REDUCTION OF WASTEWATER EFFLUENT FROM ON-SITE SEWAGE FACILITIES - CURRENT UPDATES AND FUTURE PLANS

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For Presentation at the Onsite Wastewater Mega Conference
Organized by the National Onsite Wastewater Recycling Association
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The materials being presented represent the speaker's own opinions and ***do NOT reflect the opinions of NOWRA.***

Presentation Outline

- Background Information on TOGP Research Program;
- Increasing Use of OSSF in Texas and Technology Trends;
- Interests in Reducing Liquid Discharge;
- Enhanced Vapor Effluent Discharge (EVED) Evaluation;
- Discussion / Q & A

TOGP Research Program

- Texas On-Site Sewage Facility Grant Program(TOGP) https://www.tceq.texas.gov/permitting/ossf/ossf-grant-program

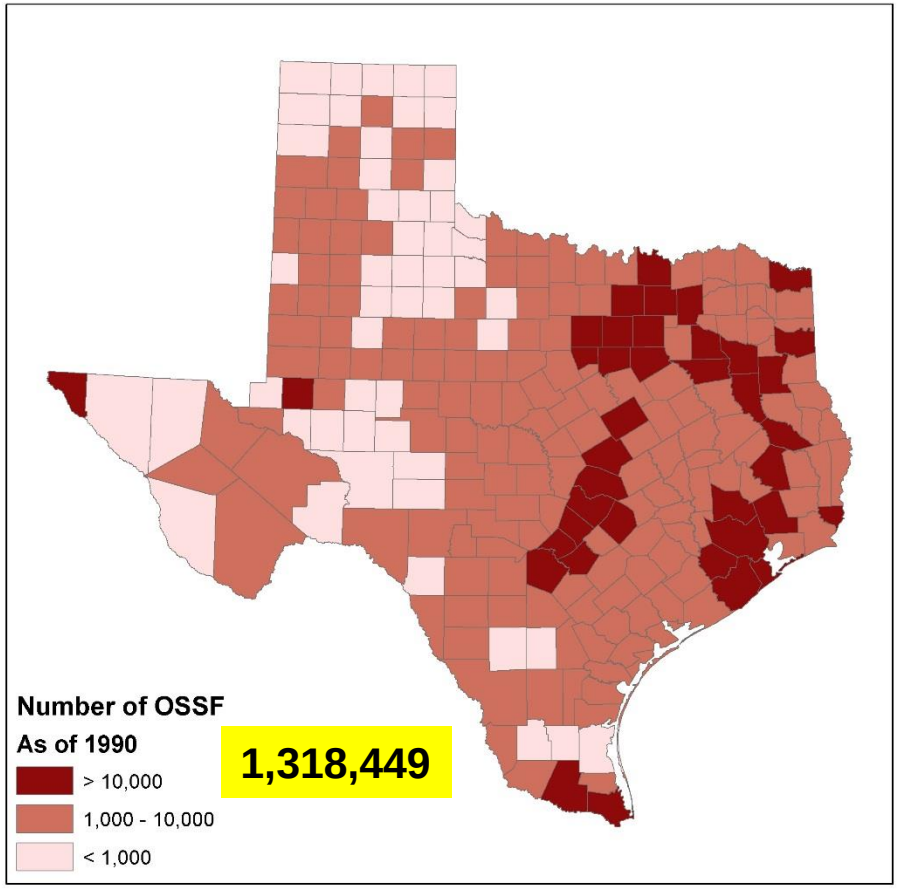
- Question – Who attended my presentation in San Marcos, TX @ NOWRA-2021? OR read the article *"The Texas Model"* in OSJ-Spring Issue?

