

# **REEU PROGRAM AT TAMU: GETTING UNDERGRADUATE STUDENTS EXCITED ABOUT ONSITE WASTEWATER TREATMENT & REUSE**

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**For Presentation at the Onsite Wastewater Mega Conference**  
Organized by the National Onsite Wastewater Recycling Association  
October 31- November 2, 2022

*The materials being presented represent the speaker's own opinions and  
**do NOT reflect the opinions of NOWRA.***

# Presentation Outline

- Background Information on REEU Program;
- Past Five-Year Program Statistics;
- Details from 2021 and 2022 programs;
- Benefits to Onsite Water Industry;
- Discussion / Q & A

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Extension

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Research

# Research and Extension Experience for Undergraduates

## REEU

- *Agriculture and Food Research Initiative Competitive Grants Program for “Education and Workforce Development.”*
- To promote research and extension learning experiences for undergraduates such that upon graduation they may enter “the workforce” with advance/necessary skills.
- **Funded by:**



United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture

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# Our REEU Program Grants...

## Phase 1 (completed)

- Summer 2017 and 2018
- 15 Students each year; **total 30 students**
- \$275,760 total funding, \$9,192/student
- Focus was OSSF performance and WQ
- 6 students were selected for semester-abroad the following summer!

## Phase 2 (ongoing)

- Summer 2019 – 2023
- 8 Students each year; **total 40 students**
- \$475,591 total funding, \$11,890/student;
- Focus is on OWR performance and RWQ
- 28 Students have completed the program, 12 students will be selected for 2023 program.

***Total 70 students exposed to On-Site/Decentralized Systems!***

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# REEU Fellowship

**To participate in the program, a student must:**

- Be a student who has not yet completed a Bachelor's degree,
- Be majoring in engineering, science, or other technology fields,
- Be at least 18 years of age,
- Have a minimum GPA of 2.75,
- Be a U.S. citizen or a permanent resident, and
- Be an agriculture science or environmental/agricultural engineering major interested in Water.

**Fellowship Highlights:**

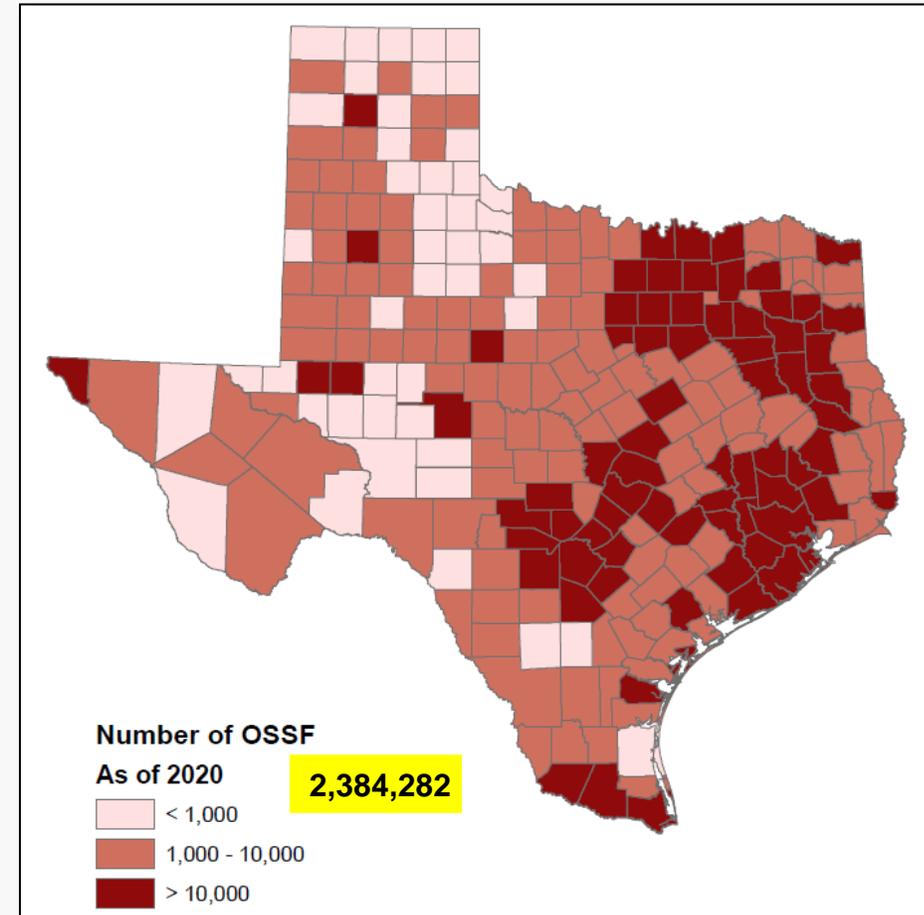
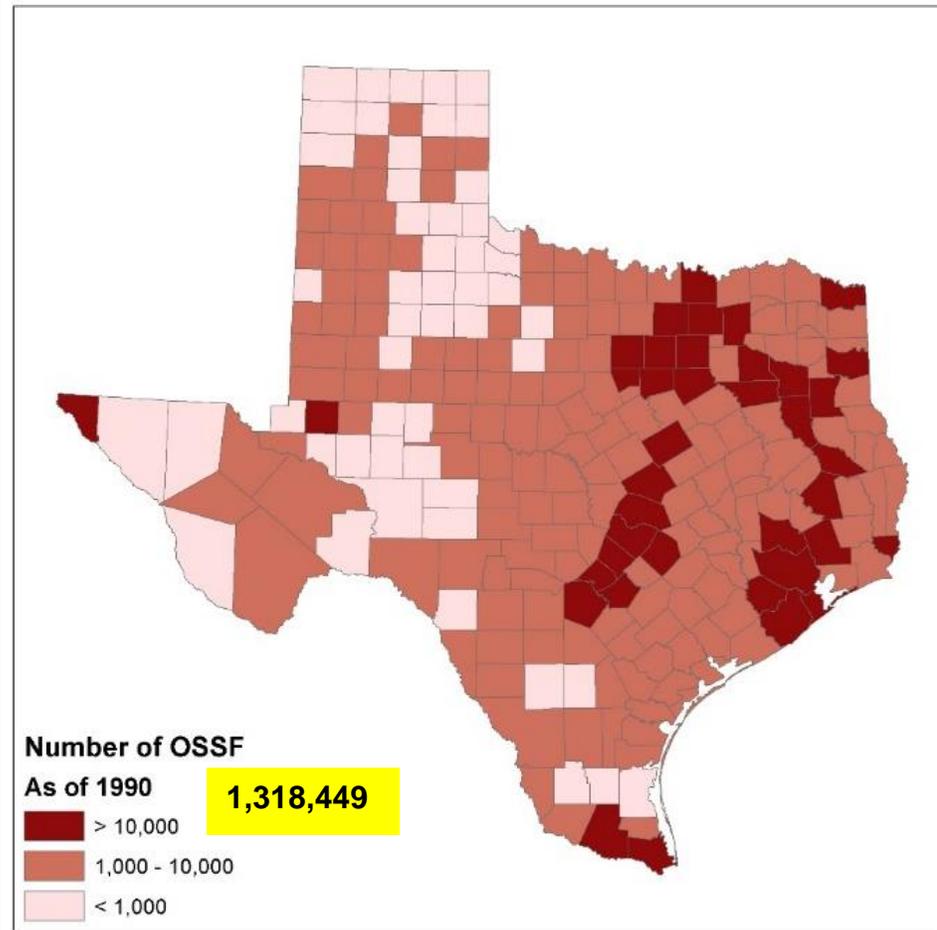
- a \$2,500 stipend, paid in two halves;
- on-campus housing;
- a \$1,000 meal allowance, paid in full;
- a travel allowance to a water quality conference or a field trip in Texas, and
- a paid internship opportunities in the following year with the AgriLife Extension Service or a company offering Water services.

