



NC DEPARTMENT OF
**HEALTH AND
HUMAN SERVICES**

Wastewater Pathogen Monitoring and H5N1: Using wastewater monitoring to support public health action on avian influenza and beyond

**Presented by: Virginia T. Guidry, PhD, MPH
on behalf of the NC Wastewater Monitoring Network**

**2025 North Carolina Pretreatment Consortium Conference
September 22, 2025**

What is wastewater monitoring?

According to the Water Environment Federation (WEF):

Public health wastewater monitoring involves systematic sample collection, processing, and analysis followed by interpretation of wastewater data to inform public health practice.

Wastewater and other forms of environmental surveillance (e.g., monitoring of air, soil, or high-touch surfaces) can be valuable complements to more traditional public health tools such as syndromic surveillance and clinical testing.

Source: WEF's Network of Wastewater Based Epidemiology: https://nwbe.org/?page_id=77

There are many WEF Resources!



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Wastewater Surveillance 101

Enroll Now

This course is designed to provide you with a foundational understanding of wastewater surveillance, an essential practice in monitoring public health.

In this introductory lesson, we will explore the basics of wastewater surveillance, including an overview of the field today, Current Programs, Key Players, and the Role of Utility Professionals in Wastewater Surveillance.

Whether you're new to the field or looking to enhance your knowledge, this course will equip you with the essential skills and insights needed to navigate the fundamentals of wastewater surveillance and the roles various stakeholders play. Start this lesson to begin discovering how wastewater surveillance plays a role in protecting our communities.

Developed in collaboration with the U.S. Centers for Disease Control and Prevention, this introductory eLearning course is designed for wastewater operators and engineers new to wastewater surveillance. It covers foundational topics in four modules:

- Module 1: An Overview
- Module 2: Current Programs
- Module 3: Key Players
- Module 4: The Role of Utility Professionals



Credit Amount: 2.0

Member Price: \$0.00

Nonmember Price: \$0.00

Source: <https://learn.wef.org/local/catalog/view/product.php?productid=265>

There are many WEF Resources!



Original May 21, 2024
Updated June 10, 2024

Influenza Information for Water Professionals

Key Take-Home Messages

Influenza viruses cause respiratory illness that can be mild or serious enough to lead to hospitalization and death. Because influenza viruses are constantly changing, people can become infected with influenza multiple times in their lifetime. Some types of influenza viruses can cause severe global pandemics.

What we know from clinical surveillance

- There are more than 1 billion cases of seasonal influenza (or “flu”) worldwide every year.
- In 2010 through 2022, seasonal flu caused 9.3 to 41 million illnesses each year in the U.S. and was consistently one of the leading causes of death.

What wastewater workers need to know

- Positive cell cultures of influenza virus from feces have been documented, but not positive cultures from wastewater. Nevertheless, spiked infective influenza virus can persist in water matrices for days, weeks, and potentially longer depending on the

Source: https://nwbe.org/?page_id=1511#influenza

COVID-19 Wastewater Monitoring:

