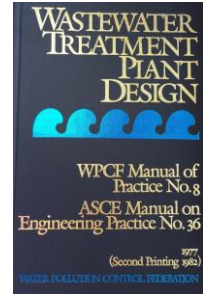


Wastewater Treatment

Innovation in Treatment of Food Processing Wastewater

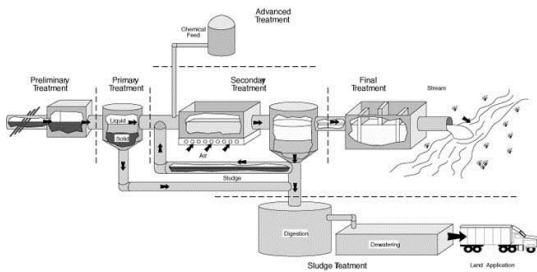
Karen Mancl, PhD
Professor Food, Agricultural &
Biological Engineering, OSU

- Established technologies
- Domestic wastewater



Wastewater Treatment

- Established technologies
- Domestic wastewater



Discharge to City Sewer?

Domestic Sewage



Food Processing Wastewater



Discharge to City Sewer?

Different from sewage

- 5 times stronger
- 100 times more grease

Food Processing Wastewater



Discharge to City Sewer?

Different from sewage

- 5 times stronger
- 100 times more grease

Food Processing Wastewater



Must change the wastewater

- Expensive
- Not very effective



Change treatment technology?



Change the treatment technology

Sand Bioreactor System

- Effective
- Low-cost

Designed to treat food processing wastewater



Whitewater Processing

- Kopp Family Business
 - 4th generation
 - 110 employees
 - 7000 turkeys per day

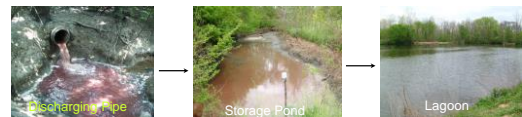


Whitewater Processing

- Kopp Family Business
 - 4th generation
 - 110 employees
 - 7000 turkeys per day
- Contacted OSU in 2000



Ohio EPA orders – Abandon old ponds



Options

- Connect to city
- City of Harrison – 10,000 people



Differences

| Pollutant | Domestic wastewater | Slaughterhouse wastewater |
|------------------------------------|---------------------|---------------------------|
| Organic matter (BOD ₅) | 200 | 800 |
| Suspended solids | 150 | 600 |
| Ammonia | 20 | 40 |
| Fat, oil & grease | 2 | 200 |



Options

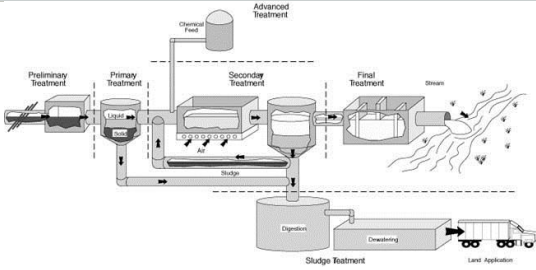
- Connect to city
- City of Harrison – 10,000 people
- 20 year cost \$12.5 million



Why so expensive?

- City uses a mechanical, aeration plant
- Wastewater has too much
 - Fat
 - BOD₅

Mechanical Treatment



Why my lab?

- Innovation in wastewater treatment
- Food, Agricultural & Biological Engineering
 - Small flows
 - Agricultural wastewaters

Industry open to new options

Lawsuit



Close



Regulators open to new options

Protect environment



Retain Jobs



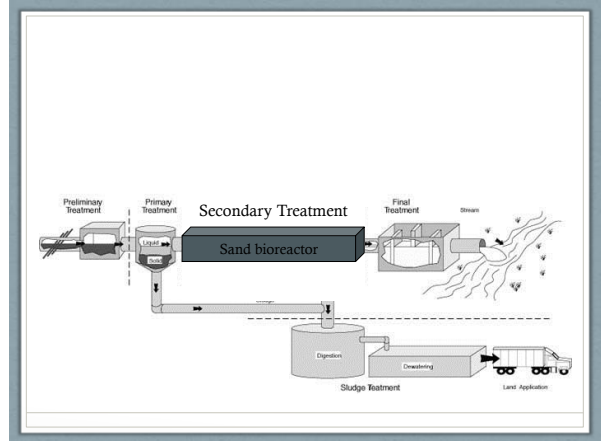
Develop & build full-scale system

Dr. Karen Mancl

Professor Food, Agricultural & Biological Engineering

Ryan Kopp

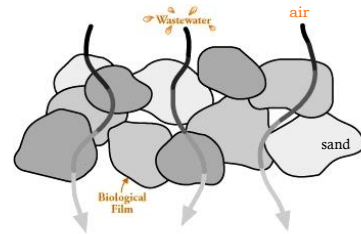
Owner, Turkey Slaughterhouse



Before & After



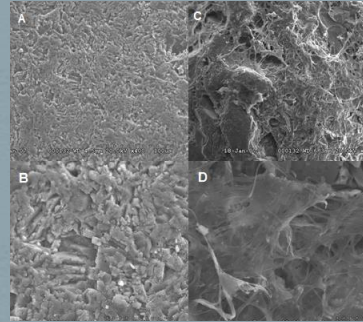
Microbial Biofilms



Biofilm



25



Gaur, Cai, Mancl, and Tuovinen. 2010.

