Recirculation systems & new Recirculation Feed

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1. **Why new farm layout?**
   - **Oxygen fluctuations in river water**
   - **Too high temperatures in summer**
   - **Water flow too low in summer**
   - **High infective pressure from the inlet water**
   - **Environmental limits on discharge- *Nitrogen removal***
   - **Management**
     - **Daily on feeding and fish handling**
     - **Maintenance on ponds**

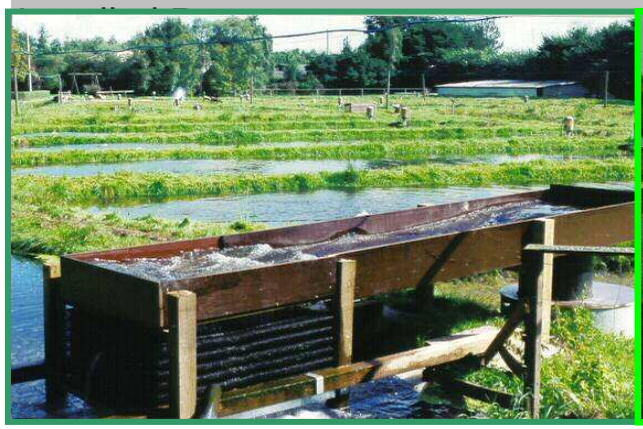
   31 "Model farms" is in operation and use 12.000 tonnes of feed

2. **Challenge with Biofilter management**
   - **Monitoring water/fish**
     - ***Nitrogen removal* (nitrification and denitrification)**
     - **Disease control – Faster reaction from manager**
   - **Energy consumption - Efficiency in technology**
   - **Feeding management – DP/DE and vegetables**

   Overall focus on reducing production cost

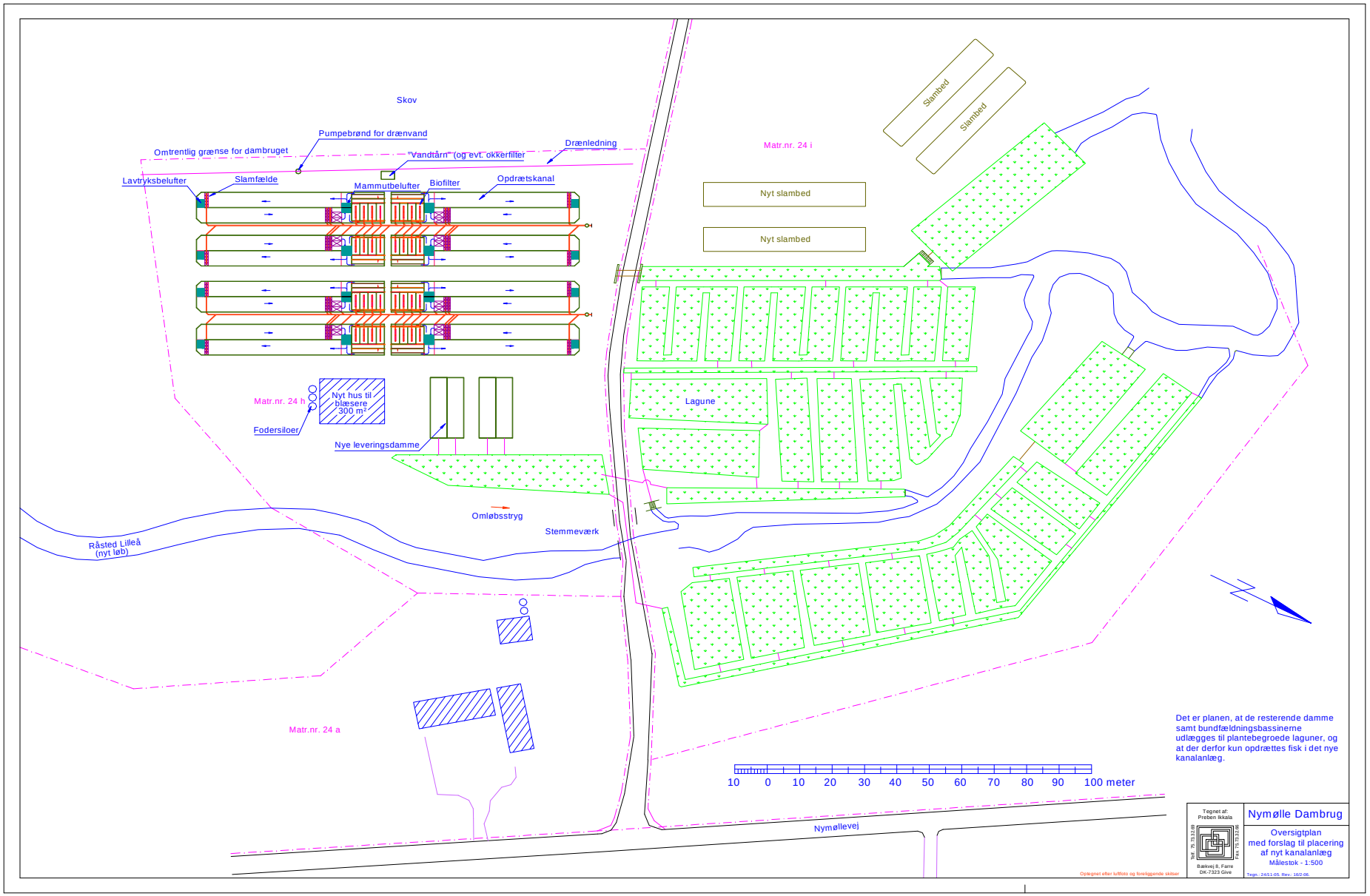
1. Fish farming in Recirculated Water
Production of trout with less fresh water supply

	Traditional earth ponds Re. Pump	Internal recirculating in channels	Model Farms with biofilter	Closed system Indoor
Production per year	100 tons	100 tons	100 tons	100 tons
Feed per day 15℃	384 kg feed	384 kg feed	320 kg feed	295 kg feed
River water	200 l/sec.	35 l/sec.		
Ground water			15 l/sec.	2,5 l/sec.
Fresh water/day			4.055 l/kg feed	732 l/kg feed
Power consumption	350 kWh/day	180 kWh/day	250 kWh/day	750 kWh/day



