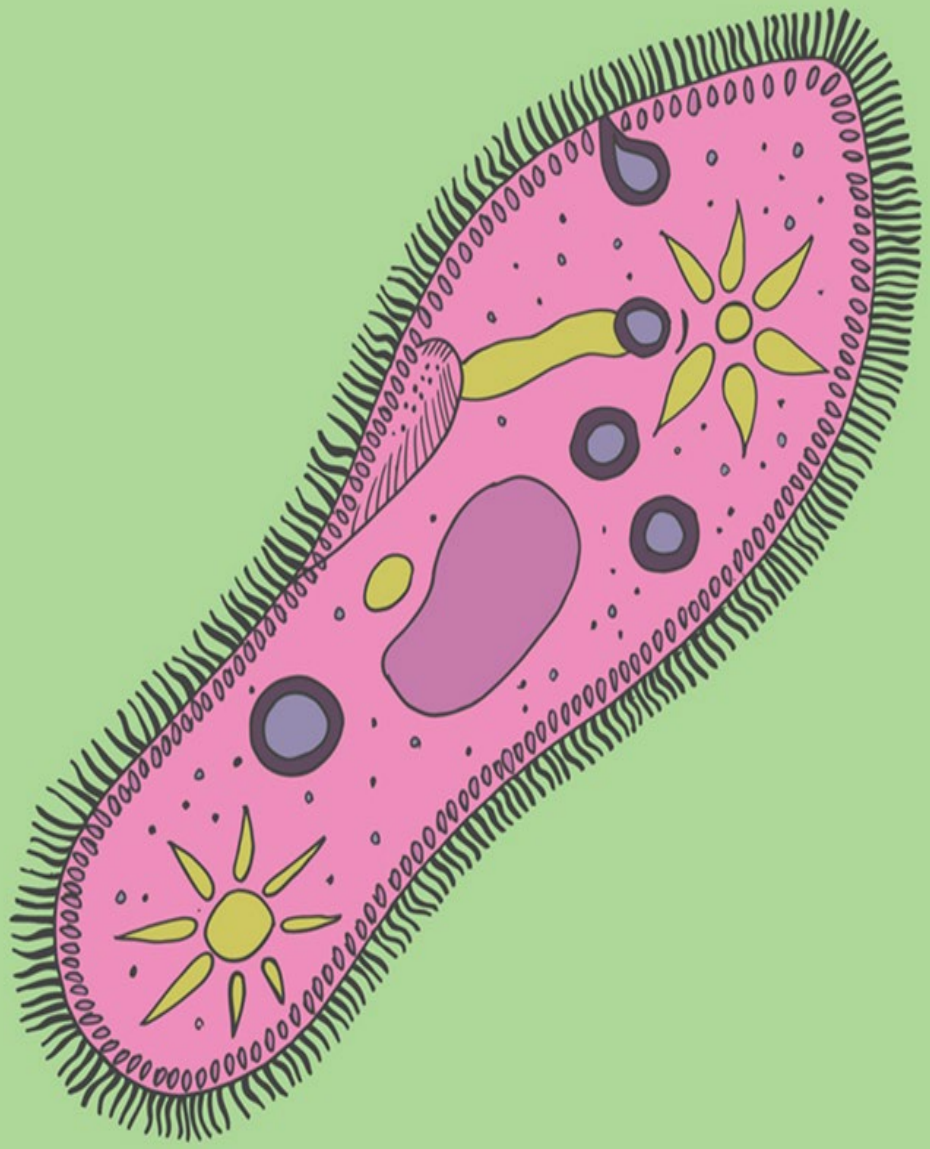
What properties are prized in a media?

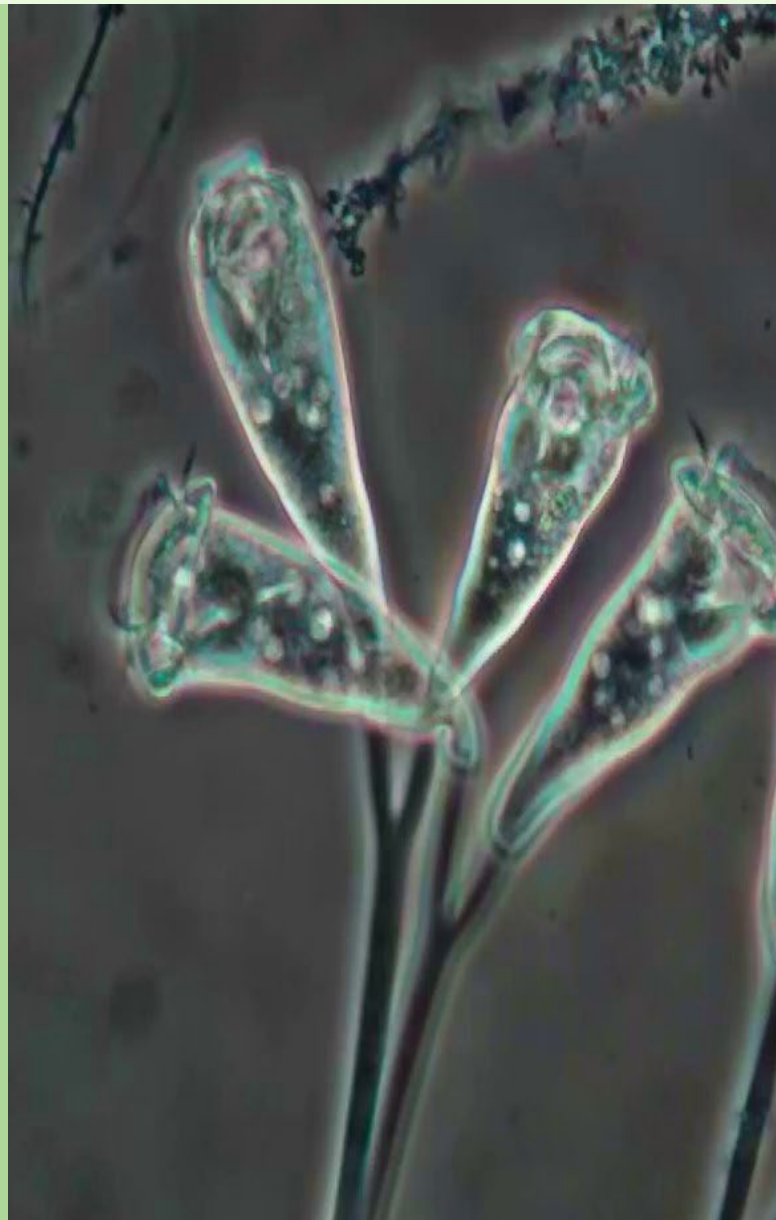
- High surface area / volume
- Pathways for water and air to enter the media and pass through and around it
- Excess liquid must quickly drain from media
- Yet still hold on to residual moisture well

