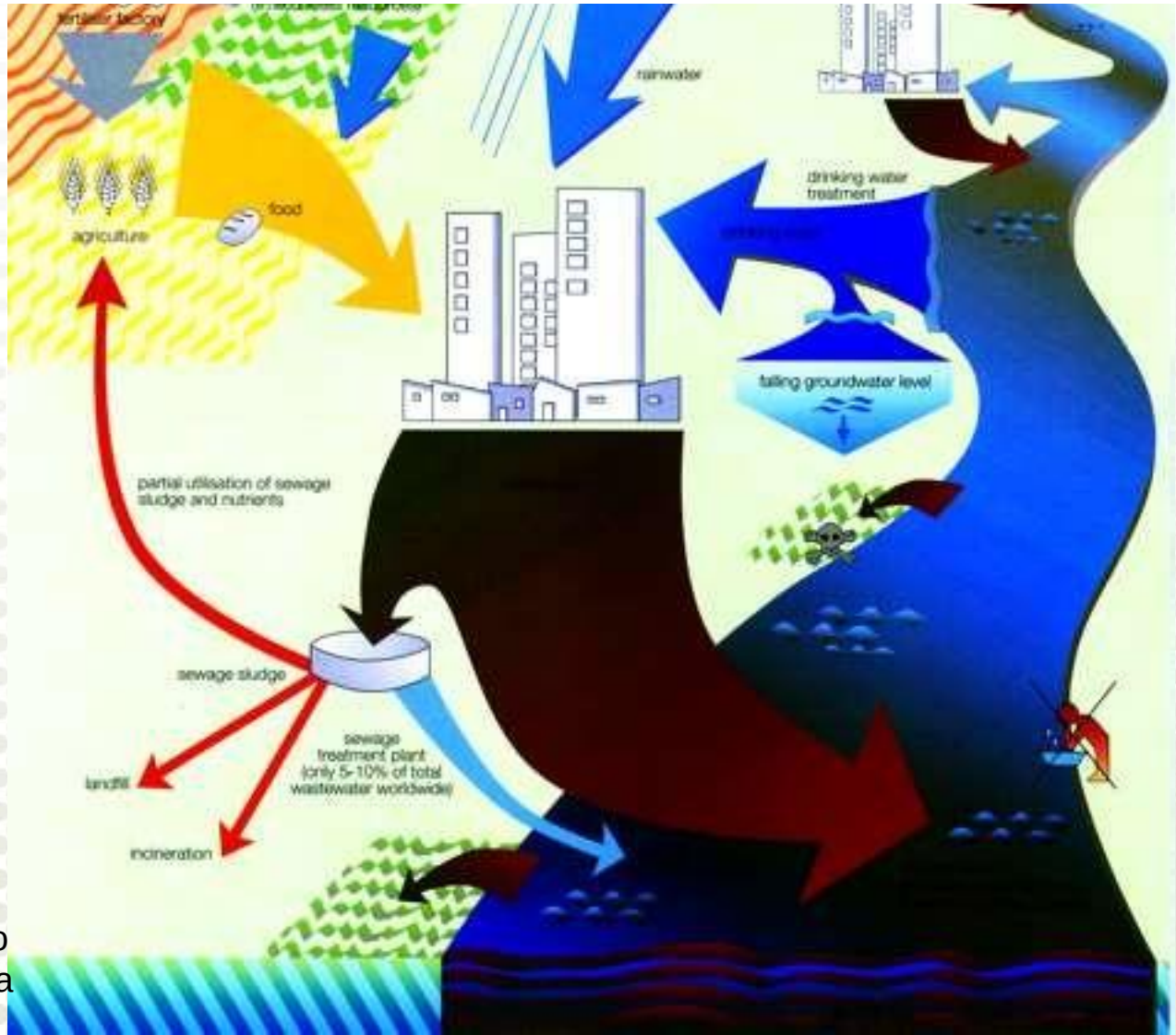
Water treatment processes

90% of the worlds wastewater does not receive any treatment (Corcoran et al. 2010)



Department o
Environmenta

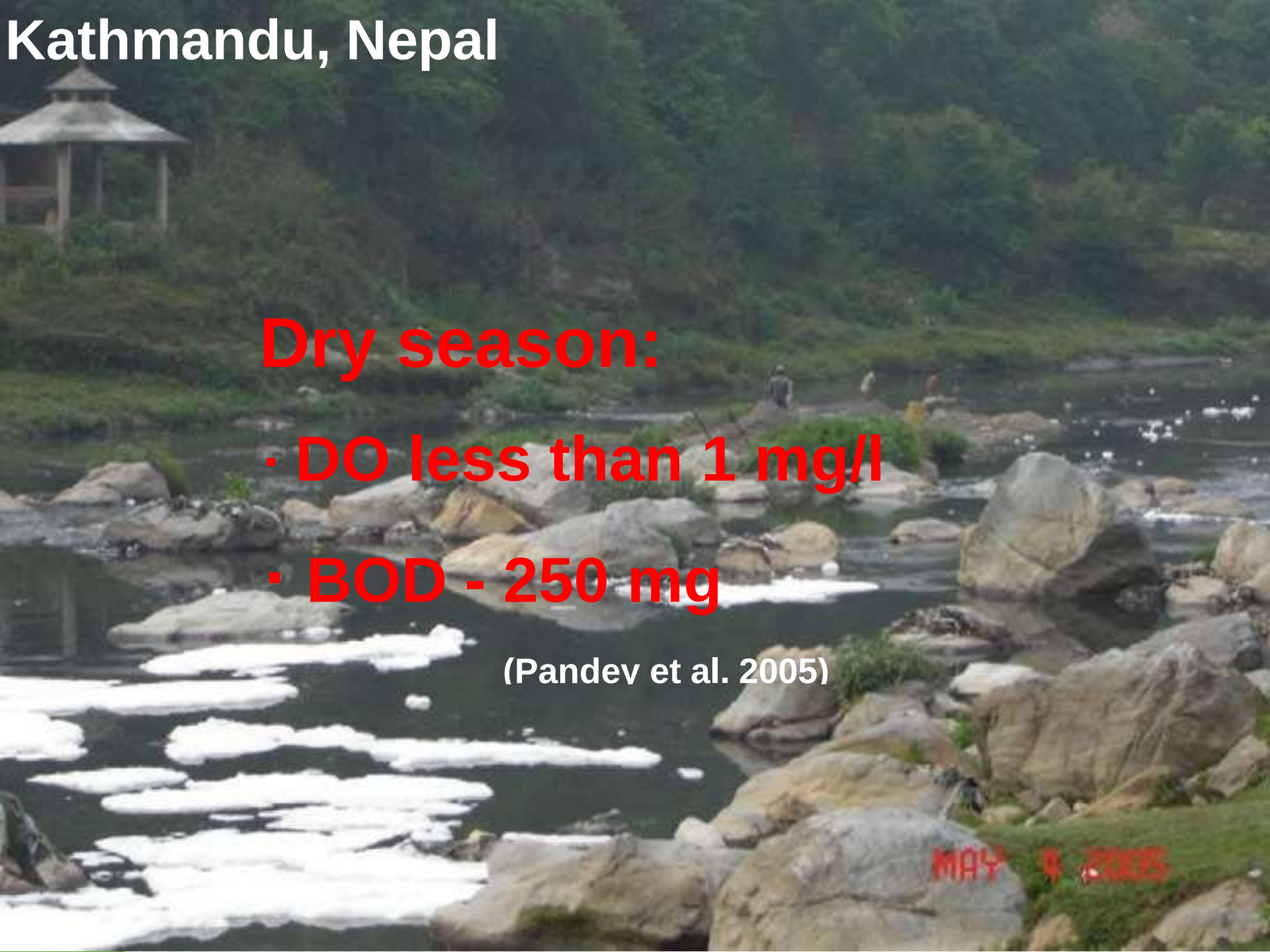
Phosphorus is the major agent triggering eutrophication (algeal blooms) in freshwaters

