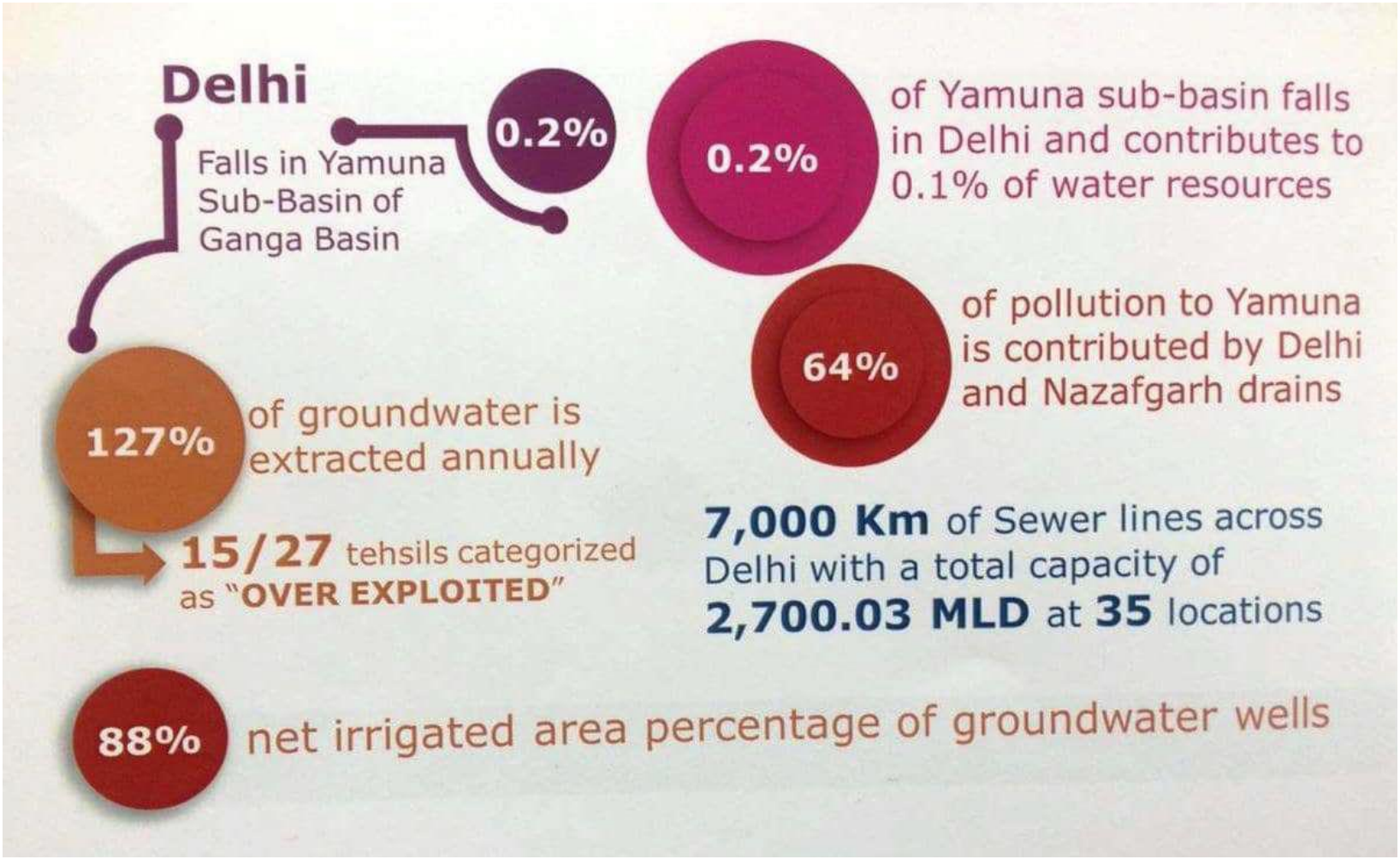
# Wastewater Management: An Alternate Approach

# Break-up of Delhi's Water & it's Pollution




About 80% of water used by community becomes wastewater, which unless properly collected, conveyed, treated and properly disposed off, may eventually pollute our precious water resources and cause environmental degradation

CONFLUENCE OF THE SUNHERI NALA WITH THE KHUSHAK NALA

SUNHERI NALA FROM LODHI ROAD AND THE LAJPAT NAGAR DRAIN

The open storm water channels or ‘Nalas’ as they are referred to, carry all excess storm water runoff from the city to the river.

During the non-monsoon seasons, the Nalas presently carry untreated domestic waste – which makes them foul smelling and dirty.

The city dumps some solid wastes into these uncared for wasted spaces, which further compounds the problem.

Is this siltation by any chance?

If so then what are we planning to do about it?

Is the cunnette wall increased every season or this is something else?

# Wastewater Drain as a Greenway

- Storm-water and sewage are potentially valuable resource natural resource that should be used to replenish our aquifers, rivers, streams and lakes as well as other on-site beneficial uses instead of being quickly discharged as a waste.