How do microbes live in a Media Filter?

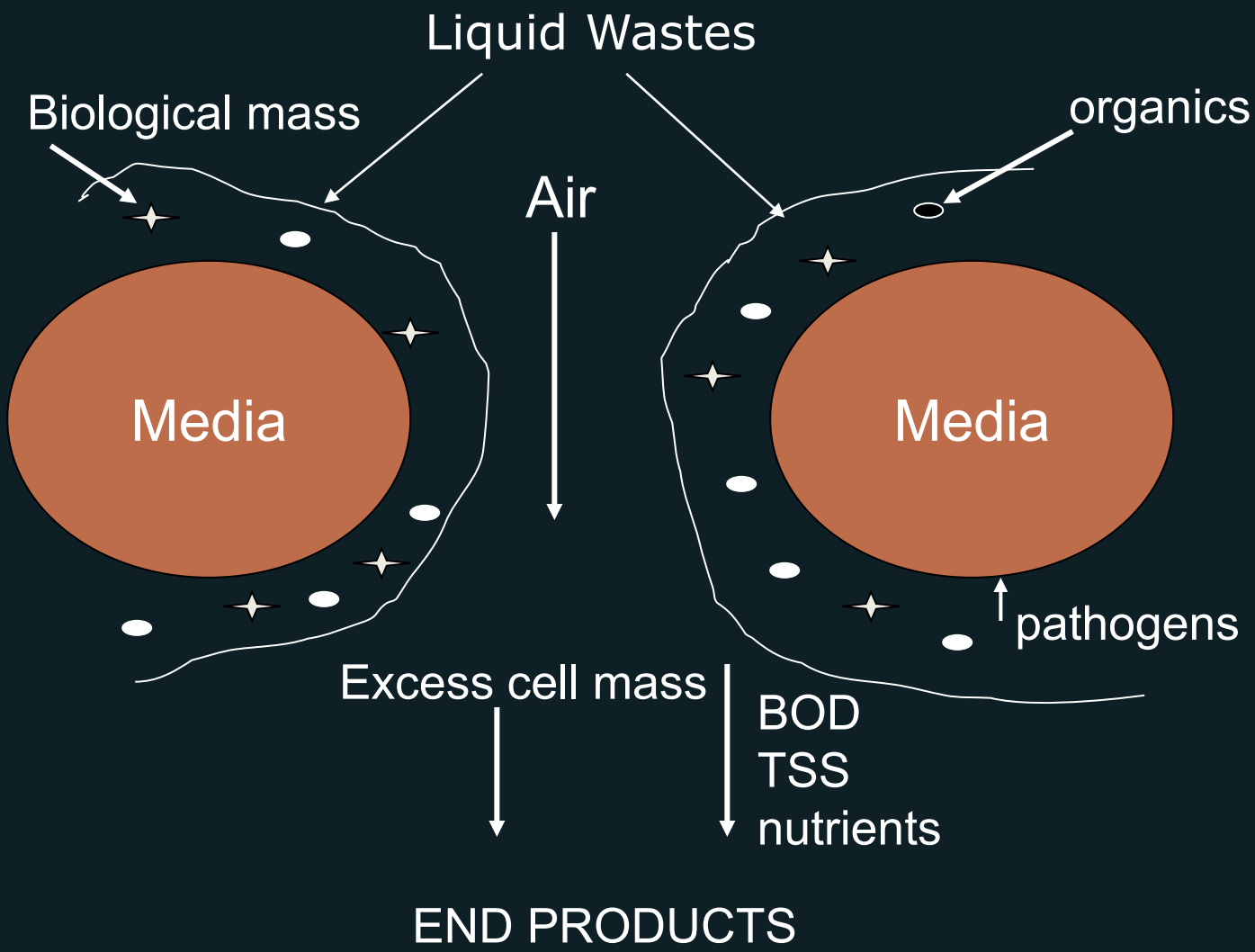
- Microorganisms are attached to a surface film & form a coating over time
- Food must come to them
- Less likely to experience extreme population crashes if food becomes scarce

