Environmental Justice: Water and Wastewater Infrastructure in HMCs

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Serving the Underserved: Addressing PFAS and Other Contaminants in Septic Systems and Private Wells

1. **Funding Agent:** EPA Multipurpose Grant
2. **Project Period:** 1/17/2022 – 3/17/2024
3. **Counties:** Bladen, Cumberland and Robeson
4. **Goal:** Gain a better understanding of the presence and concentrations of traditional and emerging contaminants in septic systems and water supply wells in some economically distressed communities of Eastern North Carolina
5. **Objectives:**
   - Identify underserved communities with aging and compromised septic systems and drinking water wells
   - Study PFAS and other pollutants (Nitrate and E. coli) in septic system effluent and private wells

Septic Systems and Private Wells in NC

- Septic systems users: ~ 50%
  - County level 14% to 93%
- Domestic well users : ~ 25%
  - County level 4% to 86 %
- Private wells and septic systems are critical to development and growth in NC, providing rural areas with drinking water and wastewater treatment.

PFAS in NC

‘Forever chemicals’ detected in multiple NC water sources, study reveals

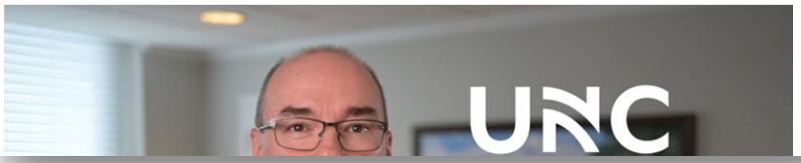
A U.S. Geological Survey study revealed that 4 out of 11 test sites in the state were positive for PFAS.