SAMPLING AND ANALYSIS

1 Communities contribute waste



2 Wastewater treatment plants collect wastewater samples and ship to DHHS partner labs

3 Labs analyze wastewater for the virus that causes COVID-19 and report to DHHS



4 DHHS submits wastewater data to CDC



5 CDC analyzes trends and sends to DHHS



6 DHHS reports results to wastewater treatment plants and local health departments

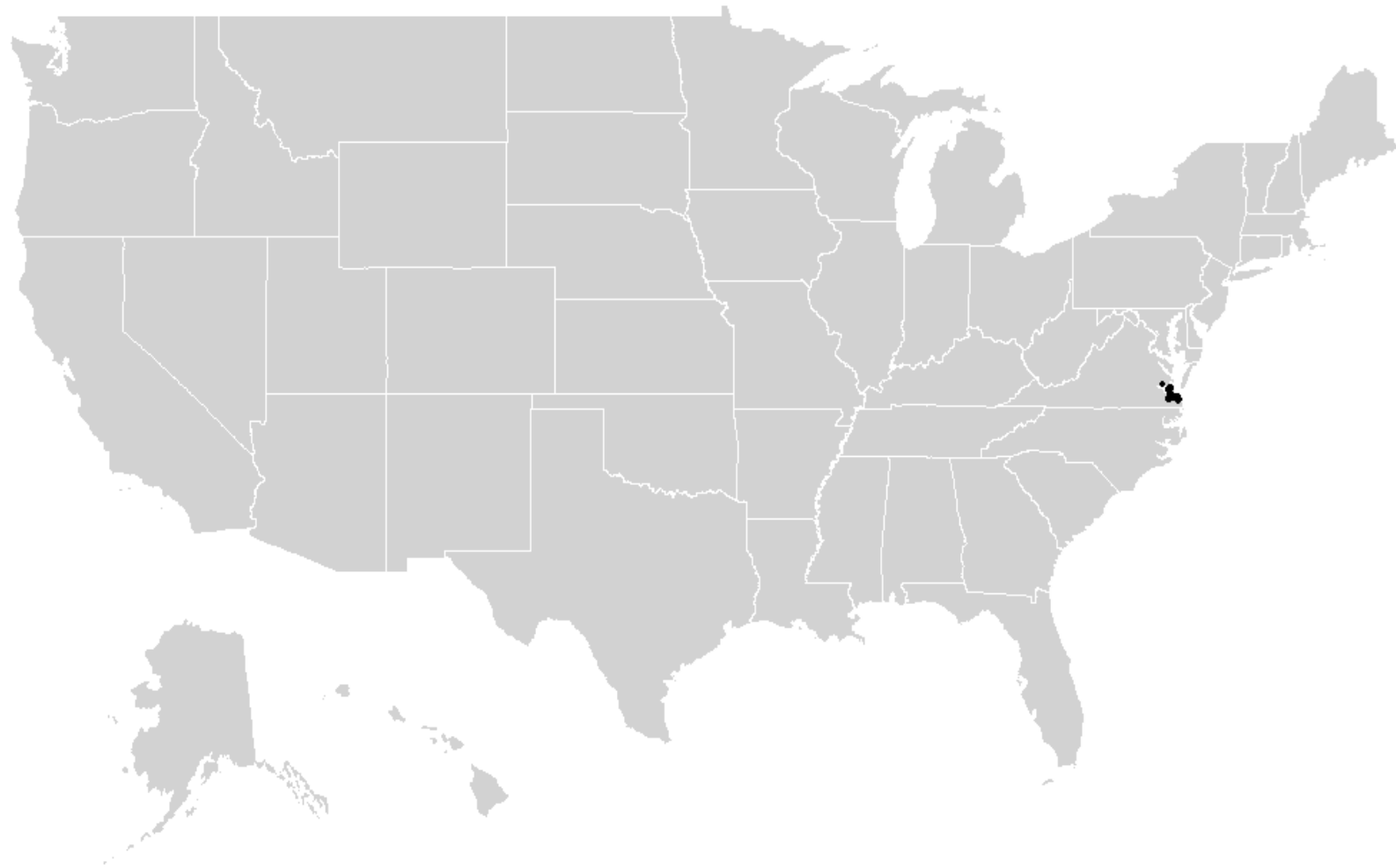
7 DHHS posts results on state dashboard



The NC Wastewater Monitoring Network is part of the CDC National Wastewater Surveillance System

Zipcodes with wastewater sampling on 2020-02-26
where point size represents contributing population

- Programs in all 50 states with over 130 Million persons covered
- **NC was one of eight initial states funded in 2021; first funded by state legislature in 2020**
- Programs are supplemented by
 - Federal wastewater testing contract awarded to Verily (~300 sites)
 - Participation in WastewaterSCAN (190 sites)



In August 2024, the CDC NWSS designated North Carolina as a Center of Excellence (CoE)