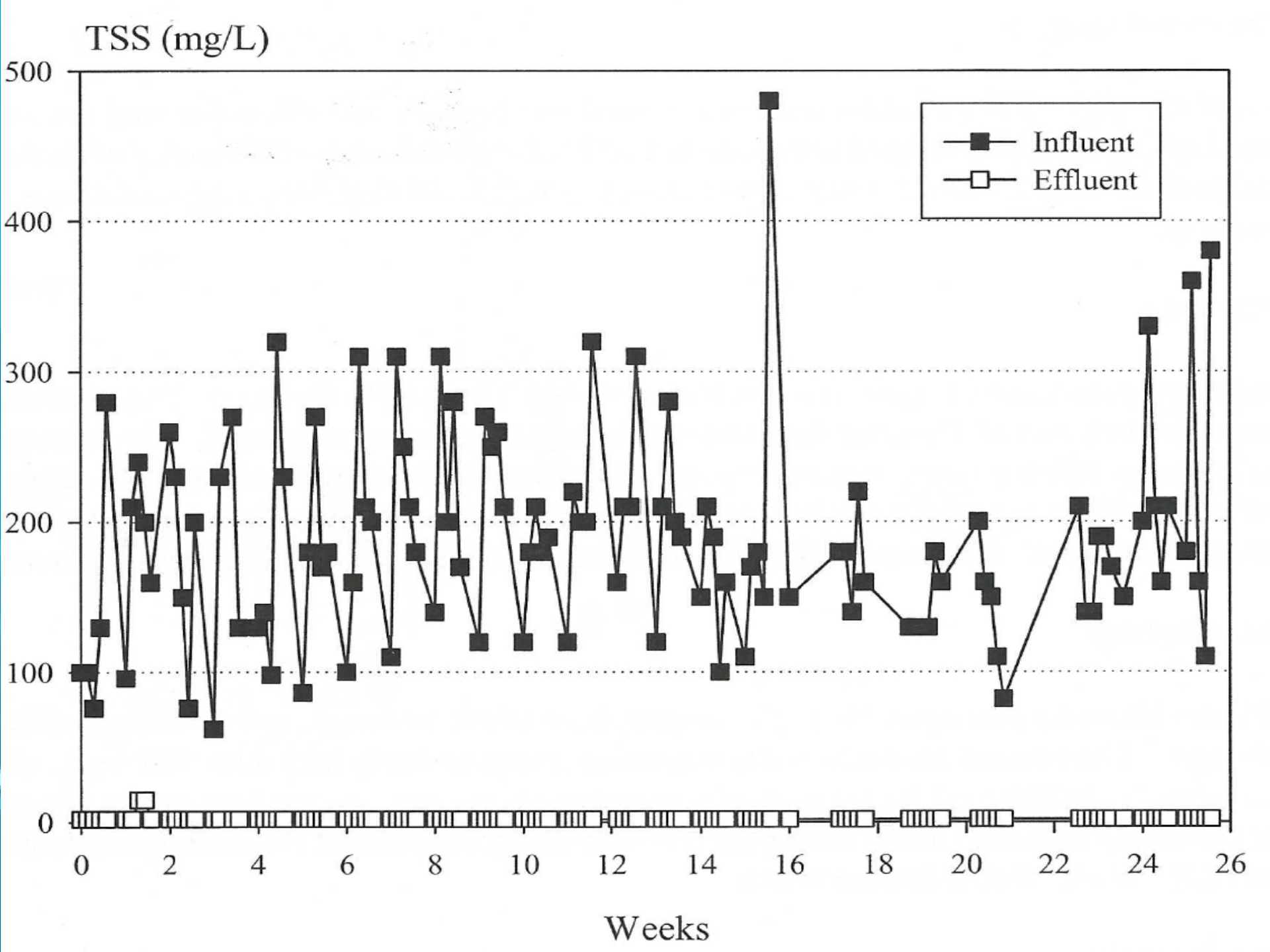
Free-swimming and stalked ciliates

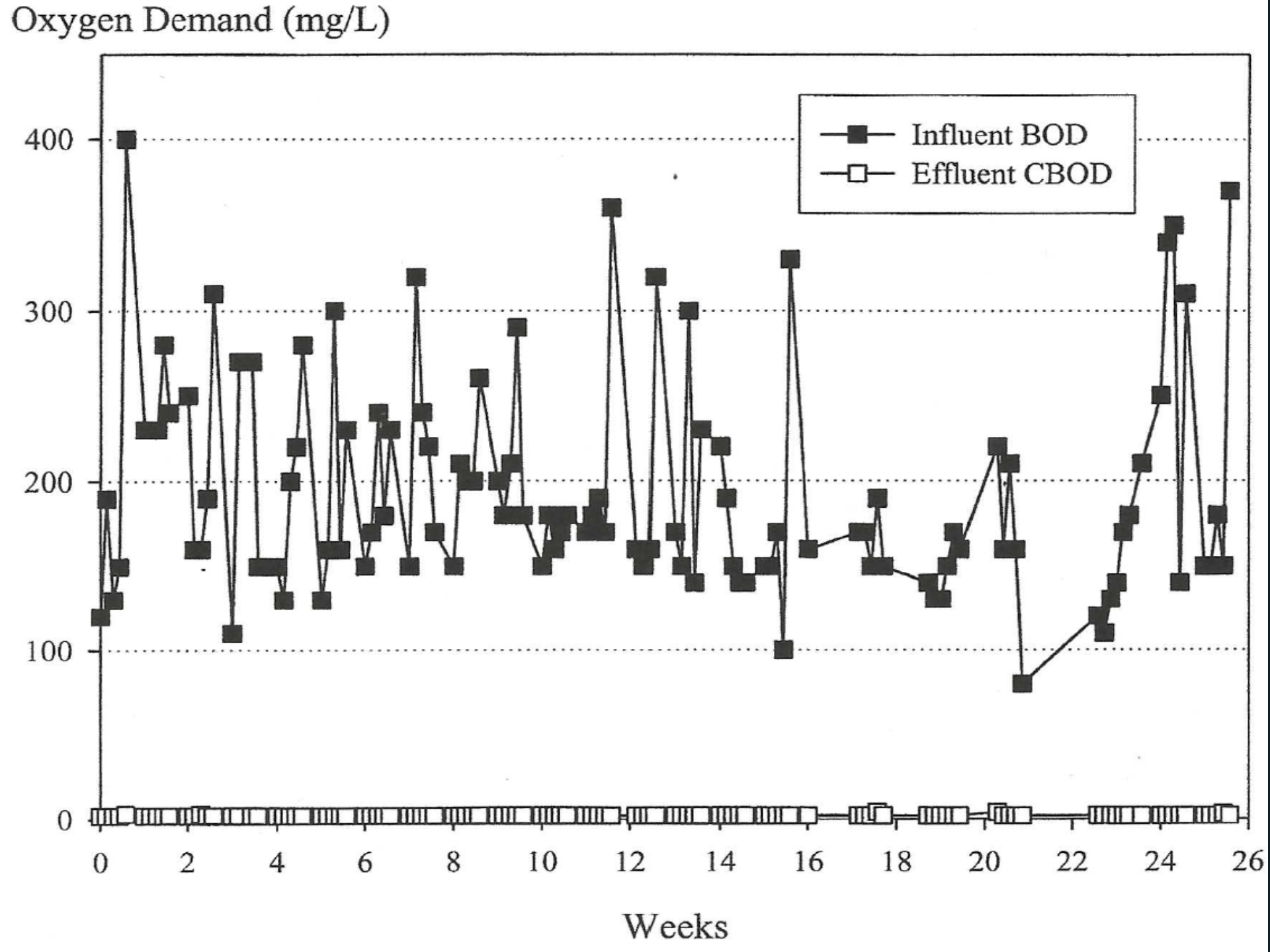