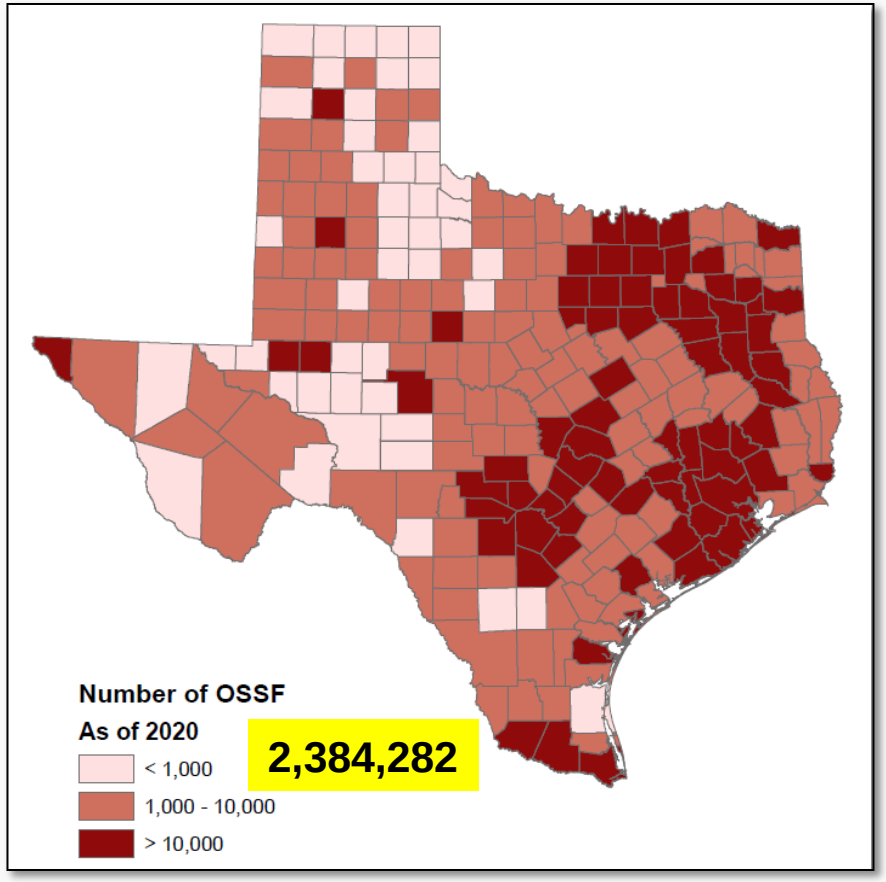
- Brief discussion on the $10 permit fee funded research program in Texas…

Extension

Research

Number of OSSFs in TX then and now…
Inventory and Mapping Program…





This information was complied from 1990 Census data and OARS data from TCEQ.

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Research

About 927,000 new permits issued since 1990… of which about 418,000 (~45%) were for ATU Spray… (# of permits/year v. year)

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Research

Highlights of TOGP-1 (completed) and TOGP-2 (in-progress)

TOGP-1 (2019-2021)

1. ATU performance, effects of high-strength and time-dosing (JW);
2. LPD design configuration, by the rules and new concepts (GB);
3. Reuse wastewater for toilet flushing, treatment-train performance (AJ).

Final reports and conference papers on OSSF Website…

TOGP-2 (2021-2023)

1. RV Parks and ATU performance in real-world (JW);
2. Drip challenges and recommendations for improvement (GW);
3. Effluent flow reduction to minimize need for disposal area (AJ).

Delayed start mid-2022, data collection started late-2022, Draft Report Due in **November 2023!**

Extension

Research

TOGP-4: Topic 2.3.4 Reduction of Wastewater Effluent from On-Site Sewage Facilities **(E-FLOW)**

Under current rules, adequate and suitable disposal area will continue to be a challenge for properties served by OSSFs. Residential and commercial properties are constantly faced with choosing between on-site disposal and the use/enjoyment of valuable real estate. **Research is needed to identify technologies and applications that can be:**

1. Utilized to eliminate liquid water discharge from on-site sewage facilities; and

2. Coupled with on-site sewage facilities to utilize roof and/or wall space for disposal area.

….. The goal is to develop solutions for alternate disposal areas.

Question: How many of you are facing this problem in your area?

Utilizing Roof / Wall Space Area?