1 .Fish Farm with biofilter. "Model farm" in concrete

Fish Farm with biofilter. "Model farm"



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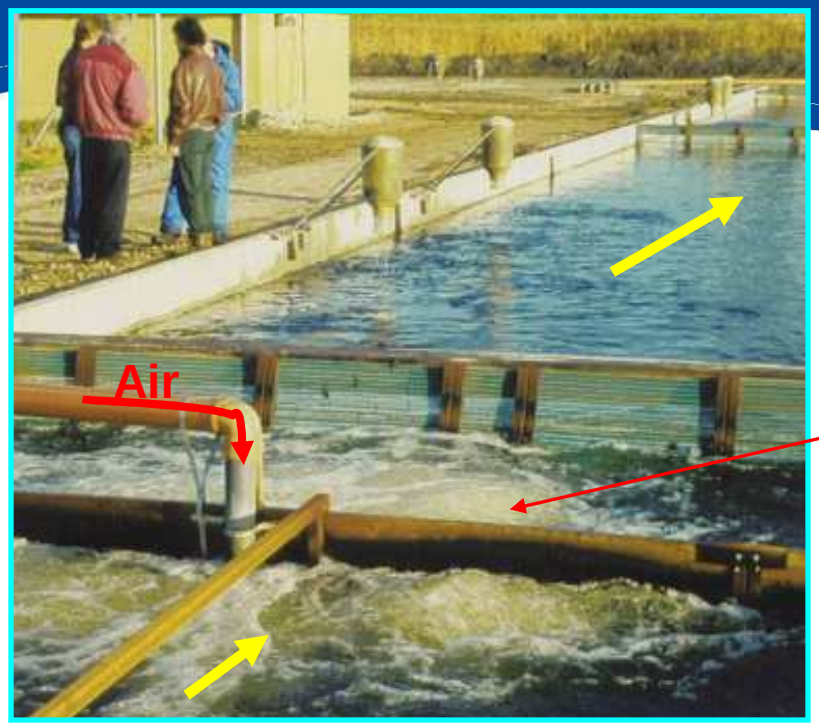
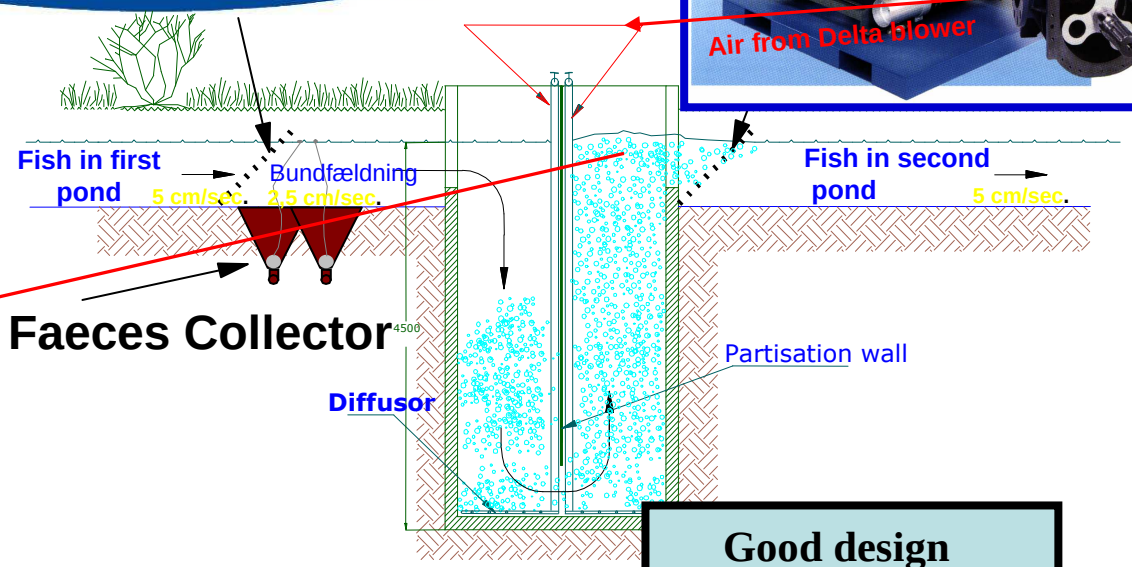
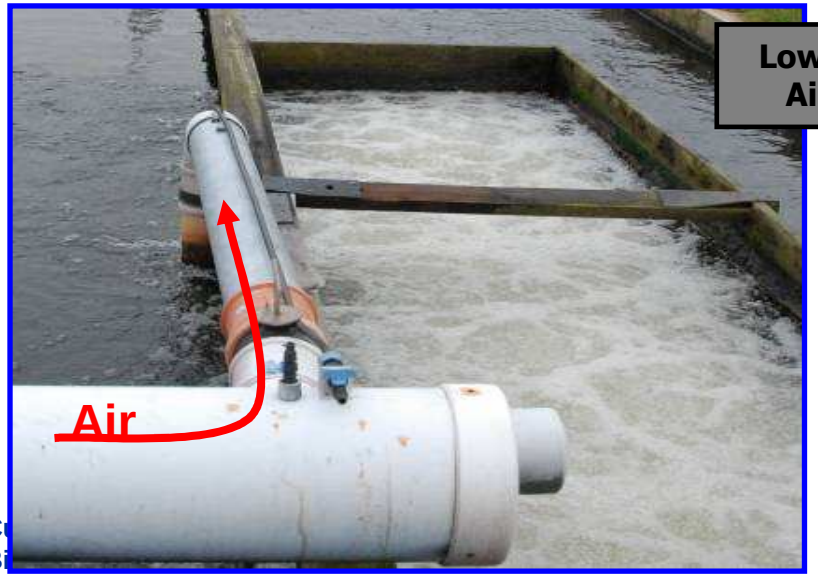
Deep Air Lift