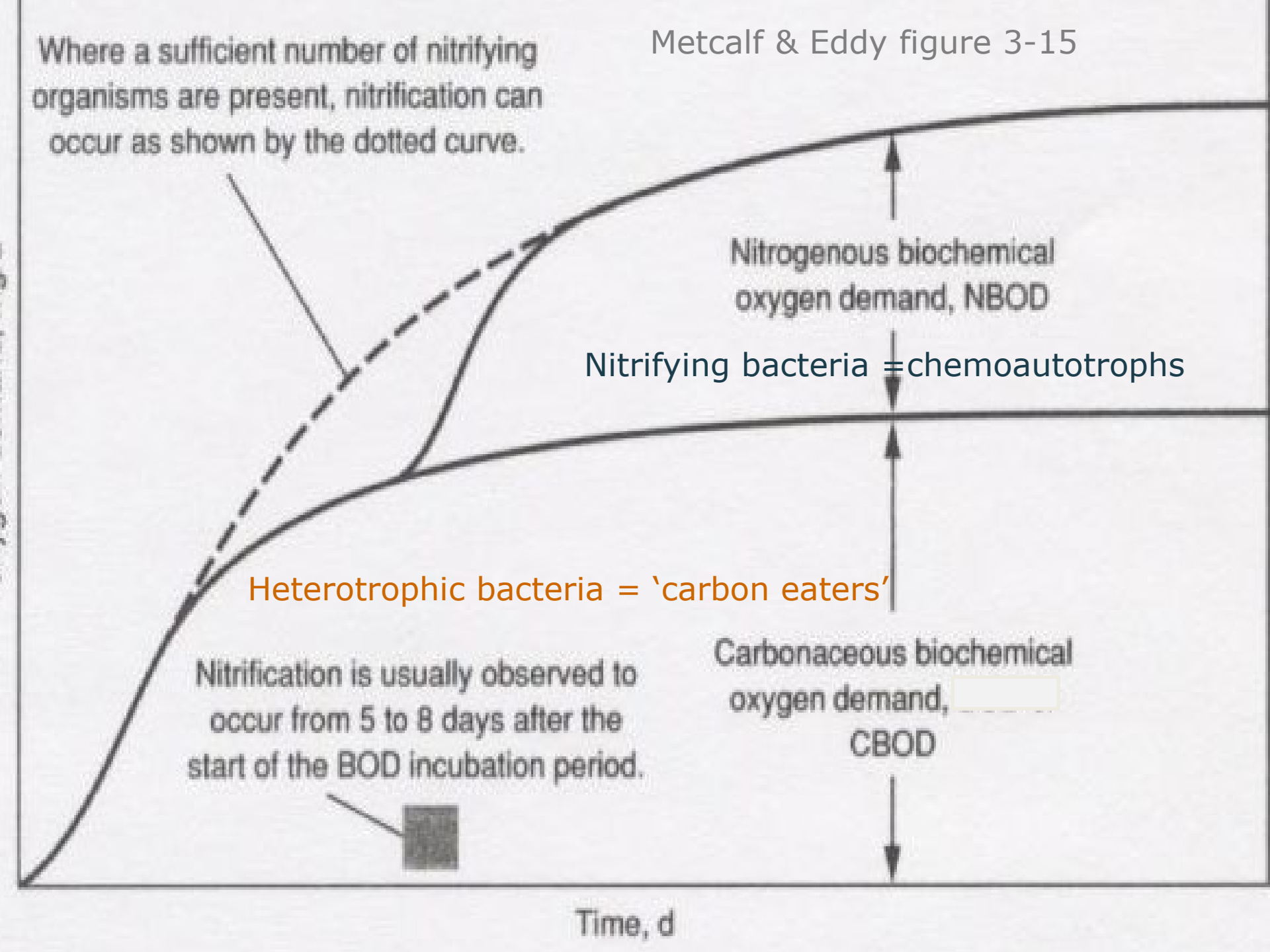
Flow & Treatment on Media
Jantrania & Gross, 2006