*Website:* <https://reeu.baen.tamu.edu/>

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# On-Site Sewage Facility (OSSF) in Texas



Average number of permits processed ~34,000 per year!

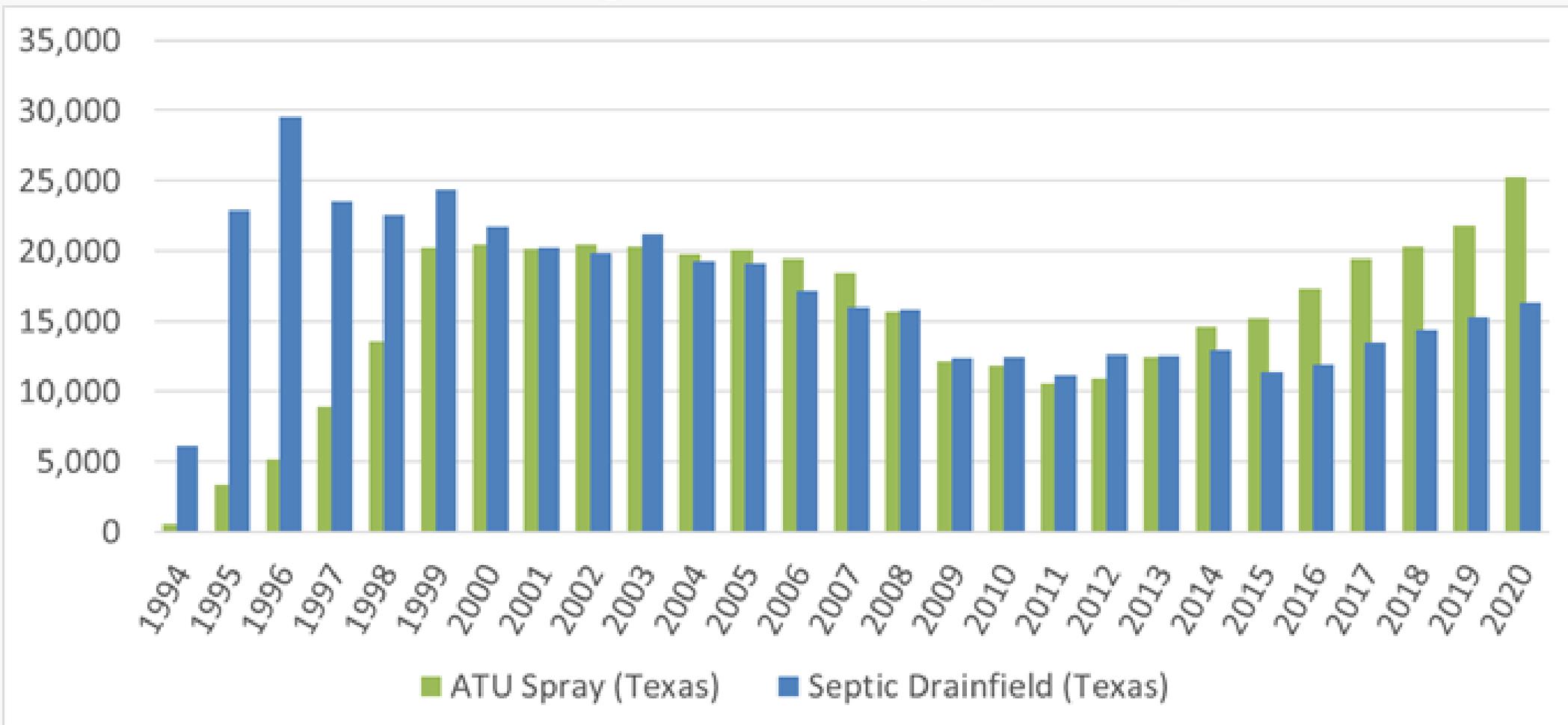
**Total as of 2021 = 2,431,151**

*~31% installed after 2000!*

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# On-Site Sewage Facility (OSSF) in Texas



*About 927,000 new permits issued since 1990... of which about 418,000 (~45%) were for ATU Spray*

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# Owts Progress during the 20<sup>th</sup> Century

- Septic tank drain-field



- Primary treatment by a septic tank (~20%), rest (~80%) by soil.

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- Aerobic tank spray-field



- Secondary treatment by ATU or Media filter (~80%), rest (~20%) by soil

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# Where we need to go from this point onward?

## REUSE

Moving from OSSF (On-Site Sewage Facility) to OSRF (On-Site Reuse Facility)

	Potable Reuse (PR)	Non-Potable Reuse (NPR)
Direct (w/o env. buffer)	<b>DPR</b> <i>e.g., Wichita Falls in 2014 and 2015</i> <a href="#">6-minute YouTube</a>	<b>DNPR</b> <i>e.g., Battery Park, Since 2003</i> <a href="#">4-minute YouTube</a> <i>TOGP-1 Reuse Project</i>
Indirect (w/ env. buffer)	<b>IPR</b> <i>e.g., Wichita Falls Since mid-2015...</i> <b>All Onsite Systems And POTWs!</b>	<b>INPR</b> <i>e.g., all water systems</i> <b>All Onsite Systems And POTWs!</b>

Research Question: Can we have onsite DPR system for a single-family home?

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# Where we need to go from this point onward?

## On-Site REUSE (PR and NPR)

- 1<sup>st</sup> Generation Onsite Systems focused on DISPOSAL (18<sup>th</sup> and 19<sup>th</sup> Century Systems);
- 2<sup>nd</sup> Generation Onsite Systems focused on TREATMENT & DISPERSAL (20<sup>th</sup> Century)
- 3<sup>rd</sup> Generation Onsite Systems will focus on ONE WATER (i.e., more treatment to get IPR using Rainwater as env. Buffer?)



PR

NPR



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# TAMU OSSF Center on RELLIS Campus



2-Acre facility with access to water and sewer lines, wastewater treatment and reuse systems, drinking water treatment systems, and a field laboratory!