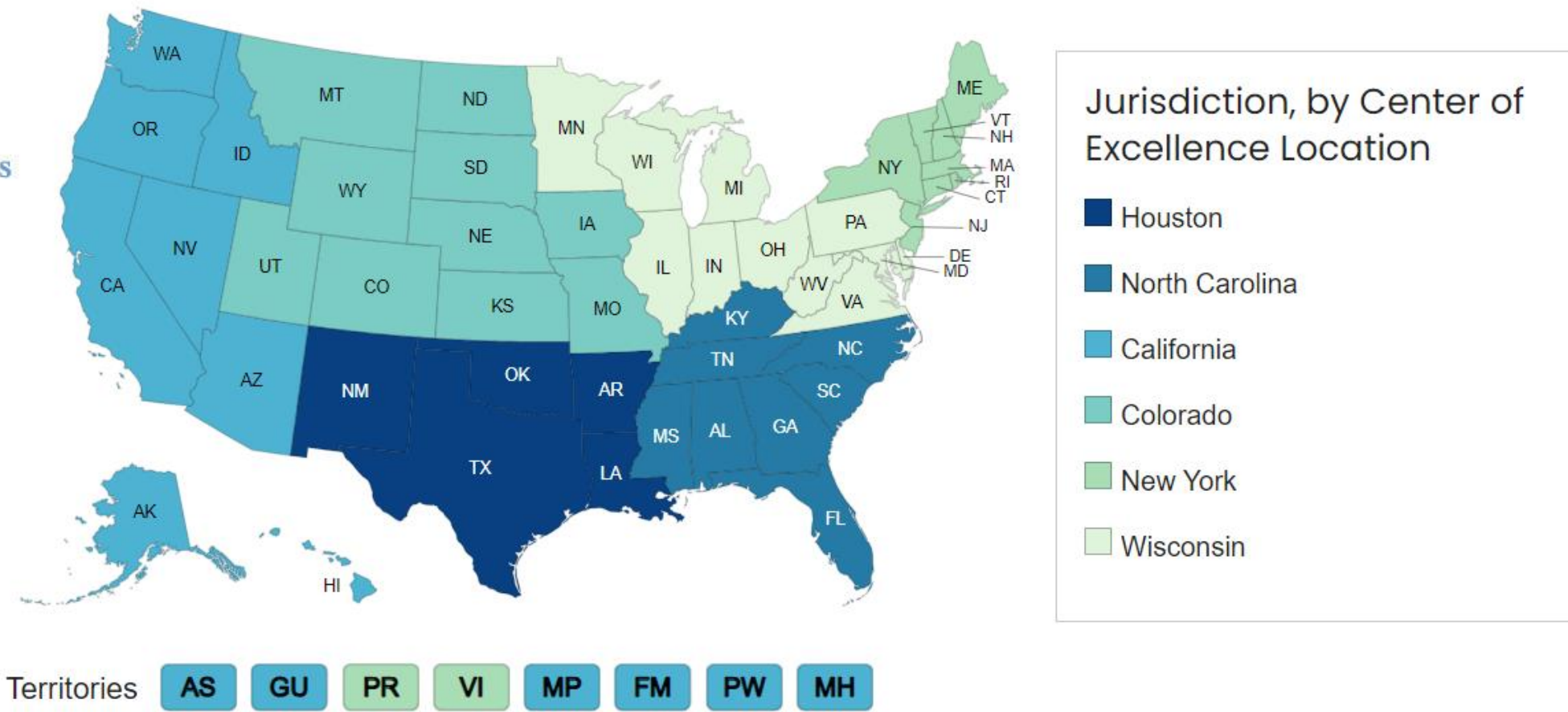
Key partnerships



UNC
INSTITUTE OF
MARINE SCIENCES



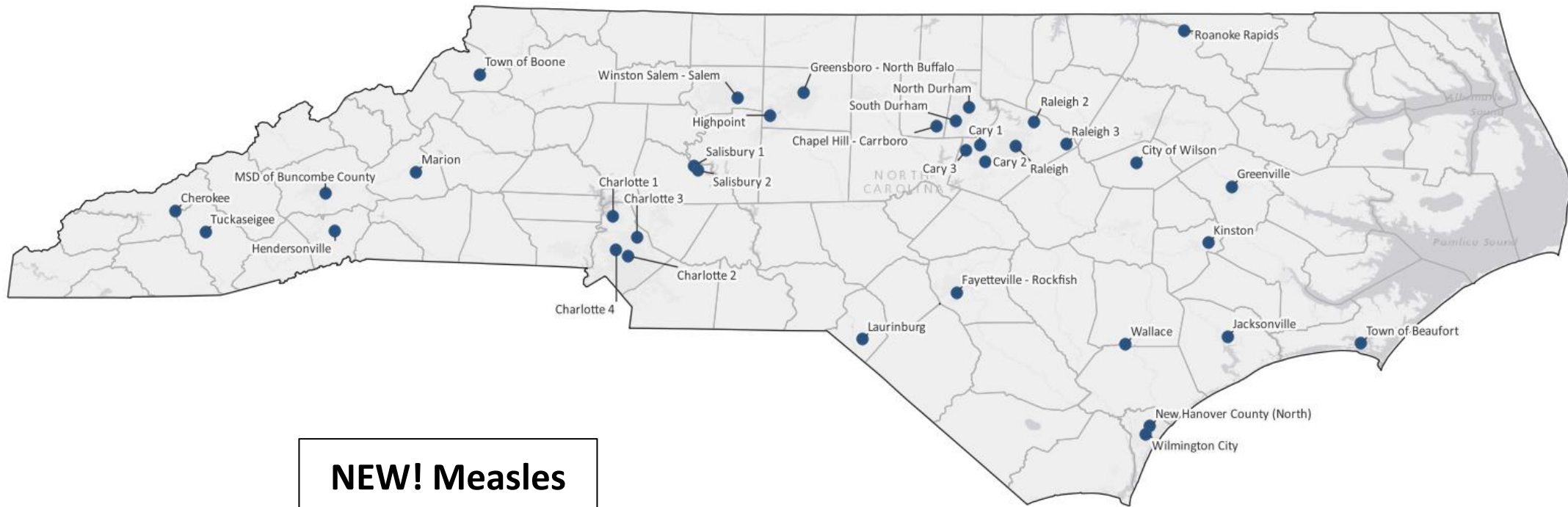
... COEs serve as **regional leaders** in wastewater surveillance implementation and coordination. They foster innovation, develop and **conduct trainings, and provide technical assistance** to jurisdictions.