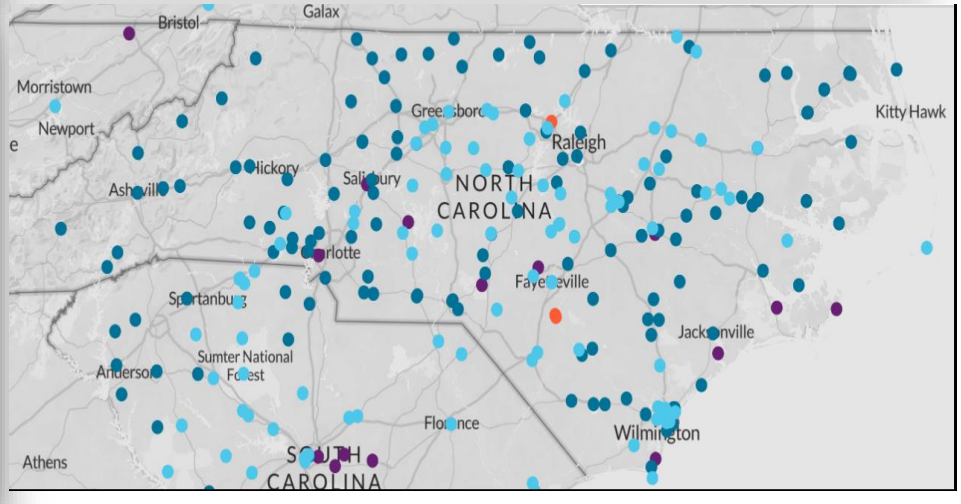
NEWS

PFAS chemicals found 16 miles from Chemours plant, North Carolina officials say

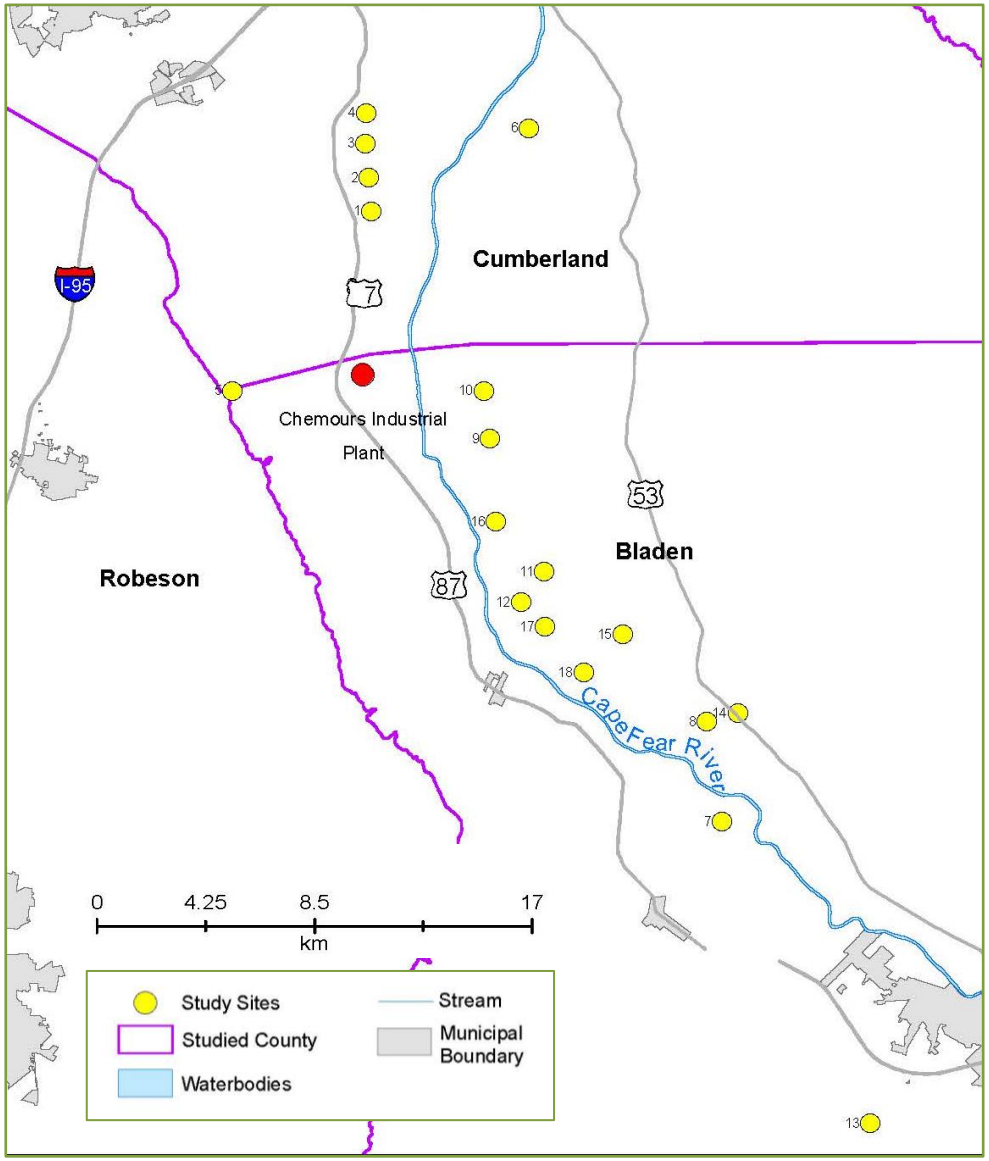
Kristen Johnson
The Fayetteville Observer

Published 6:30 a.m. ET May 7, 2021 | **Updated 2:03 p.m. ET May 7, 2021**





Study Location



Counties of Interest	Persons in Poverty (%)	Median Income
Bladen	24.55	$37,188
Cumberland	18.04	$48,177
Robeson	27.27	$35,362
North Carolina	12.8	$60,516