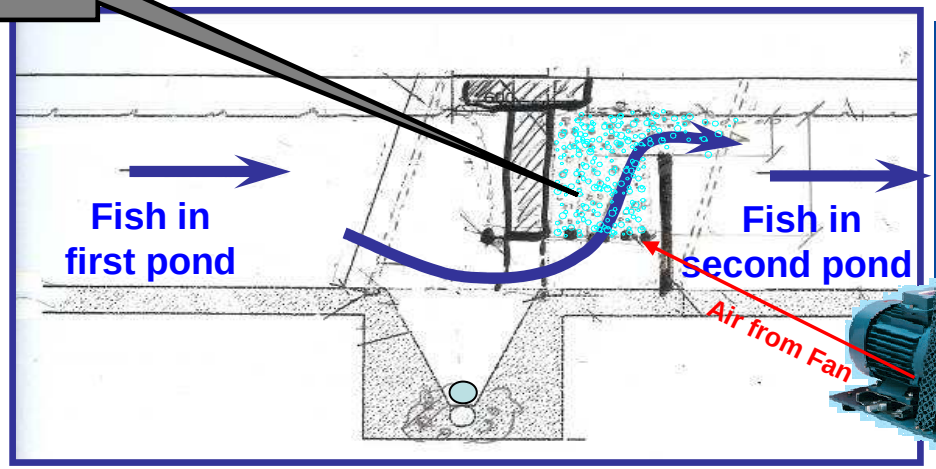




Good design include Faeces cones



Low head Air lift



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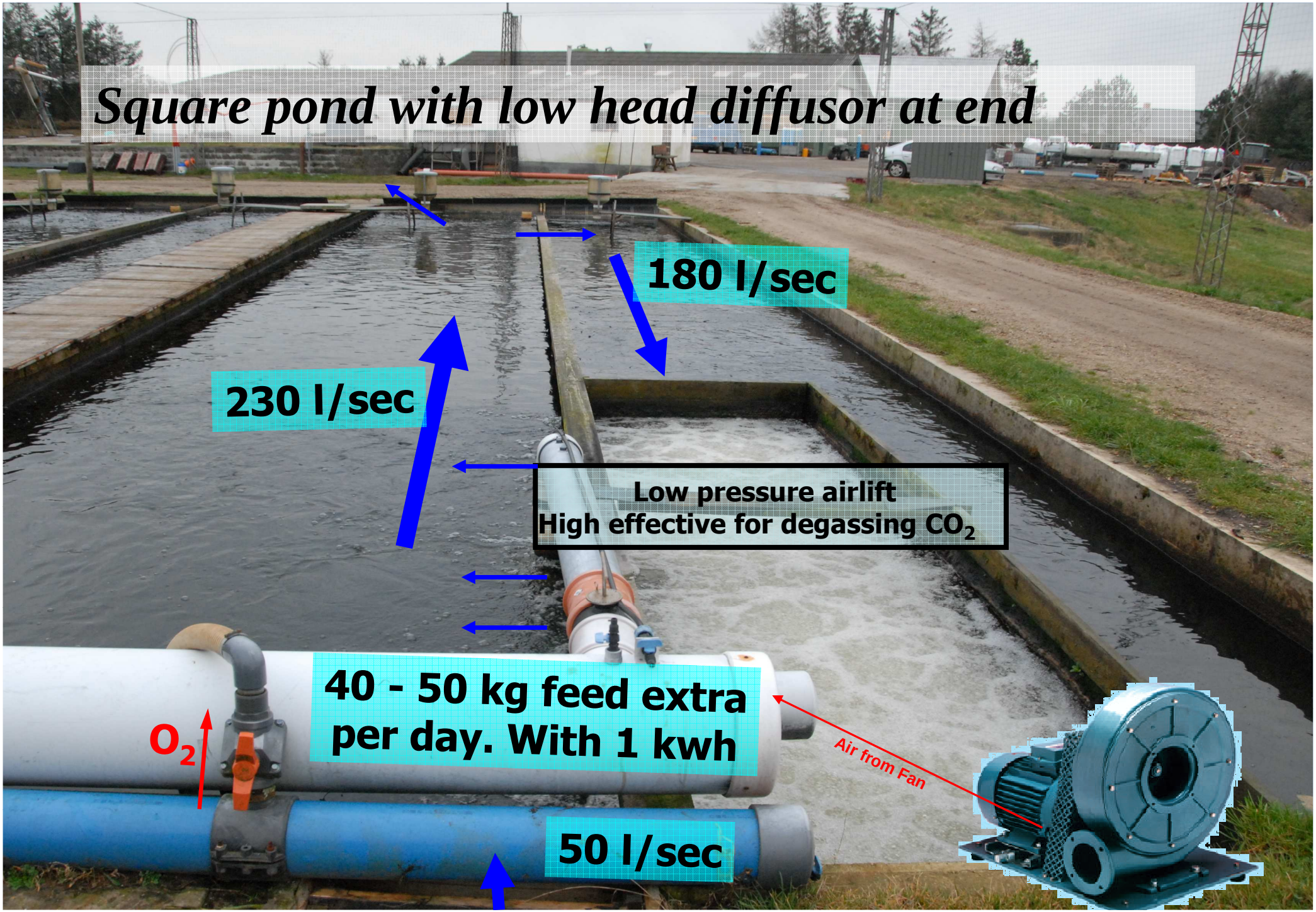
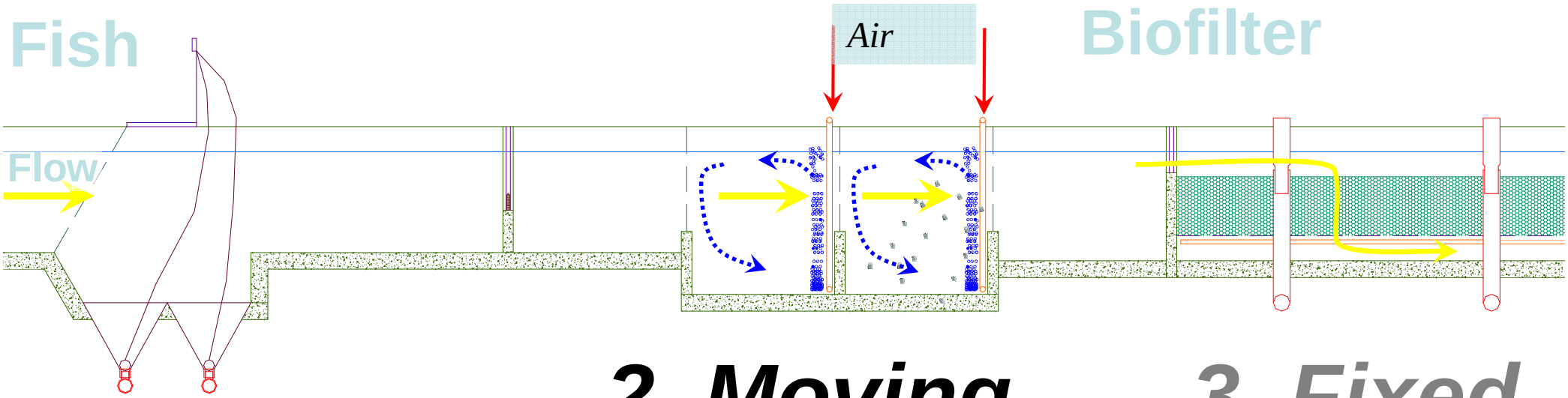
Square pond with low head diffusor at end