# Guiding Principles

- Reverting back to natural purification processes (e.g., wetlands)
- Reduce the velocity for removal of sediments
- Maximize aeration and engineer the symbiotic relationship between microorganisms and plants
- LOW maintenance and NO external energy processes
- Use of natural gradient/ NO pumping

# Levels of Treatment

## Primary

removal by physical separation of grit and large objects (material to landfill for disposal)

## Secondary

Mostly dead microbes

aerobic microbiological process (sludge)

organic matter + $O_2$ → $CO_2$ + $NH_3$ + $H_2O$

$NH_3$ → $NO_3^-$ ← aquatic nutrient

# Levels of Treatment continued

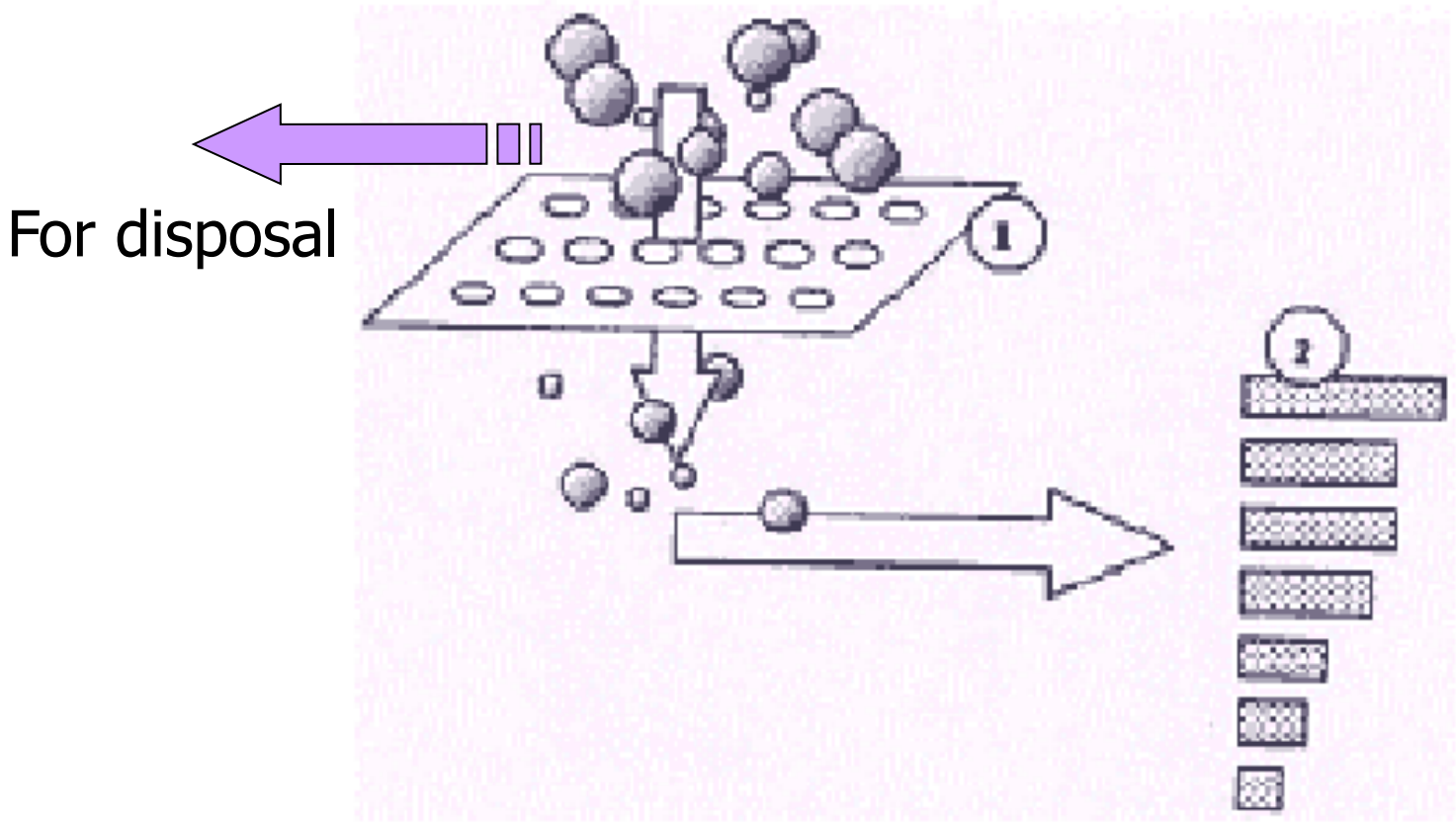
## Tertiary (advanced)

anoxic microbiological process with a different microbe

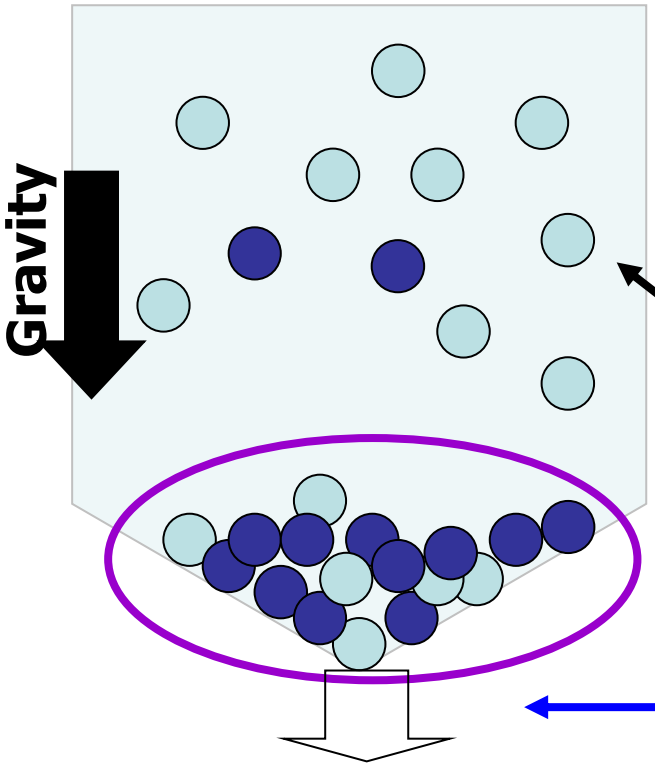
$NO_3^- \rightarrow N_2$ (escapes to atmosphere)

aeration to strip $N_2$ and re-oxygenate (add DO)

