# Denitrification of Tile-Drain Effluent:

## Technology Summary

## Proven and Experimental Technologies for Full-Scale, On-Field Applications

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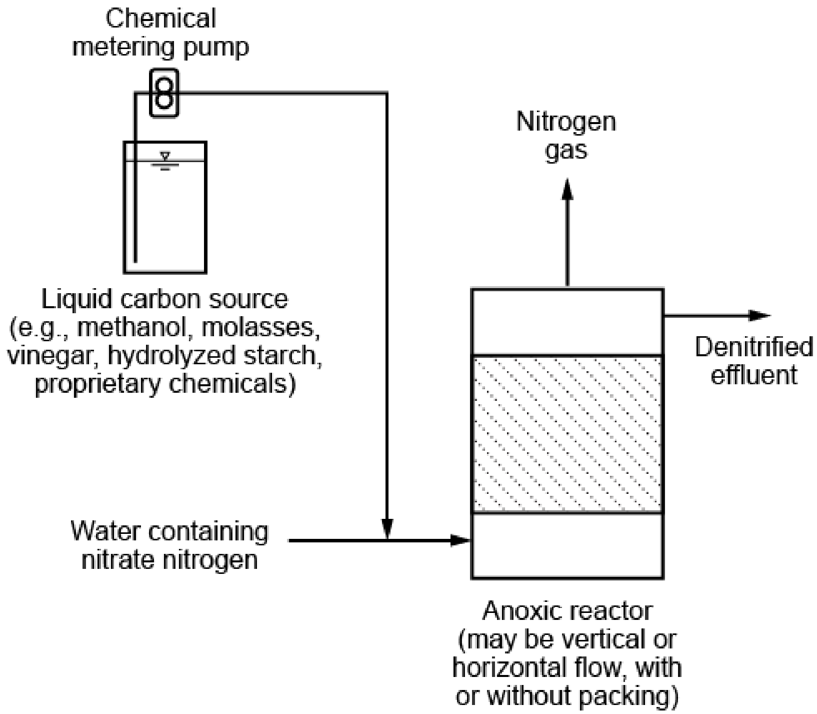
# ANOXIC REACTOR WITH CHEMICAL FEED

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1. Flow from collector pipe pumped into reactor.
2. Mixed with chemical Carbon source (methanol, etc).

Startup Cost: ~ $15,000 for 100 acre field

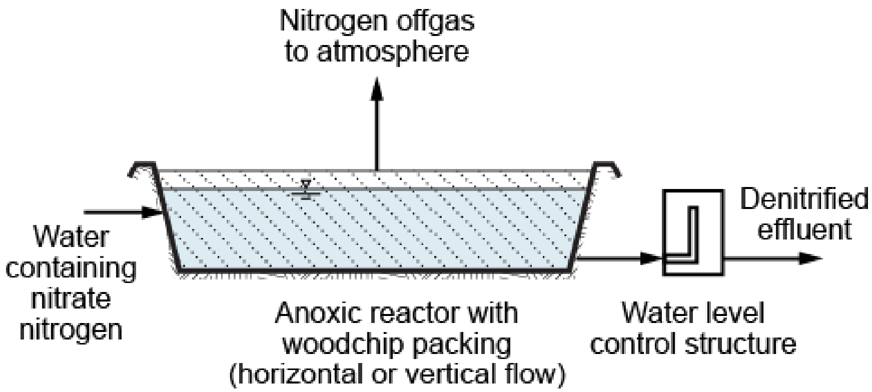
Decreased per acre cost with larger acreage

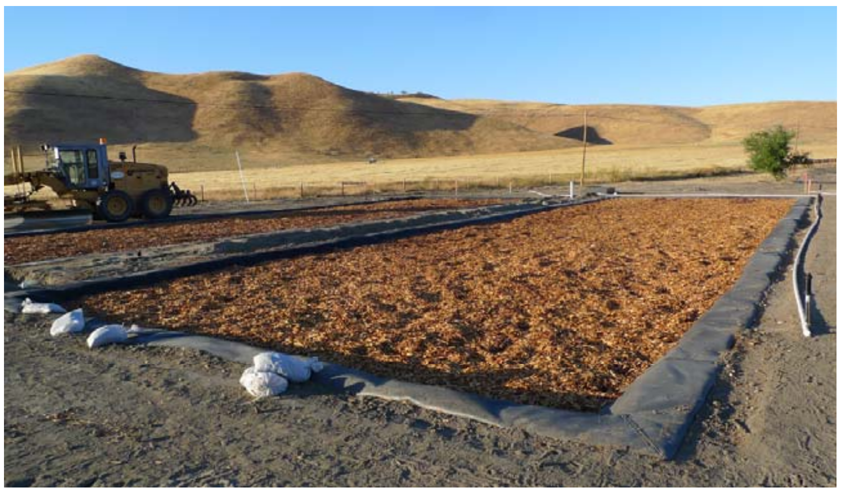
Requires:
1. Chemical inputs, tank and pump
2. Reactor (s)
3. ~ monthly operation/maintenance inputs
4. Ongoing costs for chemical inputs