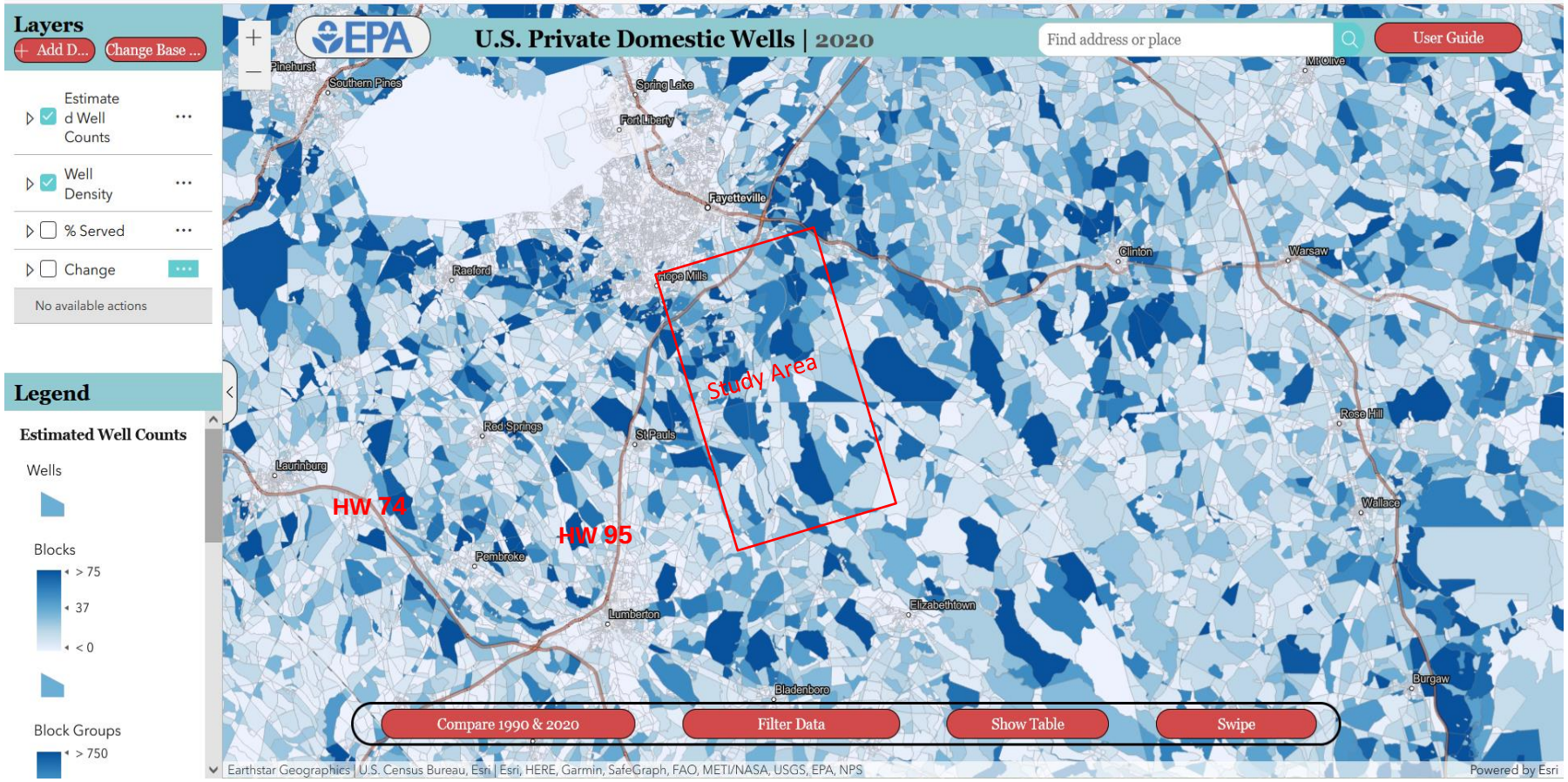
*NC Office of State Budget and Management 2021

Distribution of Water and Wastewater Infrastructure in the Study Counties

Counties	* Housing On		Avg. (2010-2020)	
	On-Site Systems (%)	Drinking Water Wells (%)	New Installations	Repaired
Bladen	68	60	28	15
Cumberland	39	18	212	190
Robeson	62	29	287	188

* Census 1990

Private Well Density in Study Location



Sample Collection

1. Wastewater: Septic tank effluent
2. Water: Private wells
3. In the field: pH, oxidation reduction potential, turbidity, temperature, and specific conductance
4. In the lab – PFAS, PFOA, and GenX, TDN, TSS, NO3, TKN, DOC, Chloride, *E. coli* and total coliform
5. Septic tank pump out

Results

Nutrient:

Total dissolved nitrogen (TDN),
Total suspended solids (TSS), Nitrate (NO3),
Total kjeldahl nitrogen (TKN),
Dissolved organic carbon (DOC)