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# Two Reuse Technologies



**Clearstream® Original System (Std-40) installed in early 1990s was replaced in March 2020...**

**Clearstream® Model 500-DA (Std-350) Reuse and Nutrient Reduction System.**



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# Two Reuse Technologies



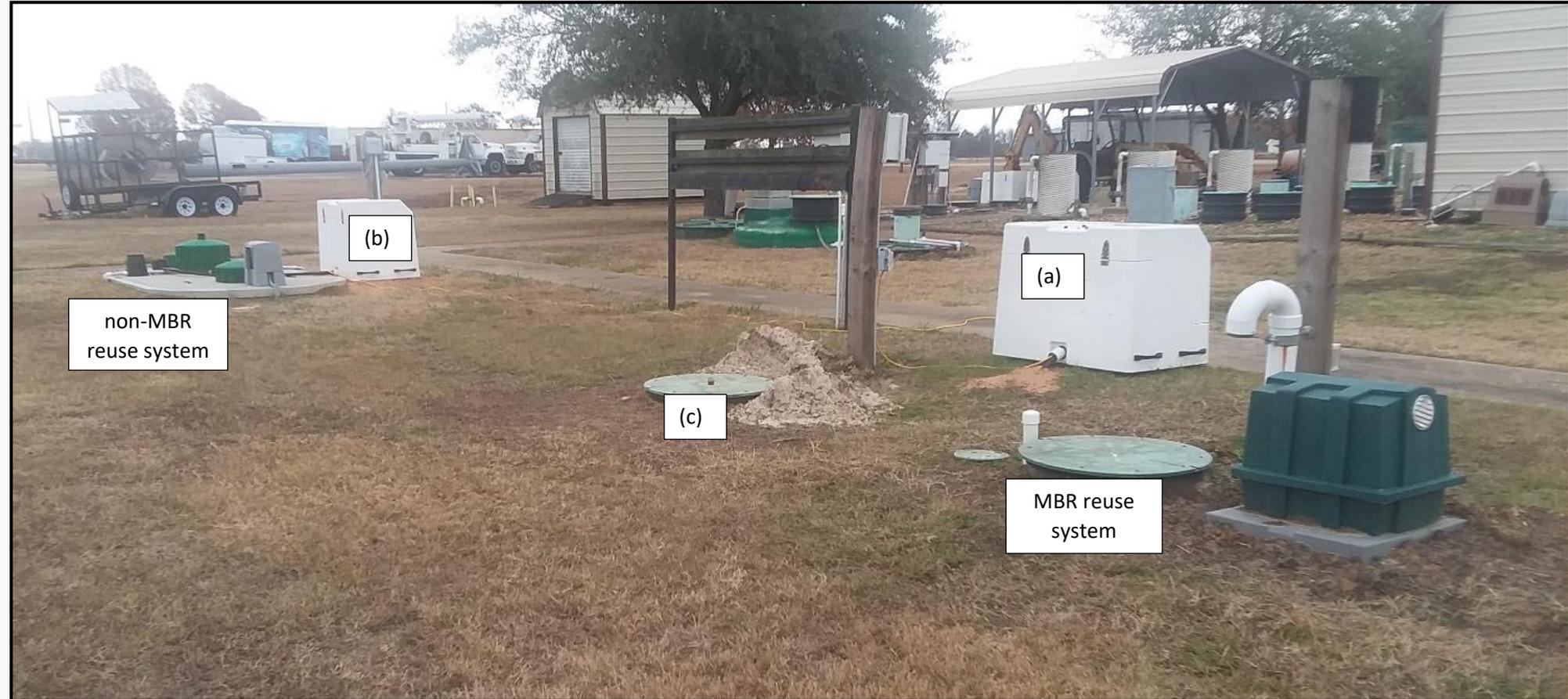
**BioMicrobics Model  
BioBarrier® MBR 0.5 (Std-350)  
installed in 2016 and  
membrane changed Dec 2020**



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# Two Reuse Technologies



*(a) and (b) are the weather-proof boxes each housing two refrigerated composite samplers. Loaned from TWRI for TOGP-1 Project.  
(c) is ozone tank for MBR effluent.*

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# PoU Water Treatment Technologies

- Activated Carbon Filter (AC)
- Capacitive Deionization (CapDI)
- Chlorine Disinfection (Cl)
- Distillation Unit (DIST)
- Ozone Disinfection (OZ)
- Reverse Osmosis (RO)
- UV Disinfection (UV)