Examples of Green Roof Green Wall
TAMU Main Campus…

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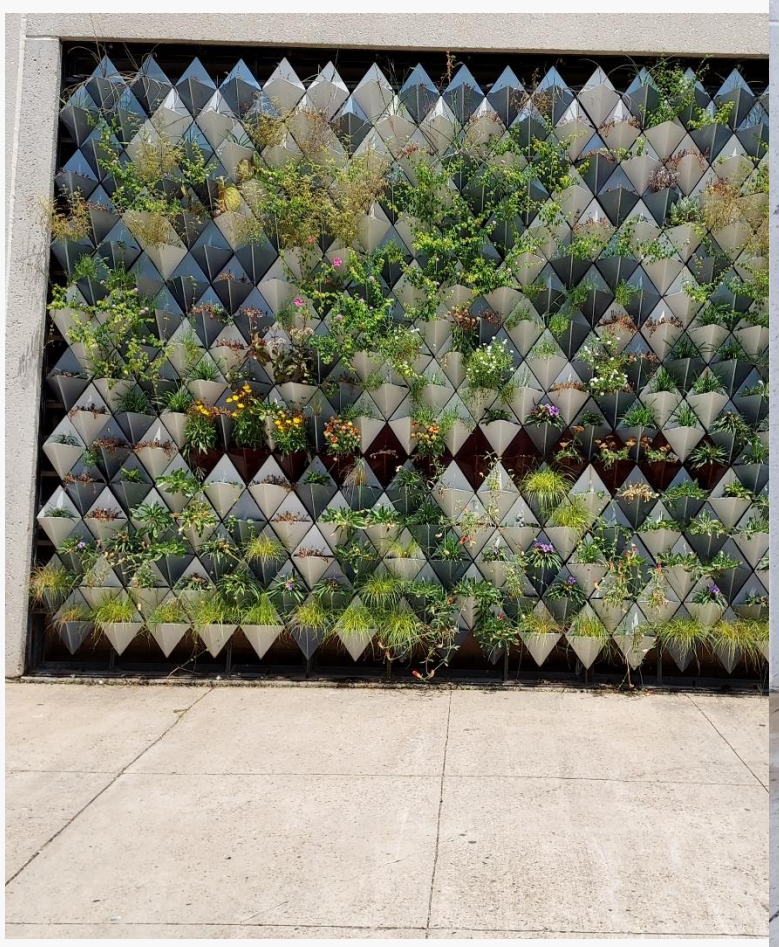
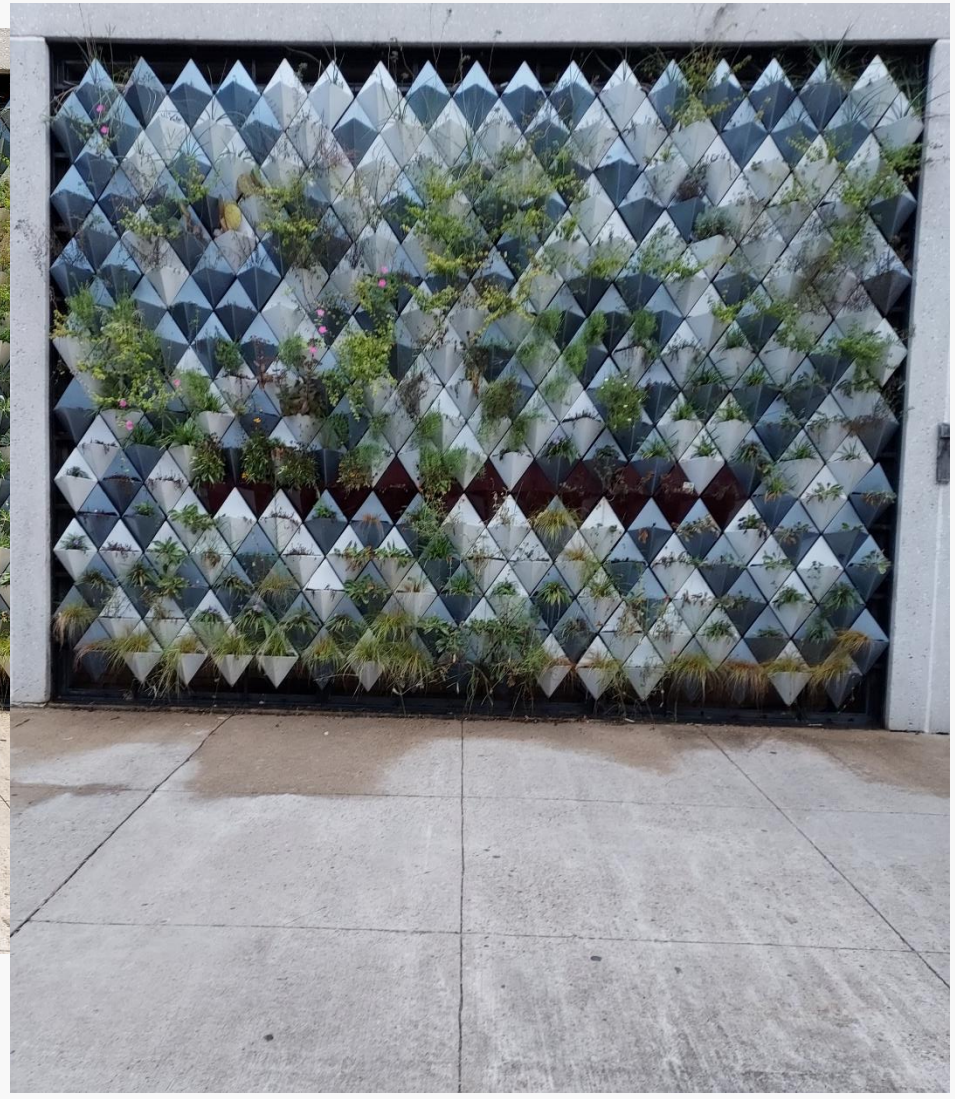
Research

Utilizing Roof / Wall Space Area?