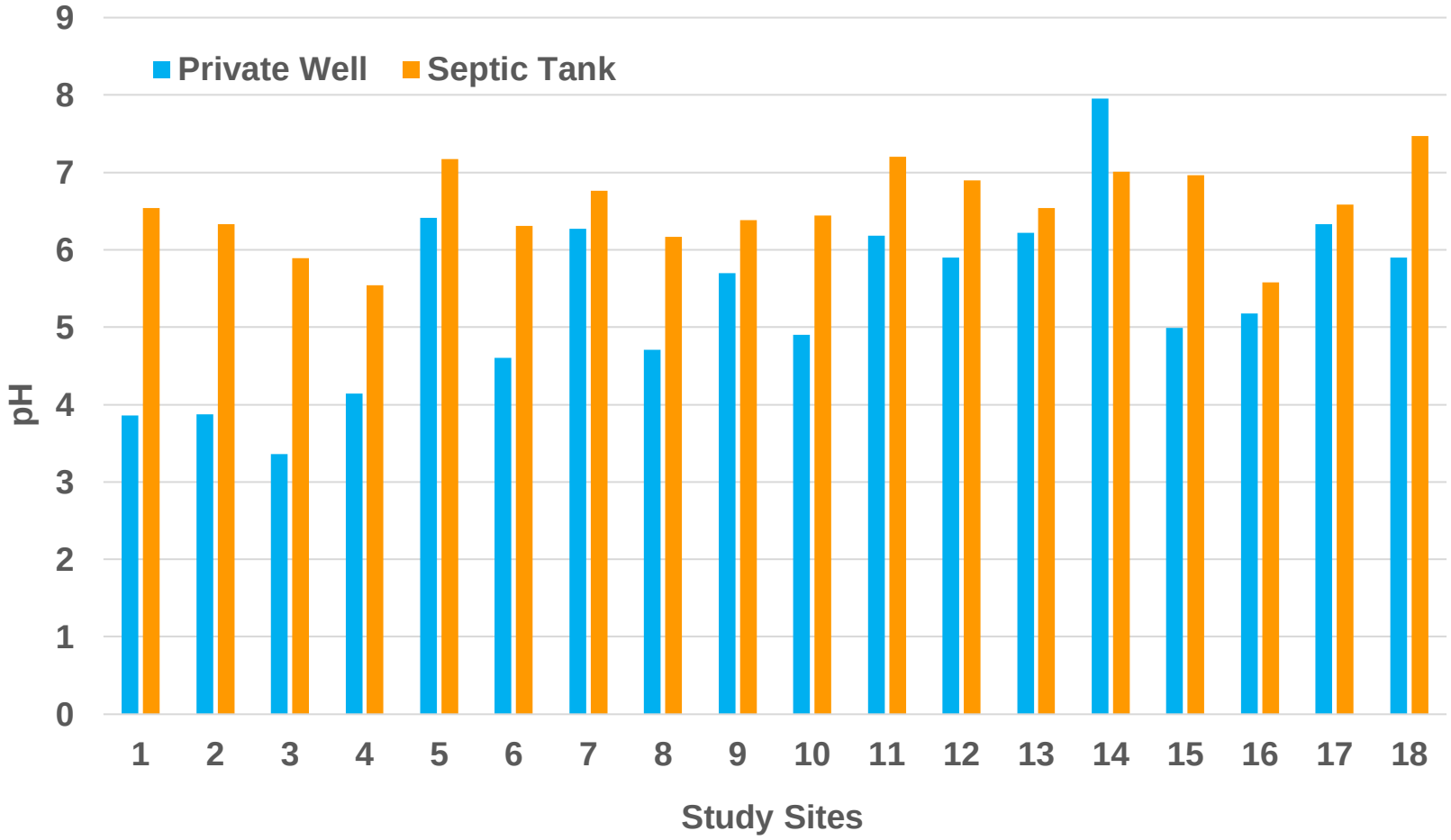
Bacteria:

E. coli
Total coliform

Synthetic chemical:

Perfluorooctanoic Acid (PFOA),
Perfluorooctyl Sulfonate (PFOS)
GenX

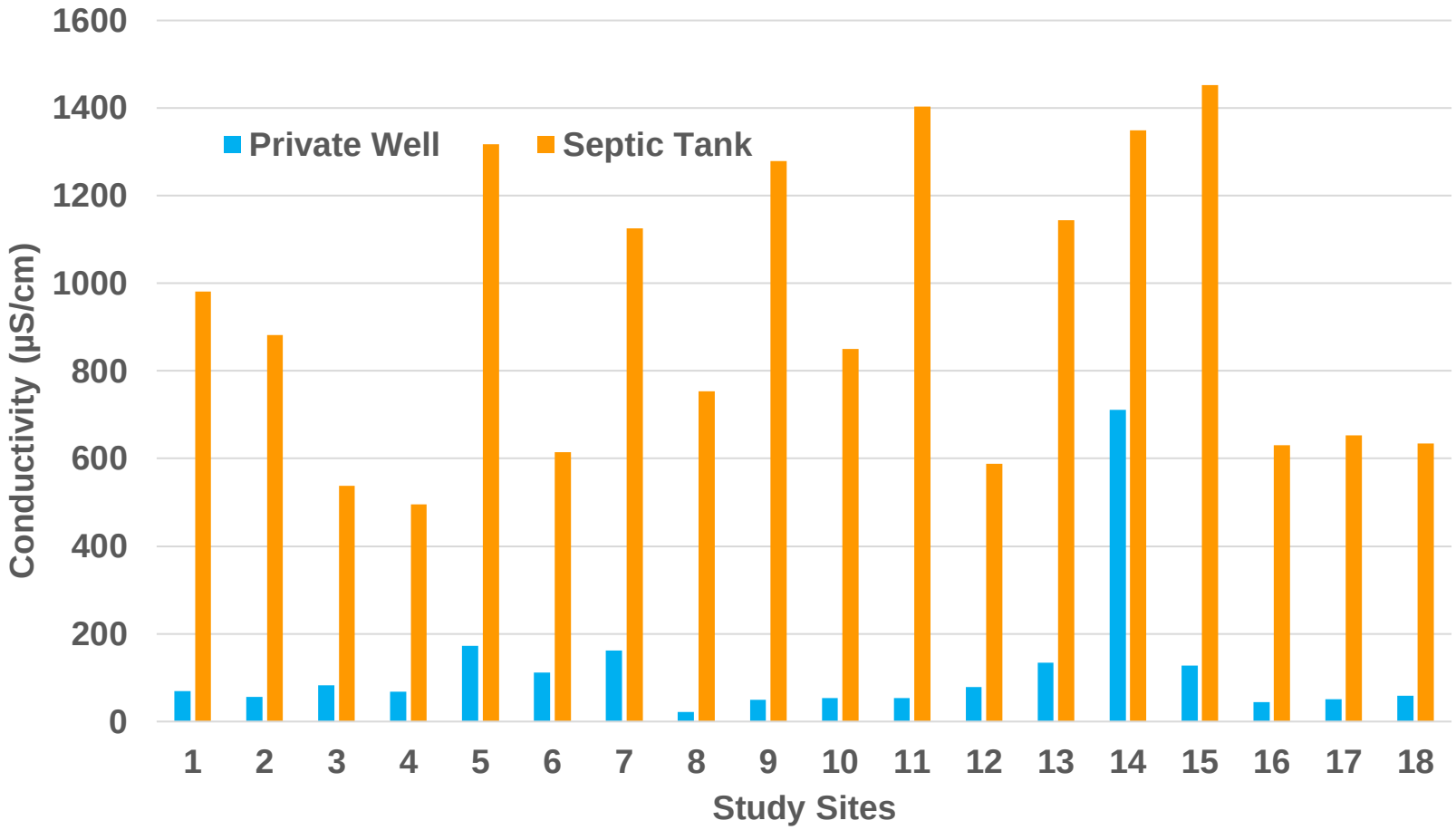
Results: pH


Private Well
Septic Tank
pH
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Study Sites

Results: Bacterial Concentrations

Sites	*E. coli* (MPN/100 mL)		Total Coliform (MPN/100 mL)	
	Private Well	Septic Tank	Private Well	Septic Tank
1	0	32,200	0	2,599,400
2	0	39,400	0	4,840,000
3	0	244,600	0	111,200
4	0	2,000	0	4,840,000
5	0	2,000	0	383,600
6	0	120,400	0	1,226,200
7	0	1,804,500	0	9,931,500
8	0	487,000	1	3,873,000
9	0	26,000	0	2,897,000
10	0	15,000	0	1,361,500
11	0	61,000	0	4,604,000
12	0	1,732,800	0	4,840,000
13	0	67,000	0	1,179,500
14	0	37,000	0	540,500
15	0	308,000	0	6,498,500
16	0	133,000	0	10,000,000
17	0	113,000	0	9,931,500
18	0	2,176,000	0	2,442,000

Results: Conductivity



Results: Nitrogen Series

Sites	NO3-N (mg/L)		NH4 (mg/L)	
	Private Well	Septic Tank	Private Well	Septic Tank
1	0.46	< 0.01	0.04	67.76
2	1.22	< 0.01	0.14	56.07
3	0.52	< 0.01	0.2	34.56
4	1.81	0.01	0.06	28.11
5	0.04	0.03	0.4	64.45
6	0.3	0.01	0.07	32.51
7	0.01	0.01	0.06	80.73
8	< 0.01	0.02	0.24	45.24
9	< 0.01	0.01	0.25	46.57
10	< 0.01	0.01	0.34	72.55
11	< 0.01	0.02	0.34	121.68
12	< 0.01	0.01	0.59	31.56
13	0.01	< 0.01	0.12	84.92
14	0.01	0.01	0.23	102.19
15	3.21	0.01	4.41	166.59
16	0	0.02	0.71	68.56
17	0	0.01	0.21	56.62
18	1.64	0.37	0.14	38.45