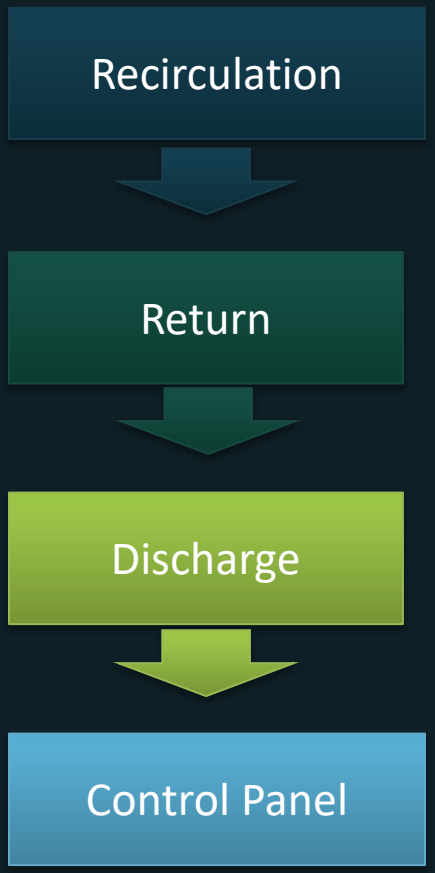

TSS (mg/L)
500
400
300
200
100
0
Influent
Effluent
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Weeks


Oxygen Demand (mg/L)
Influent BOD
Effluent CBOD
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Weeks

Metcalf & Eddy figure 3-15



3-pump System Operation



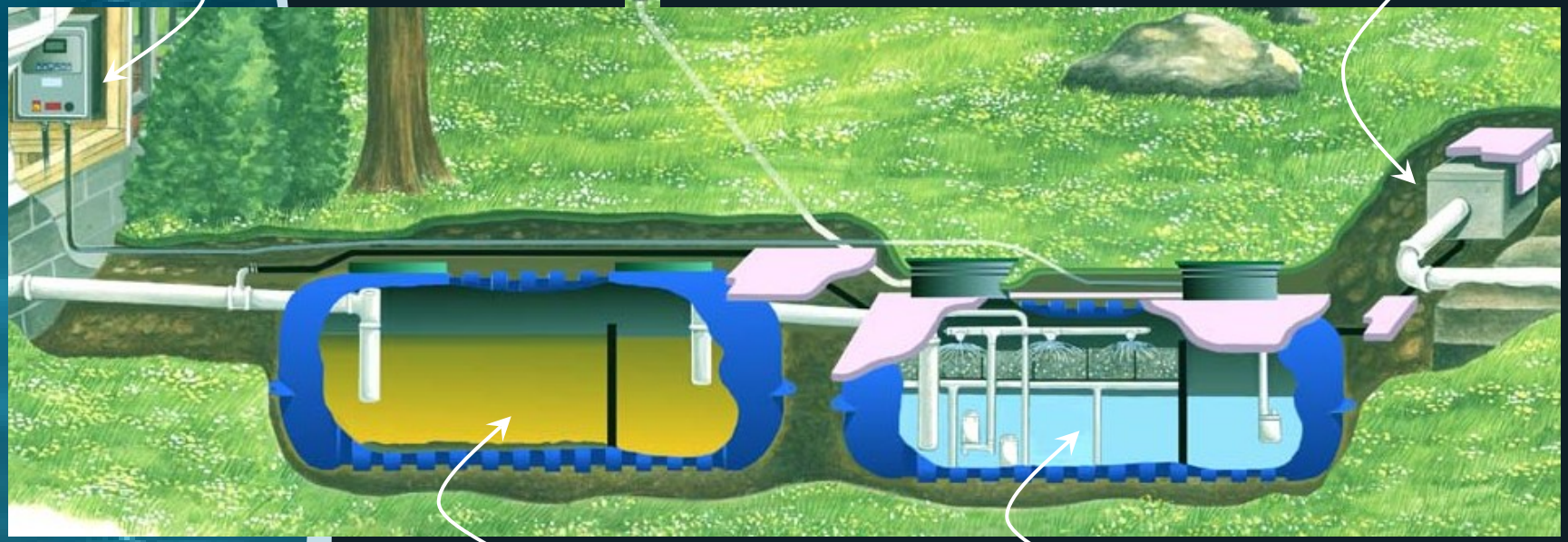
Recirculation Pump is dual function – sprays wastewater over treatment media & draws in outside air through use of Venturi

Return Pump sends sloughed solids back to head of primary septic tank & recycles nitrified wastewater to create anoxic conditions

Discharge Pump discharges treated wastewater to disposal field(s) up to 24 times a day

Control Panel monitors all activity in system & sends alarm conditions for any problems