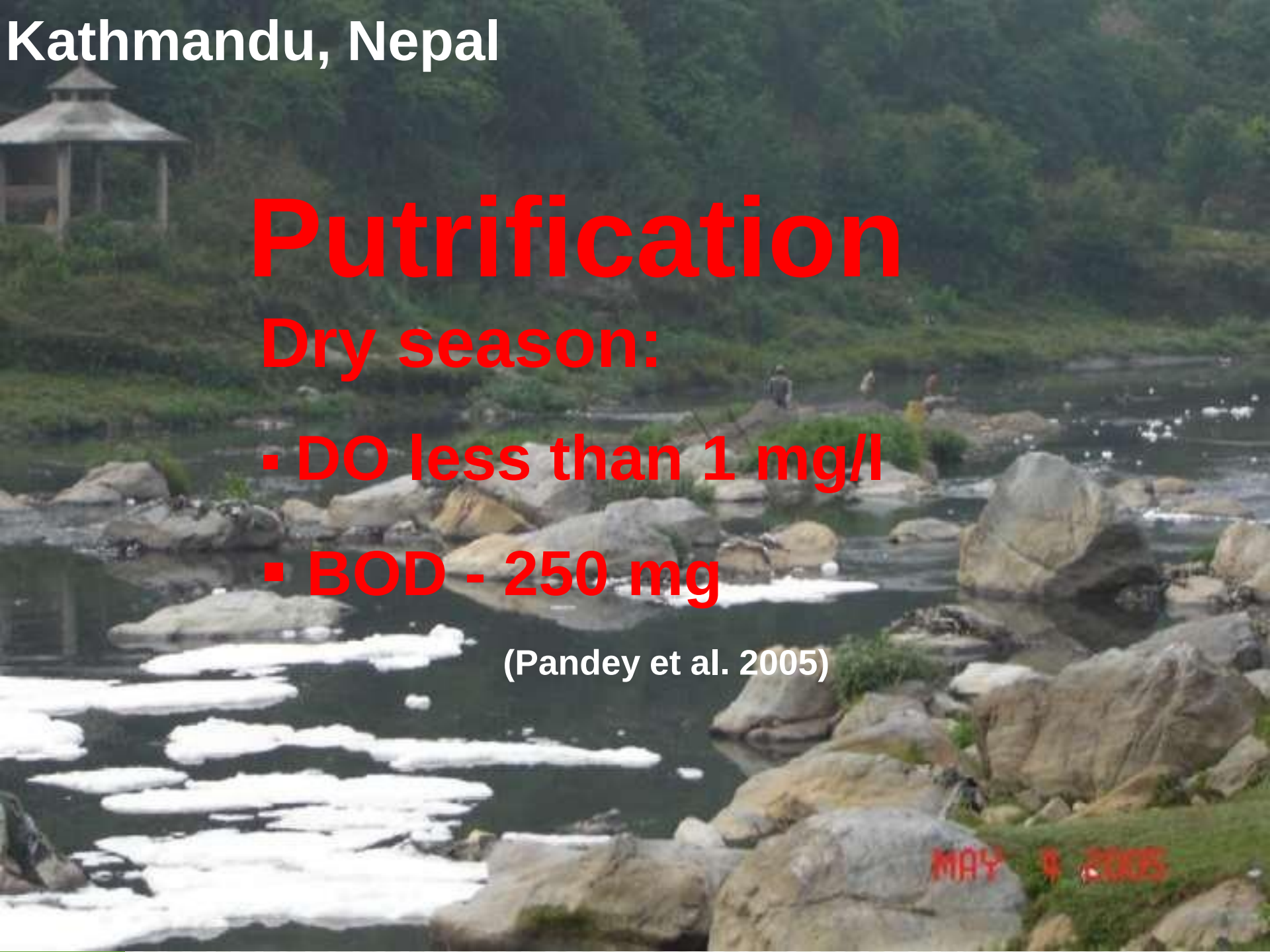
The North Sea

Nitrogen is considered the main element triggering eutrophication in saltwater

Photo: R. Gjørven

www.umb.no


Kathmandu, Nepal
Dry season:
· DO less than 1 mg/l
· BOD - 250 mg
(Pandev et al. 2005)


Kathmandu, Nepal
Putrification
Dry season:
▪ DO less than 1 mg/l
▪ BOD - 250 mg
(Pandey et al. 2005)

Wastewater treatment -
removal parameters

The objectives of sewage treatment will always include the reduction of the concentration of at least one of the below constituents:

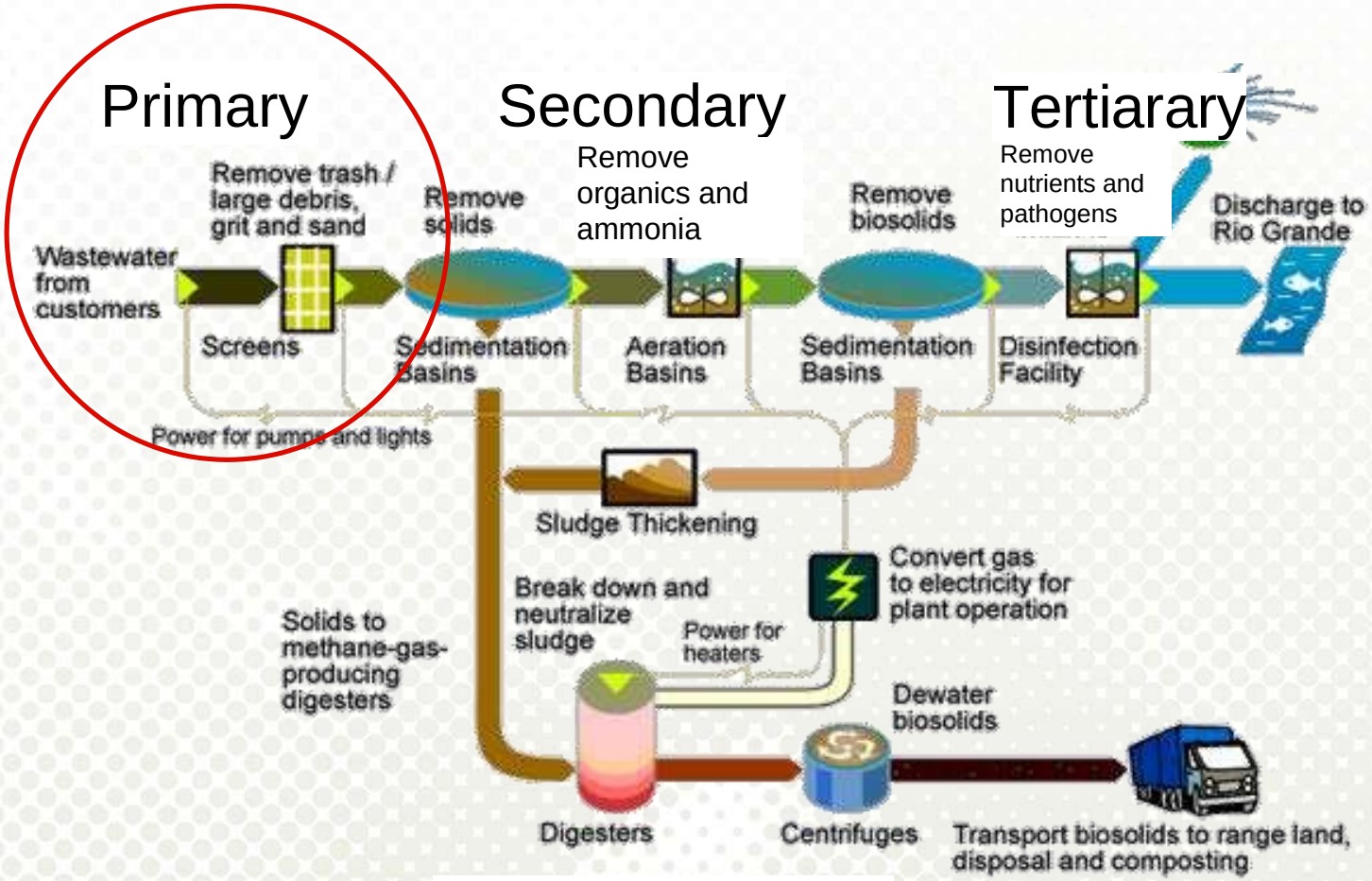
- Suspended solids;
- Organic (biodegradable) material;
- Nutrients (nitrogen and phosphorous);
- Pathogenic organisms (expressed as E. Coli)
- Medicine residues, organic chemicals (POP´s)
- Heavy metals