Results: PFOA, PFOS and GenX in Wells

Location	PFOA (ppt)	Times > HA	PFOS (ppt)	Times > HA	GenX (ppt)	Times > HA	DEQ GenX (ppt)	DEQ PMPA (ppt)
*Site 1- Well	0	0	0	0	0.35	0	3.5	60
*Site 2 -Well	0	0	0	0	2	0	4.3	59
*Site 3 - Well	15.6	3900	0.15	7.5	0	0	< 2.5 U	30
*Site 4- Well	0	0	0	0	0	0	6.9	60
Site 5 -Well	1.1	275	0	0	31.7	3.2		
*Site 6 - Well	2.3	575	0.13	6.5	29.6	3	20	170
Site 7- Well	0	0	0	0	0	0		
*Site 8 -Well	11.6	2900	0	0	0	0	1.04	8.44 X
*Site 9 - Well	19.3	4825	15.4	770	44	4.4	102	163
Site 10- Well	10.9	2725	8.8	440	43	4.3		
*Site 11 -Well	0	0	0	0	0	0	< 1.77 U	< 3.54 U
*Site 12 - Well	0	0	0	0	0	0	< 2 U	2.2
Site 13- Well	2.7	675	0	0	0	0		
Site 14- Well	0.93	232.5	0	0	0	0		
*Site 15- Well	22.8	5700	0.15	7.5	6.2	0	3.5	140
*Site 16- Well	0	0	0	0	0	0	76.4	66.9
*Site 17- Well	72.4	18100	0.64	32	0	0	< 2 U	< 2 U
*Site 18- Well	4.9	1225	78.2	3910	0	0	< 2 U	< 2 U

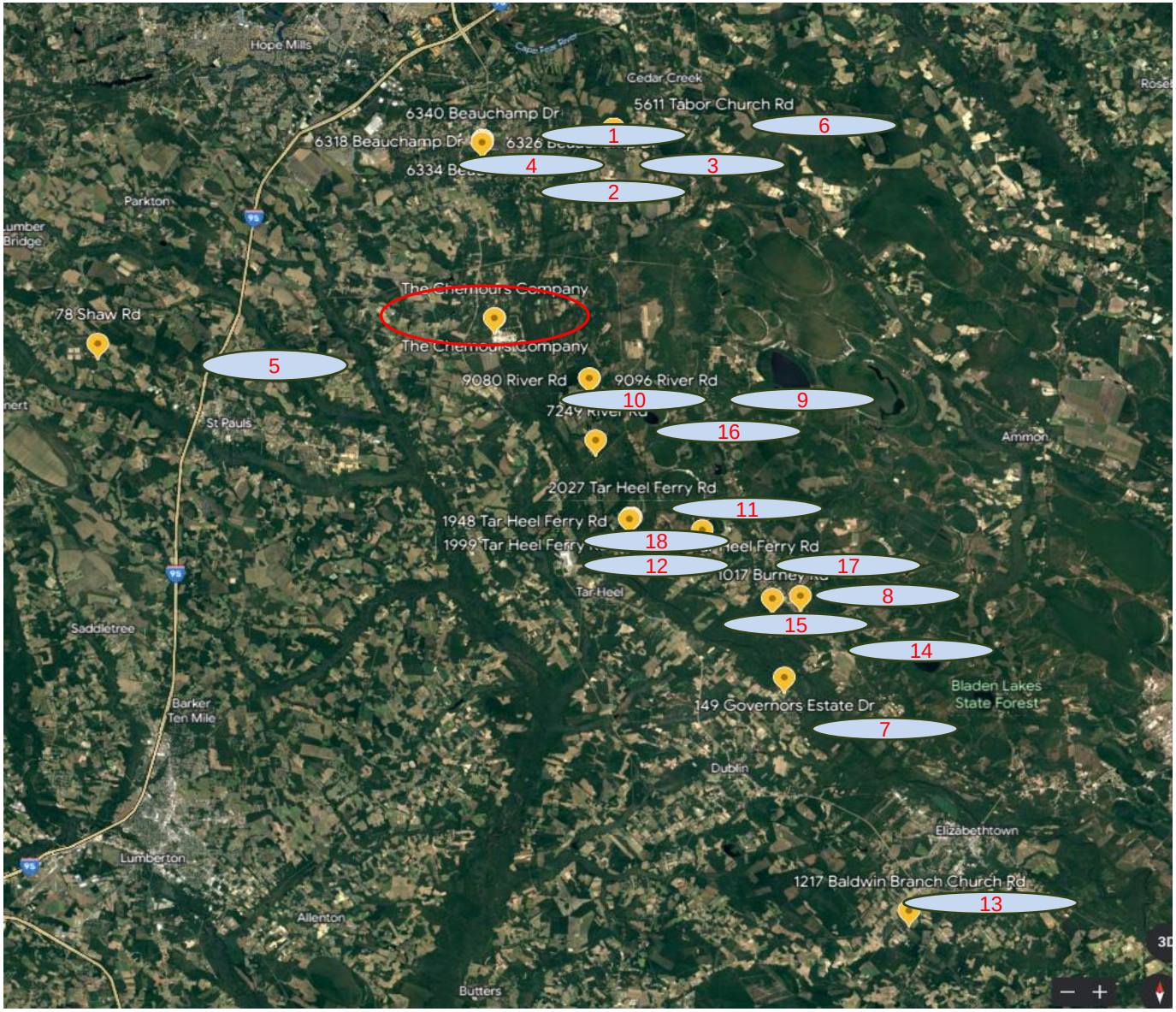
*Wells sampled by NCDHHS and NC DEQ.

