Improving Ammonia and Phosphorus Removal in SSF Wetlands

by

Margaret Forbes, Joe C. Yelderman, Jr. and Robert Doyle

Baylor University

PREPARED IN COOPERATION WITH AND FINANCED BY THE TEXAS ON-SITE WASTEWATER TREATMENT RESEARCH COUNCIL

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Baylor Wastewater Research Program

Certification and Testing Aerobic On-site Treatment Units

Introduction

Why wetlands?

- In places where traditional leach fields are not feasible (ie; thin soils over bedrock).
- Interim or additional treatment

Introduction

Why Standard 40?

- **NSF/ANSI Standard 40 is well documented**
- **NSF/ANSI Standard 40 is a rigorous evaluation procedure that simulates household use**
- **NSF/ANSI Standard 40 can be repeated**

Design Dosing Method

- **Dosing**

  500 gpd

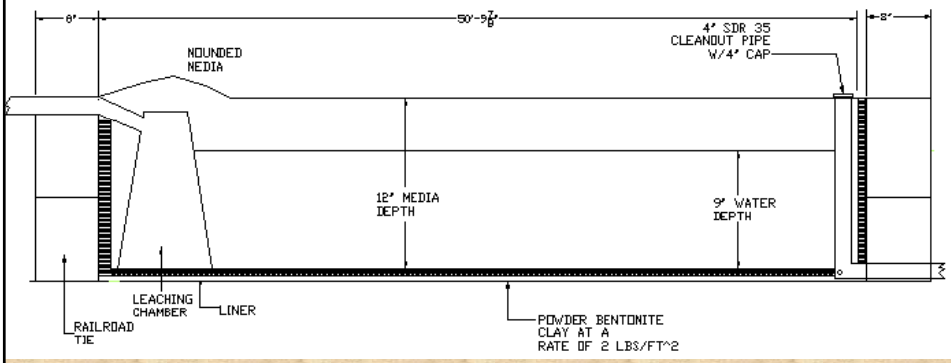
  5 gal/dose at 100 doses/day

  35 between 6am-9am

  25 between 11am-2pm

  40 between 5pm-8pm

Subsurface-flow Wetland Design



- 50 feet long X 10 feet wide X 1 foot deep
- 9-inches of water
- 0-gradient, rubber-lined, gravel-filled

Waco Wetland

Brazos R.

Transplants

washed roots

Plants

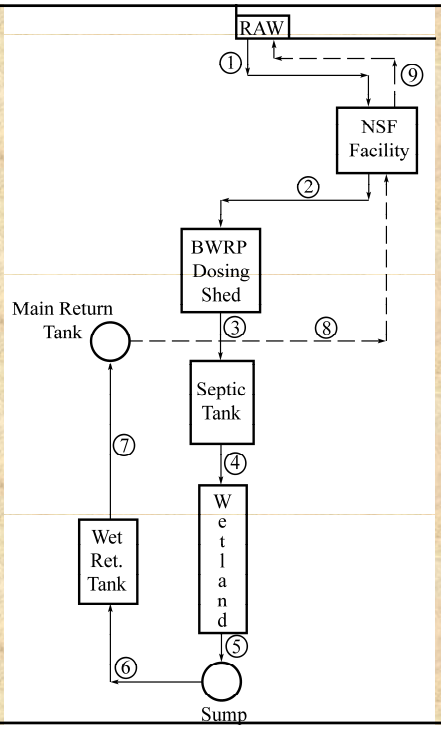
Density 1/3-ft^2

Cattail, Bulrush, Pickerel weed and Iris

No Plants			No Plants	
P	P	P	P	P
P +	P +	P	P +	P +
I	P	I	P	I
I	P	I	P	I
P	P	P	P	P
P +	P +	P o	P +	P +
P	P	I	P	P
B	B	B	B	B
B	B	C	B	B
B +	B +	C	B +	B +
B	B	C	B	B
B	B	B	B	B

Sampling Methodology

- **Raw** (1)
  - BOD and TSS
- **Septic effluent** (4)
  - BOD and TSS
  - CBOD and TSS
  - nutrients
- **Wetland effluent** (5)
  - CBOD and TSS
  - nutrients