Green Wall for Disposal Area??

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Research

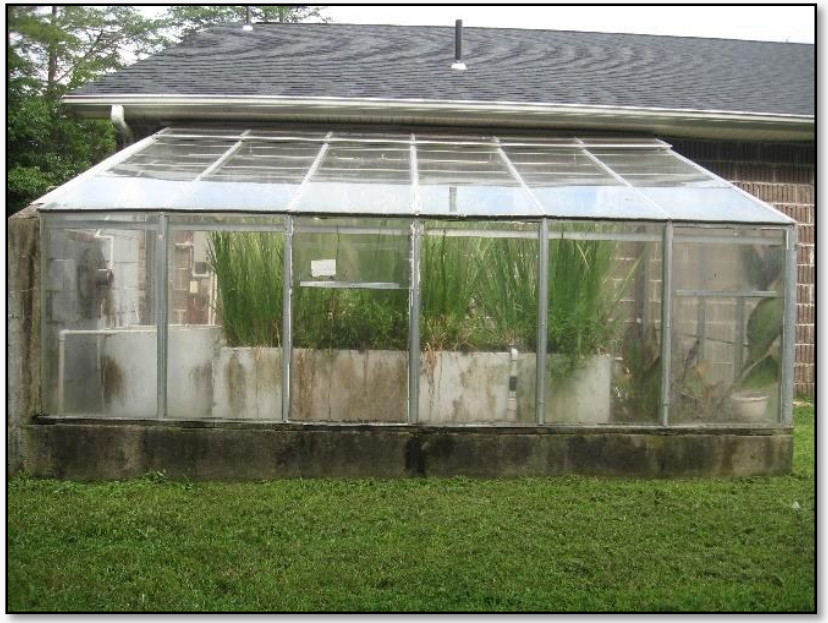
Green Roof in Houston

The building entrance and the LEED Certification signage

The Green Roof covering about one-acre space, and big wet spots nearby indicating over irrigation and/or lack of ET losses. NOTE: AC condensate is used for irrigating the Green Roof.

Eliminate or Reduce Liquid Discharge Using Something Else…

- "Enhanced Vapor Effluent Discharge" (EVED™) Technique… or a modified ET Bed with indoor non-potable reuse?
- *My Experience with Masonic Lodge Project in VA (long story…)*



Liquid discharge reduced by >90% (ET + Reuse)

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Research

Maximizing use of our Research Center

TOGP-1

- ATU
- LPD
- Reuse

TOGP-2

- DRIP
- E-FLOW
- *Reuse*

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Research

We are going to study 1st Generation EVED Technique:

Wetland in a Greenhouse

Wetlands reduce liquid discharge…*(ET losses)*

TABLE VII
ANNUAL AVERAGE NET EVAPORATION
(EVAPORATION - RAINFALL)

REPORTING STATION	NET EVAPORATION*, RET INCHES/DAY
Amarillo	0.21
Austin	0.14
Beaumont	0.04
Big Spring	0.24
Brownsville	0.15
Chilicothe	0.20
Canyon Lake	0.15
College Station	0.12

ET Bed sizing for CS
0.12 inch/day = 0.07 gpd/sq.ft.

Q: Can this sizing requirements be reduced? If so, by how much??

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Research

1st Generation EVED Technique:
Wetland under a Semi-Climate Control Greenhouse

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Research

Ryan found wetland plants from Houston area….