# Screening



# Primary Sedimentation

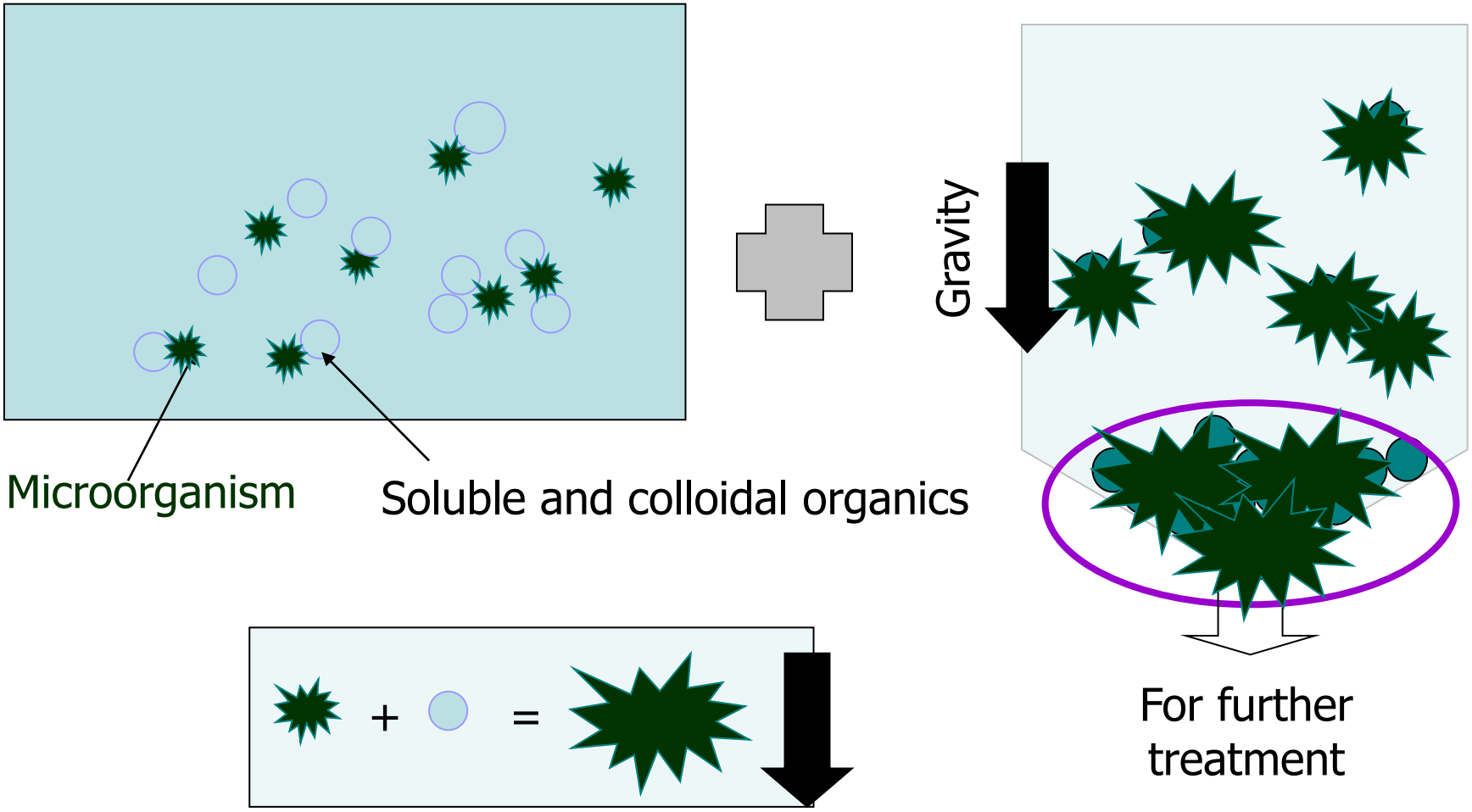



**Sedimentation** is the gravity setting, and thus removal, of materials more dense than a suspending fluid.

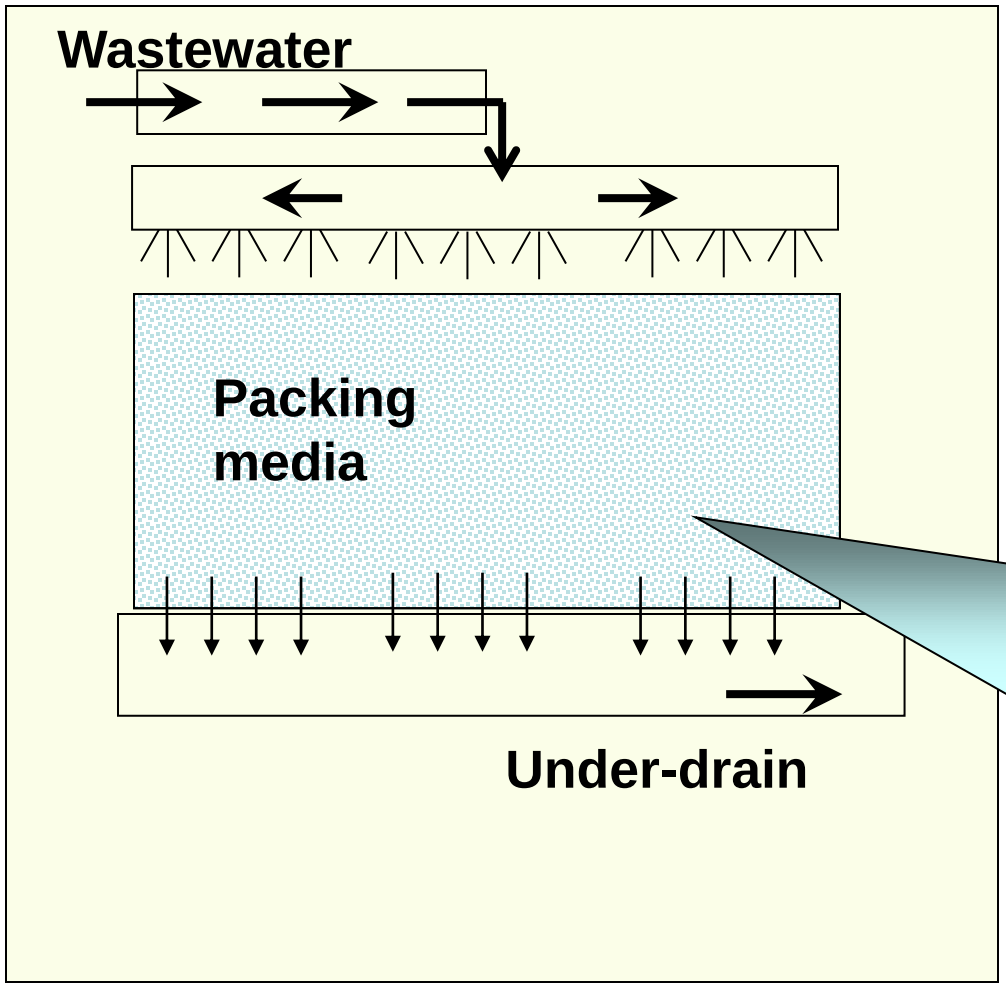
Organic matter, grit, clay, sand, and bacteria

