Rainbow and Silver Springs Basin Working Groups

CURRENT RESEARCH WITH PASSIVE ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS (OSTDS)

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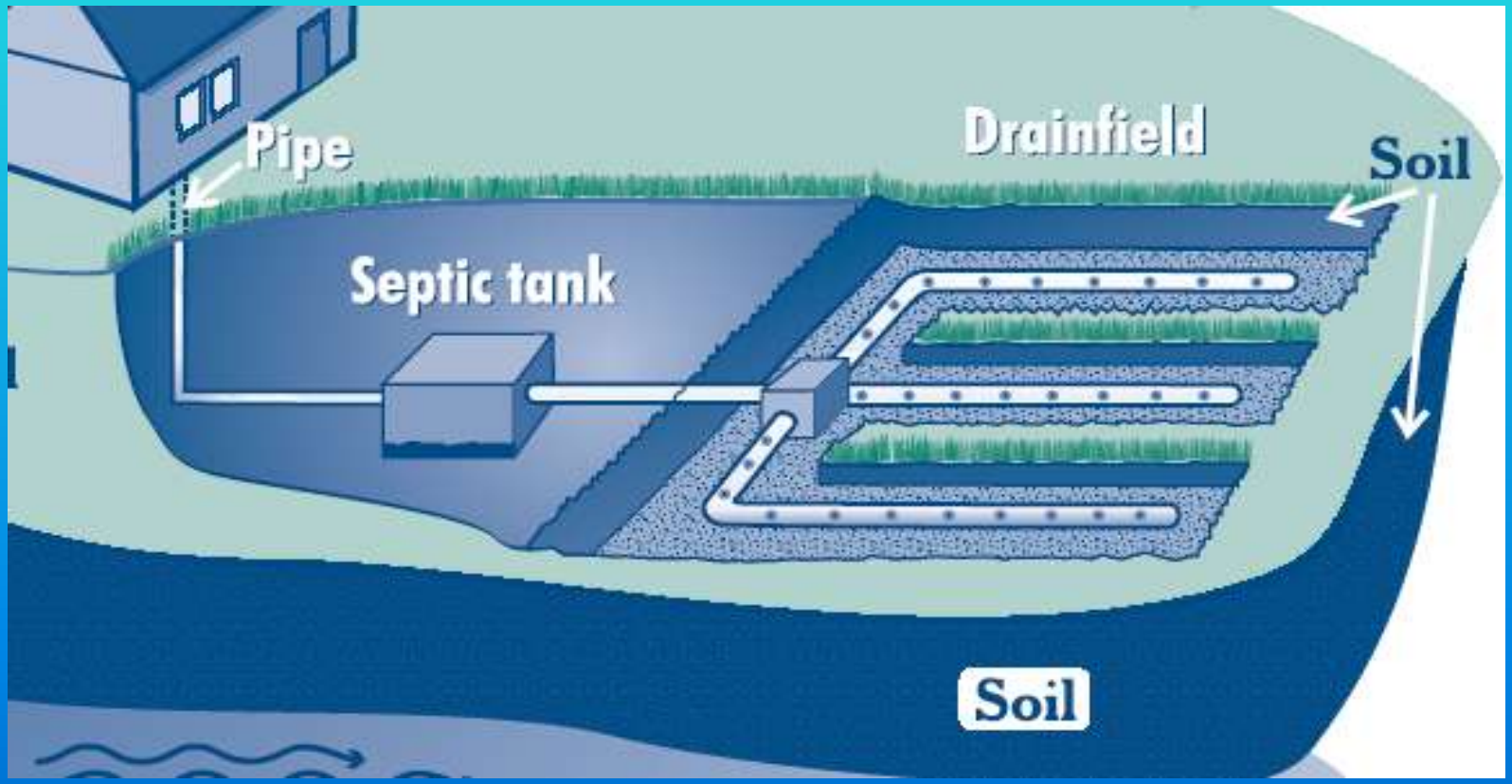
University of Central Florida

GOAL

- Conduct tests and provide data that can be used to help develop the next-generation passive, cost-effective Onsite Sewage Treatment and Disposal Systems (OSTDS) for Florida Use.