Effluent from Onsite Reuse Technologies (MBR and Clearstream) is processed with one or more of these PoU Water Treatment Technologies

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# USDA-NIFA Funded REEU Program

- Phase-1 2017 and 2018, and renewed as Phase-II in 2019 for five years... <https://reeu.baen.tamu.edu/>



2017



2018



2022



2019



2021

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# REEU Program from 2017 to 2022

Ethnicity of Applicants:	2017	2018	2019	2020	2021	2022	2023	TOTAL	
Black/African American	8	7	4	C O V I D	5	6		30	52%
Caucasian/Asian	2	5	3		2	4		16	28%
Latino/Hispanic	5	2	1		2	1		11	19%
No information	0	0	0		0	0		0	0%
Other	0	1	0		0	0		1	2%
	<b>Pre-Covid</b>				<b>Post-Covid</b>				
<b>Gender:</b>									
Female	10	11	5	5	8			39	67%
Male	5	4	3	4	3			19	33%
<b>TOTAL GROUP SIZE =</b>	15	15	8	9	11			<b>58</b>	
<i># of Applications Received</i>	44	23	10		20	14		111	

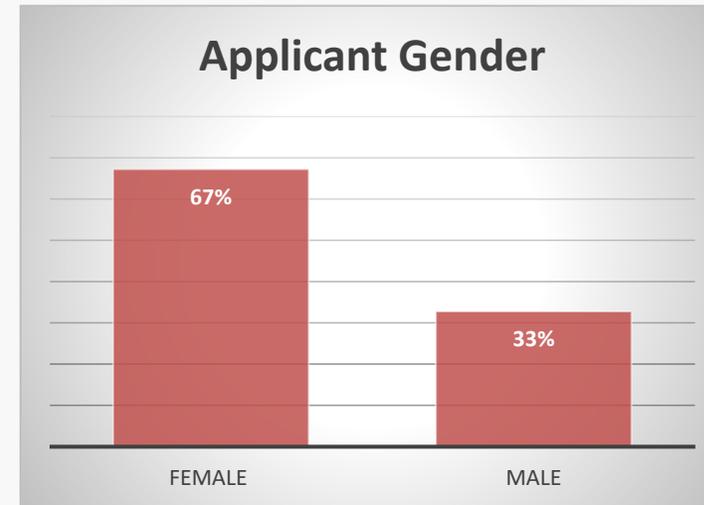
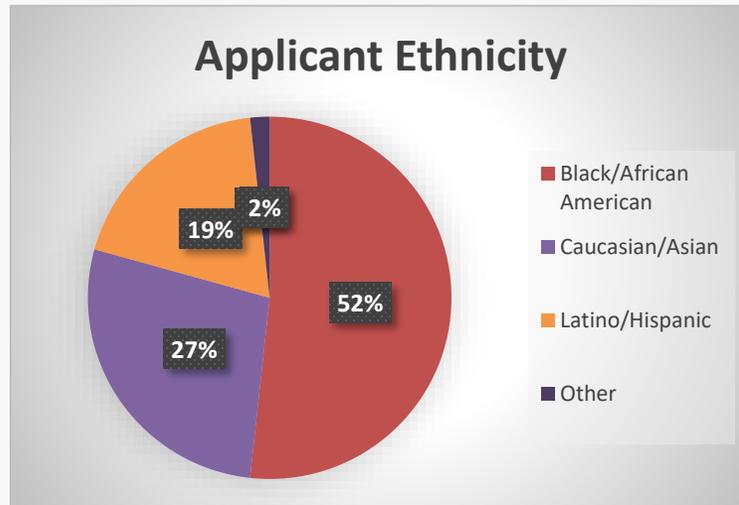
To apply for 2023 program, visit <https://reeu.baen.tamu.edu/>