<https://www.cdc.gov/nwss/centersofexcellence.html>

NC Routinely Monitors of Five Pathogens at 34 Sites

NC Wastewater Monitoring Network began in January 2021



**SARS-CoV-2
(COVID-19)**

**Influenza A and B
+ responsive subtyping
for H1, H3, and H5**

**Respiratory
syncytial virus
(RSV)**

Samples are mainly collected as a 24h composite

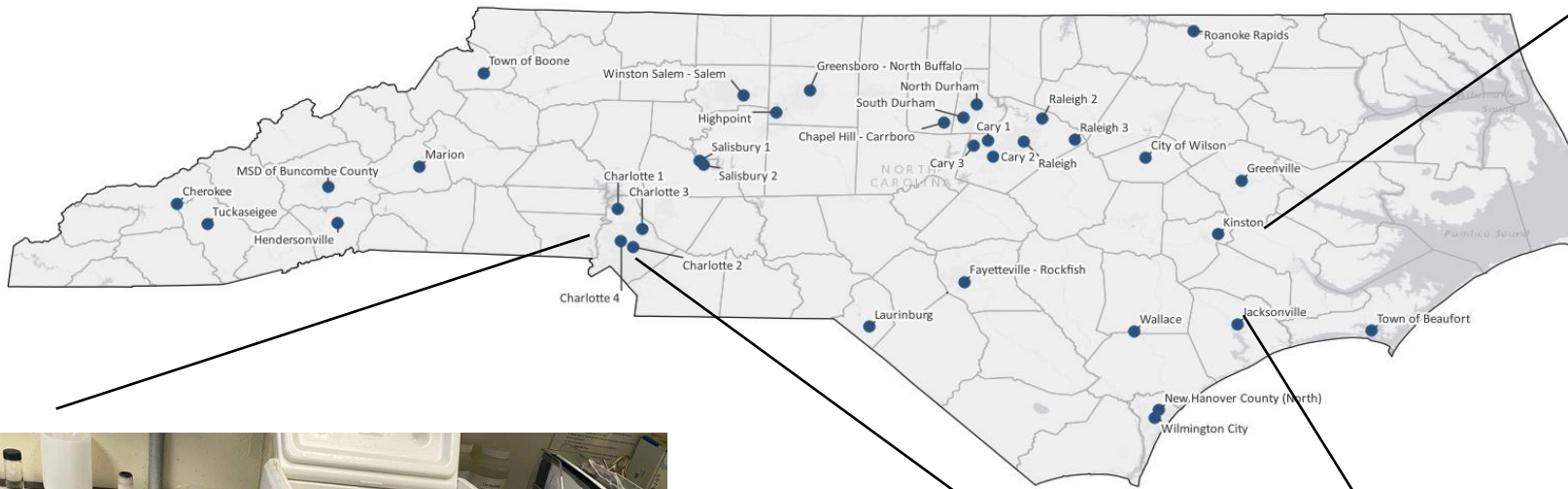


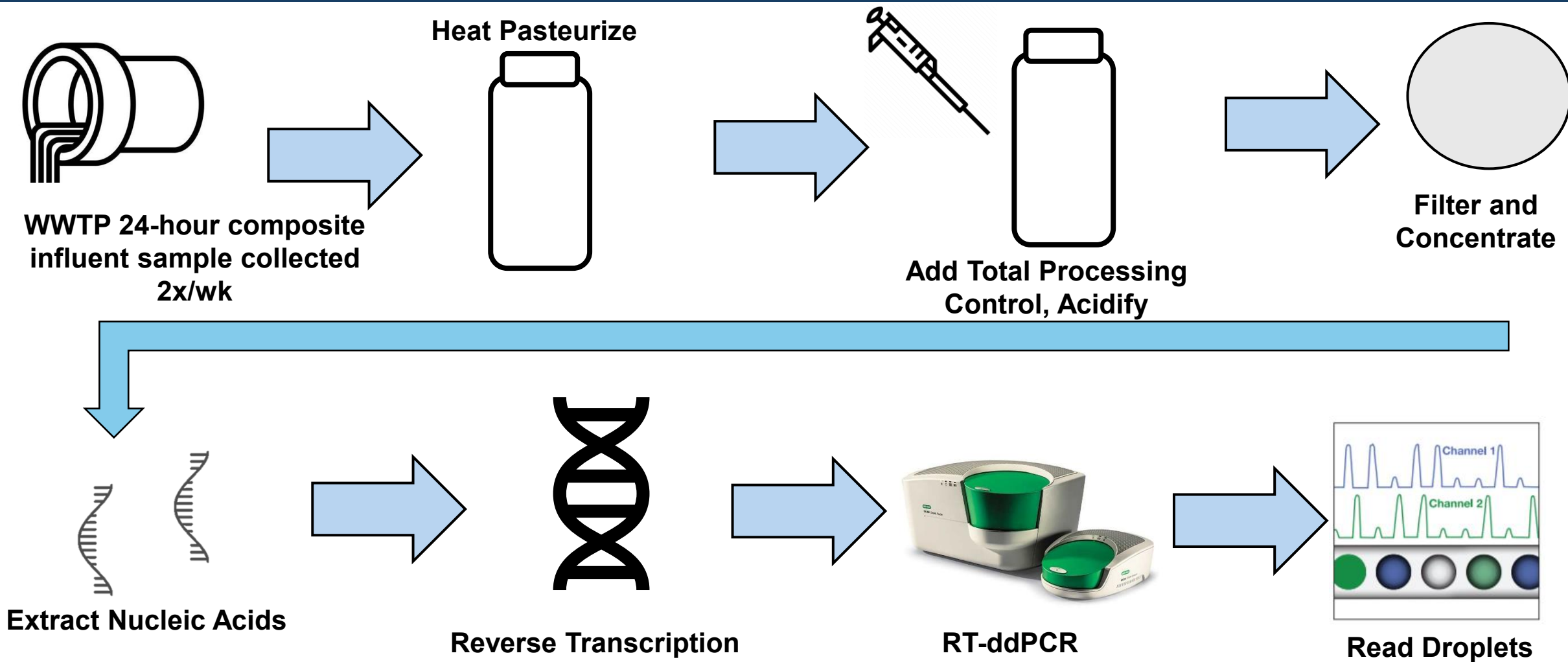
Photo credit: Tom Clerkin



Photo credit: Jimmy Pridgen



Samples are processed and analyzed by ddPCR



Wastewater monitoring is one of three key metrics on NC Respiratory Virus Summary Dashboard

(Updated Noon Each Wednesday)

Overall Wastewater trends correlate well with Emergency Department and Hospitalization Data Trends

But also provide complementary data!

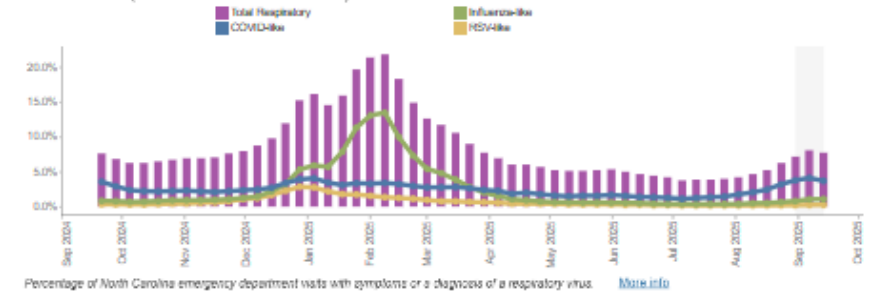


<https://covid19.ncdhhs.gov/dashboard>

Updated Every Wednesday by approximately 12:00 p.m.
Last updated September 17, 2025

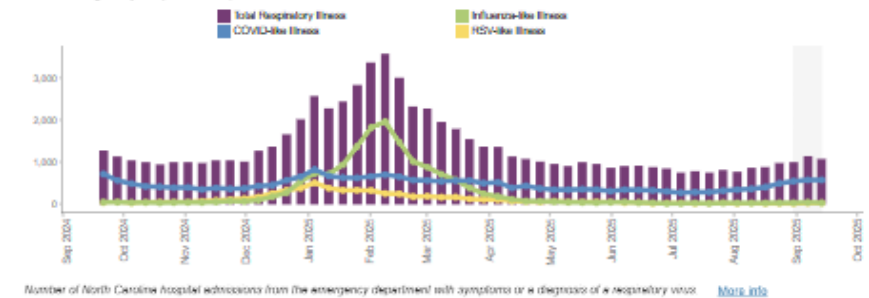
Emergency Department Visits for Respiratory Viruses

Latest Week: 7.7% of emergency room visits had symptoms of a respiratory virus, a decrease from the week before. (The week before was 8.0%.)



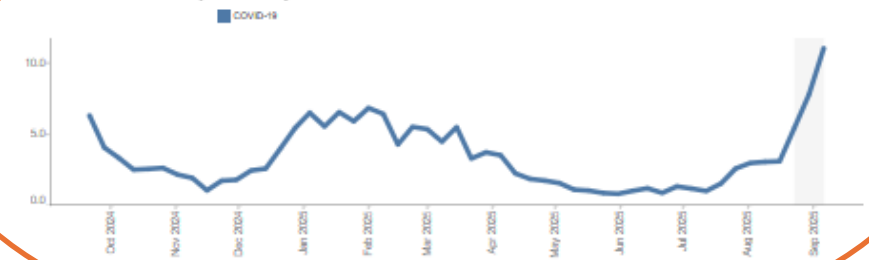
Hospital Admissions from the Emergency Department

Latest week: There were 1,082 hospital admissions from the emergency department for people who were diagnosed with or had symptoms of a respiratory virus. This includes, but is not limited to, Influenza, RSV or COVID-19. This is a decrease from the week before. (The week before was 1,146 hospital admissions from the emergency department)



COVID-19 Wastewater Monitoring

Latest Week: The wastewater viral activity level statewide is 11.0 which is Very High for COVID-19. Wastewater viral activity levels may indicate the risk of infection in an area.