Primary sedimentation – Remove about 1/3 $BOD_5$ and 2/3 Suspended Solids

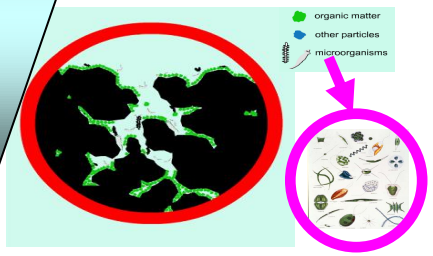
# Biological Treatment

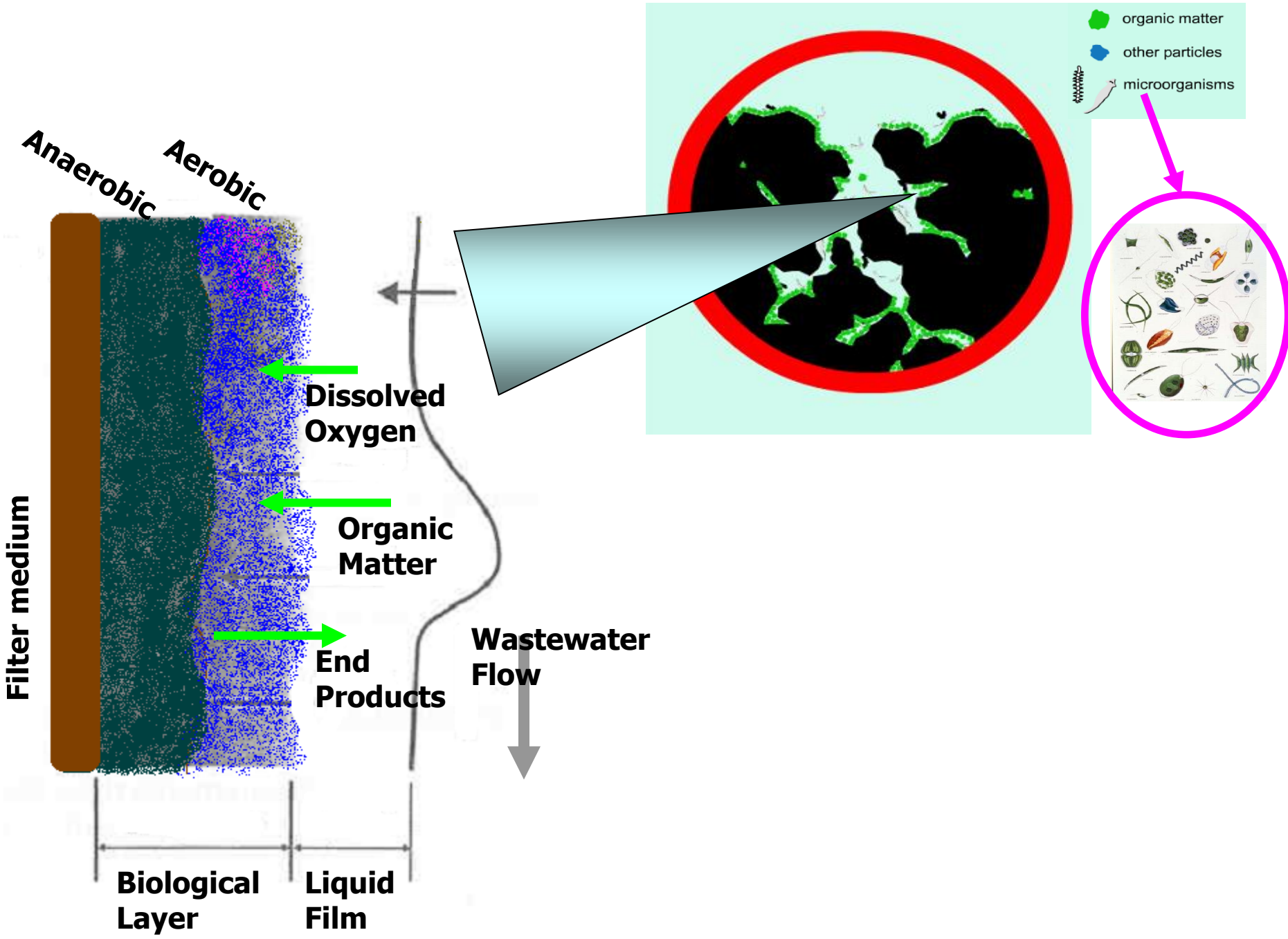


# Trickling Filter

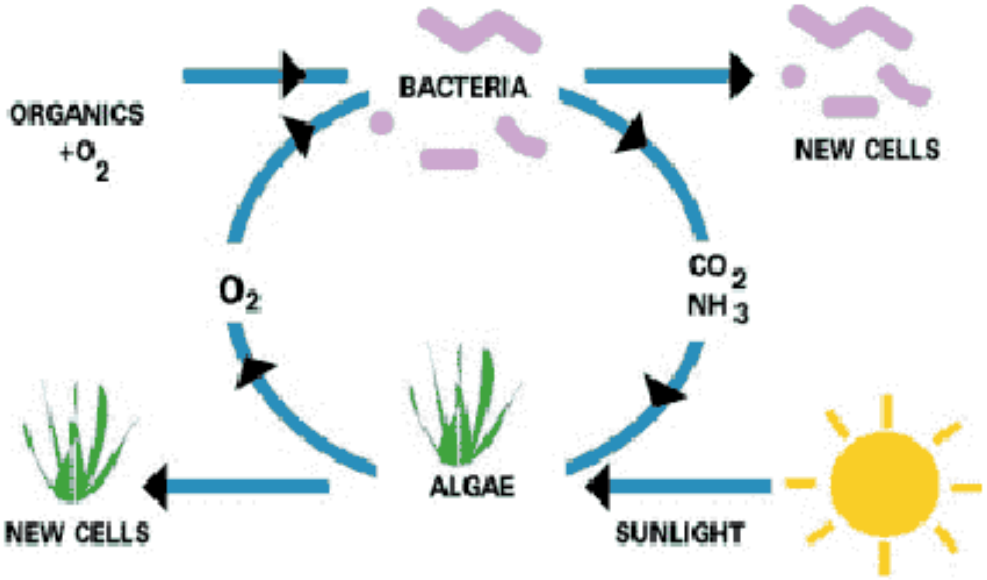



- TF consists of:
  - An arrangement that sprays wastewater over a filter medium.