Methods of Removal

The contaminants in wastewater are removed by different **unit processes**:

- Physical (sedimetation, flotation, screening, filtration)
- Biological (trickling filters, RBC, activated sludge)
- Chemical (chemical precipitation, ozonation, chlorination)

Wastewater Treatment – Processes



Sludge treatment

Methods of Removal

Physical Unit Processes (mainly primary)

Treatment methods in which the application of physical forces predominates are known as physical unit operations. Typical unit operations are:

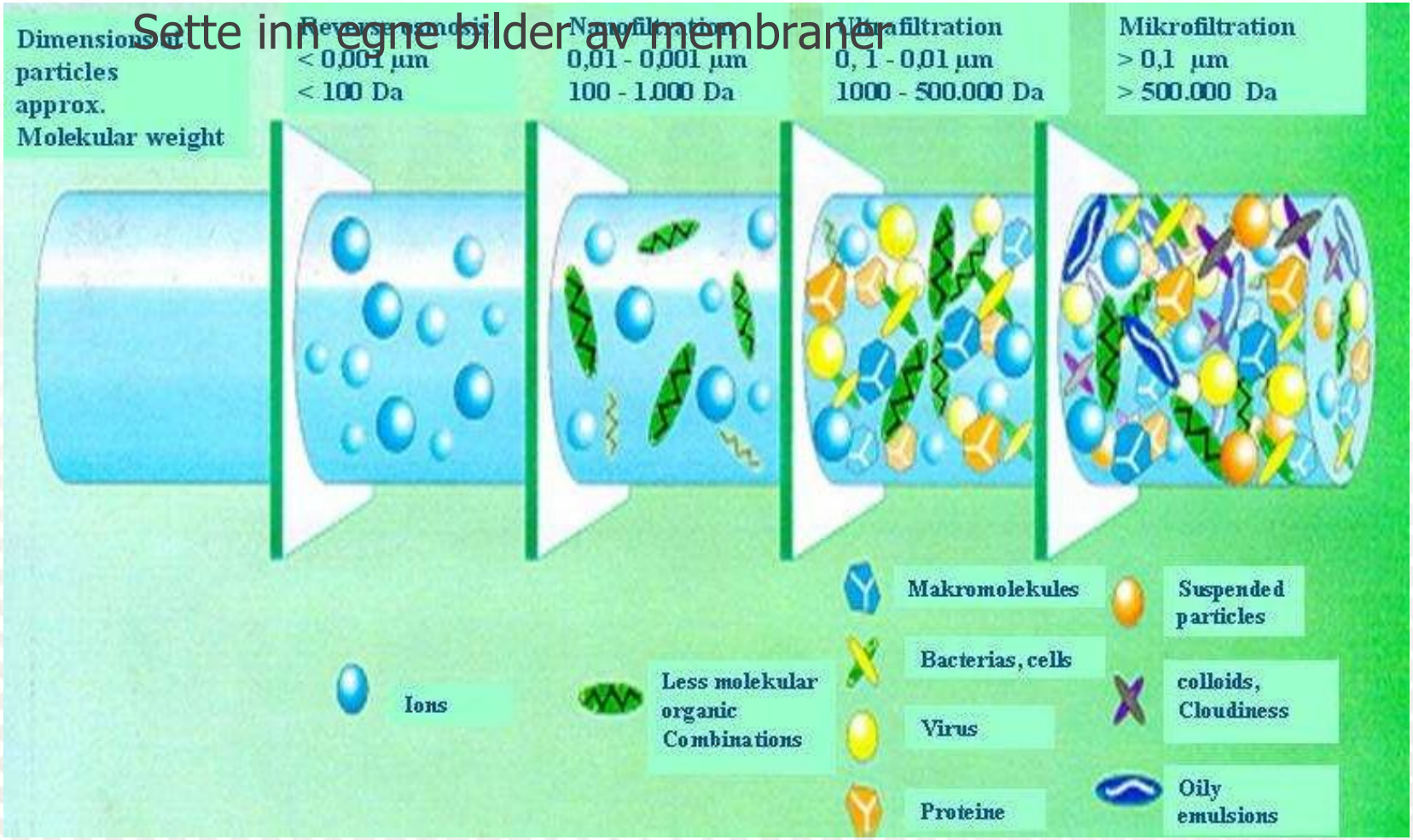
- Screening
- Sedimentation
- Floatation
- Membrane filtration* (< 1um)