Chemours Private Well Sampling Summary

Location	PFOA (ppt)	Times > HA	PFOS (ppt)	Times > HA	GenX (ppt)	Times > HA	DEQ GenX (ppt)	DEQ PMPA (ppt)
*Site 1- Well	0	0	0	0	0.35	0	3.5	60
*Site 2 -Well	0	0	0	0	2	0	4.3	59
*Site 3 - Well	15.6	3900	0.15	7.5	0	0	< 2.5 U	30
*Site 4- Well	0	0	0	0	0	0	6.9	60
Site 5 -Well	1.1	275	0	0	31.7	3.2		
*Site 6 - Well	2.3	575	0.13	6.5	29.6	3	20	170
Site 7- Well	0	0	0	0	0	0		
*Site 8 -Well	11.6	2900	0	0	0	0	1.04	8.44 X
*Site 9 - Well	19.3	4825	15.4	770	44	4.4	102	163
Site 10- Well	10.9	2725	8.8	440	43	4.3		
*Site 11 -Well	0	0	0	0	0	0	< 1.77 U	< 3.54 U
*Site 12 - Well	0	0	0	0	0	0	< 2 U	2.2
Site 13- Well	2.7	675	0	0	0	0		
Site 14- Well	0.93	232.5	0	0	0	0		
*Site 15- Well	22.8	5700	0.15	7.5	6.2	0	3.5	140
*Site 16- Well	0	0	0	0	0	0	76.4	66.9
*Site 17- Well	72.4	18100	0.64	32	0	0	< 2 U	< 2 U
*Site 18- Well	4.9	1225	78.2	3910	0	0	< 2 U	< 2 U