  - Filter medium: rocks, plastic, or other material.
- The water is collected at the bottom of the filter for further treatment.

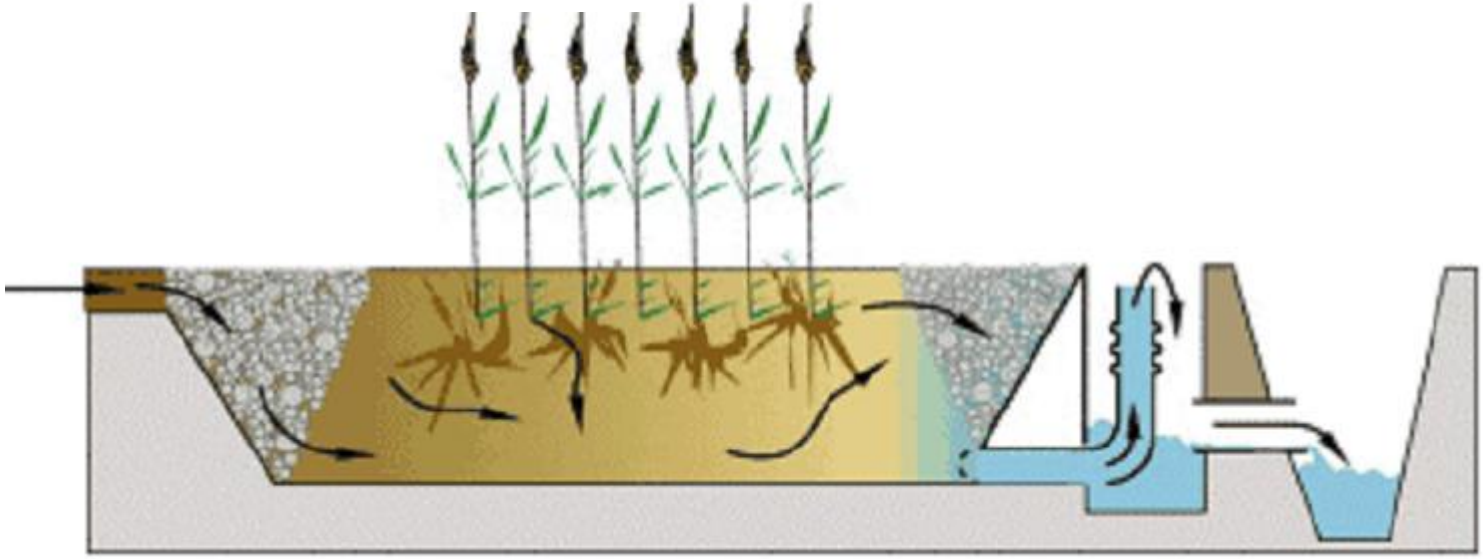



organic matter
other particles
microorganisms
Anaerobic
Aerobic
Filter medium
Dissolved Oxygen
Organic Matter
End Products
Wastewater Flow
Biological Layer
Liquid Film