Two tank Installation

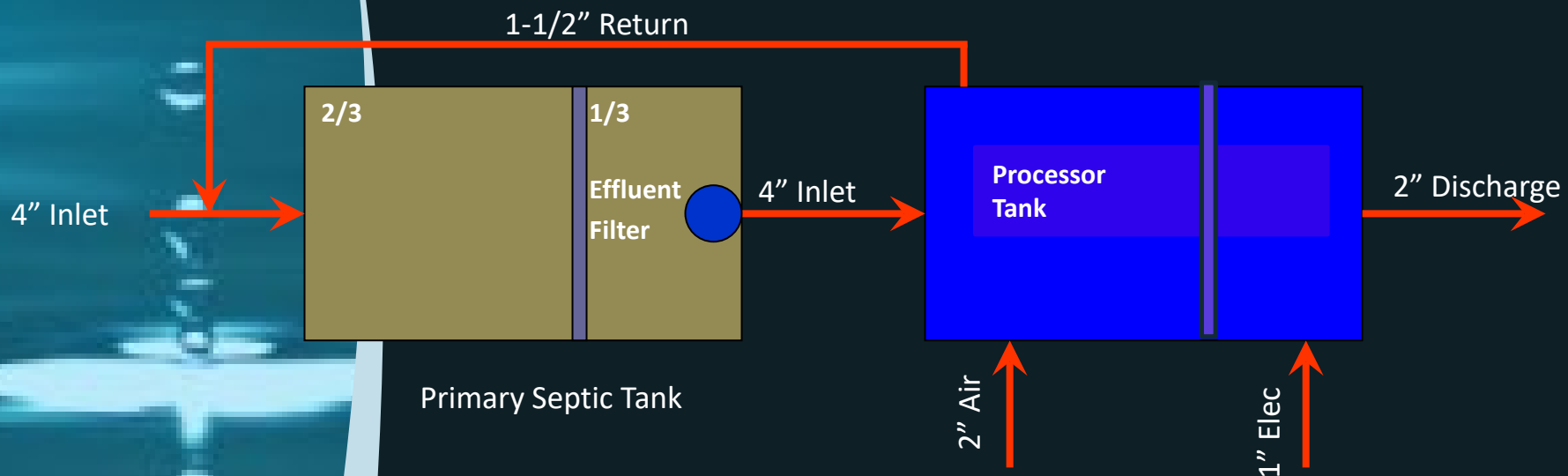


Residential System Overview

Primary Septic Tank
- ✓2 Compartment
- ✓Effluent Filter

Processor Tank
- ✓Polystyrene Bead Treatment Media
- ✓Self Cleaning Processor

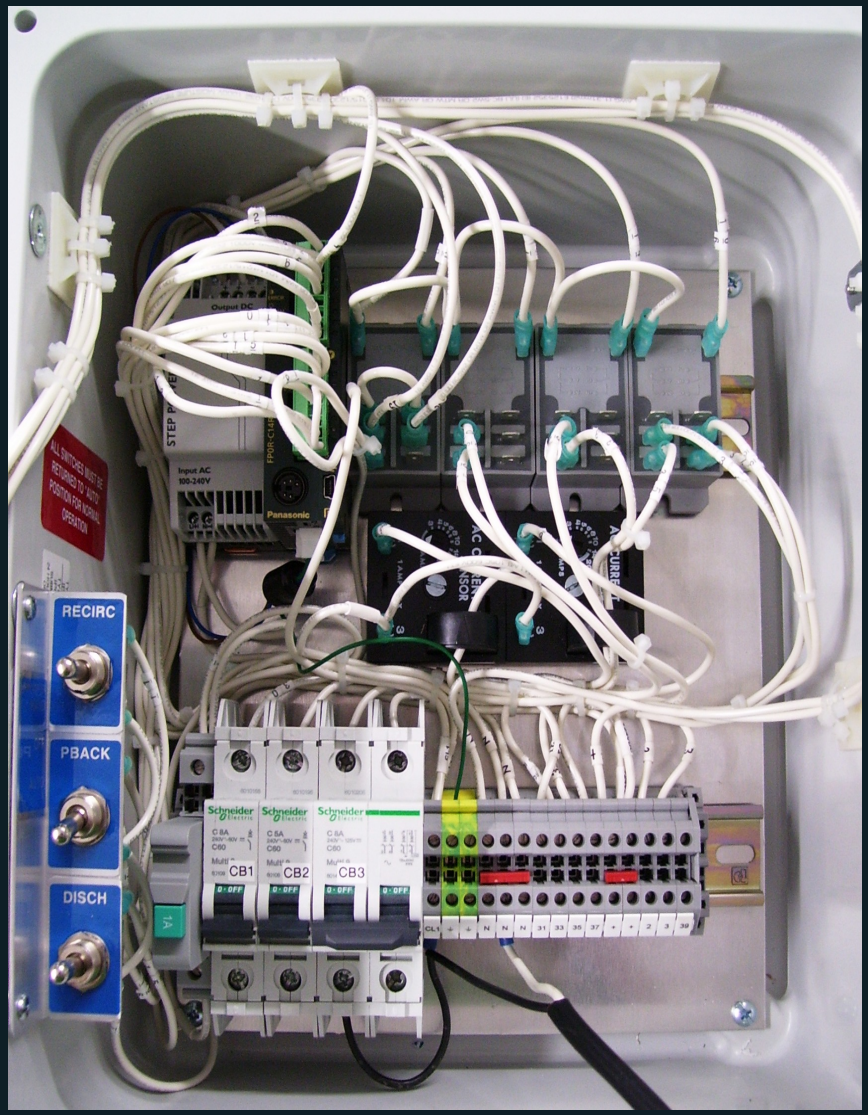
External Piping
- ✓Inlet / Discharge Line
- ✓Return Line
- ✓Air Intake
- ✓Electrical Conduit