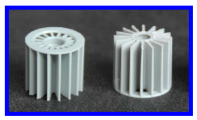

150 m3

1. Fish Farm with biofilter. "Model farm"

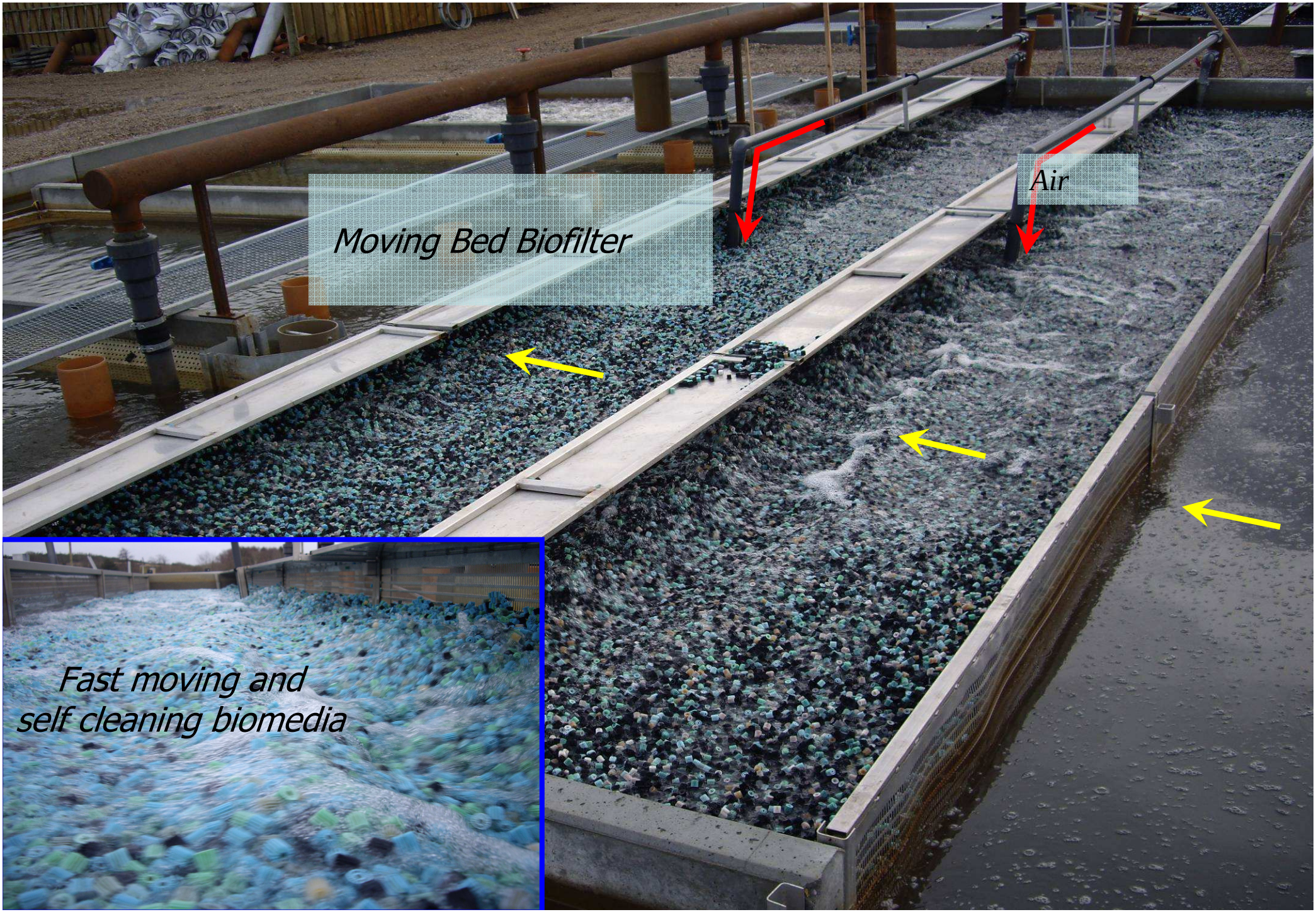


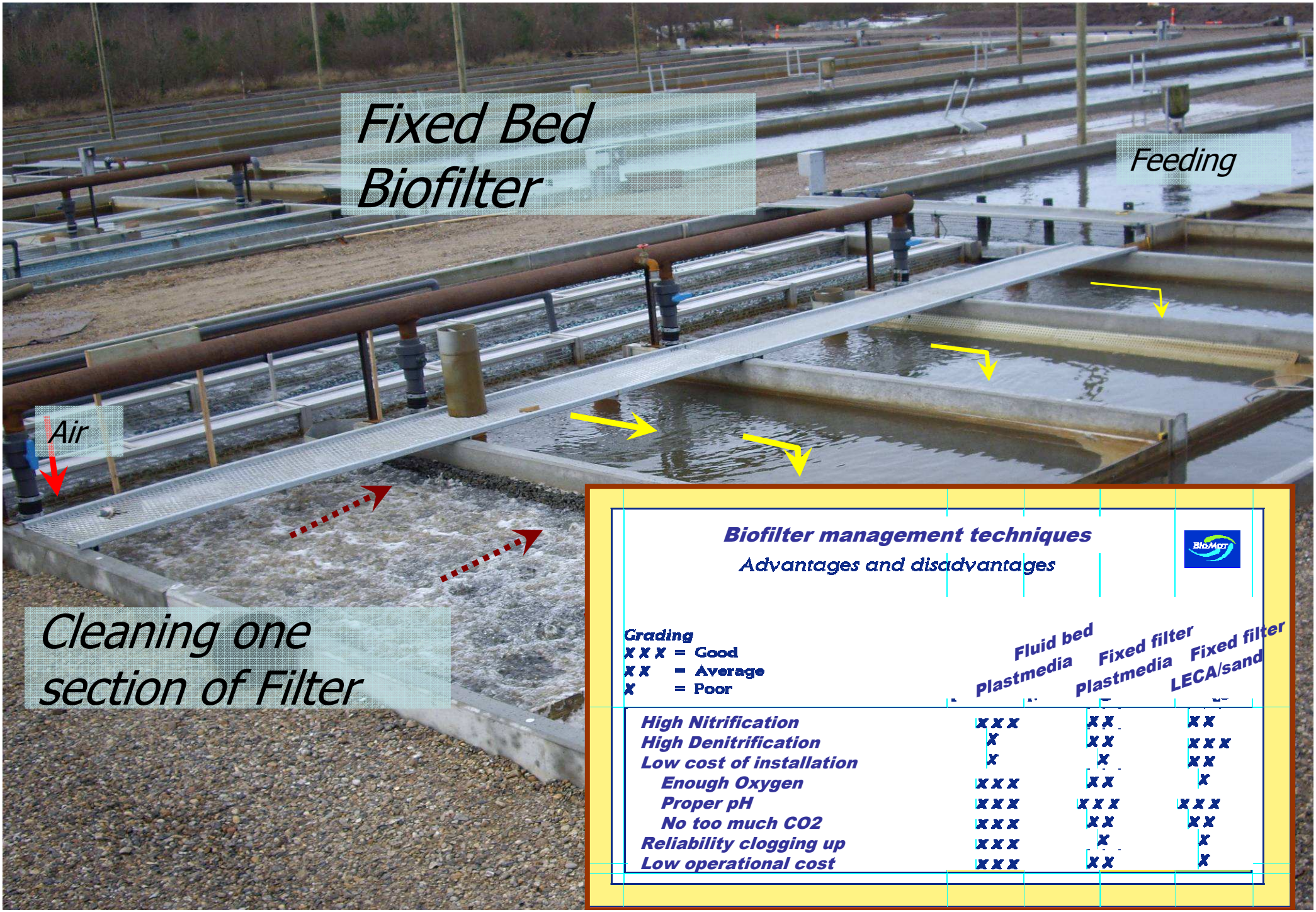
1. Cones

2. Moving Bed



3. Fixed Bed


Moving Bed Biofilter
Air
Fast moving and
self cleaning biomedia



Biofilter management techniques

Advantages and disadvantages

Grading
x x x = Good
x x = Average
x = Poor

	Fluid bed Plastmedia	Fixed filter Plastmedia	Fixed filter LECA/sand
High Nitrification	x x x	x x	x x
High Denitrification	x	x x	x x x
Low cost of installation	x	x	x x
Enough Oxygen	x x x	x x	x
Proper pH	x x x	x x x	x x x
No too much CO2	x x x	x x	x x