*Tertiary treatment

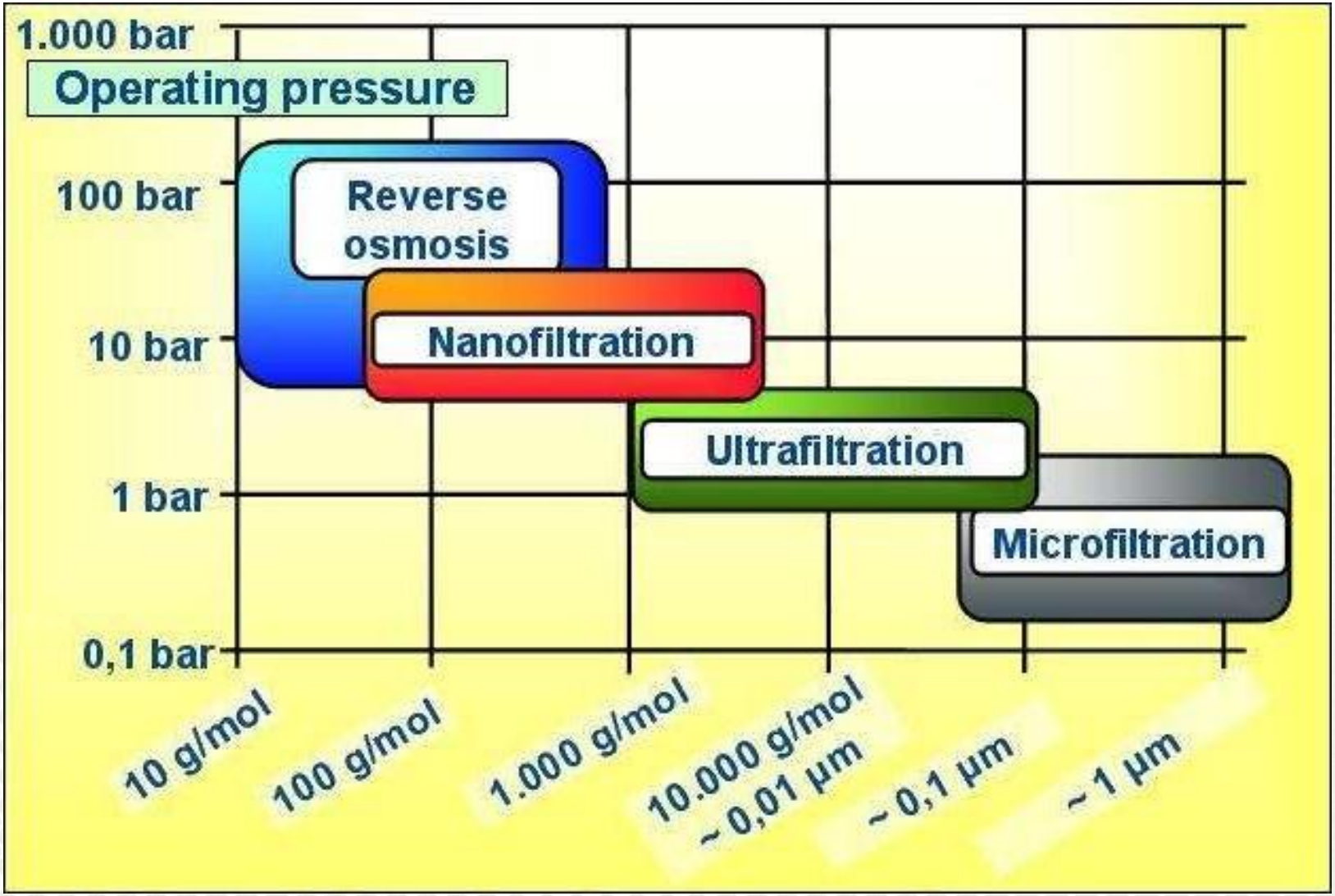
Salsnes filter

Membrane Filter Technology (tertiary)

Sette inn egne bilder av membraner



Membrane Filter Technology

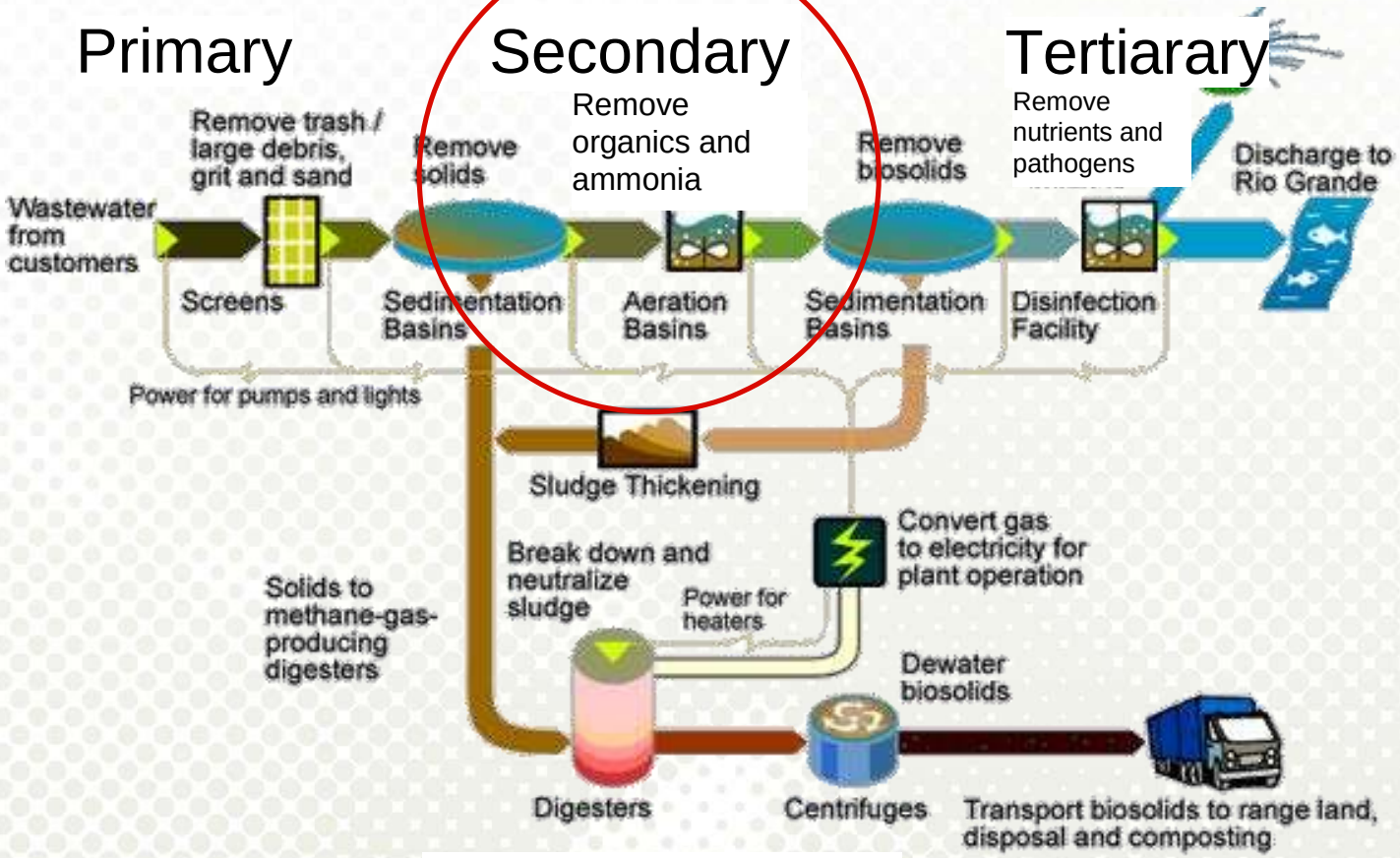


Malthe Winje

Naandi

Just Water

Wastewater Treatment – Processes



Sludge treatment

Methods of Removal (Contd.)

