BIOLOGICAL WATER TREATMENT SYSTEMS

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Treatment technologies for runoff

- Sediment basins
- Filter strips
 - Vegetative buffers
 - Vegetative waterways
- Constructed water (wetland) treatment basins (CWs)
 - Surface-flow
 - Subsurface-flow
- Floating wetlands







SCRI - CLEAN WATER³ Reduce, Remediate, Recycle

Filter strips & vegetated waterways



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Wetland (water basin) functions

- Soils provide habitat for microbes
- Microbes process
 - nutrients
 - organic contaminants
- Vegetation slows water
- Plant uptake/absorption
 - nutrients
 - trace metals
 - other compounds



Surface-flow CWS



Case Study: Monrovia® Cairo, GA



REDUCE, REMEDIATE, RECYCLE

Case Study: CW1 – 14 years



- 120 acres of production drain to wetland
- 9.3 acre wetland
- Two-stage
 - deep cell
 - shallow cell



Virtual tour of CW1



Runoff collection channel with nitrification structures

Nursery bed runoff collection

1500 ft flow control channel (handles 2"/hr rainfall events)



1 ac retention pond, pumpingPumping runoff into 1st stagestation, and transfer pipe30" deep wetlands

First stage vegetation planted in bands



Rare open water in 1st stage; ~ 48" deep



Gravity feeding 2nd stage 8" deep wetlands



Gravity discharge of cleaned water from 2nd stage wetlands



Discharge channel



1st stilling pond after recent cleaning (removes remaining suspended sediments)



2nd stilling pond located just prior to discharge into woodlands

How well do surface-flow CWs clean nursery runoff?



Nitrogen results



Nitrogen results



REDUCE, REMEDIATE, RECYCLE

Phosphorus results



Surface-flow CWS

- Most efficient with high to moderate runoff volumes
- Efficient nitrogen removal
- Phosphorus not consistently treated
- Pesticide removal 50-98%
 - organochlorine
 - organophosphate
 - pyrethroid



Subsurface flow CWS





REDUCE, REMEDIATE, RECYCLE

Subsurface flow CWS

- Reduce ammoniacal N emissions
- Efficient nitrogen & <u>phosphorus</u> removal
 - sediment will become P saturated
- Pesticide removal depends upon pesticide class



Floating treatment wetlands (FTW)





Floating wetland: functions

- Large root surface area for microbe habitat
- Particulate filtration
- Nutrient removal
- Provide "edge" shelter & general wildlife habitat





Floating wetlands uncertainty

- Plant nutrient uptake
 - When to harvest
 - Best plant species
- Bacteria removal capacity





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Remediation efficiencies

	Water Treatment Basin Design (% Removal)		
Contaminant	FTW	Pond/Wetla nd System	Submerged Gravel Wetland
TSS	-	71 ± 35	83
TP	44 ± 75	9 - 54	33-90
TN	58 - 84	50 - 90	19-90

TSS = total suspended solids | TP = total phosphorus | TN = total nitrogen

Conclusions

- Each technology discussed has specific benefits and limitations
- Technology applied for remediation depends upon site-specific considerations
 - operation size
 - treatment volume
 - contaminants of concern
- Ecological treatment options are effective remediation tools



Contact Information

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Resources: Constructed Wetlands: A How to Guide for Nurseries Available for free: <u>http://tinyurl.com/sustainable-nursery</u>

Cleanwater3.org – treatment technology information