Pre-engineered systems available

Proven technology

# ANOXIC WOODCHIP REACTOR AT-GRADE or BELOW-GRADE



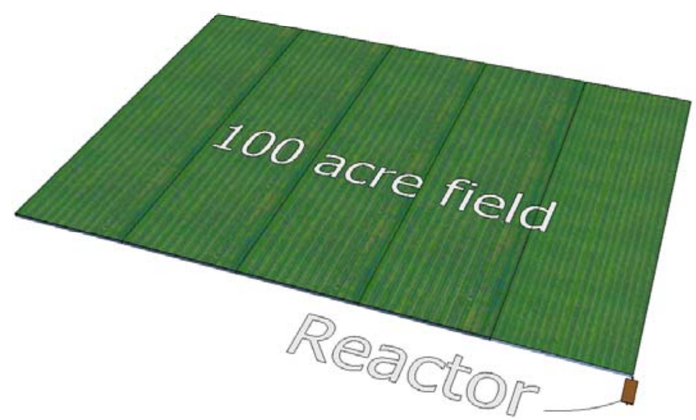
1. Passive system
2. Flow from collector pipe pumped into reactor
3. Wood chips as Carbon source

Startup Cost: ~ $20,000 for 100 acre field

Decreased per acre cost with larger acreage

Requires:
1. Reactor basin
2. Woodchips
3. Minimal operation and maintenance

Proven technology, longest running test ~10 yrs

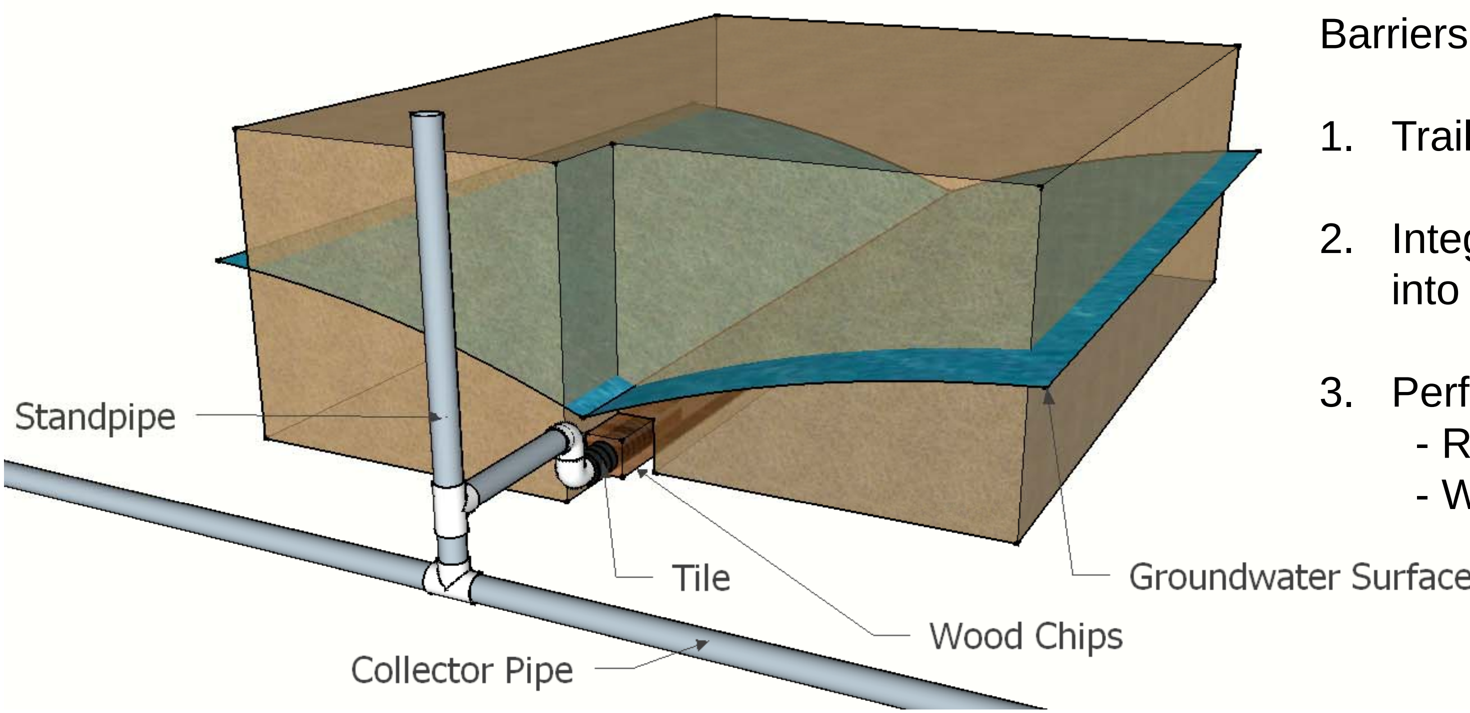


# *In-situ* treatment option for tile drains
## (concept only – untested)

1. Insert woodchips in with tile drain
2. Passive denitrification at tile drain

Startup Cost:  20% to 70% increase over normal tile drain installation
*expected based on preliminary analysis*

Requires:
1. Modification of tile installation equipment
2. Wood-chip trailer/dispenser
3. ~240 feet of ditch per cubic yard of chips

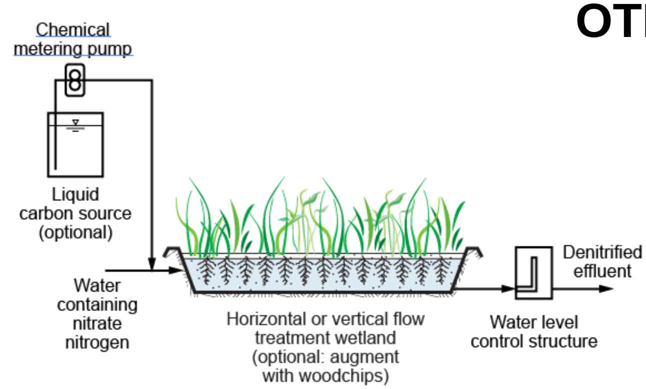



Barriers to implementation:

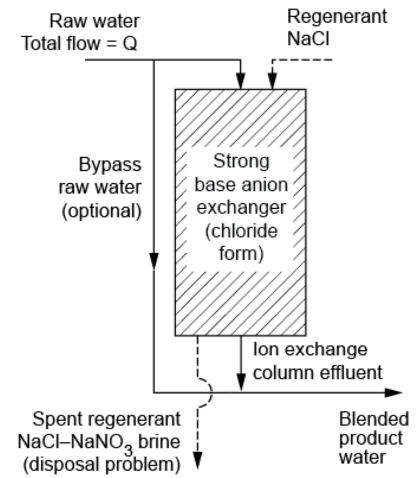
1. Trailer/chute design
2. Integration of chip delivery into plow
3. Performance testing on
   - Rate of chip application