Residential Treatment Media

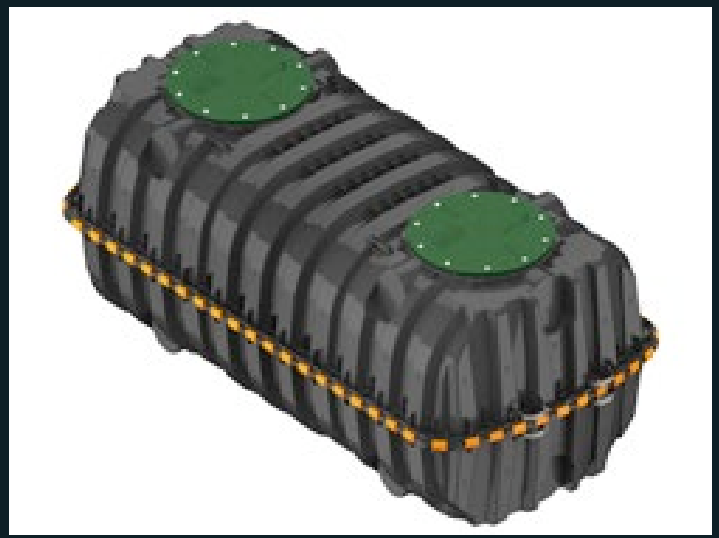
Residential Control Panel

- NEMA 4x Enclosure
- Audible / Visual Alarm
- Hand / Off / Auto Switches
- Removable OIT



Residential Processors

Processor Model	Bedrooms	Tank Capacity
500 gpd	4	1,060 Gallons
750 gpd	6	1,250 Gallons
1,000 gpd	8	1,500 Gallons



Residential System landscaped

Nitrogen Reducing Aerobic Treatment Units

- Are Effective at Removing 85% + of Nitrogen from Wastewater
- Must Have Anaerobic, Anoxic & Aerobic Environments to sequentially nitrify / denitrify wastewater
- Systems Must Fully Nitrify the Wastewater before Denitrification occurs
- Factors that Optimize Nitrification
  - Plenty of Air
  - Stable pH
  - Water Temperature above 50^{o}F
  - Sufficient Alkalinity to buffer system pH
  - Long Retention Times

Removing Nitrogen Biologically (Nitrification)

2-Step Process

Nitrosomonas spp.

$NH_4^+ \rightarrow NO_2^- + \text{energy}$

Nitrobacter spp., *Nitrospira* spp.