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# USDA-NIFA Funded REEU Program

*58 students' demography:*



Universities Represented		
Auburn University	LeTourneau University	TAMU-SA
Colorado School of Mines	Lewis University	Tennessee State University
Florida A&M University	Oklahoma State University	Texas Tech University
Franklin and Marshall College	PVAMU	University of Kentucky
Kansas State University	TAMU	University of Puerto Rico



# BAEN-491/TAMU-499, Zero Credit Class

## Summer-1 Semester (five weeks)

- Week 1:** Orientation, Safety Training, Project Defined, Center Tour and Sample Collection/Analysis Practice;
- Week 2:** Classroom Lectures, Sample Collection, Lab Work, Friday Tours;
- Week 3:** More Lectures, Finish Sample Collection, Start Data Review
- Week 4:** Invited Speakers, Homework and Quiz, Discuss Final Reports;
- Week 5:** Compete Data Analysis, Finalize Poster, Present Results by Group, Prepare Class Video, and Final Presentation on the Last Day and Graduation!

REEEU 2022 Program Overview (Revised on 05-31-2022)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 29	May 30	<b>May 31<sup>st</sup> Day</b> REEU Check In 9AM-10AM at dorm, then drive to RELIS for Lunch and Safety training Noon to 4PM	<b>June 1</b> Hands on exp starts @ Center; sample collection and field analyses	2 T-9 Training Hands on exp starts @ Center and Lab; sample collection and field analyses	3 Hands on exp starts @ Center and Lab; and finalize research project, NIFA, and AT visit.	4 Practice session @ the Center and in Lab if necessary
5	6 Classroom & START research program today @ Center and in Lab	7 Classroom & field work @ Center and in Lab	8 GIS and Mapping PPT, and Field work continues	9 Mentoring Session-I, and Field work continues	10 Extension PPT from AF (Zoom) LAUNCH Zoom; HW assignment	11 <i>GET READY FOR FIELD TRIP WEEK</i>
12	13 PV Campus Visit, sample collection, discussion; Check-In GLV	14 Galveston Day-1 Work with GLO and Beach Watch Team and mini workshop.	15 Galveston Day-2 Collect sample; leave by 2PM back to CS	16 Galveston Sample Analysis and discussion	17 Mentoring Session-II, Picnic, OSSF Business tour, and HW	18 <i>Juneteenth Celebration – JM to lead?</i>
19 Start working on video and posters (V&P)	20 Extension guest lecture; continue working on V&P	21 TOWA and TWON lectures. Data collection and analysis	22 HW presentations and discussion; Field/Lab work	23 Field/Lab work to be completed today!	24 Field trip day till about 2PM; Field/Lab rest of the day!	25 <b>LAST day to complete all field work.</b>
26	27 4-H Water Ambassadors AM Hours, Data analysis discussion and finalize posters and video	28 Data analysis discussion and finalize posters and video	29 Last day to complete all the work; FINAL Exam in PM hours	30 Start wrapping up; final day to work @ the Center!	<b>July 1 Last Day</b> Class Presentations, Certificates and Lunch, REEU Check Out by 1PM.	<b>July 2</b>

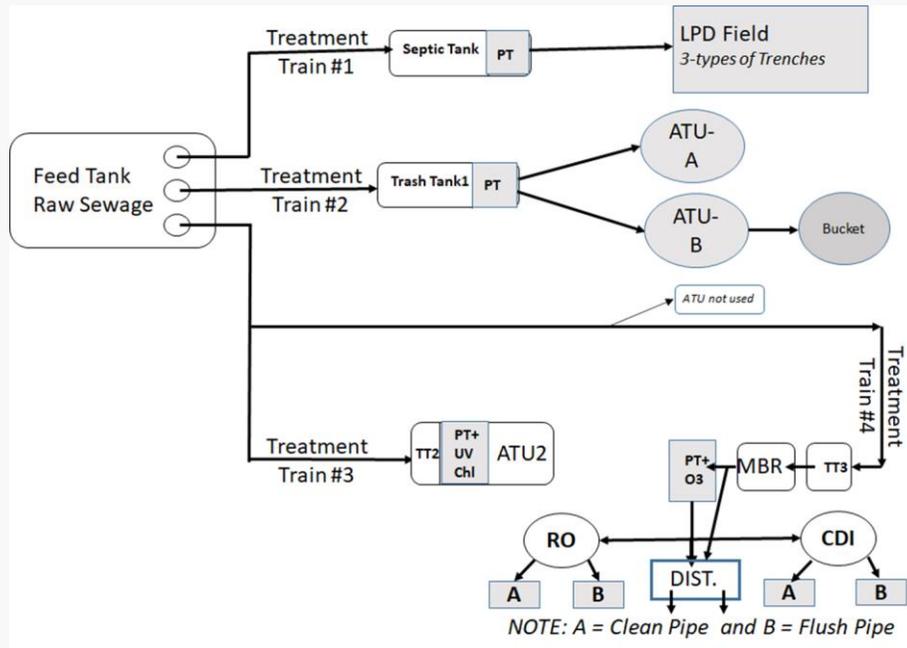
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# Research Projects from past two years