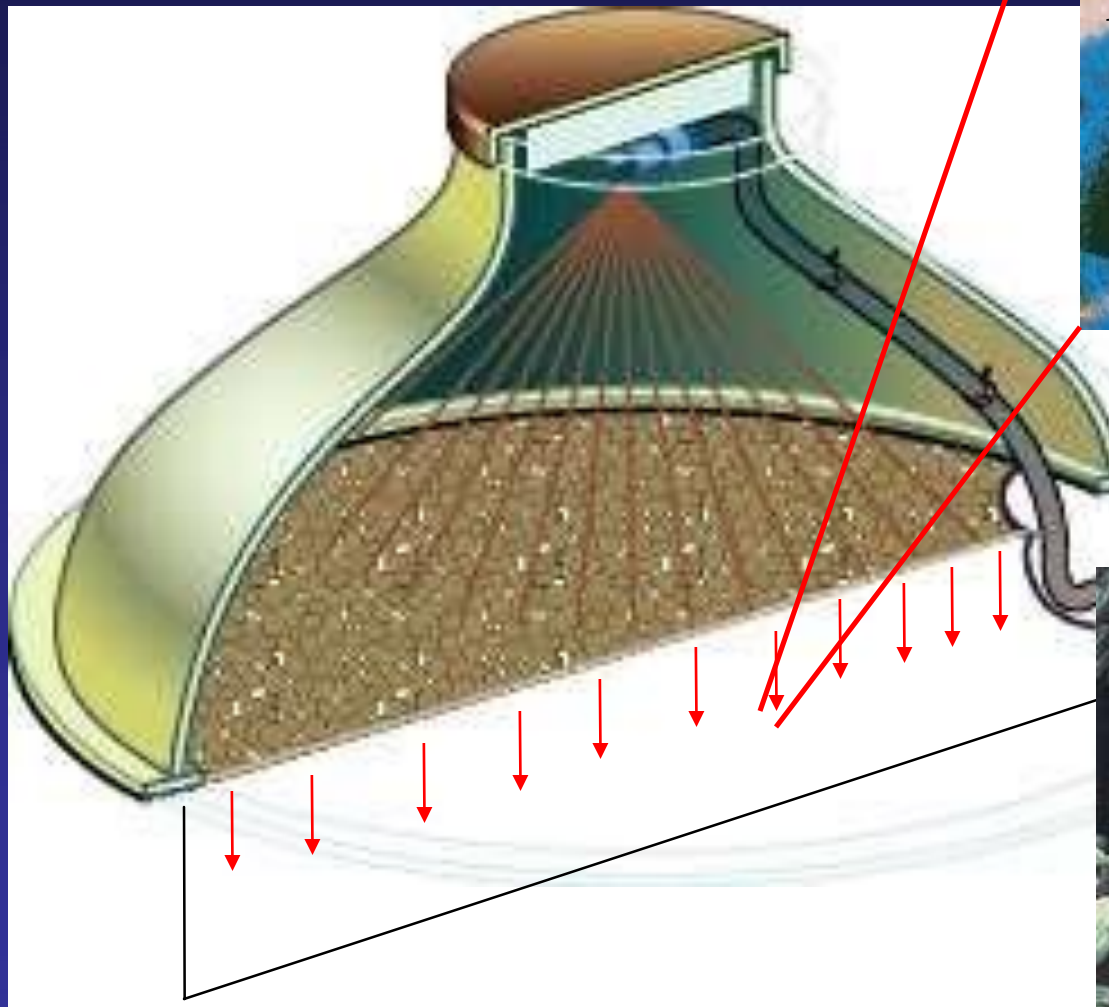
Biological Unit Processes (mainly secondary)

The treatment method in which the removal of contaminants is brought about by biological activity are known as biological unit process. Some examples are:

- aerobic processes - presence of dissolved oxygen
  - Biofilters
  - Trickling filters
  - Activated sludge
- anaerobic processes – absence of dissolved oxygen
  - Denitrification (tertiary)
  - Septic tanks
  - Ponds