Conventional Design



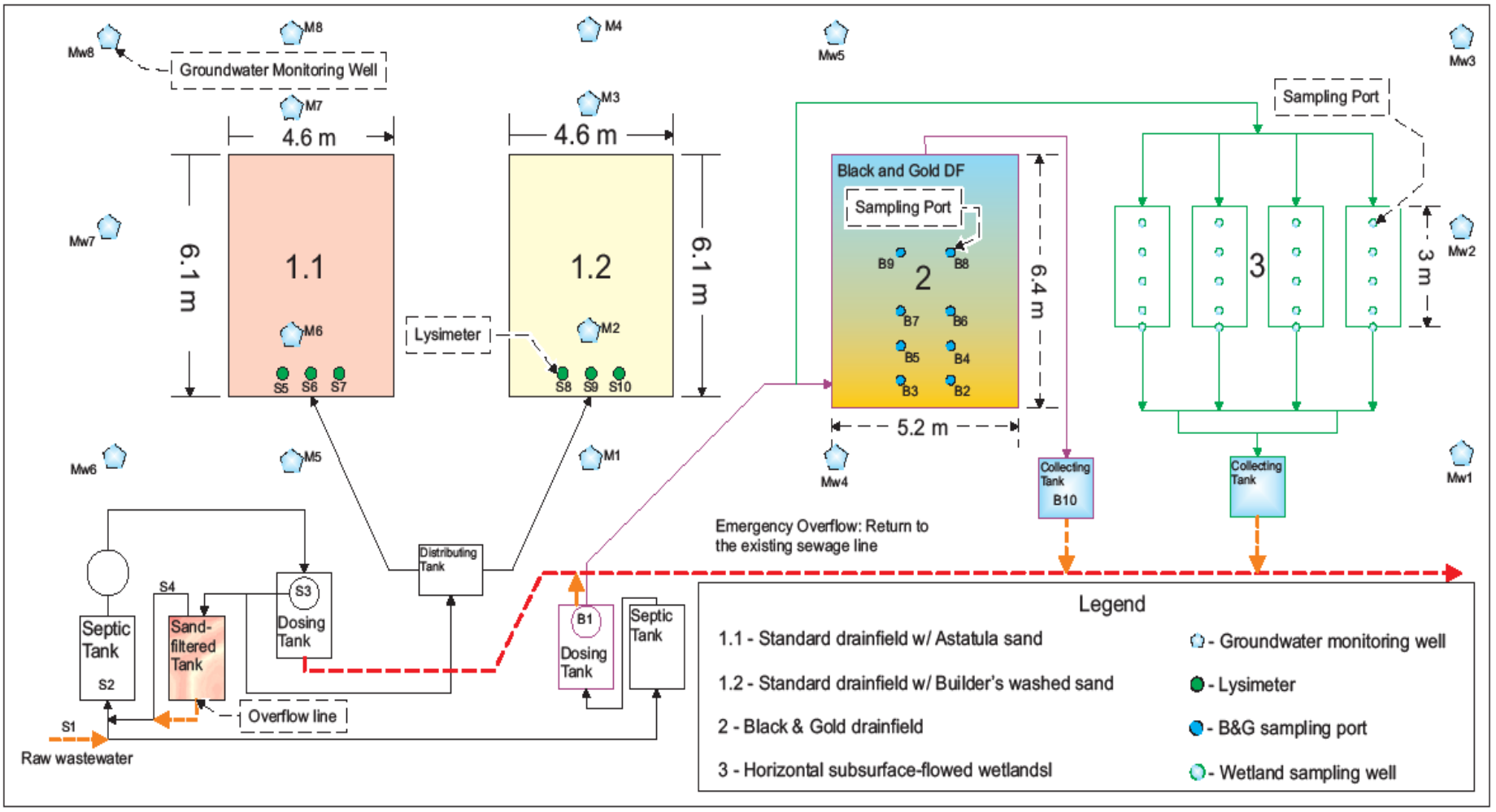
Can low cost alterations be made to this system to achieve nitrogen control?

Treatment Options Evaluated

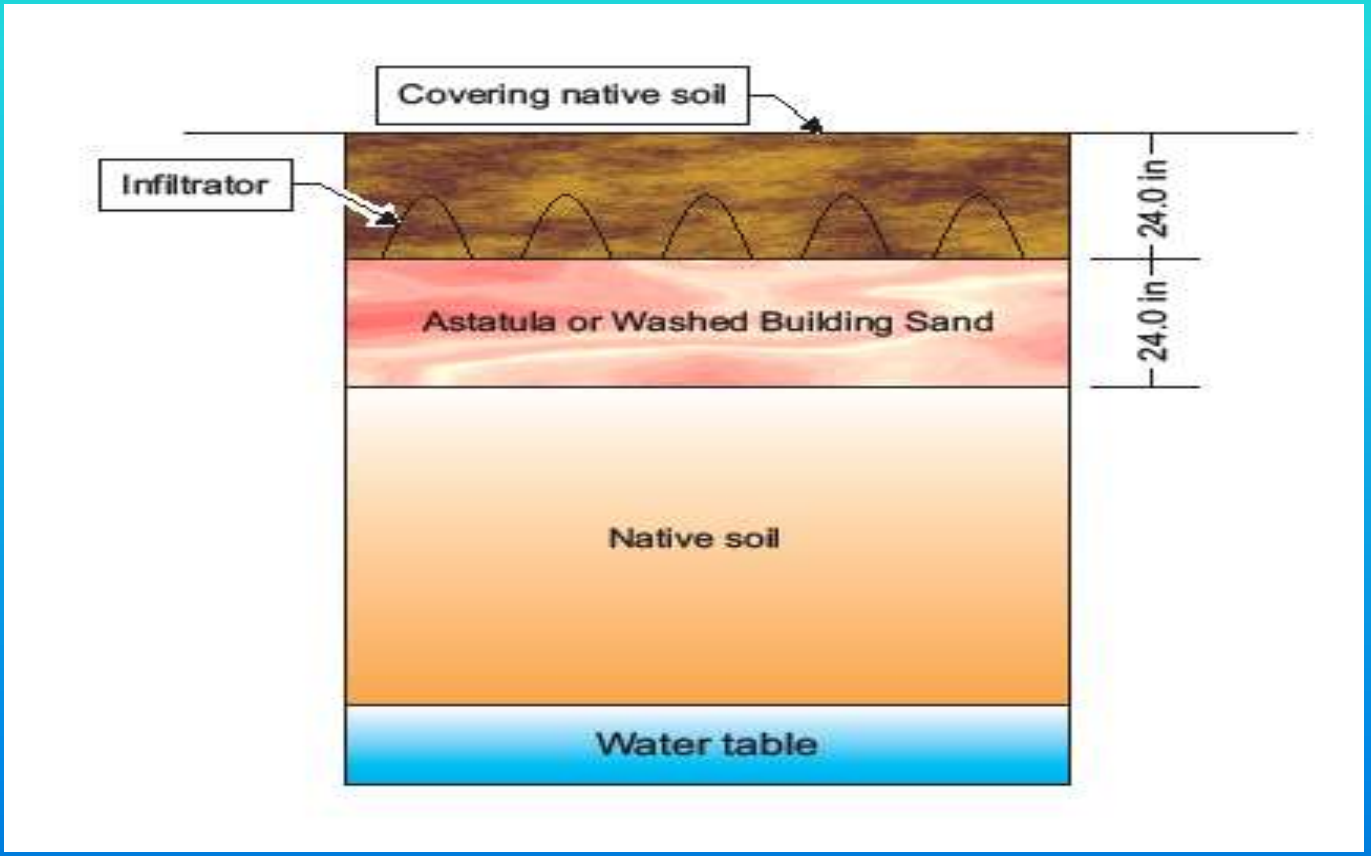
- Conventional drainfields
  - Two different materials in drainfield
    - Astatula sand
    - Washed building sand
  - Standard septic tank with recirculation
- Sorption media (B&G) drainfield
- Sub-surface Upflow Wetland (SUW)
  - With sorption media
  - With different plant species
  - New flow pattern