The wastewater viral activity level indicates whether the amount of virus in the wastewater is Very Low (0 to 2), Low (>2 and <=3.4), Moderate (>3.4 and <=7.0), High (>7.0 and <=14.0), or Very High (>14.0). [More info](#)

Wastewater monitoring data are used frequently by the public and access correlates to disease activity

Respiratory Summary Dashboard

1

Most viewed dashboard



278,688 views



147,344 active users

Wastewater Dashboard

2

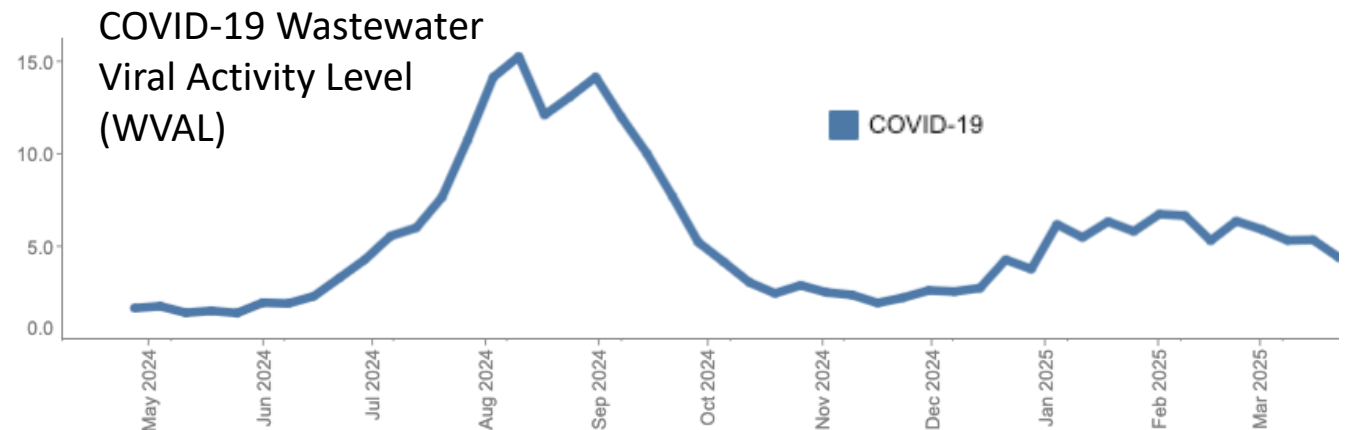
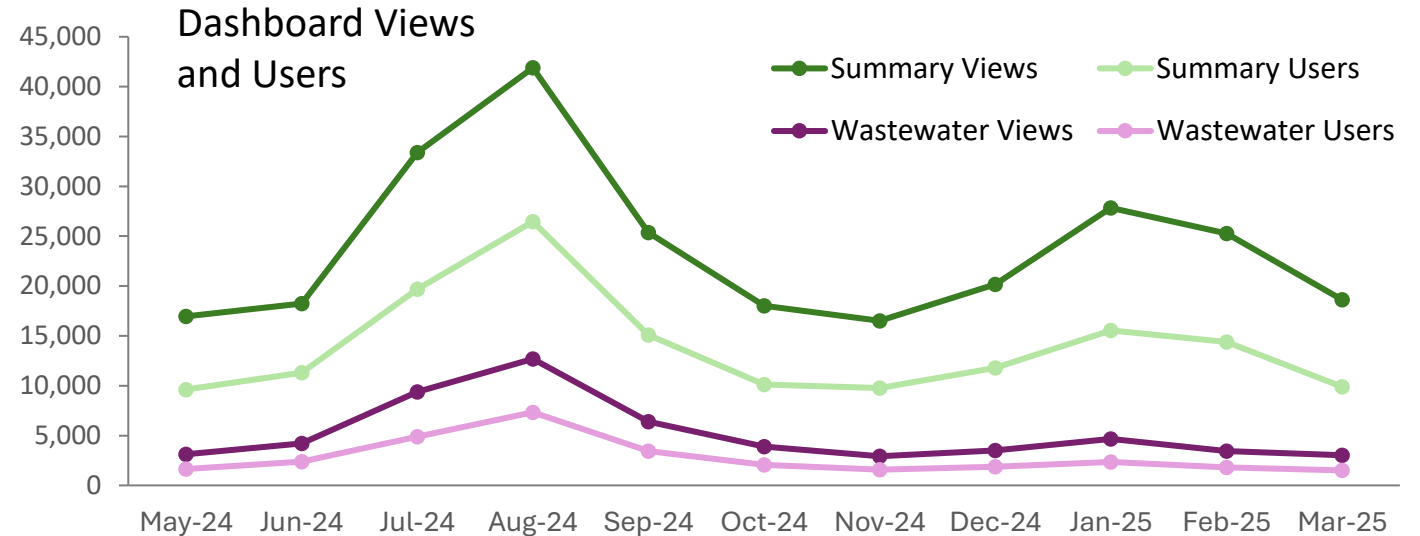
2nd most viewed dashboard