Planted same number and type of plants in both wetlands

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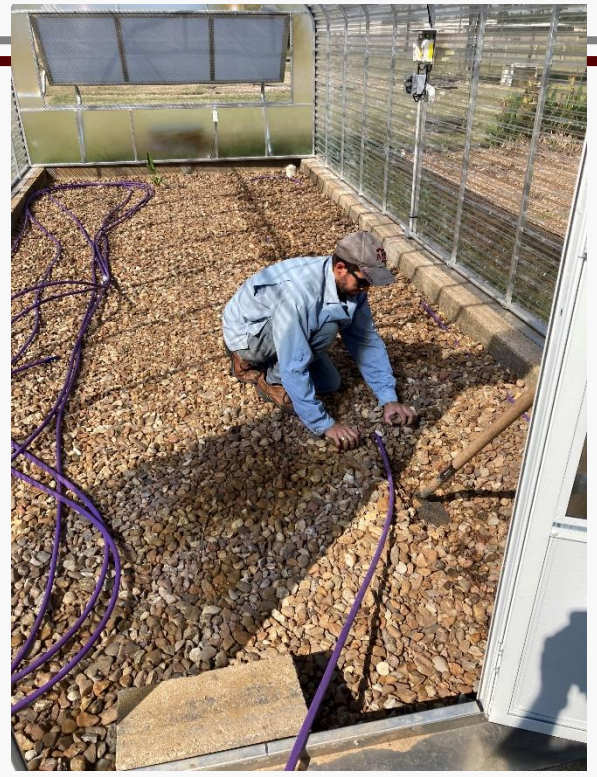
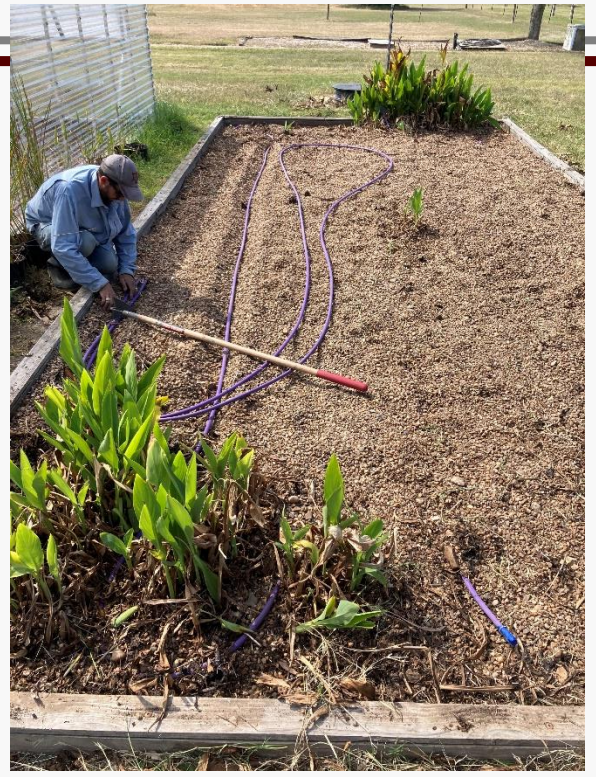
Research





<u>Combining two projects…</u>

DRIP and E-FLOW **(Late Oct. ’22)**

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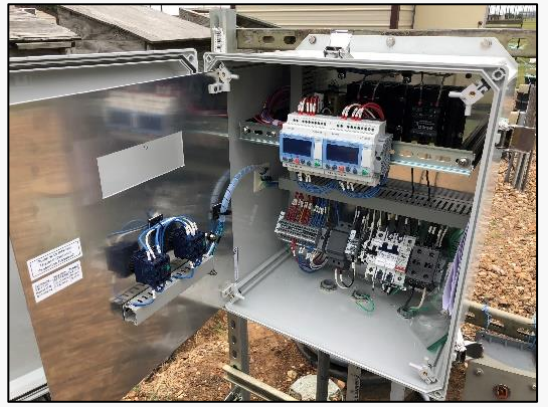
E-FLOW Project Plan

- Dose both the wetland cells (~100 GPD) using ATUs from last project, and record the influent and effluent flow (daily average); *CHALLENGE – How to measure effluent flow?*
- Monitor weather data, rainfall, temperature, wind speed, humidity, etc.;
- Compare the effluent flow (liquid discharge) from both the wetland cells, *open cell and greenhouse cell*;
- Prepare recommendations for designing EVED technique from the observations!

Measuring Flows…

- GPD going in (Influent) measured using the flow meters installed during the TOGP-1 ATU Project..