Reliability clogging up	x x x	x	x
Low operational cost	x x x	x x	x

2. Challenge with Biofilter management

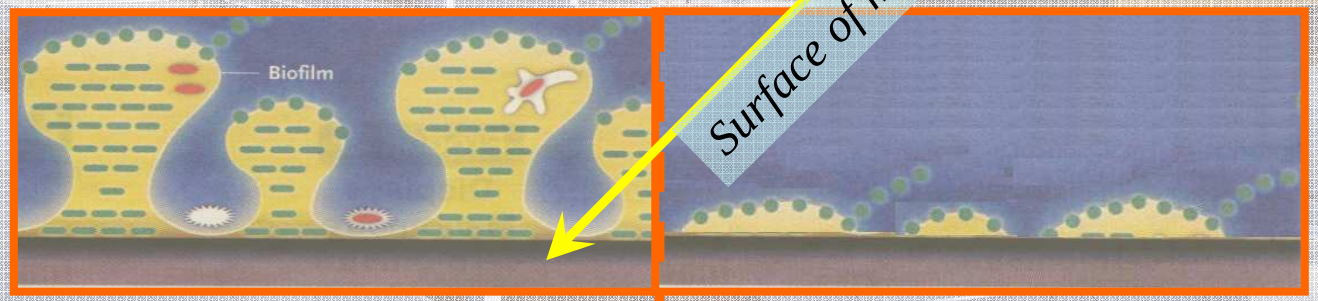
60 m^3 of biofilter > 250 kg feed

Important
- **Proper design**
- **Good management**

Biofilm for Biological filtration

Heterotrophic bacteria break down uneaten feed and waste.

Autotrophic bacteria convert ammonia to nitrite and nitrate



Slimy long-haired biofilm

Solid thin biofilm

3-400 g biofilm growth per kg feed.

Submerge filter media must be cleaned.

Oxygen from incoming water

7,3 g biofilm growth per kg feed

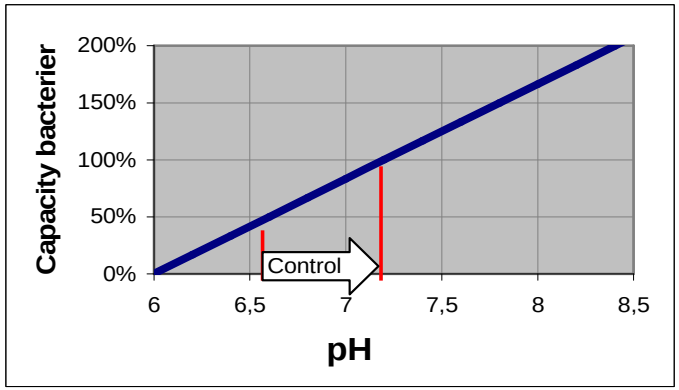
Fluid bed filter not to be cleaned.