OWTS Center at UCF, Orlando

Note: isolated the B&G and SUW from the groundwater

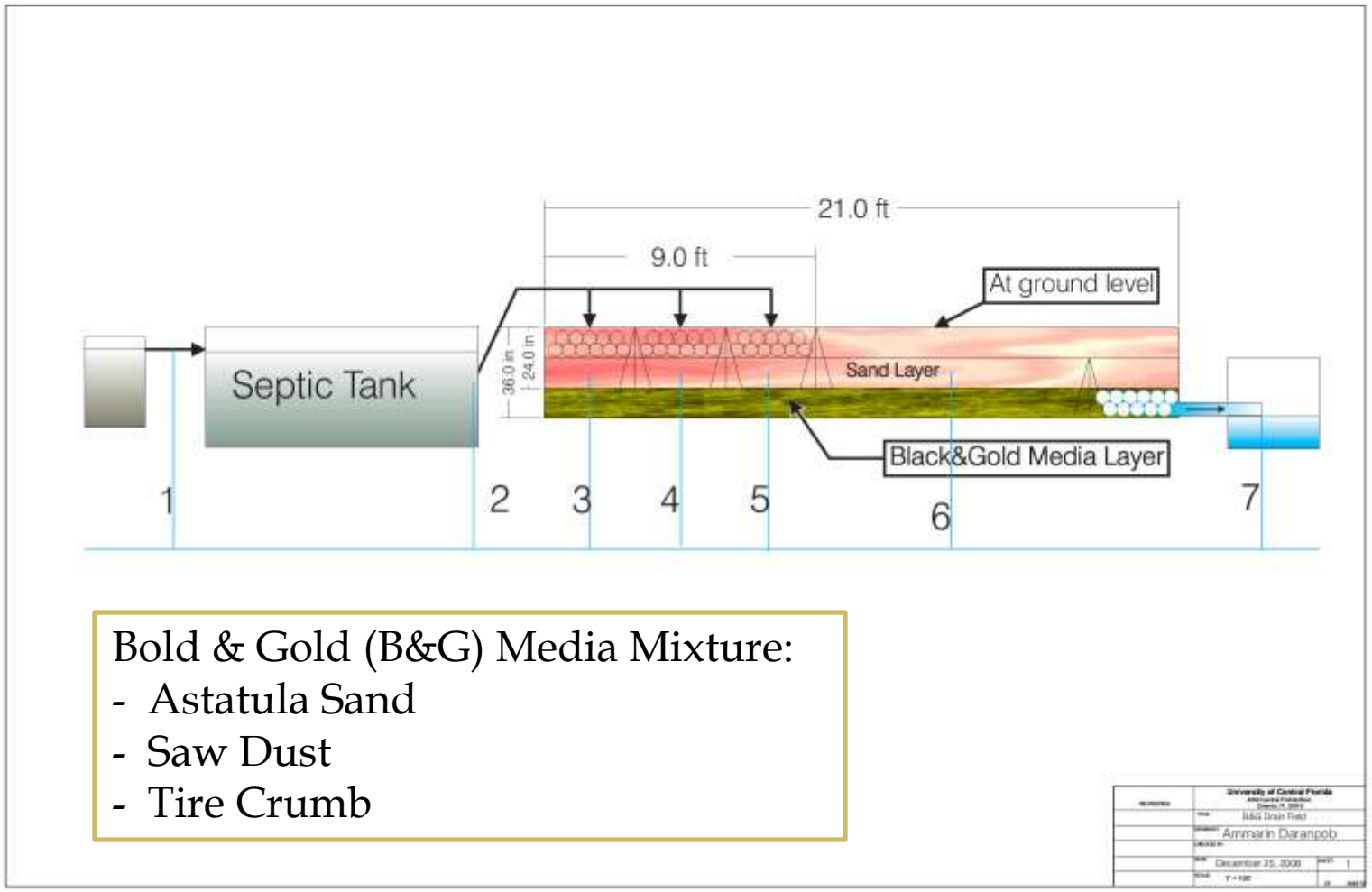


Standard Drainfield Design



Astatula sand and Washed Building sand are used in two conventional drainfields for performance comparison

Bold & Gold Drainfield



Bold & Gold (B&G) Media Mixture:

- Astatula Sand
- Saw Dust
- Tire Crumb

Sub-Surface Upflow Wetland Design

Wetland ID	Previous wetland plant	Replacement plant
Wetland 1	Softrush	Canna
Wetland 2	Halifax maidencane	Blue flag
Wetland 3	Giant Cutgrass	Bulrush
Wetland 4	No plant	No plant

Expanded Clay Growth Media Mixture:
- Expanded Clay
- Vermiculite
- Peat Moss

Pollution Control Media Mixture:
- Tire Crumb, Saw Dust
- Astatula Sand, and
- Lime Stone

Standard Drainfields

Std. drainfield w/
Washed Building sand

Std. drainfield w/
Astatula sand

Recirculaton System

Dosing Tank

Sand Recirculation Tank

Return Pipe

Septic Tank

B&G Drainfield

MIXING B&G MEDIA

EPDM LINER 45-MIL

B&G Drainfield

BAFFLES INSTALLATION

Bold&Gold media

PTI PIPES INSTALLATION

Outlet pipe

Astatula sand

Inlet pipes

Sub-Surface Wetlands

WOOD FRAME

EPDM LINER

Sub-Surface Wetlands

3/8″ River gravel

Geofabric

Sub-Surface Wetlands

Halifax Maideneane

Common Soft Rush

Giant Cutgrass

Control Wetland

Evaluation using:

RT-PCR,

Bacteria Count,

Nutrients

Other water chemistry

Certified Laboratory Analyses

Real-Time PCR

- **Reverse Transcription-Polymerase Chain Reaction (RT-PCR) is a technique for mRNA detection and quantification.**
- **RT-PCR is used to detect and count microorganisms that breakdown ammonia and nitrate in drain fields.**
- **Ammonia Oxidizing Bacteria (AOB)**
- **Nitrite Oxidizing Bacteria (NOB)**
- **Denitrifiers**

NSF 245 and UCF Wastewater Raw waste or influent numbers

	TSS (mg/L)	CBOD5 (mg/L)	TN (mg/L)	TKN (mg/L)	ALK (mg/L as CaCO3)	Temperature (Celsius)	pH (S.U.)
UCF Average Influent	217.9	119.2	44.4	47.1	297.2	23.6	7.6
NSF/ANSI 245	100 - 350	100 - 300	-	35 - 70	> 120	10 - 30	6.0 - 9.0
NSF/ANSI 40	100 - 350	100 - 300		35 - 70	> 175	10 - 30	6.5 - 9.0
Status	OK	OK		OK	OK	OK	OK