26

Sand Treatment

- ✦ Microorganisms
 - Organic matter & ammonia is their food

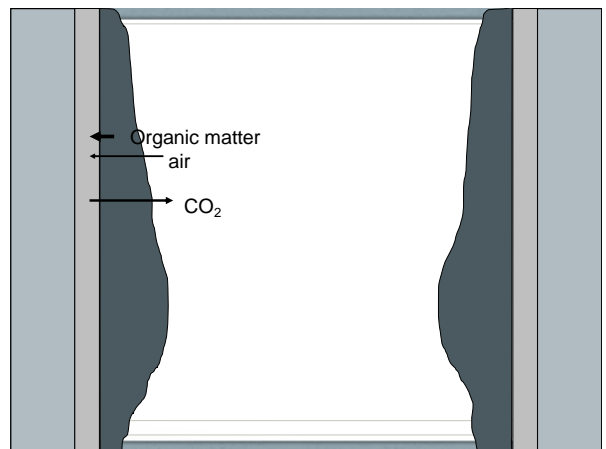
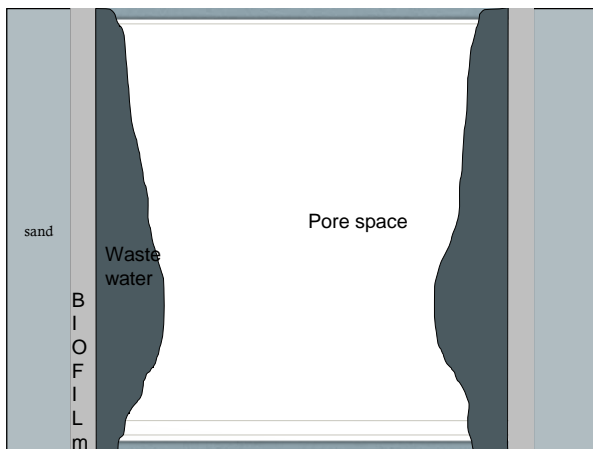
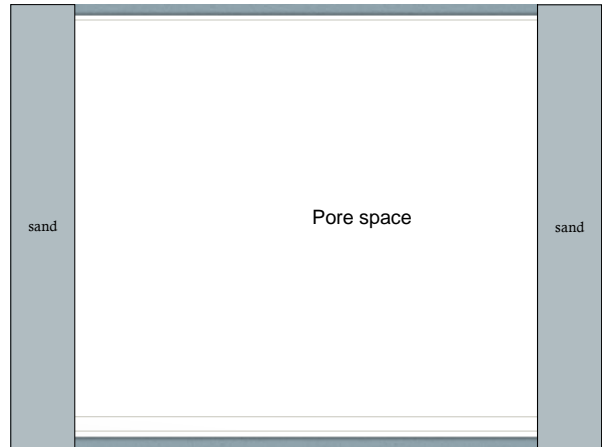
Sand Treatment