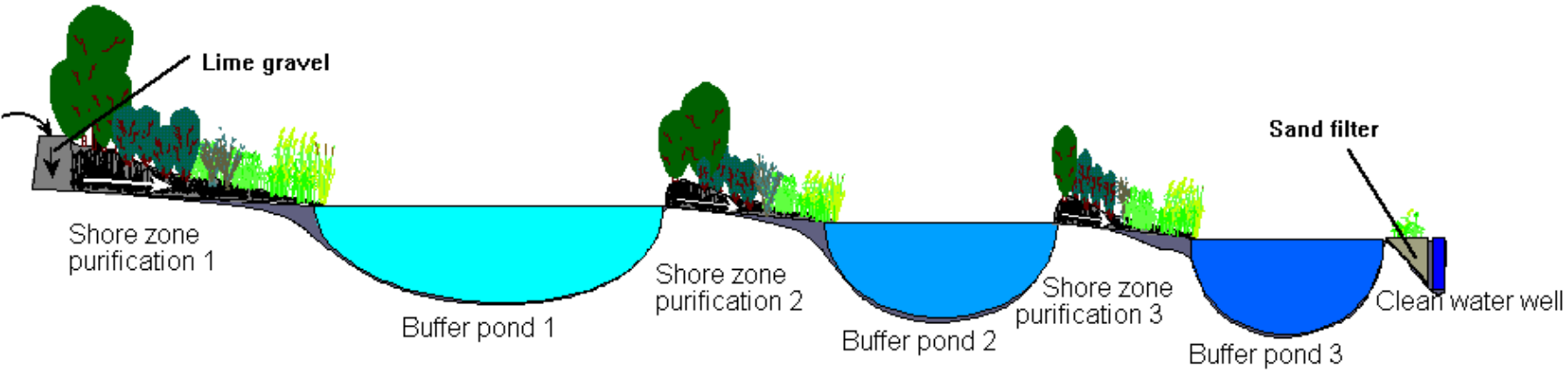
# Wetland systems

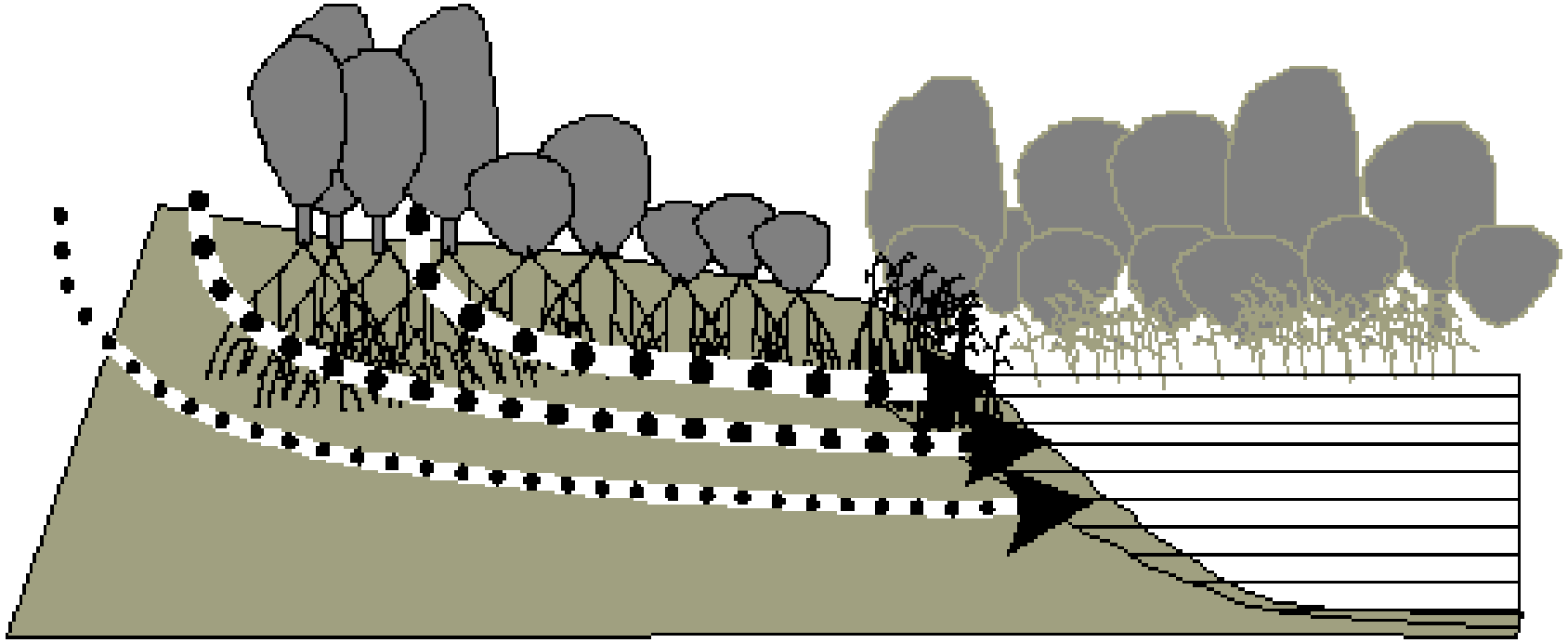



Symbiotic relationship between bacteria and algae in a wastewater

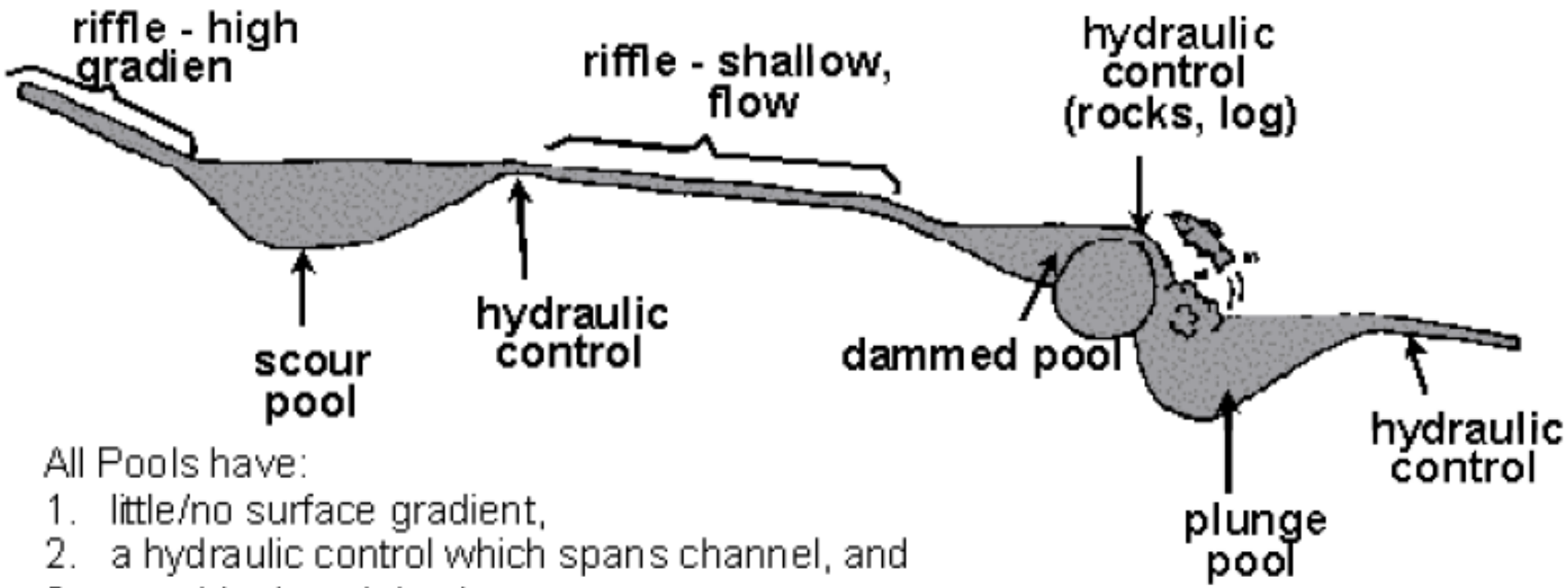