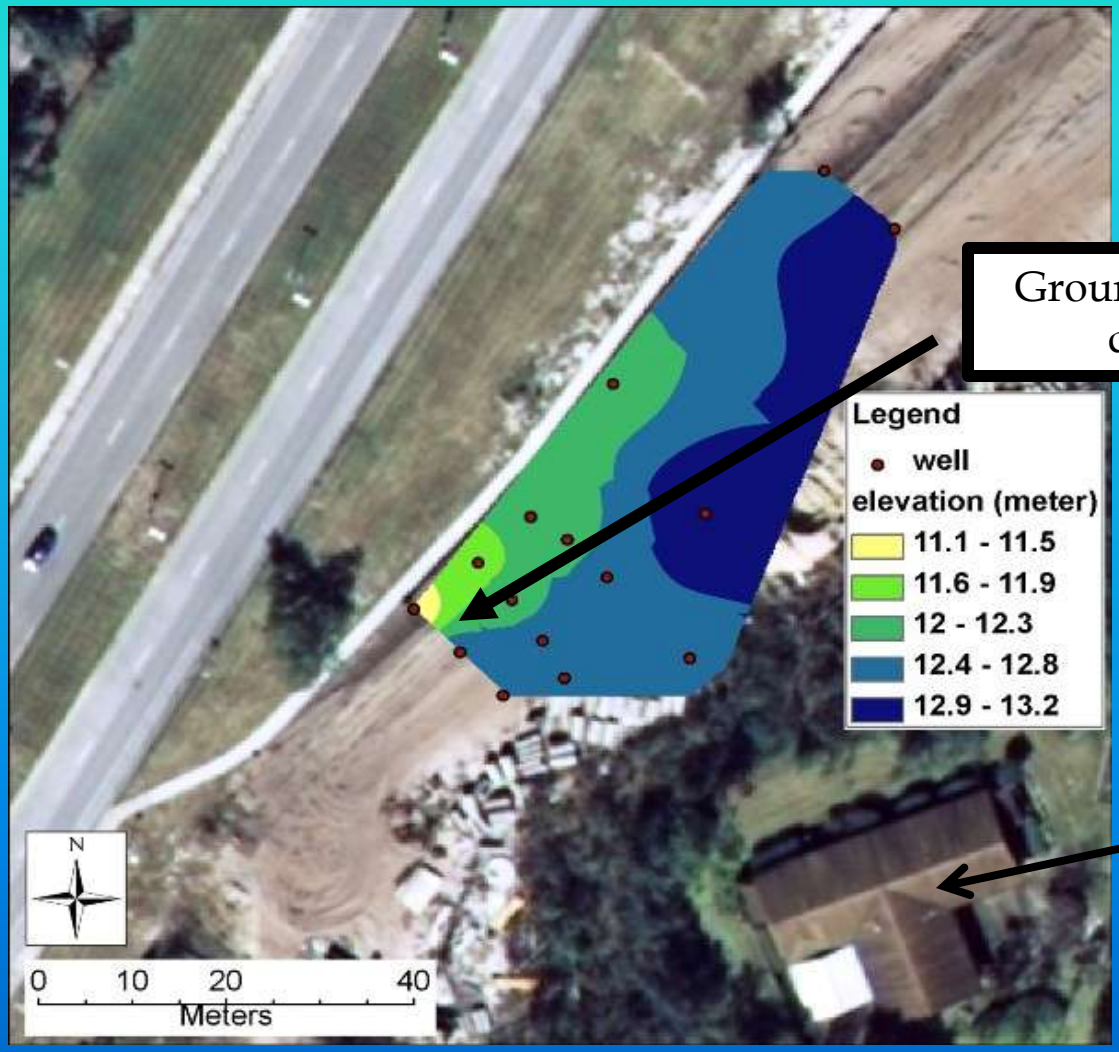
Wastewater is from a scholarship dorm with 15 beds, kitchen and laundry and when students not there, flow is from the University Reception Home (AKA the President's Home).