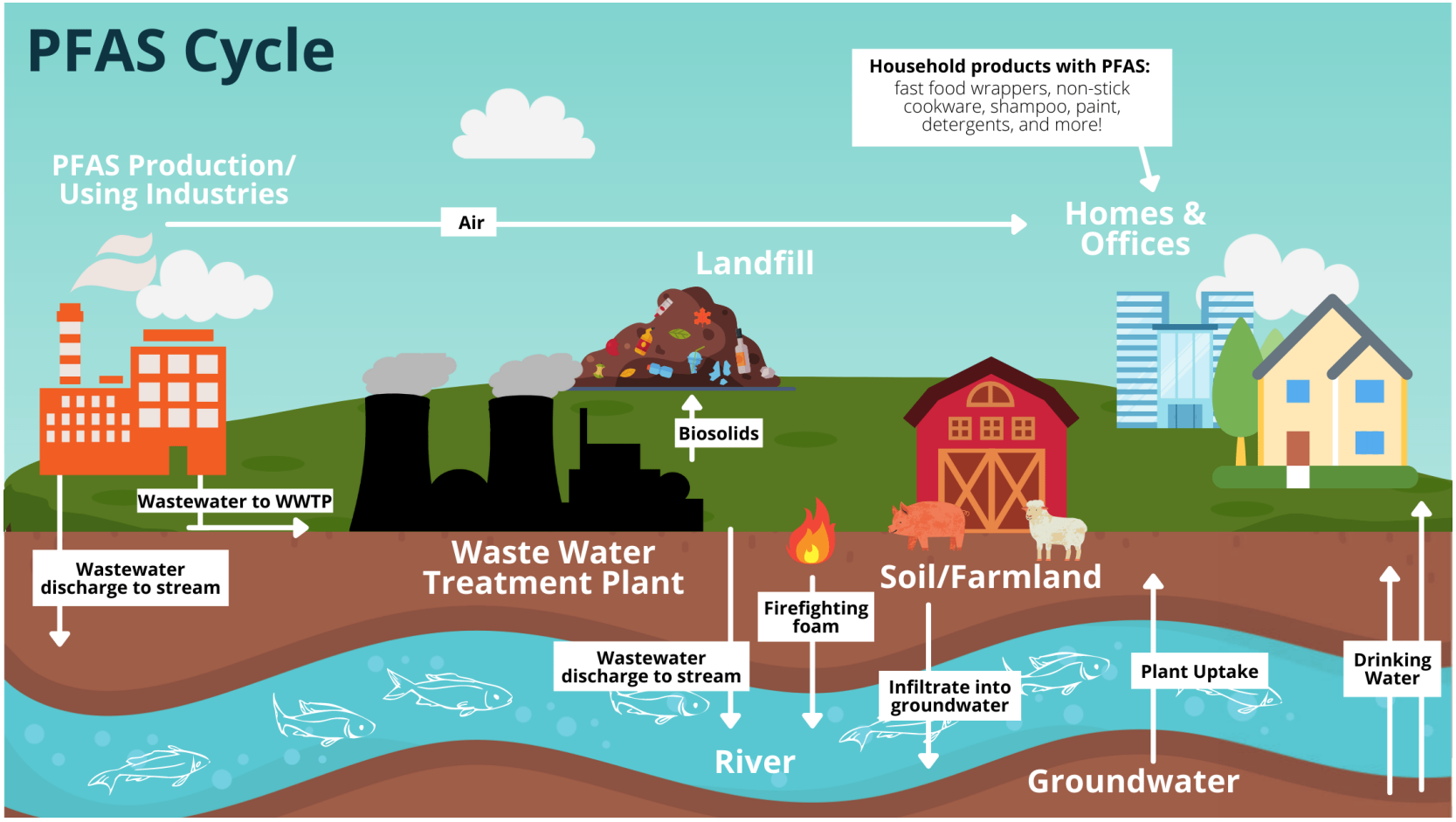
HA Rank

Wells	Sum HAs	Rank
1	0	13
2	0	12
3	3908	5
4	0	14
5	278	11
6	584	10
7	0	16
8	2900	7
9	5599	3
10	3169	6
11	0	18
12	0	17
13	675	9
14	233	8
15	5708	2
16	0	15
17	18132	1
18	5135	4



Results: PFOA, PFOS and GenX in Wastewater

Location	PFOA (ppt)	PFOA Well	PFOS (ppt)	PFOS Well	GenX (ppt)	GenX Well
Site 1 – Septic Tank	1.5	0	0	0	2.3	0.35
Site 2 – Septic Tank	4.6	0	17.7	0	33.7	2
Site 3 – Septic Tank	2.1	15.6	57.8	0.15	11.3	0
Site 4 – Septic Tank	3.4	0	5.8	0	8.5	0
Site 5 – Septic Tank	1.8	1.1	18.7	0	25	31.7
Site 6 – Septic Tank	13.7	2.3	6.9	0.13	13.8	29.6
Site 7 – Septic Tank	22.3	0	47.9	0	96.3	0
Site 8 – Septic Tank	12.7	11.6	97.5	0	9.5	0
Site 9 – Septic Tank	4.6	19.3	16.6	15.4	120.1	44
Site 10 – Septic Tank	9.8	10.9	13.1	8.8	20.8	43
Site 11 – Septic Tank	0	0	6.4	0	2.6	0
Site 12 – Septic Tank	3.9	0	143.5	0	17.3	0
Site 13 – Septic Tank	0	2.7	11.5	0	221.2	0
Site 14 – Septic Tank	8.3	0.93	11.9	0	155	0
Site 15 – Septic Tank	5.5	22.8	12.2	0.15	71.3	6.2
Site 16 – Septic Tank	7.3	0	15	0	9.6	0
Site 17 – Septic Tank	8.7	72.4	4.8	0.64	0.12	0
Site 18 – Septic Tank	37	4.9	33.9	78.2	1.6	0



https://www.clearwatersystems.com/forever-chemicals/

Conclusions

- 61% of drinking water wells samples contained PFOA that exceeded HA level of 0.004 ppt)
- 39% of drinking water wells samples contained PFOS that exceeded HA level of 0.02 ppt)
- 22% of drinking water wells samples contained GenX that exceeded the HA level of 10 ppt.
- None of the well water sample tested positive for *E. coli.*
- One of 18 sites was positive for total coliform (1 MPN/100 mL)
- Nitrate concentrations in the water supplies were all below 10 mg/L and 78% below 1.0 mg/L

Take Home Messages

- Based on lab analysis results, the main threat to human health in this region with regards to contamination of the private wells was with the synthetic chemicals PFOS, PFOA, and GenX.
- It is important that private drinking water wells in this region are routinely monitored for these chemicals and filtration systems, or alternative sources of water be provided where needed to protect human health.
- No federal or State programs providing funding for PFAS sampling of private wells.
- Handful of funding programs currently available to assist homeowners in repairing or replacing failing systems

Recommendations

Viable methods and means to address potential threats to the public health in underserved communities suffering from environmental inequities.

Investigation of possible environmental risks, information sharing/education, and reasonable solutions are key to achieving environmental justice for these communities.

Fair share of water and wastewater infrastructure funds to cover operation and management of private wells and septic systems with designated amount of legislature approved funds to repair or replacement of malfunctioning septic systems and domestic wells for underserved communities.

Safeguarding of public health and protection of the environment by both state and local officials without burdening underprivileged, underserved residents with the substantial costs of testing well and repairing or replacing septic systems.




Question???