## 2021 Project:

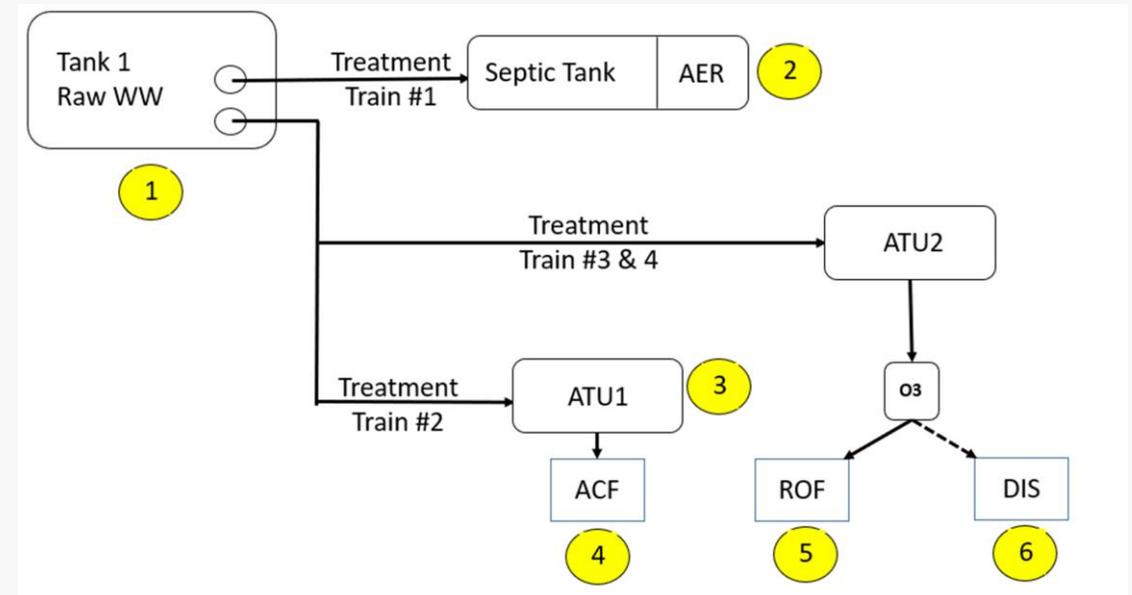
Waste Not, Want Not: A Comparison of Reuse Wastewater Systems



*REEU Overlapped TOGP Research Projects!*

## 2022 Project:

From Waste to Taste: An Analysis of Reuse Wastewater Systems

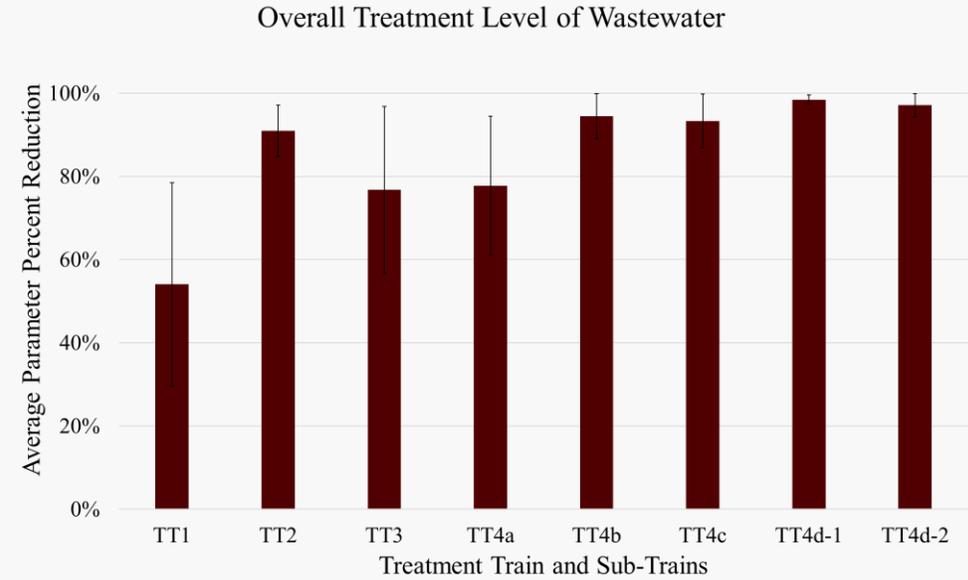


Simplified research plan, from last year experience!

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# Highlights from 2021-REEU Program...