- GPD going out (Effluent Discharge) measured using the tool designed and built by Ryan…

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Research

First Freeze…. December 2022…

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Research

Plant Growth Comparisons…

Early October

Early November

Early January, after the 1st freeze…

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Late February 2023…

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Research

June 2023 during the REEU program…

Water quality and quantity data will be included in the final report

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Research

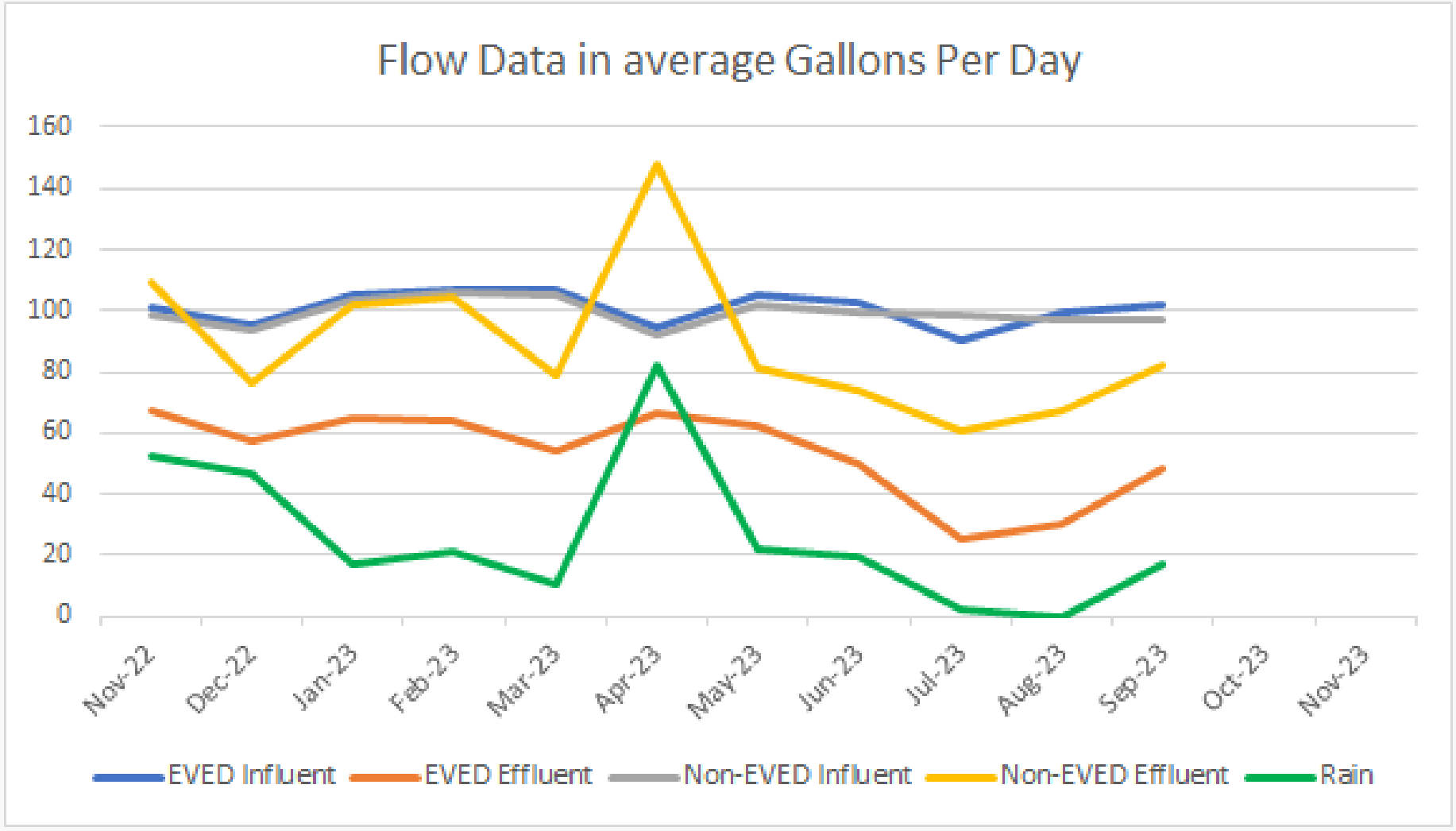
Data collection, daily averages

Greenhouse Wetland						Open Wetland						RAIN
Obs #	Date	Avg Temp	Avg RH%	Influent GPD	Effluent GPD	Obs #	Date	Avg Temp	Avg RH%	Influent GPD	Effluent GPD	GPD
1	11/17/22	57.3	N/A	102.4	36	1	11/17/22	51.3	N/A	99.5	15	
2	11/18/22	60.6	N/A	102.4	51	2	11/18/22	51.9	N/A	99.5	80	
3	11/19/22	48.6	N/A	102.6	77	3	11/19/22	43.0	N/A	98.5	130	
4	11/20/22	52.7	N/A	101.8	72	4	11/20/22	43.3	N/A	99.4	85	
5	11/21/22	50.5	N/A	85.6	51	5	11/21/22	44.6	N/A	83.0	124	
6	11/22/22	60.3	N/A	102.6	76	6	11/22/22	51.0	N/A	99.6	87	
7	11/23/22	69.8	N/A	100.7	55	7	11/23/22	61.8	N/A	99.3	77	
8	11/24/22	65.7	N/A	102.0	100	8	11/24/22	63.9	N/A	99.3	154	131
9	11/25/22	62.5	N/A	102.6	95	9	11/25/22	59.8	N/A	99.3	81	8
10	11/26/22	64.2	N/A	102.8	86	10	11/26/22	56.2	N/A	99.1	272	228
11	11/27/22	63.3	N/A	102.8	69	11	11/27/22	54.8	N/A	99.9	142	0
12	11/28/22	65.4	N/A	102.8	62	12	11/28/22	58.2	N/A	100.5	122	0
13	11/29/22	75.0	N/A	102.4	66	13	11/29/22	71.9	N/A	100.2	85	0
14	11/30/22	60.9	N/A	103.0	52	14	11/30/22	50.2	N/A	99.9	81	0
15	12/01/22	57.3	N/A	102.4	61	15	12/01/22	48.6	N/A	100.3	80	0