60,394 views

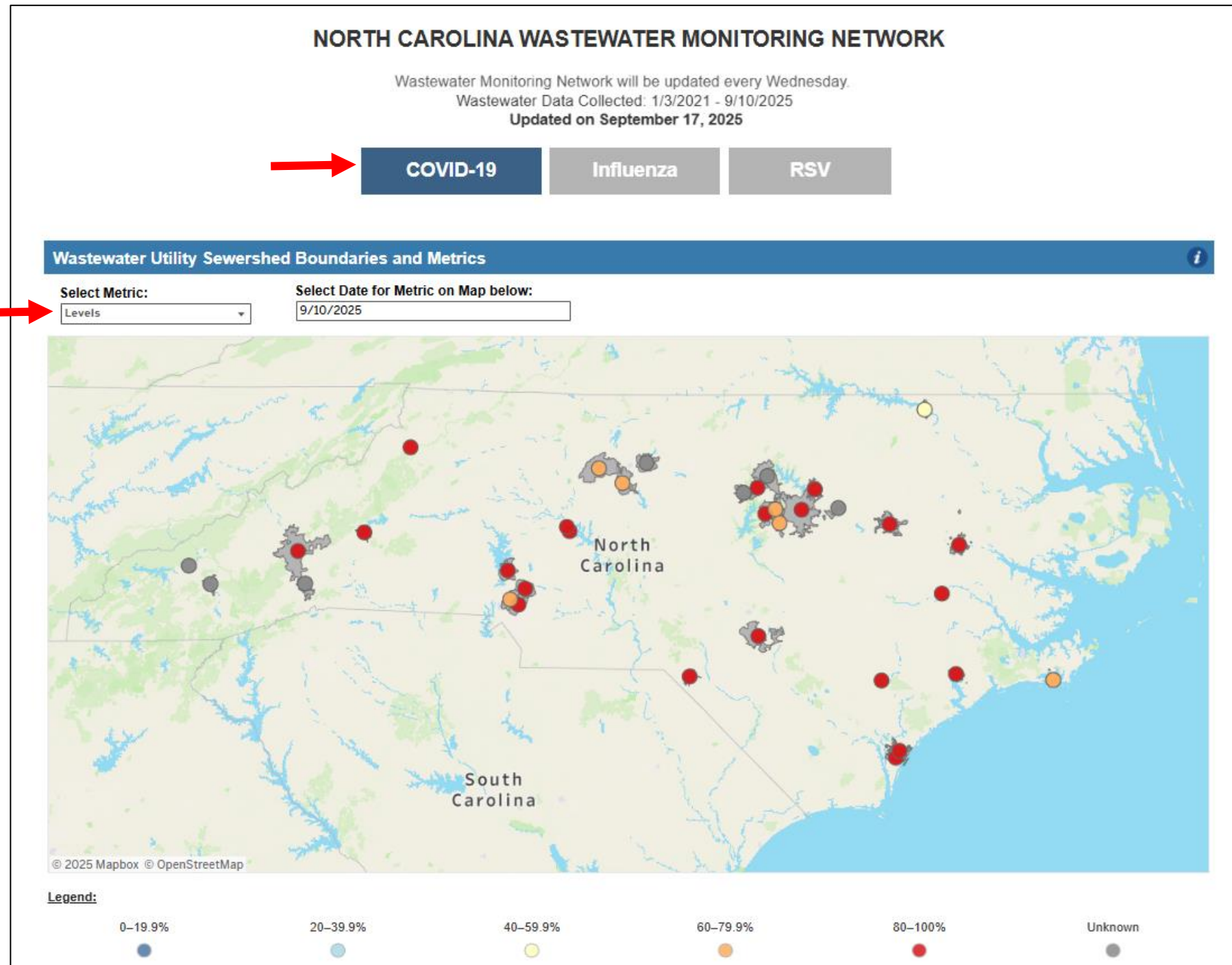


28,230 active users



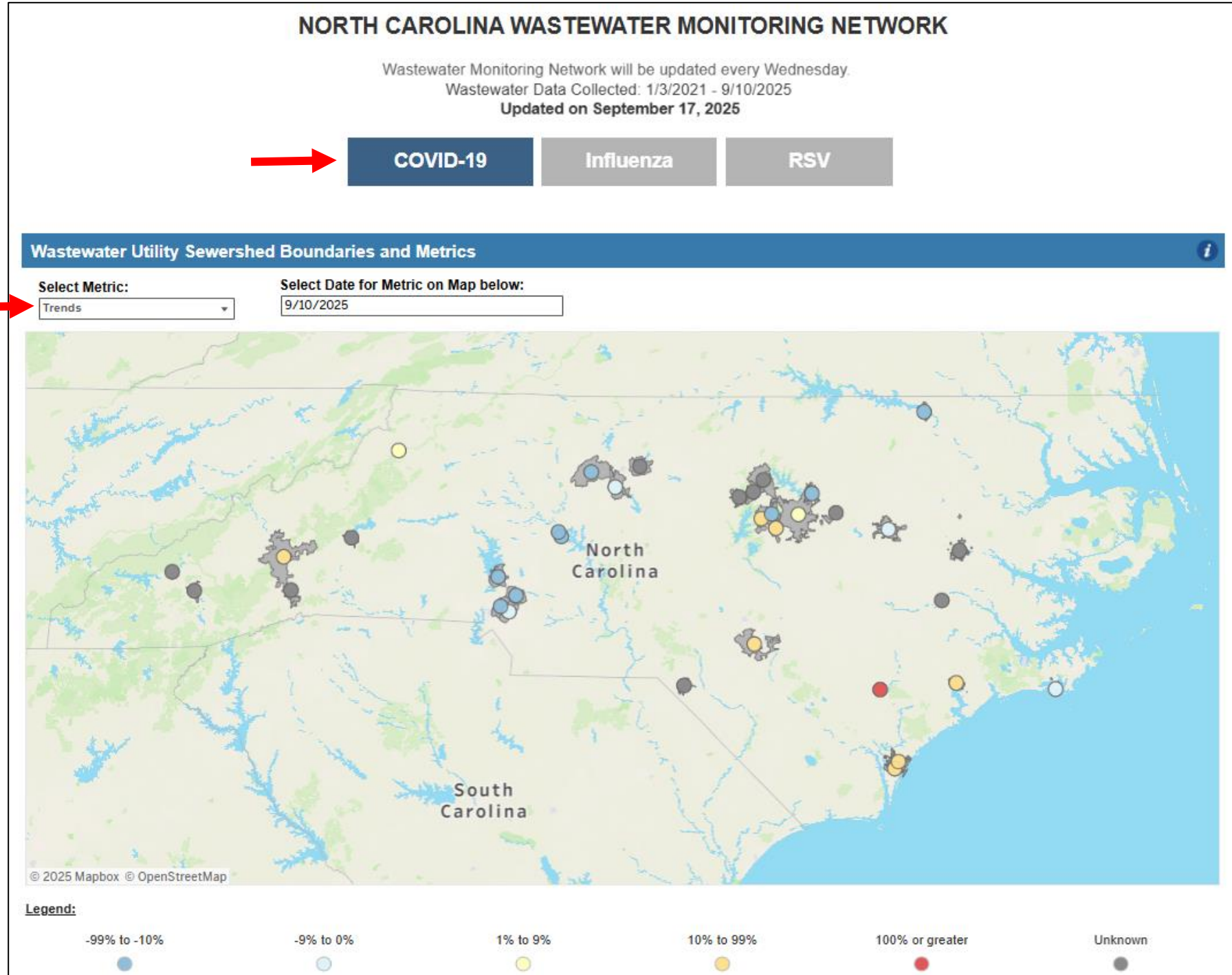
NEW DASHBOARD! SARS-CoV-2 Wastewater Site Levels

Site levels are
highest at
27/28 sites.