Monitoring Wells

Drill 11-13 foot borehole to install monitoring wells

A monitoring well

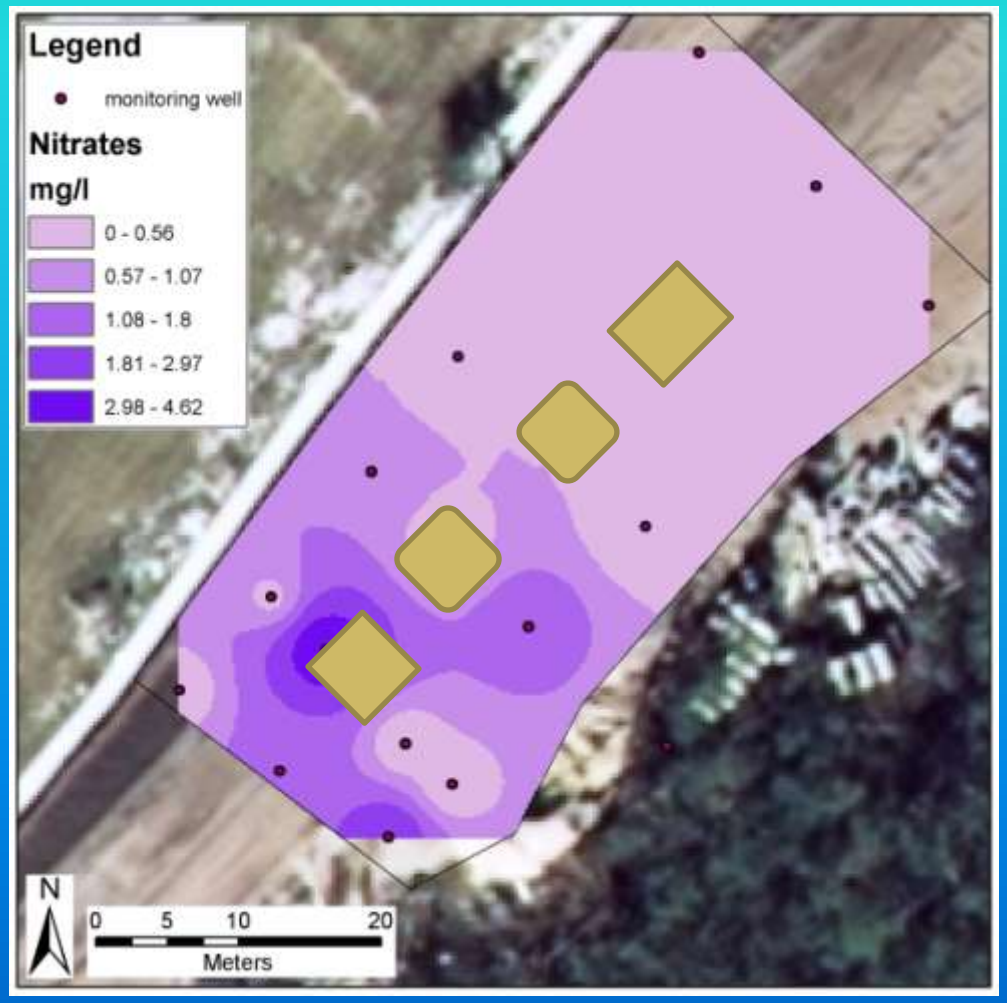
Groundwater Gradient



Groundwater flow direction

Scholarship House

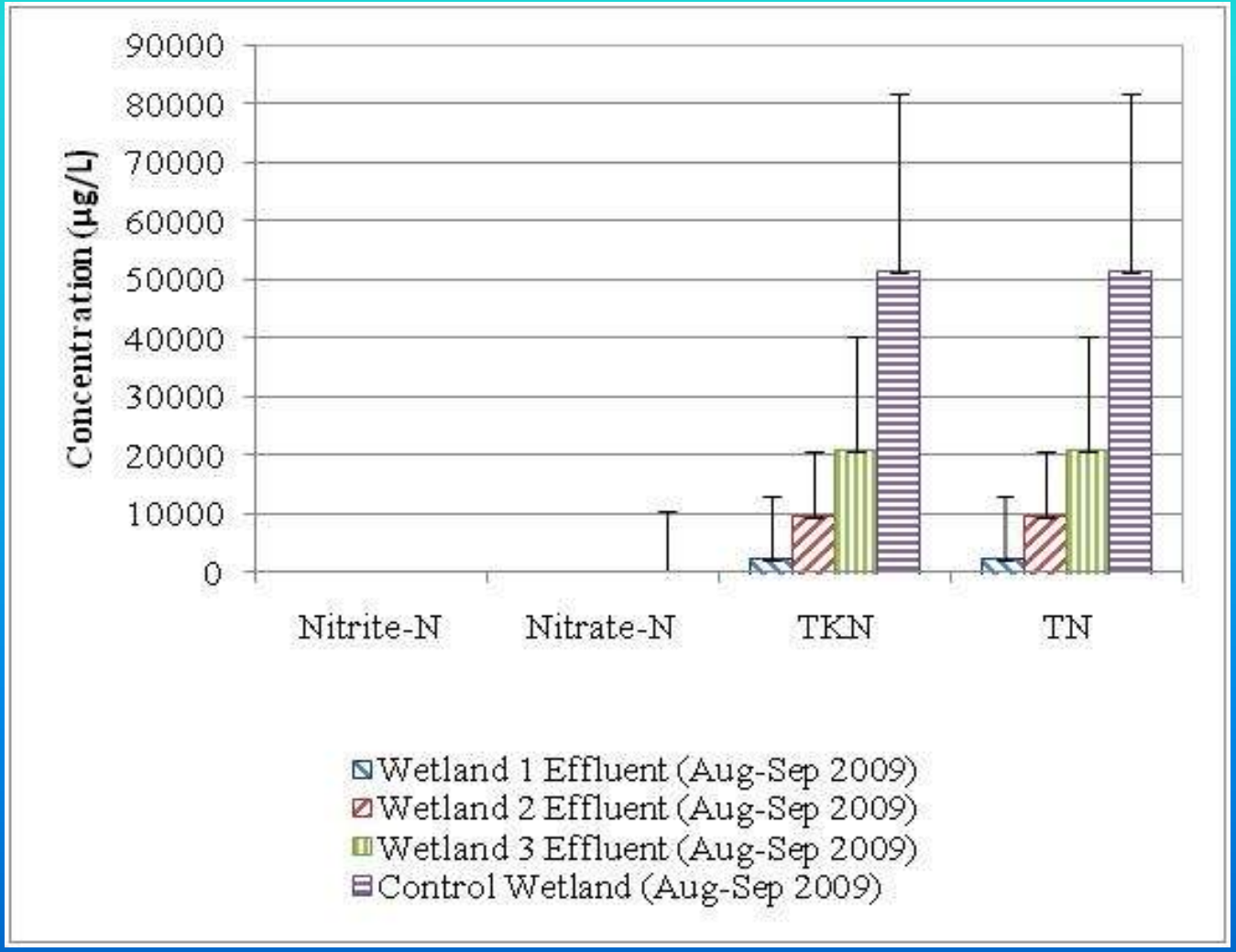
Nitrate in Groundwater March – April 2009