$NO_2^- \rightarrow NO_3^- + \text{energy}$

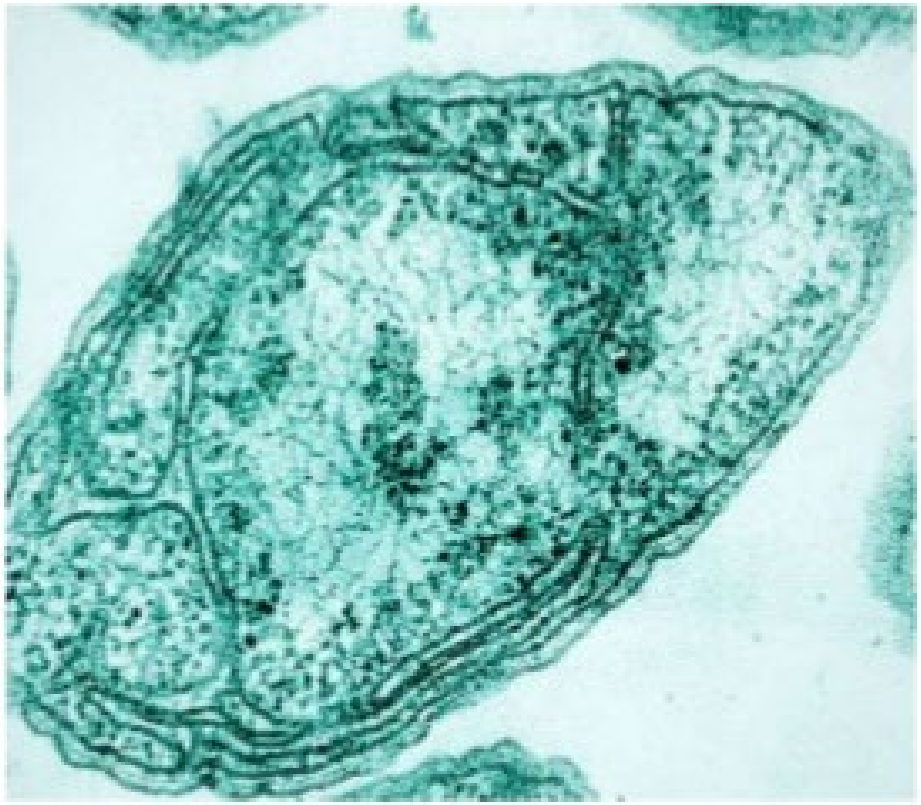
} Nitrifers Autotrophic

Overall Reaction

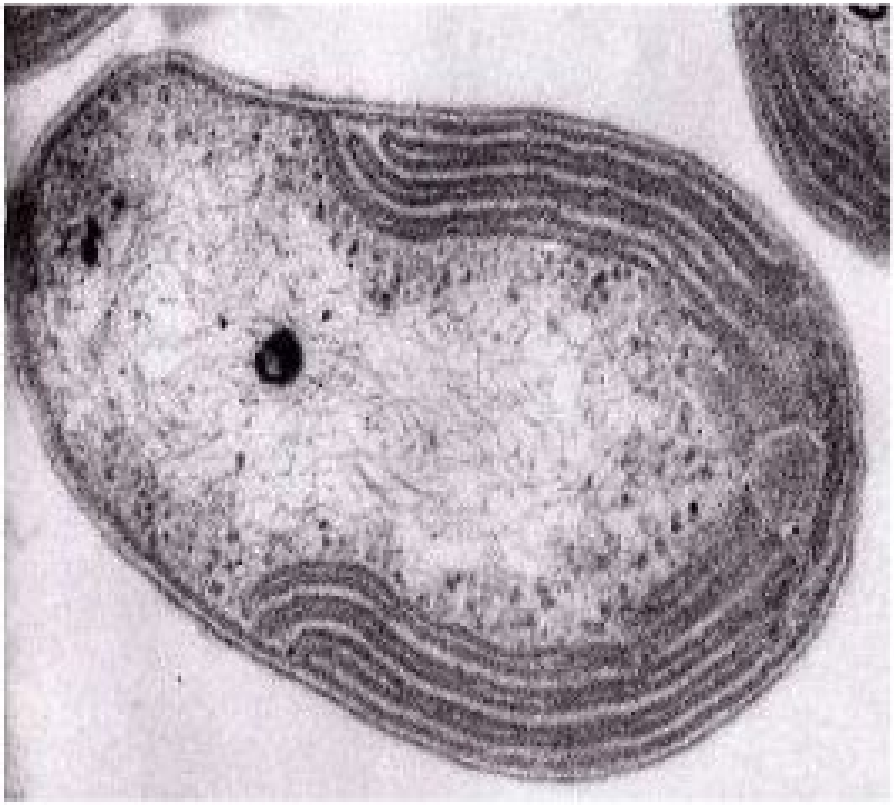
$$NH_4^+ + \boxed{2O_2} \rightarrow NO_3^- + \boxed{2H^+} + H_2O$$

- Requires Oxygen (4.6 lb/lbN)
- Uses up Alkalinity (7.1 lb/lbN)

Nitrifying bacteria



Nitrosomonas



Nitrobacter

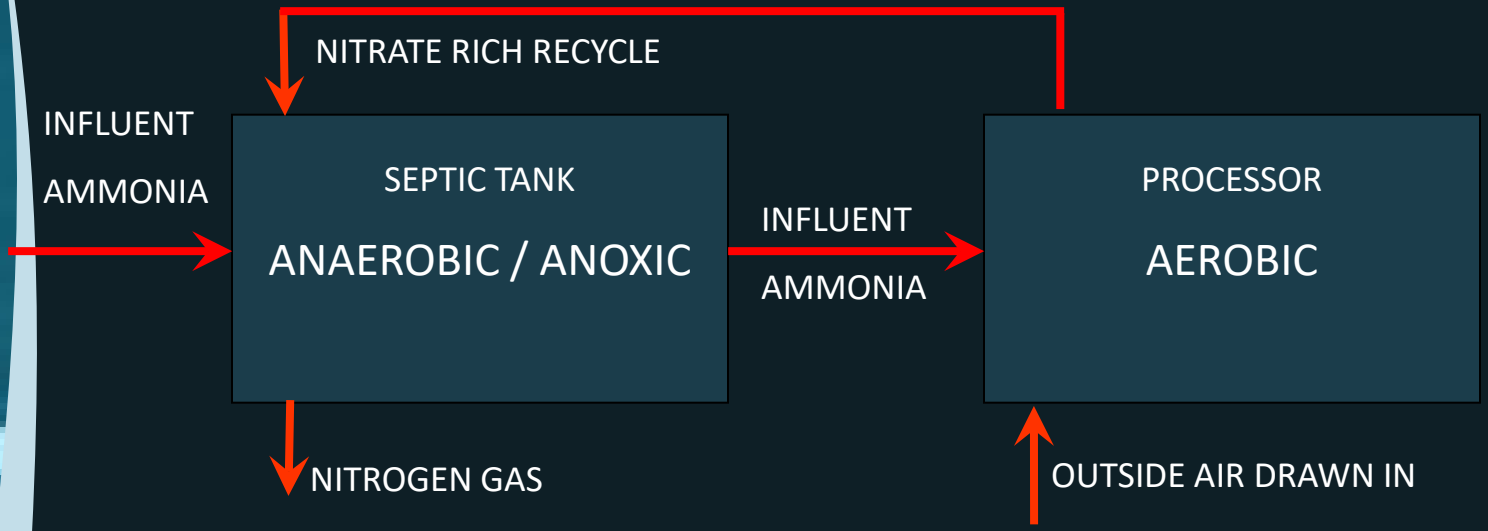
Nitrogen Removal Explained

Nitrification — The Conversion of Influent Ammonia to Nitrite →Nitrate

Denitrification — The Conversion of Nitrate to Nitrogen Gas:

Separating O_2 from NO_3 to Release N_2 (Gas)

"You Must Nitrify Before You Can Denitrify"



Operation & Maintenance

- Onsite Visual Inspection of All System Components
  - Tank, pumps, float switches, control panel, telemetry and audio/visual alarm
  - Visual inspection of electrical splices and contacts, check/record amperage and voltage readings
  - Visual inspection of filter media
  - Exercise all mechanical valves
- Sensory examination of treated effluent for clarity, odor, oily sheen, foaming or any other unusual characteristics
- Download flow data – 90 days of flow stored in PLC
- Maintain inspection log with entries for all service activities, observations, and field test readings.

Operation & Maintenance