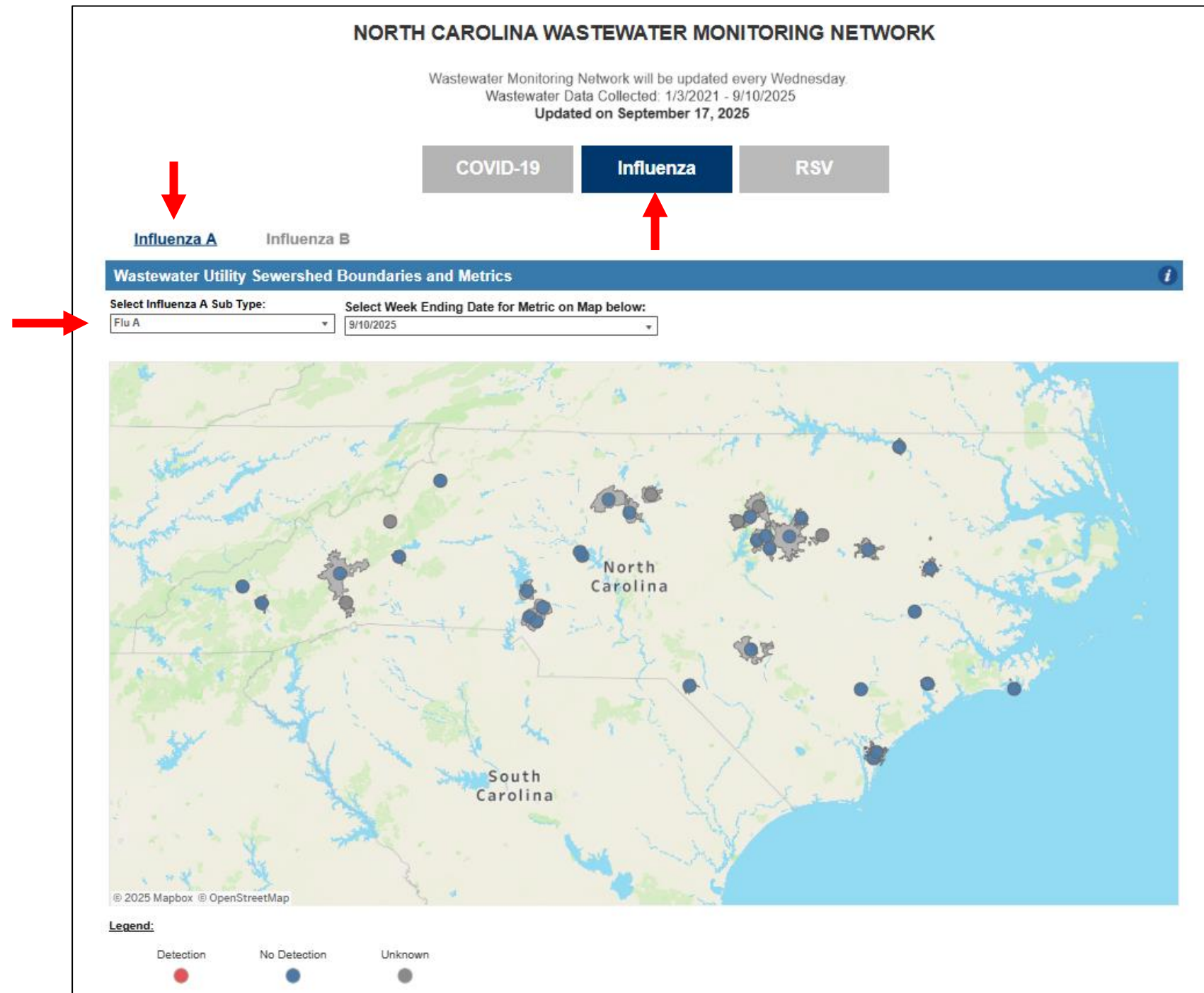
**NEW
DASHBOARD!
SARS-CoV-2
Wastewater Site
Trends**