# Continuous Pool and Filtration System



## Basic characteristics of a pool/riffle system

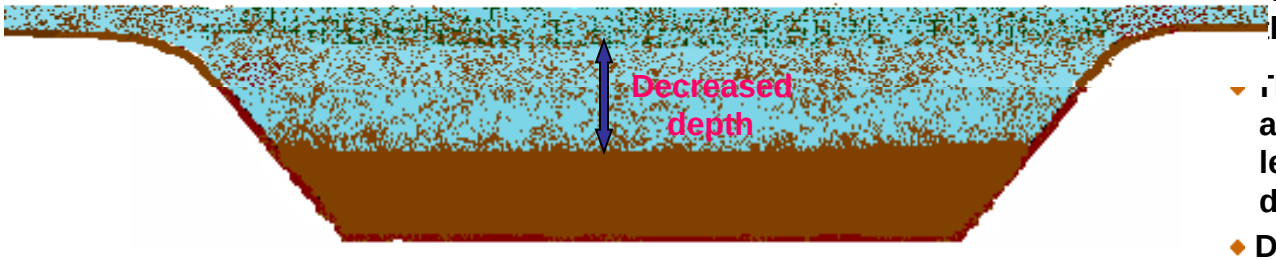



All Pools have:

1. little/no surface gradient,
2. a hydraulic control which spans channel, and
3. a residual pool depth.