Oxygen from Air lift

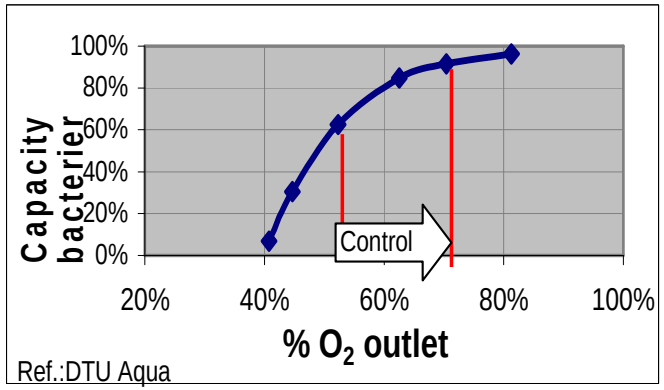
Oxygen from incoming water

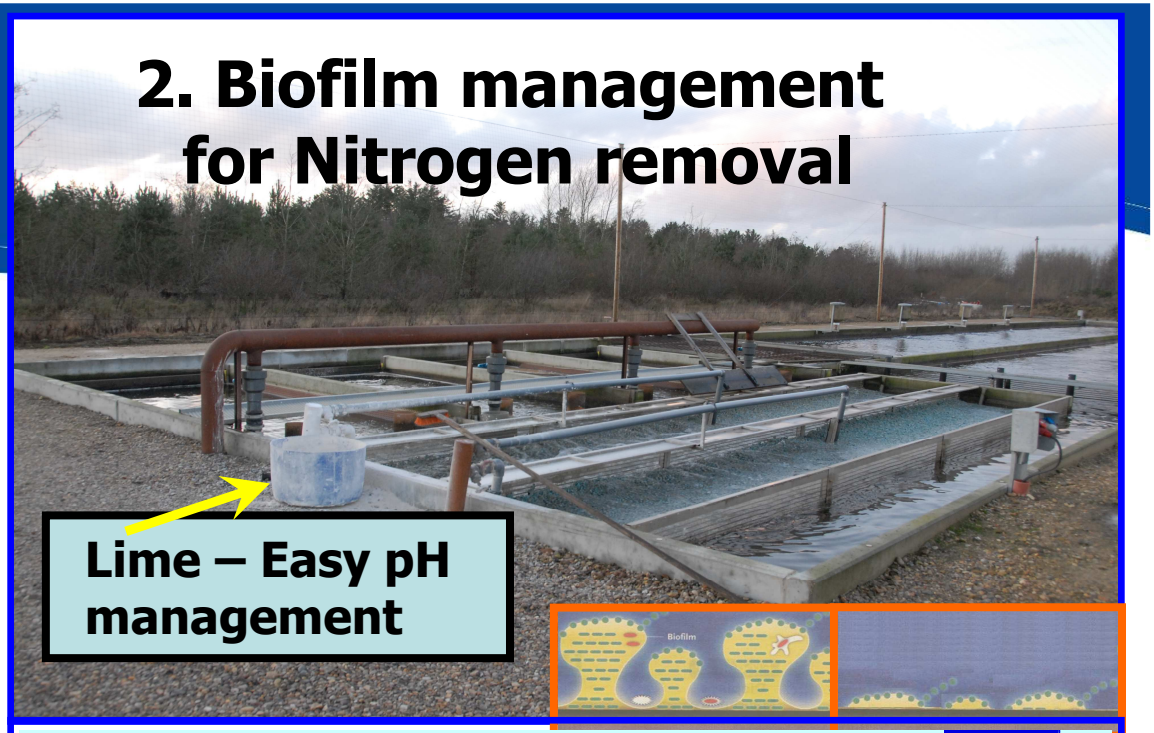
2. Biofilm management for Nitrogen removal

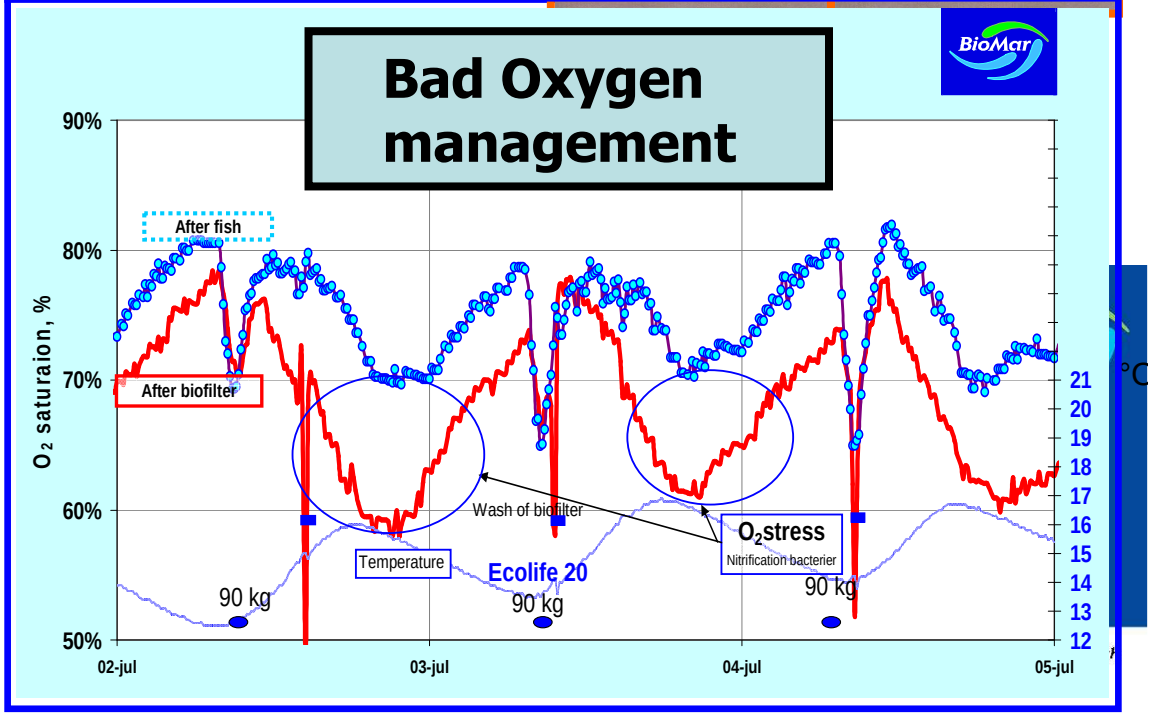
- **Water parameter**
  1. **Alkalinity**
  2. **pH**