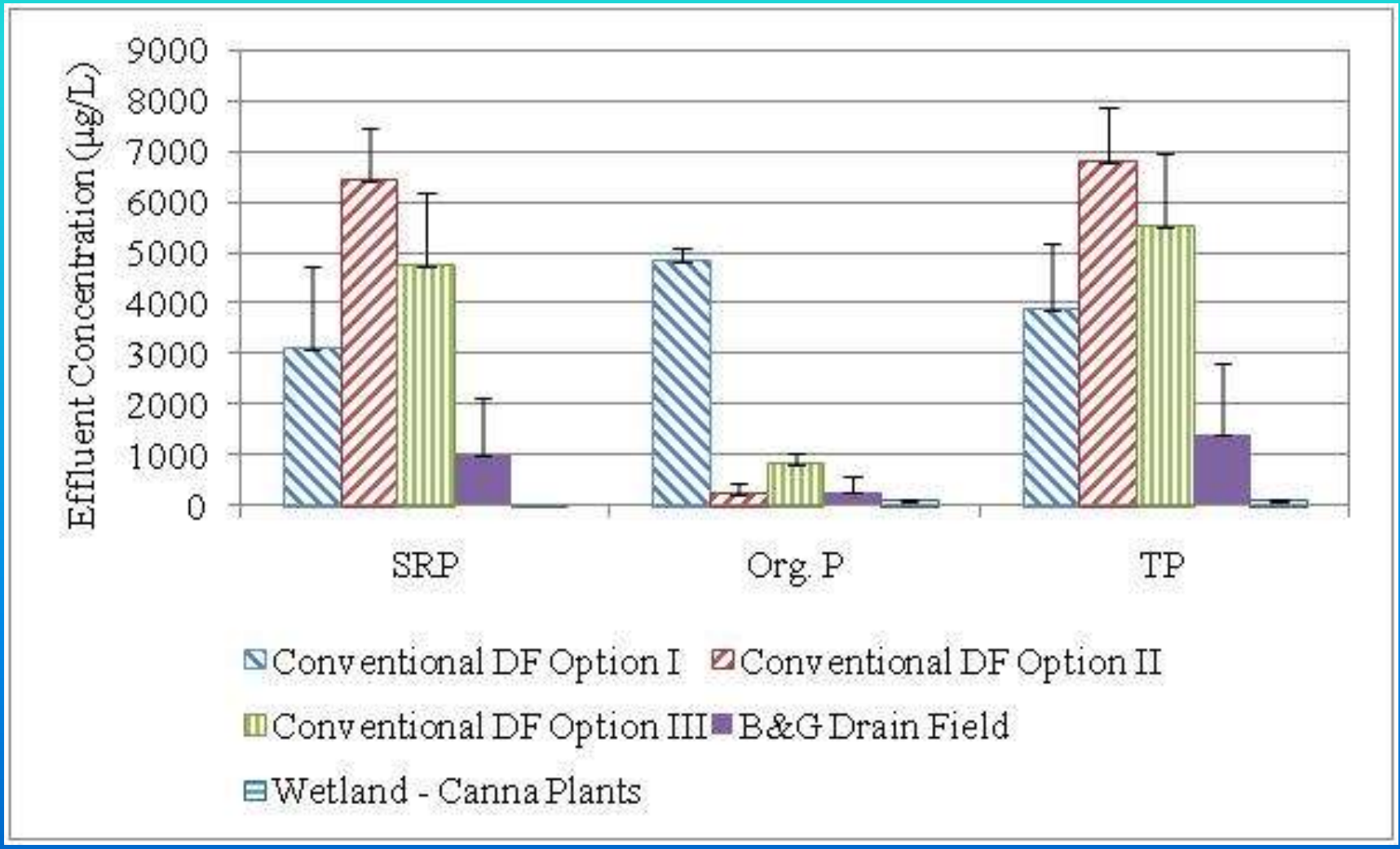
Highest NO3-N Measure under The conventional Drainfield was 29.9 mg/L.