   - Water depth over pipe

# OTHER SYSTEM TYPES

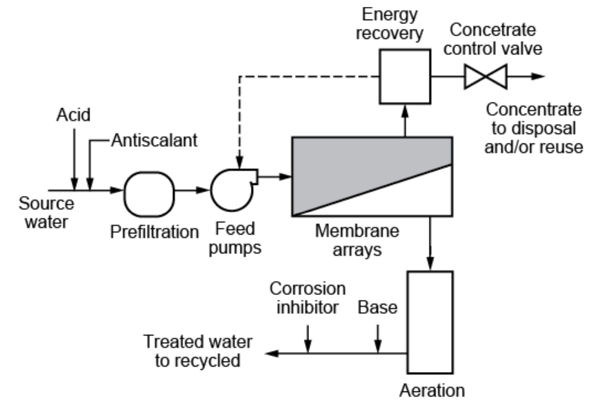
**Hybrid Constructed Wetland**
plants uptake nutrients
- space inefficient without chemical feed




**Ion Exchange**
similar to a water softener
+ recoverable N
- very expensive
- high maintenance
- must remove regenerant salts from brine to use the recoverable N




**Reverse Osmosis**
like bulk water dispensers or under-sink units
+ smallest footprint
+ recoverable N
- other constituents come along with N
- very expensive
- high maintenance



# SUMMARY

Technologies exist for treatment of tile-drain effluent.

Passive and semi-passive biological treatment is most cost effective.

Engineering of systems for specific applications is required.

There is a trade-off between space requirement and operations/maintenance cost.

Innovations in tile-drain installation may produce technology that reduces initial cost of denitrification technology and eliminates space requirements.

Pamphlets are available at this meeting with descriptions of these technologies and more details.

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QUESTIONS or COMMENTS?