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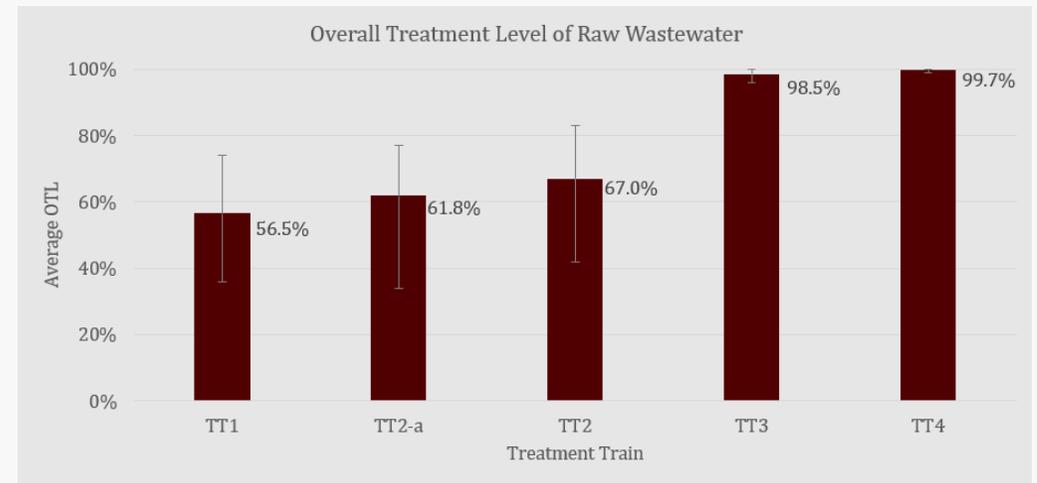
# 2021-REEU Class Video



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# Highlights from 2022-REEU Program...



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# 2022-REEU Class Video



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# Pre- and Post- Assessment Results

## 10 Questions Quiz

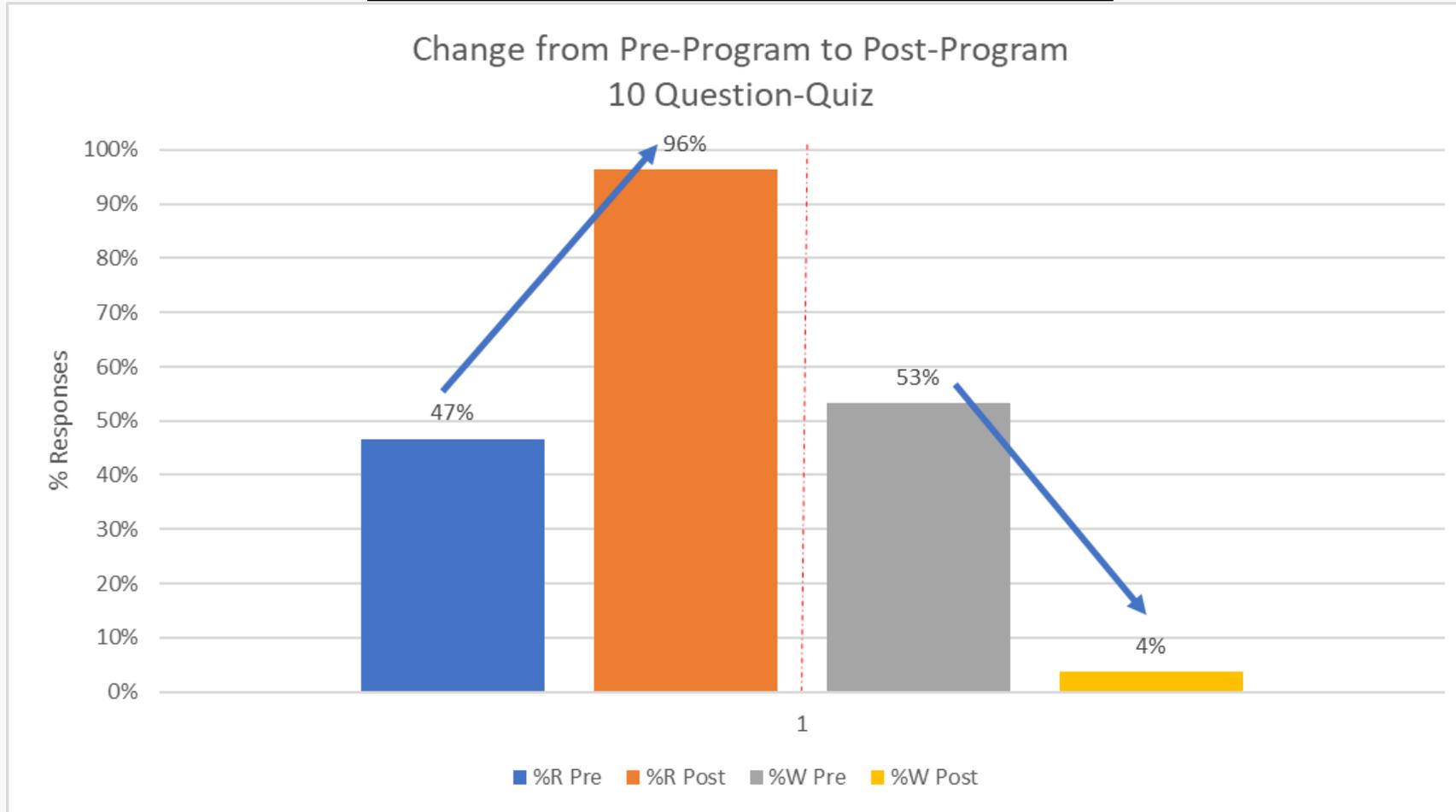
- Which of the following is/are **cations** found in soil?
  - Calcium ( $\text{Ca}^{++}$ )
  - Chloride ( $\text{Cl}^-$ )
  - Phosphate ( $\text{PO}_4^{---}$ )
  - b. and c.
- Which one of the following is NOT a component of the treatment process?
  - $\text{N}_2$
  - $\text{N}_3$
  - $\text{NO}_3\text{-N}$
  - TKN
- Air is composed mainly of which **gas**?
  - Oxygen
  - Carbon dioxide
  - Nitrogen
- How much does a gallon of water **weigh**?
  - 3.84 lb
  - 4.83 lb
  - 8.34 lb
- A septic tank can remove as much or more BOD from raw wastewater than an aerobic treatment unit.
  - True
  - False
- In United States of America, all the homes are connected to a sewer system.
  - True
  - False
- It is now possible to convert today's wastewater into drinking water for tomorrow.
  - True
  - False