Biofilter

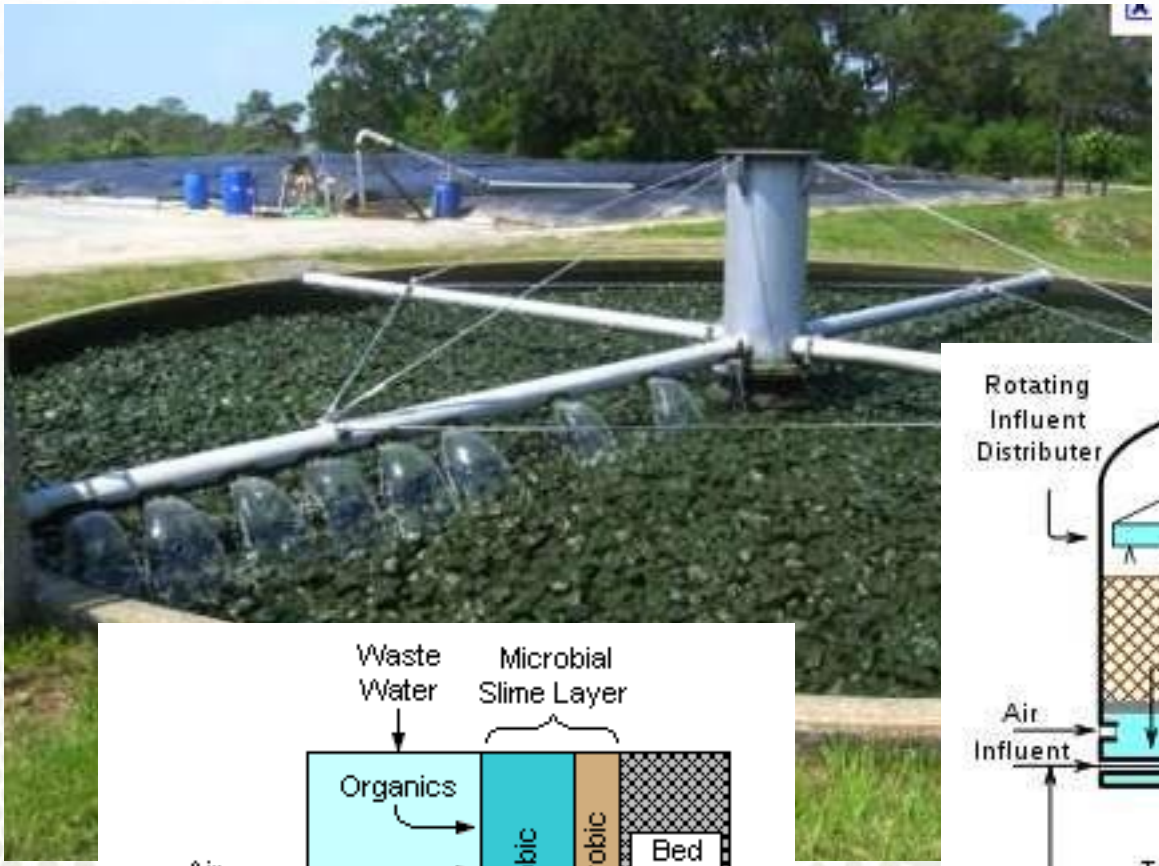
Porous media

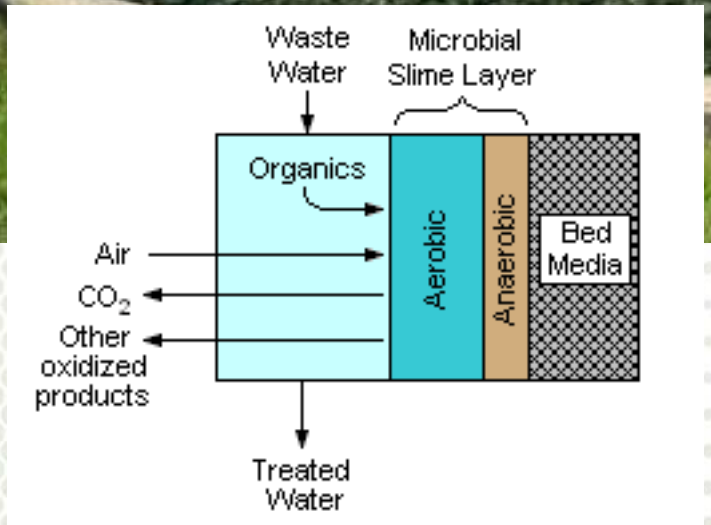


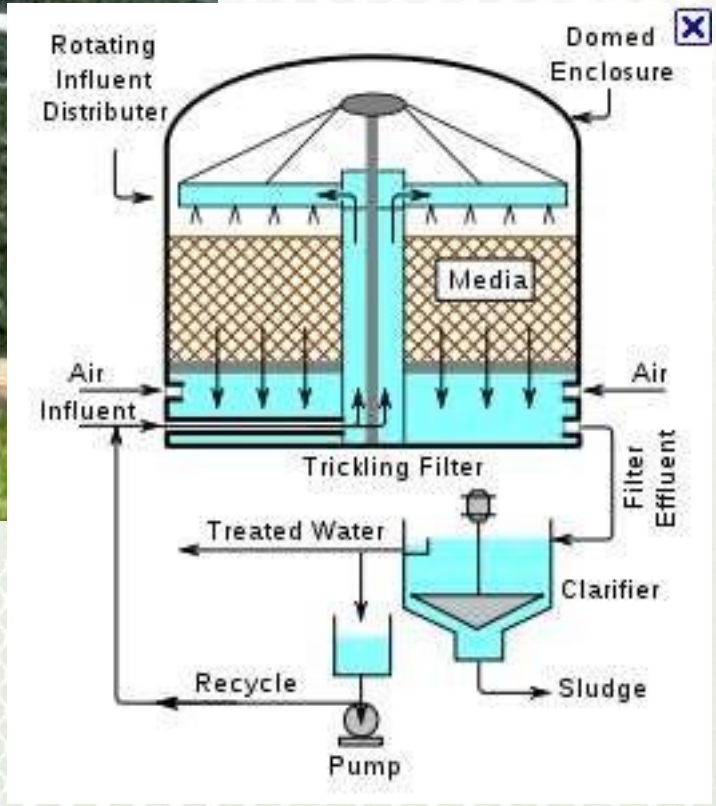
Surface area
> 5000m^2/m^3

Wastewater spraying over a biofilter

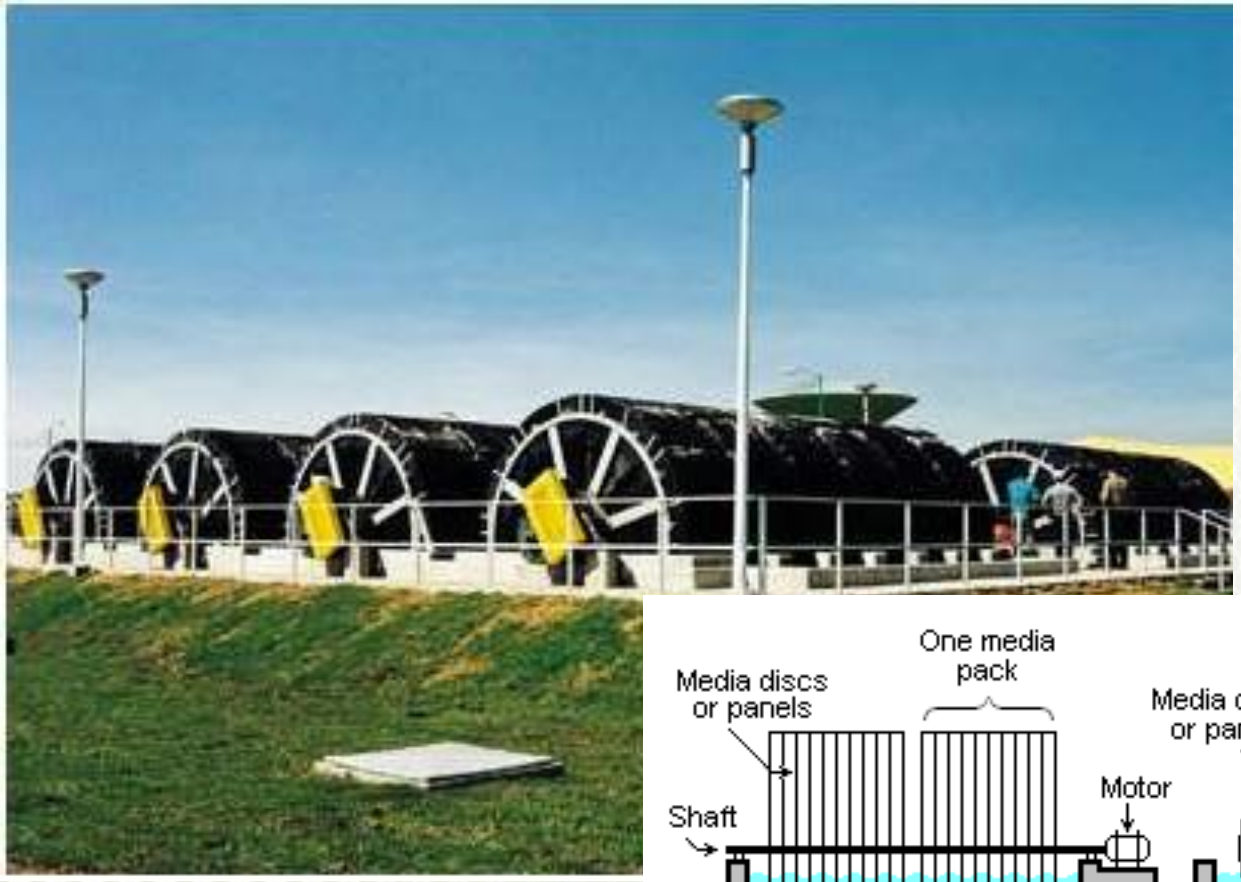
Biofilter: trickling filter (fixed biofilm)