3. **Oxygen, CO_2 and N_2**







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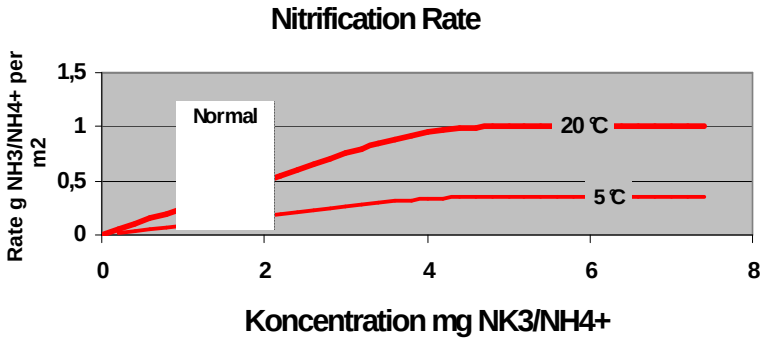
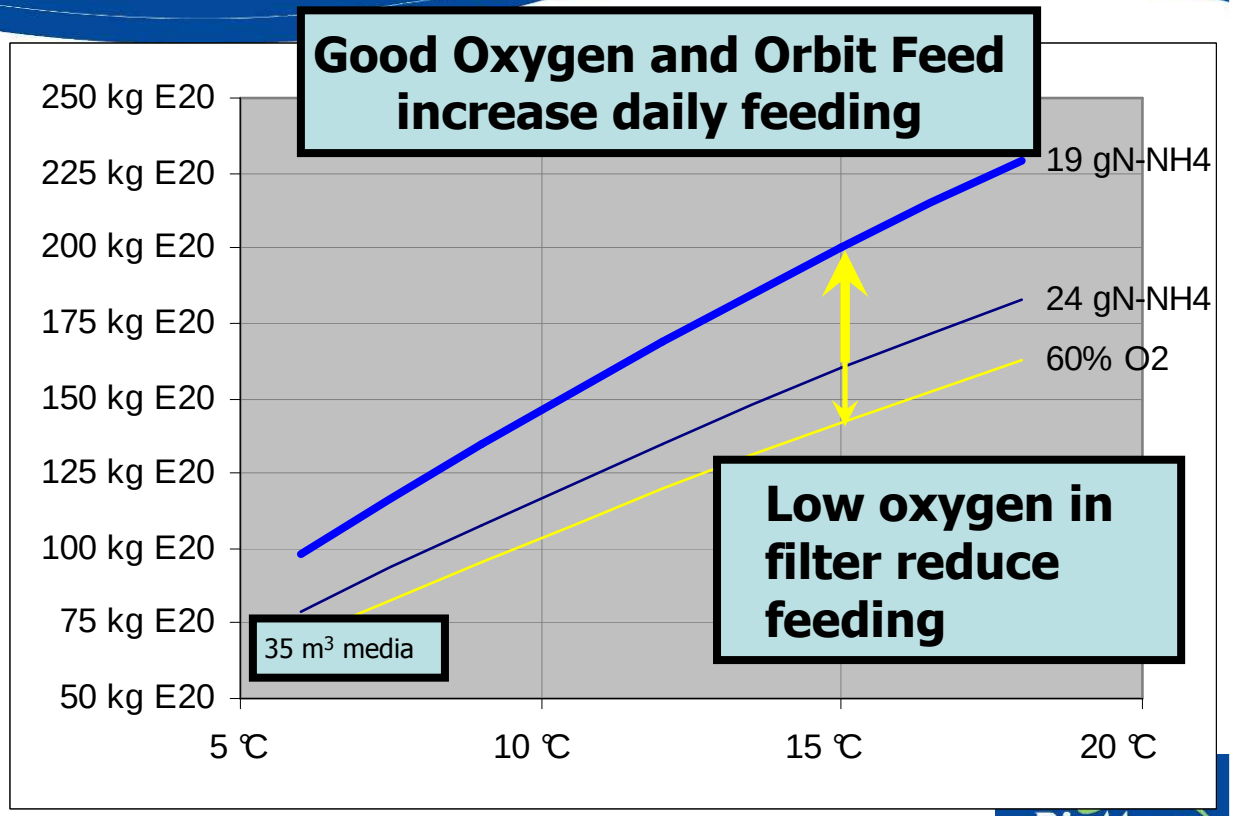
2. Biofilm management for Nitrogen removal

- **Water parameter**
  1. **Alkalinity**
  2. **pH**
  3. **O_2, CO_2, N_2 & Temp.**





4. **Feed per day and select feed standard/Orbit for higher nitrogen retention and less faeces**

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3. What is optimal for Farmer. Summery

Necessary analyses of the specific farm:

- **Biomass in tonnes**
- **Diagnosis of Fish diseases- Vet are within reach**
- **Water flow through biofilter/ponds**
- **Water parameter**
  - **Alkalinity**
  - **pH**
  - **Oxygen, CO_2 & N_2**
  - **Feed selected for high nitrogen retention and good faeces structure**
- **Others**