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# Pre- and Post- Assessment Results

## 10 Questions Quiz



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# Stipend Offered to Selected Students for a Follow-Up Internship

- Selected students get up to \$4,000 in matching funds to pursue a paid internship in a “real-world” public or private entity working on Water or Extension related subject;
- Student submits a short report and a video presenting their experience working in “real-world”;
- Idea is to bring these students in to Water/Extension work-force, which is aging!

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# Video Presentation by a 2021 Student Internship at a Water Company



# What's Next....

- 2023 is the final year of our REEU program;
- We plan to fill 12 seats from USA, and we are expecting 6 to 9 students from India to join our program at their cost!
- Next year research will focus on analyzing the water from the best treatment-train we have found so far to determine if the reuse water quality meets the Drinking Water Standards!
- We are planning to apply for renewal of this program for five more years!



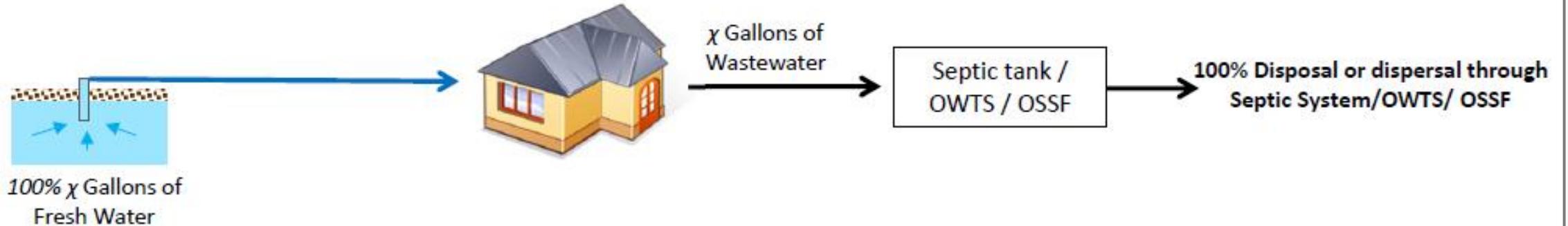
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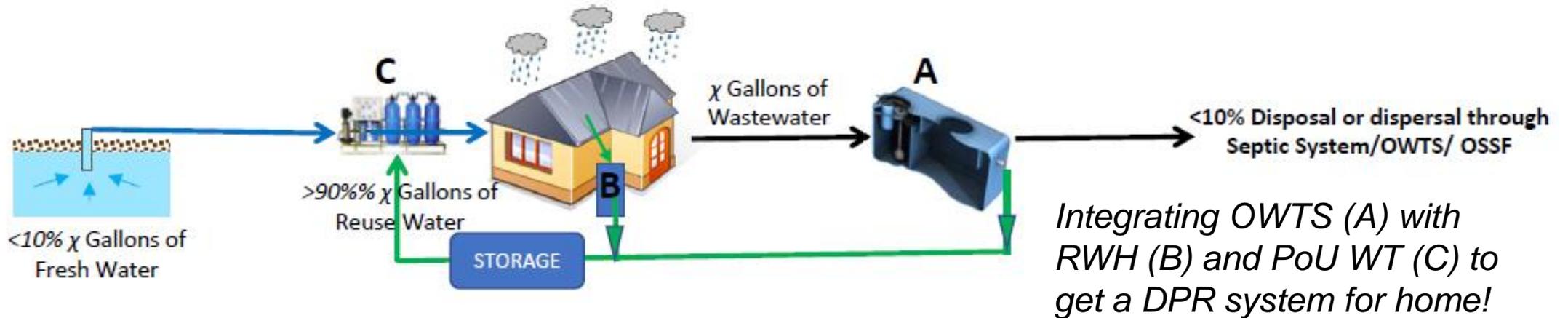
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# We Want to Know if this Possible!

Is the Onsite Industry ready to go from this:



to this by 2050?:



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**Questions / Comments?**

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**THANK YOU**

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