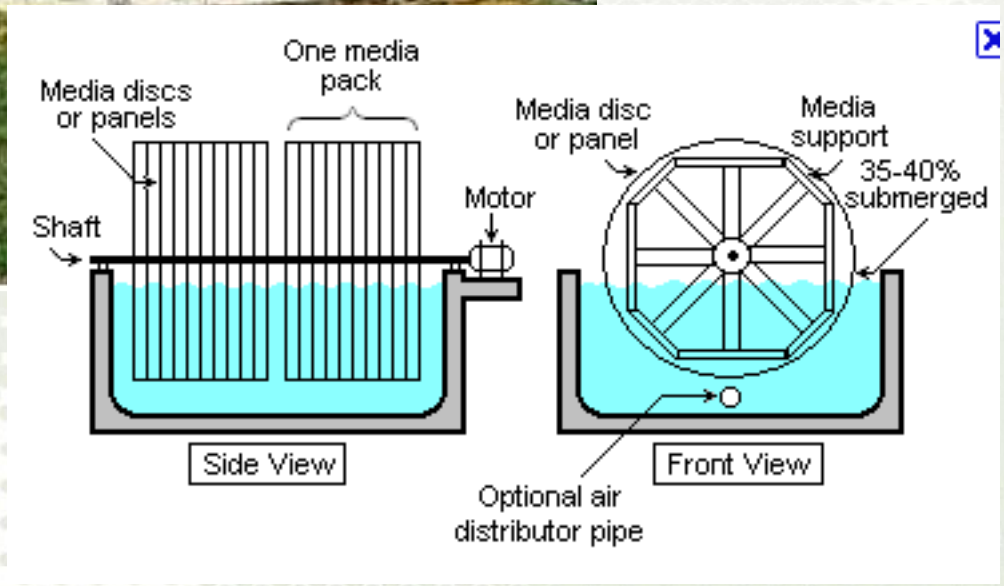




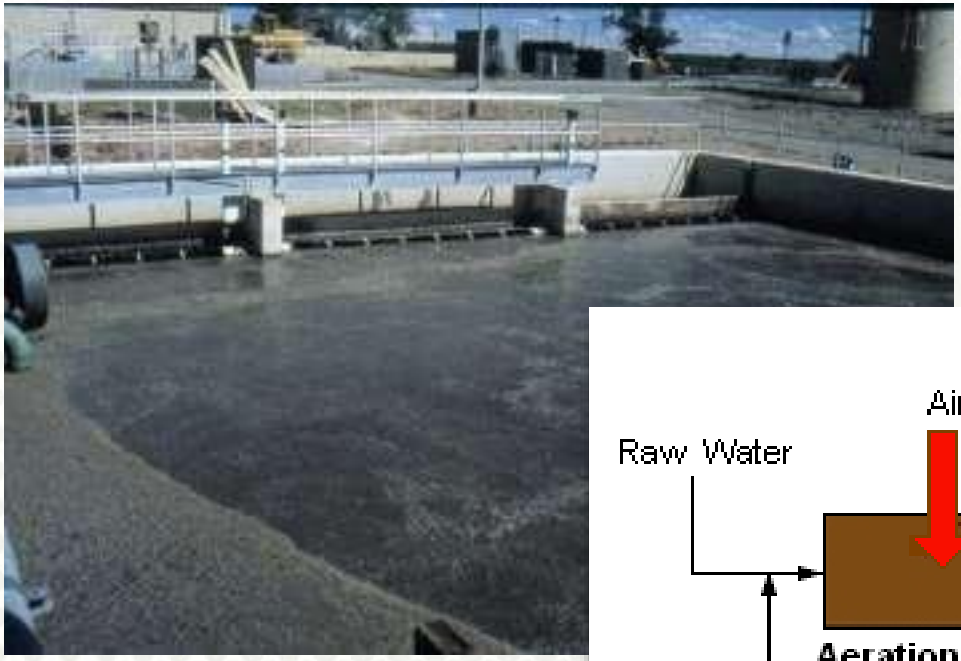


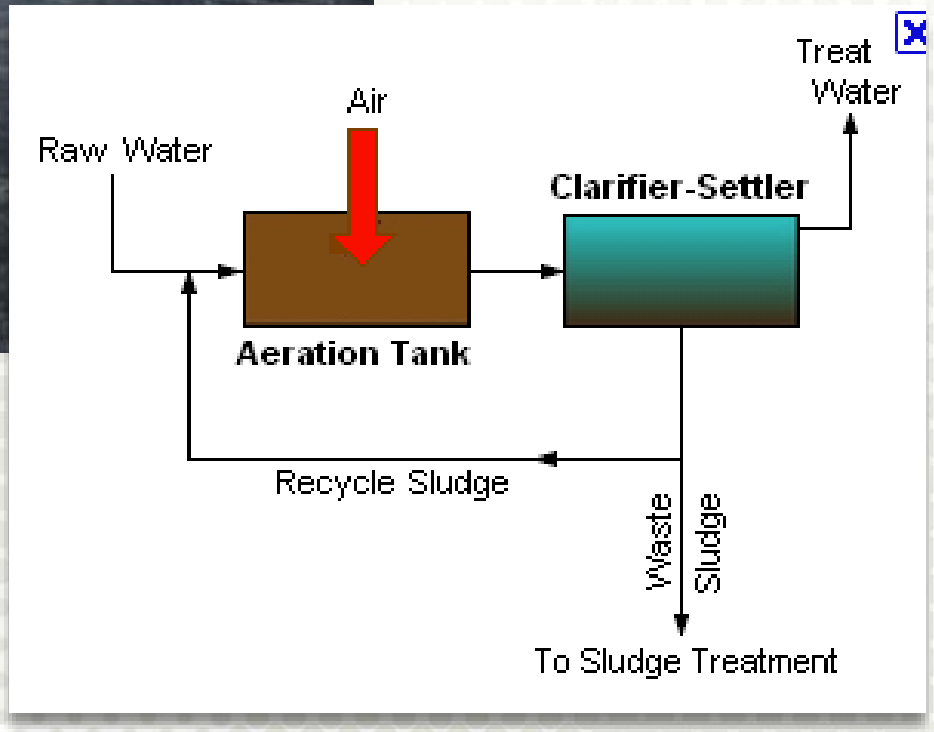
Biofilter: Rotating biological contactor - RBC (fixed biofilm)