SRP in Groundwater March – April 2009

Nitrogen Species in SUWs
Wetland 1 (Cana) was best



Effluent Phosphorus Comparisons Average Values



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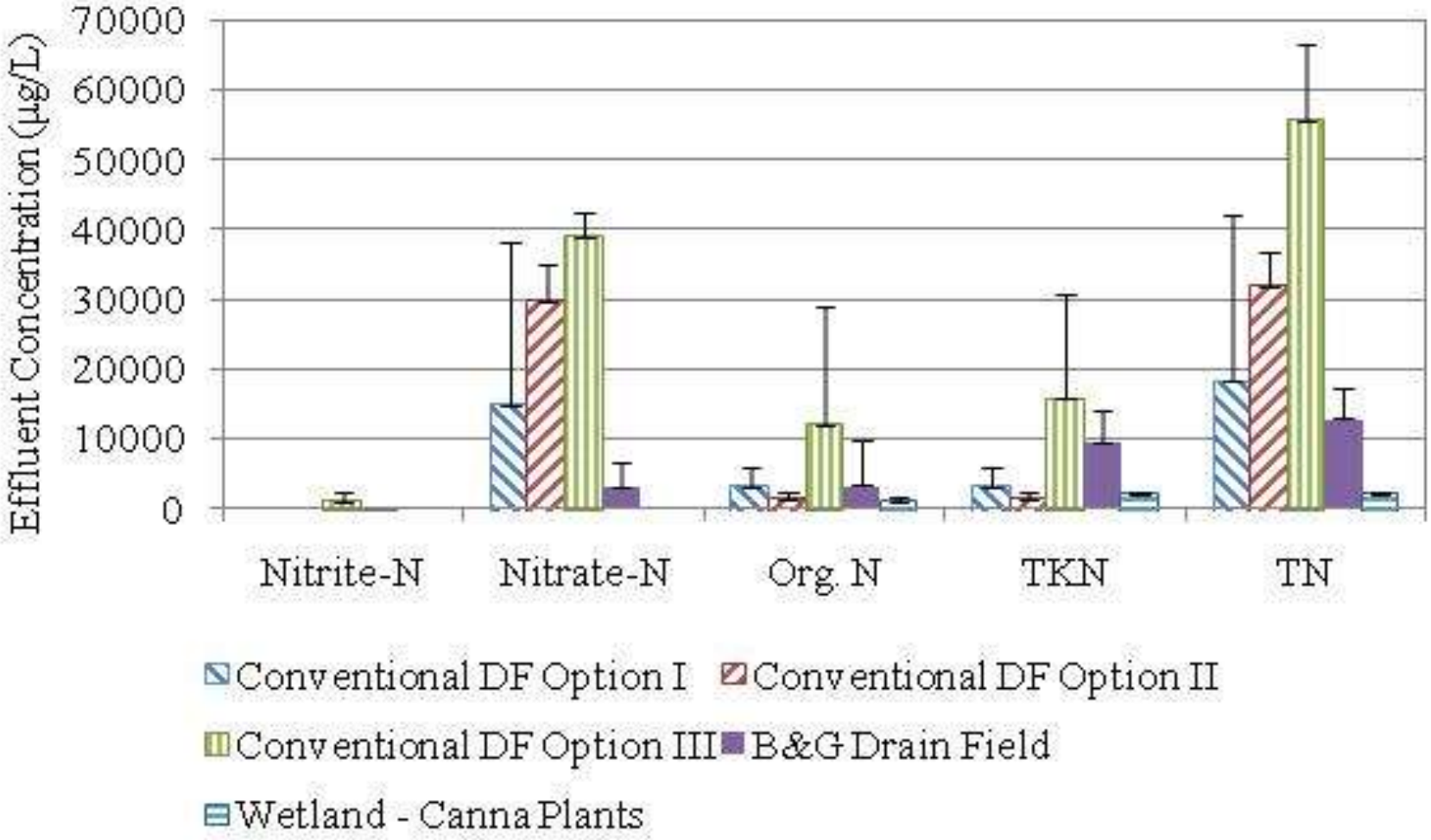

Effluent Comparisons Average values

	Conventional DF with recirculation	Conventional DF no recirculation	B&G Sorption Drain Field	SUW – Sorption with Canna Plants
CBOD5 (mg/L)	7	1	8	4
Nitrate-N (mg/L)	29.8	38.9	3.15	0.006
TN (mg/L)	31.1	55.7	12.9	1.96
SRP (mg/L)	6.44	4.73	1.00	0.018
TP (mg/L)	6.78	5.52	1.39	0.096
Fecal (cfu/100mL)	1	1	11	657
E.Coli. (cfu/100mL)	1	1	9	7

Effluent Removal Percentages

Comparisons of Average Values

Concentration Changes (- indicates an increase)#					
	Conventional DF Recirculation I	Conventional DF Recirculation II	Conventional DF Recirculation III	B&G Drain Field	SUW - Canna Plants
BOD5 (mg/L)	90.14%	95.91%	98.51%	85.15%	94.79%
CBOD5 (mg/L)	91.86%	96.01%	98.45%	88.35%	95.74%
TN (µg/L)	49.07%	52.29%	16.21%	70.21%	96.69%
SRP (µg/L)	38.66%	-33.98%	-28.44%	79.11%	99.51%
Org. P (µg/L)	3.21%	86.73%	66.91%	83.56%	96.68%
TP (µg/L)	48.70%	11.01%	9.21%	81.79%	98.41%
Fecal (cfu/100mL)	>99.9%	>99.9%	>99.9%	>99.9%	>99.9%
E.Coli. (cfu/100mL)	>99.9%	>99.9%	>99.9%	>99.9%	>99.9%

Cost Comparisons
Mid Year 2009 data, 500 gpd basis

	Construction Cost with 20% contingency ($)	Annualized Construction Cost at 6% interest rate and 20 years ($)	Annual Operating cost ($)	Unit Cost $/1000 gallons
Conventional OSTDS	$ 6,920	$ 600	$ 200	$ 4.38
B&G with sorption media	$ 9,320	$ 810	$ 200	$ 5.53
SUW with sorption media and plants	$ 10,200	$ 890	$ 400	$ 7.07
Continuous Feed Cyclic Reactor & Drip Irrigation	$ 18,200	$ 1,590	$ 1,800	$ 18.58
Recirculation Tank & Drip Irrigation	$ 27,800	$ 2,420	$ 1,850	$ 23.40

Sub Surface Upflow Wetland

Cost effective and can “look good”

Installation and Completed Site

Sorption Media Anaerobic Tank, Florida's Showcase Green Envirohome
Indialantic Florida

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Thank You…. Questions and Discussion

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