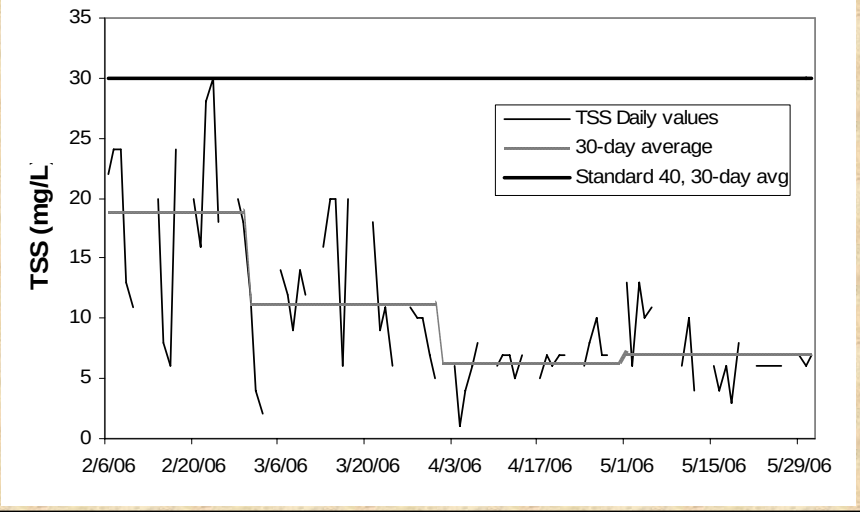
Sampling Methodology

influent

- **$CBOD_5$,TSS**
  - **Influent and effluent**
    24-hr flow-proportional composite,
    5 days/week

effluent

The TSS daily and 30-day averages compared to Standard 40, 30-day average



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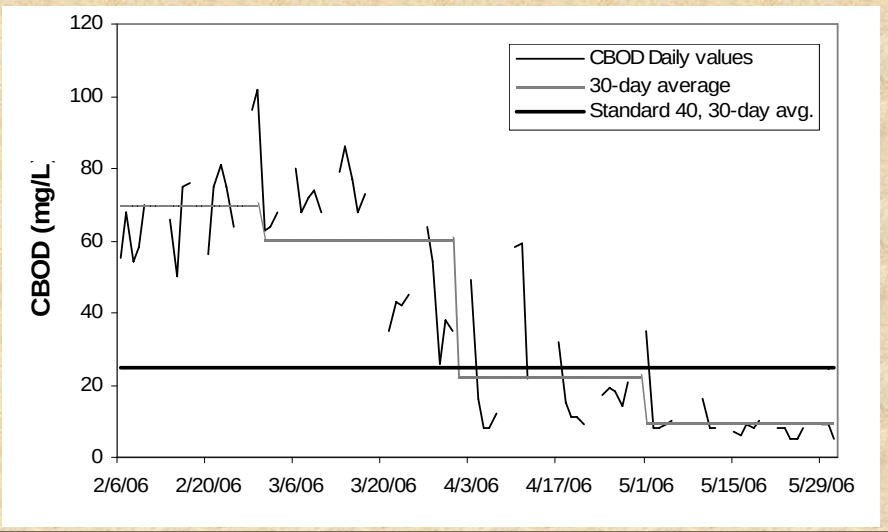

Wetland effluent weekly averages following stress tests

June & July 2006	Wash day	Working parent	Power out	Vacation
TSS (mg/L)	5	5	5	4
CBOD (mg/L)	7	5	6	9

Vacation Stress Temperatures

- July 17, 2006, the wetland surface temperature averaged **109.58 F**

Standard 40 Wetland Vacation Stress

- From left to right & top to bottom
- Days- 0, 2, 6, 8, 10 then 10 days after water was re-introduced.
- July 9-17, 2006
- Temperatures > 100F
- 74% of water lost
- 36% of plants lost

Wetland effluent weekly and monthly design loading averages following stress tests

	Week 1 day	Week 2	Week 3	Month
TSS (mg/L)	4	3	4	4
CBOD (mg/L)	3	3	7	4

CBOD 30-day Average % Reduction

	Raw Effluent (mg/L)	Septic Effluent (mg/L)	Wetland Effluent (mg/L)	Wetland % Reduction	System % Reduction
February	254	127	70.1	44.6	72.4
March	249	128	60.1	53.2	75.9
April	289	106	22.2	79.1	92.3
May	220	45.5	9.5	79.2	95.7

Wetland effluent 30-day averages during design loading

	Feb.	Mar.	Apr.	May
TSS (mg/L)	18.9	11.3	6.35	9.13
CBOD (mg/L)	70.0	60.1	22.2	12.8
pH	6.97	6.88	6.80	6.53
Temp. (°C)	15.3	20.0	23.4	25.9
TN (mg/L)	26.4	29.5	34.5	24.5
TP (mg/L)	3.20	4.73	4.55	5.35

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