328	10/10/23	73.4	75.0	103	0	328	10/10/23	68.9	78.4	101	66	5
329	10/11/23	73.9	72.0	102	2	329	10/11/23	67.9	79.9	101	102	2
330	10/12/23	75.3	73.3	102	24	330	10/12/23	70.1	78.8	100	81	0
331	10/13/23	78.9	65.4	103	45	331	10/13/23	74.9	68.8	101	91	0
332	10/14/23	69.2	60.0	103	48	332	10/14/23	64.2	50.2	101	62	0
333	10/15/23	67.1	60.3	105	50	333	10/15/23	60.5	55.4	102	81	0

Extension

Research

Graphical Presentation of Daily Flow Data



Extension

Research

Data collection, monthly averages

	Aveage Influent and Discharge By Months							Aveage Temp and % RH By Months			
	Greenhouse, EVED			Open, Not-EVED			*RAIN*	Greenhouse, EVED		Open, Not-EVED	
	Influent	Effluent	**% Reduction**	Influent	Effluent	**% Reduction**	*GPD*	Temp	%RH	Temp	%RH
Nov-22	101	68	**33%**	98	110	**-11%**	*53*	61.2	N/A	54.4	N/A
Dec-22	95	57	**40%**	94	76	**19%**	*47*	64.9	N/A	61.9	N/A
Jan-23	105	65	**38%**	103	102	**1%**	*17*	61.0	66.6	55.1	73.7
Feb-23	107	64	**40%**	106	104	**1%**	*11*	63.5	67.7	56.5	74.8
Mar-23	106	54	**49%**	105	79	**25%**	10	70.3	70.3	64.4	69.3
Apr-23	94	66	**30%**	92	148	**-61%**	82	72.1	74.2	66.0	74.0
May-23	106	62	**41%**	102	81	**20%**	22	79.6	74.9	75.1	75.6
Jun-23	103	50	**52%**	100	74	**26%**	19	86.4	69.8	83.4	70.9
Jul-23	90	26	**72%**	99	61	**39%**	3	89.6	66.0	87.4	62.1
Aug-23	99	30	**70%**	97	67	**31%**	0	90.9	58.7	89.7	52.1
Sep-23	102	48	**52%**	97	82	**15%**	17	86.6	62.3	84.3	59.7
Oct-23											
Nov-23											
AVG	**101**	**54**	**47%**	**99**	**89**	**10%**	**26**	**75.1**	**67.8**	**70.8**	**68.0**
RANG	**90 - 107**	**26 - 68**	**30% - 72%**	**92 - 106**	**61 - 148**	**0% - 39%**	**0 - 82**	**61.0 - 90.9**	**58.7 - 74.9**	**55.1 - 89.7**	**52.1 - 75.6**

Data collection to end in mid-November for this project reporting, after which it will continue for the next year or two!