# CHOOSING DRAIN CROSS-SECTIONAL SHAPE

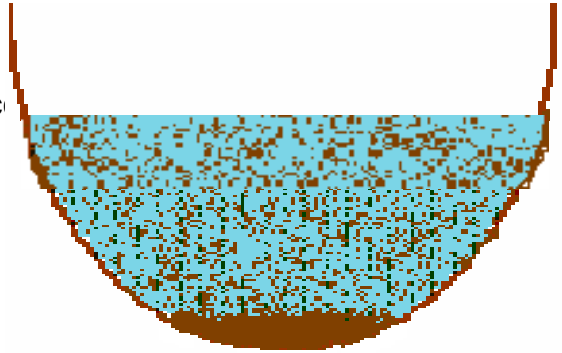
## Trapezoidal Section ✗



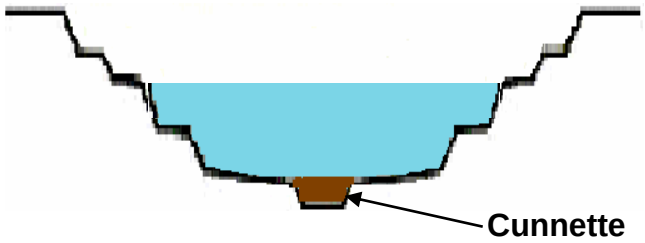

- With time the incoming sediment load in the drain starts settling at the bottom.
- The settled sediments obstruct the flow and causes further settling which in turn leads to decreased depth and hence decreased cross-section of the drain
- Drain bank gets eroded and leads to overflow and hence flooding conditions

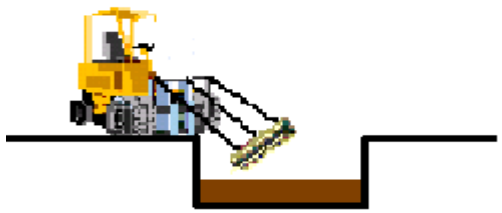
## Parabolic Section ✗

- The sediment load settles at the bottom but does not obstruct the flow and henc the desired self cleansing velocity is maintained in the drain
- Hence, an 'IDEAL SECTION' but will be modified for practical purpose



## Stepped Section ✓



- Parabolic section is modified by introducing some steps and will be used in-situ
- The silting occurs in the cunnette of the drain. The stepped portions of the drain accommodate the resultant increased level of flow
- It can also carry the excess or the flood flows very efficiently minimizing the flood occurring probability
- Desilting basins will be provided at every 1 km length of the drain and manual/mechanical cleaning of the silt settled will be done frequently

Can we revert back to natural purification systems?

CONFLUENCE OF THE DEF. COL. DRAIN WITH THE DRAIN COMING FROM NDMC AREA – KHUSHAK NALA

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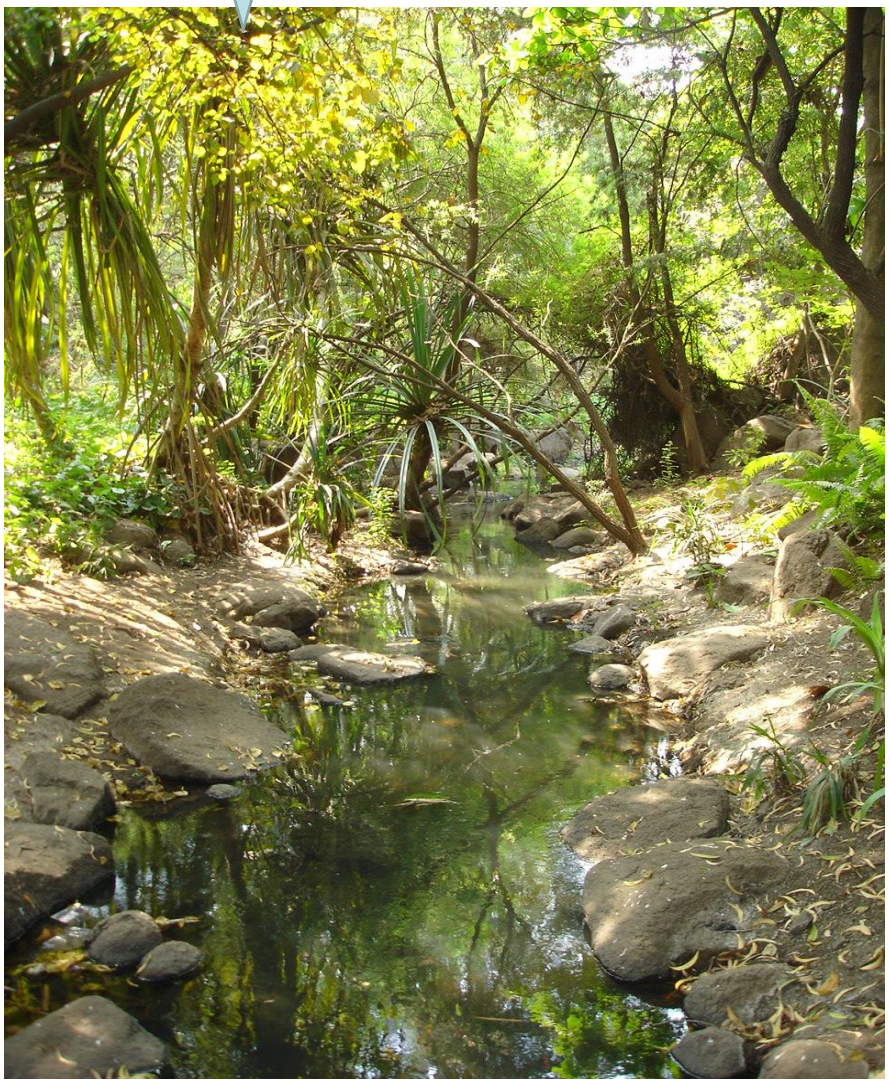
- Maximize aeration and engineer the symbiotic relationship between microorganisms and plants



Thank You!