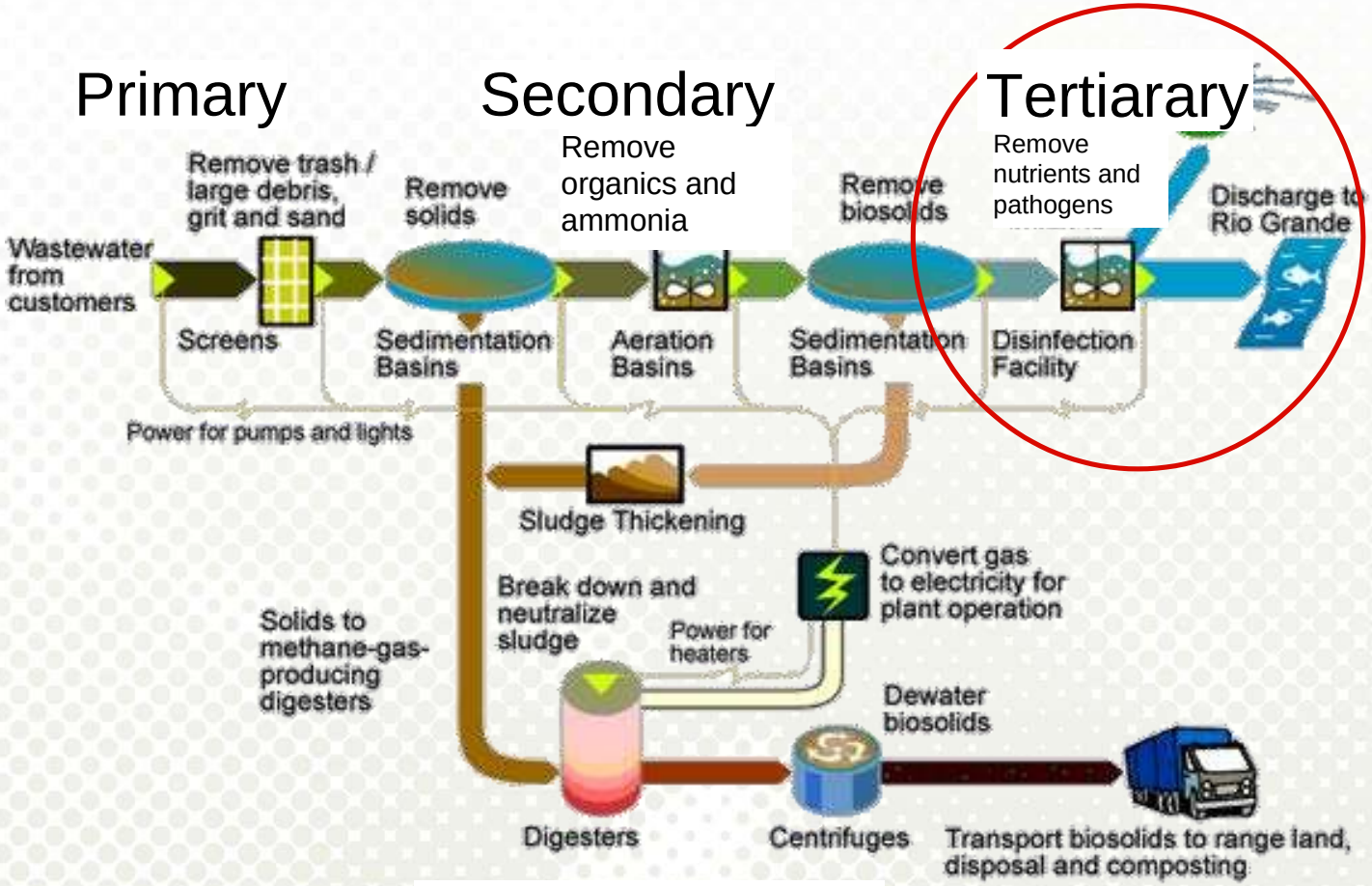
Biological treatment: Activated sludge
(biofilm in suspension)





Activated sludge
700 000 pe

Wastewater Treatment - Processes



Sludge treatment

Methods of Removal (Contd.)

Chemical Unit Process (tertiary)

Treatment methods in which the removal or conversion of contaminants is brought about by the addition of chemicals or by chemical reactions are known as chemical unit processes. Some of the most common are:

- **Precipitation (lime, Fe- of Al salts, Struvite formation)**
- Adsorption
- Disinfection

Methods of Removal (Contd.)

Chemical Unit Process (tertiary)

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- **Adsorption (Ion exchange)**
- Disinfection

Methods of Removal (Contd.)

Chemical Unit Process (tertiary)

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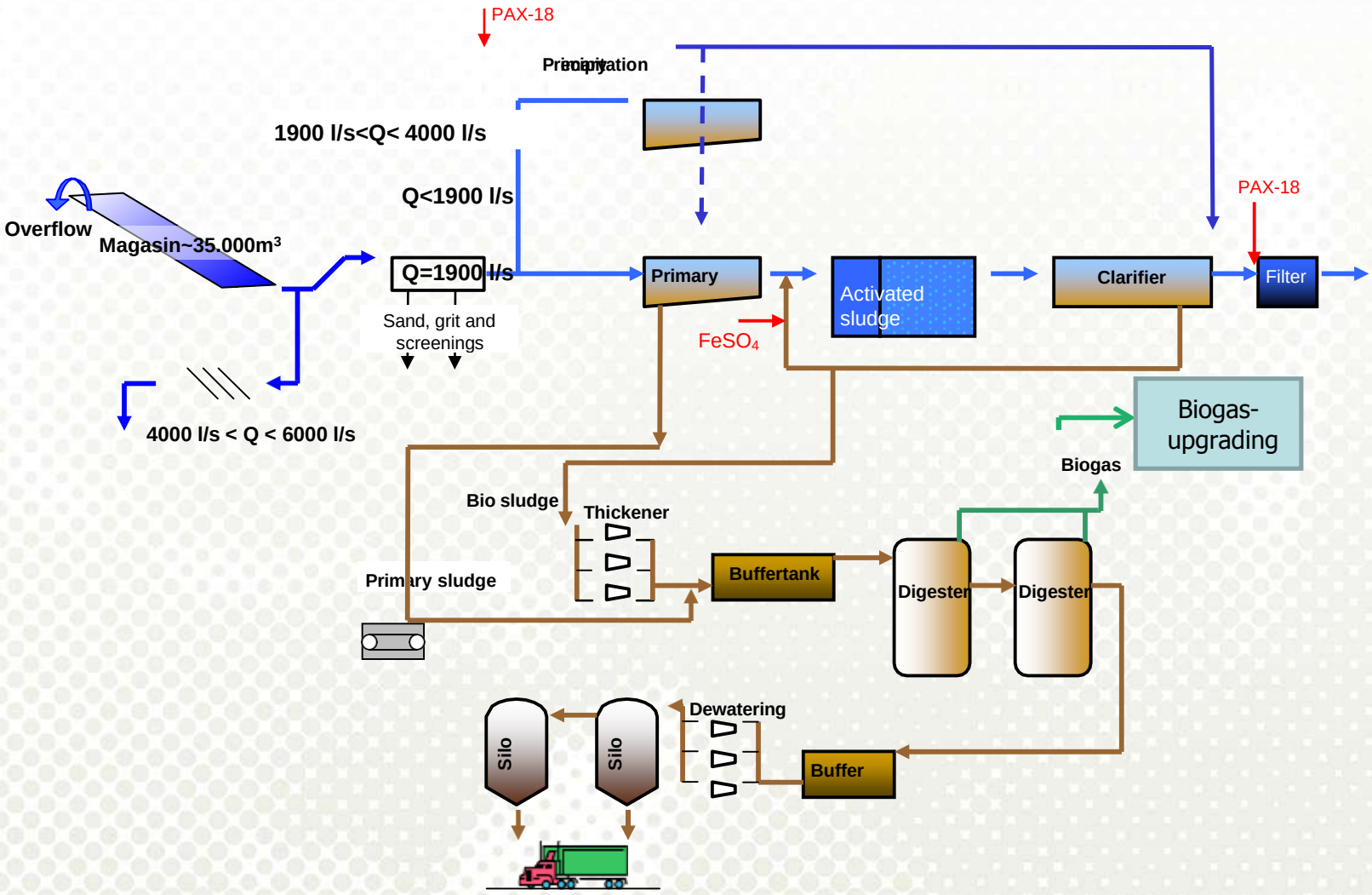
- Precipitation
- Adsorption
- **Disinfection (chlorination, UV-light, Ozone)**

Water and sludge treatment process at Bekkelaget



Removal efficiency %

Parameter	Primary	Secondary	Tertiary
SS	50 - 80	80 - 90	>90
BOD	20 - 40	70 - 90	>90
P	<10	30	>90
N	<10	30	70
E. Coli	1 log	2 -3 log	3 - 5 (7)* logs

*with disinfection