Extension

Research

Water Balance Model

For a home with	225	GPD Flow							
	3,008	sq.ft. min ET bed needed							
WE GOT ONLY	300	sq.ft. of Wetland beds!							
Research Question: CAN THIS AREA REQUIREMENT BE REDUCED BY NEW E-FLOW DESIGNS?									
Simple idea - Load both wetlands @100 GPD and measure Outflow. Compare measured GPD Outflow with Estimated value.									
Inflow for Wetland ONLY=	22	GPD Allowed		Inflow with Greenhouse =	45	2	times; ASSUMED VALUE		
						50%	If true then the area needed		
GPD Inflow =	100			GPD Inflow =	100				
GPD Outflow Estimated=	**78**	COMPARE THESE		GPD Outflow Estimated =	**55**	CHECK ACTUAL VALUES AT THE END			
GPD Outflow Actual =	**90**			**GPD Outflow Actual =**	**54**				

		36	GPD Reduction more by EVED compared to Not-EVED						
		4.82	cu.ft. per day more than Normal						
		300	from sq.ft. wetland area						
		0.02	ft/day more ET losses by EVED than Not-EVED						
		0.19	**in/day increase in ET losses**						
College Station Data									
Evap - Rainfall =		0.12	inches/day						
EVED Rate =		0.31	inches/day						
		161%	increase in net ET rate						
		2.61	times the Normal ET rate						

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Research

What's Next….

- Continue flow data collection for another year or two;
- Implement a real-world home demonstration project that will incorporate EVED and reuse for toilet flushing to determine effluent flow reduction;
- Evaluate feasibility of using under the parking lot area for effluent dispersal, visit existing project sites;
- Work with the Industry Association (TOWA) and Regulatory Agency (TCEQ) to develop recommendations for rule change!

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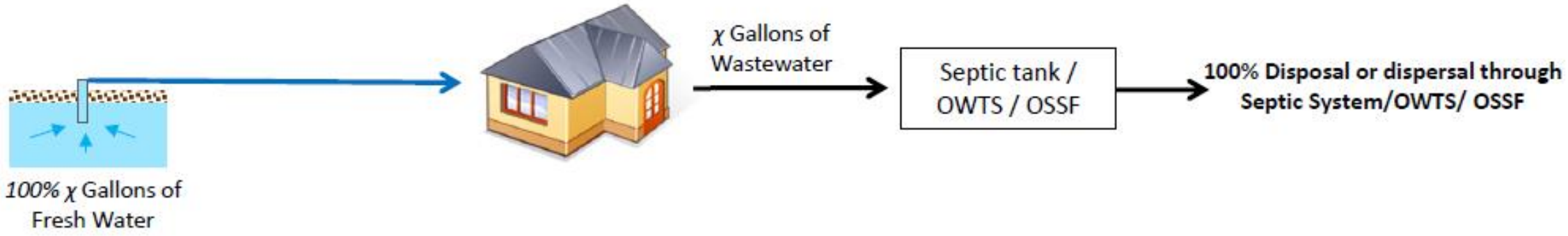
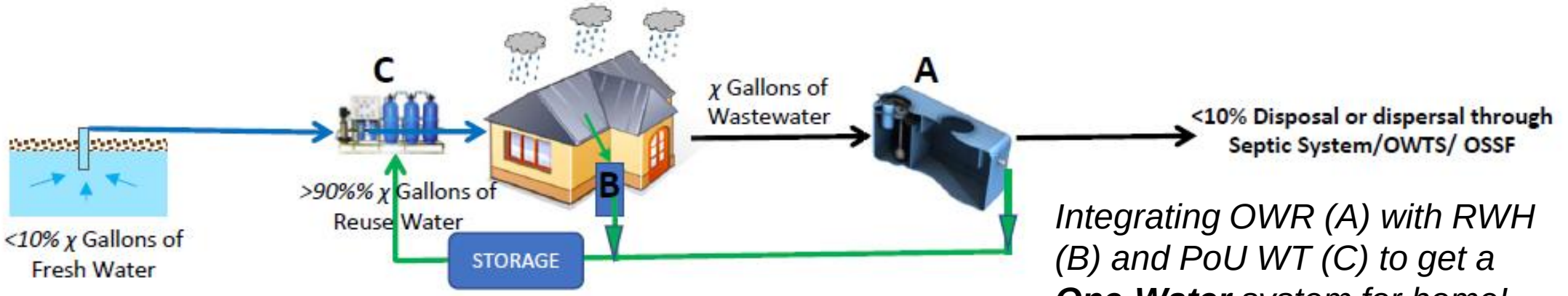
Research

We Want to Know if this Possible!

Is the Onsite Industry ready to go from this:



to this by 2050?:



Integrating OWR (A) with RWH (B) and PoU WT (C) to get a ***<u>One-Water</u>*** *system for home!*

Extension

Research

Questions / Comments?

THANK YOU

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