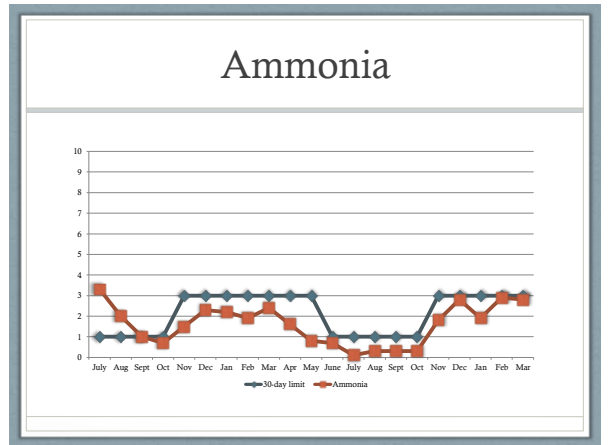
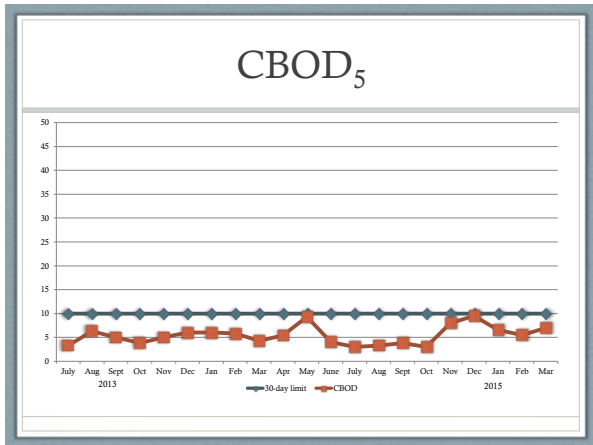
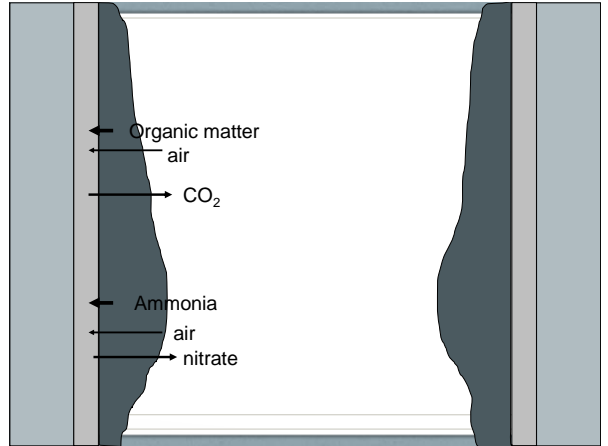
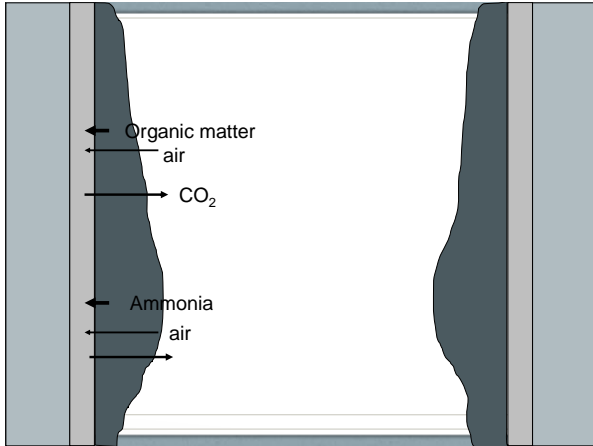
- ✦ Create ideal environment for microorganisms

Sand Treatment

■ Create ideal environment for microorganisms

- Surface to attach to
- Air
- Water
- Food





Before & After



Since 2012 – full-scale system meets all regulatory discharge standards

Fat, Oil and Grease Removal

| | Influent | Effluent |
|---------------|----------|--------------|
| | FOG | FOG |
| Sept. 6, 2012 | 212 | Not detected |
| Oct. 30, 2012 | 139 | Not detected |
| Nov. 19, 2012 | 189 | Not detected |
| Dec. 19, 2012 | 374 | Not detected |
| Jan. 9, 2013 | 80.8 | Not detected |
| Feb. 13, 2013 | 168 | Not detected |
| Feb. 27, 2013 | 273 | Not detected |
| Mar. 27, 2013 | 42.4 | Not detected |

Options

- City of Harrison
 - Annex
 - Sewer extension
 - Pretreatment
 - Surcharge
- Decentralized
 - Sand bioreactor
 - Onsite construction
 - Discharge permit

Costs

Connect to City

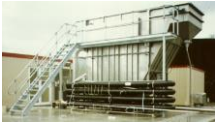
- \$12.5 million



Costs

Connect to City

- \$12.5 million



New System

- \$2.6 million



Costs

Connect to City

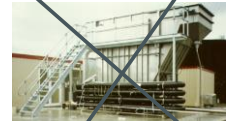
- \$10.56/1000 gal
- Plus pretreatment



DAF

New System

- \$3.90/1000 gal
- No pretreatment costs



Why costs so low?

Simple to build



Easy to operate

- Low electricity
- No sludge
- 1 full-time operator



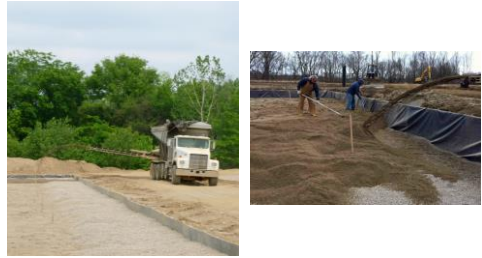
Liners with underdrain



Media



Layers of sand, coarse sand & pea gravel



Construction

- Easy
- Local force labor
- Purchased construction equipment
- Local aggregate company



Restaurants



Food processors



Resorts

Conclusions

- Sand Bioreactors
 - Best option for food processing wastewater
 - Local jobs
 - Saved money
 - Protects stream



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