Hallundbæk
230 tons

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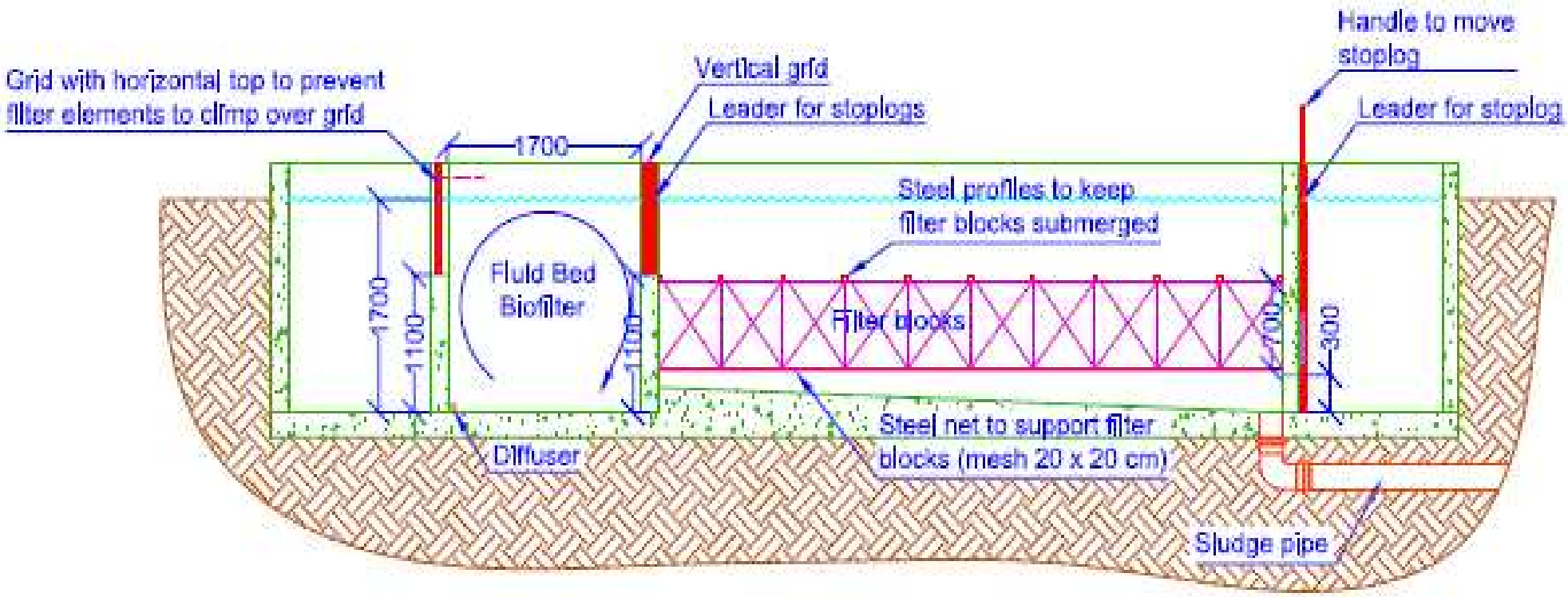

Cross section E - E: Scale - 1:50

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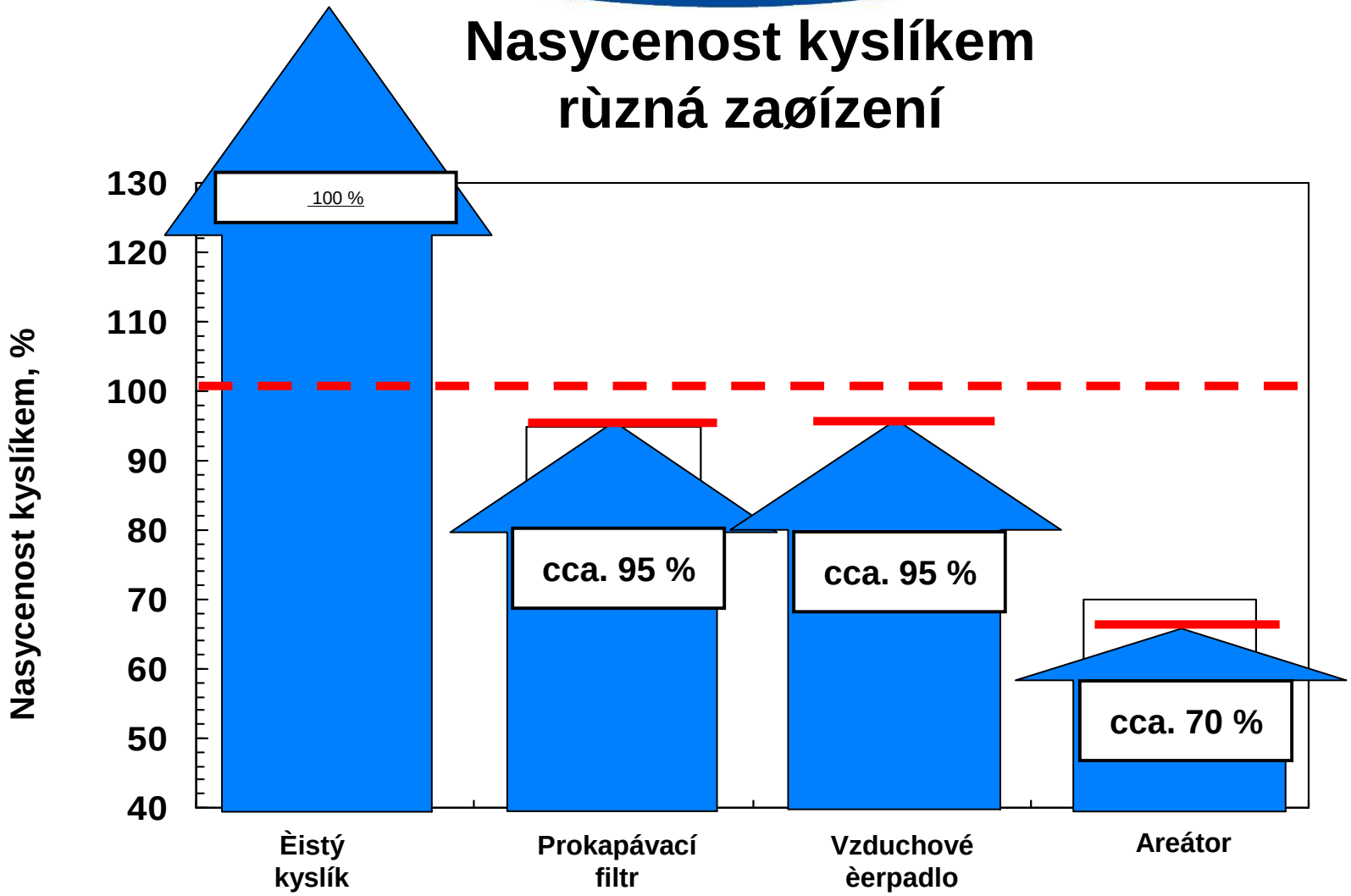

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