**Site levels are
increasing at
8/23 sites.**



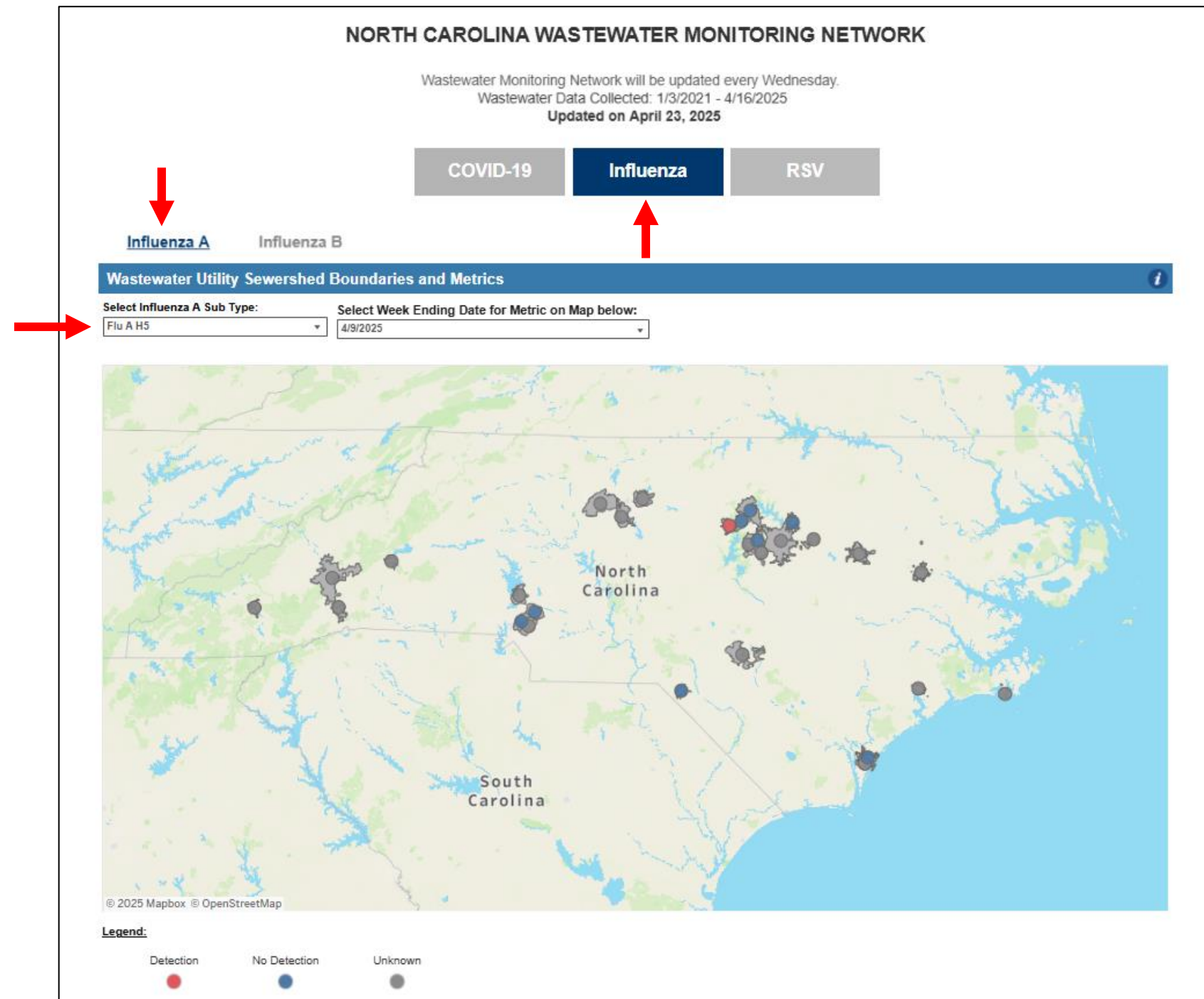
**NEW
DASHBOARD!**
FLU A, including
subtyping for H1
H3 and H5, is
publicly
available for
select sites.

**There were no
detections for
week
ending 09/10/20
25.**



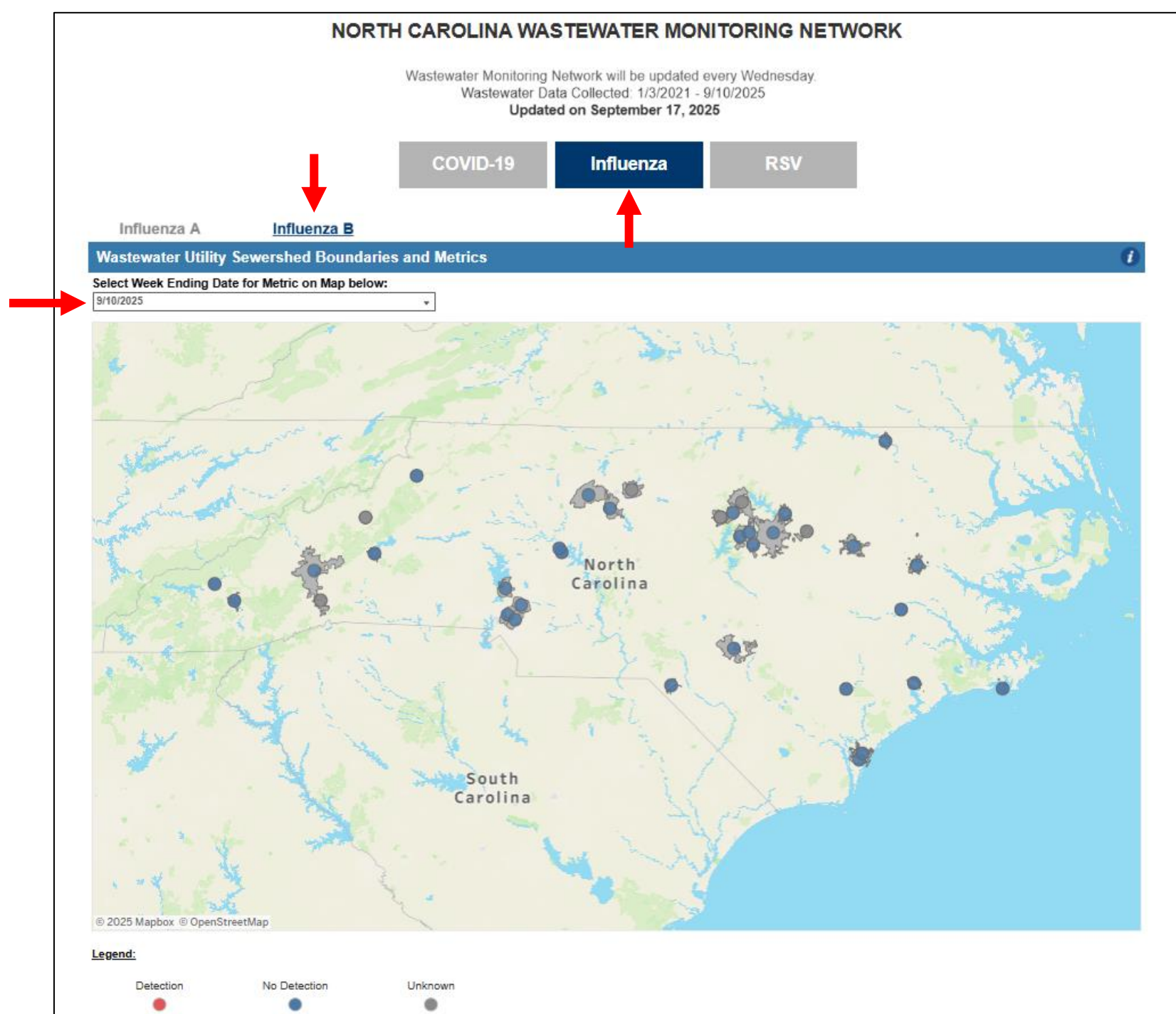
**NEW
DASHBOARD!**
FLU A, including
subtyping for H1
H3 and H5, is
publicly
available for
select sites.

There was a
single detection
for week ending
04/09/2025.
(HISTORIC)



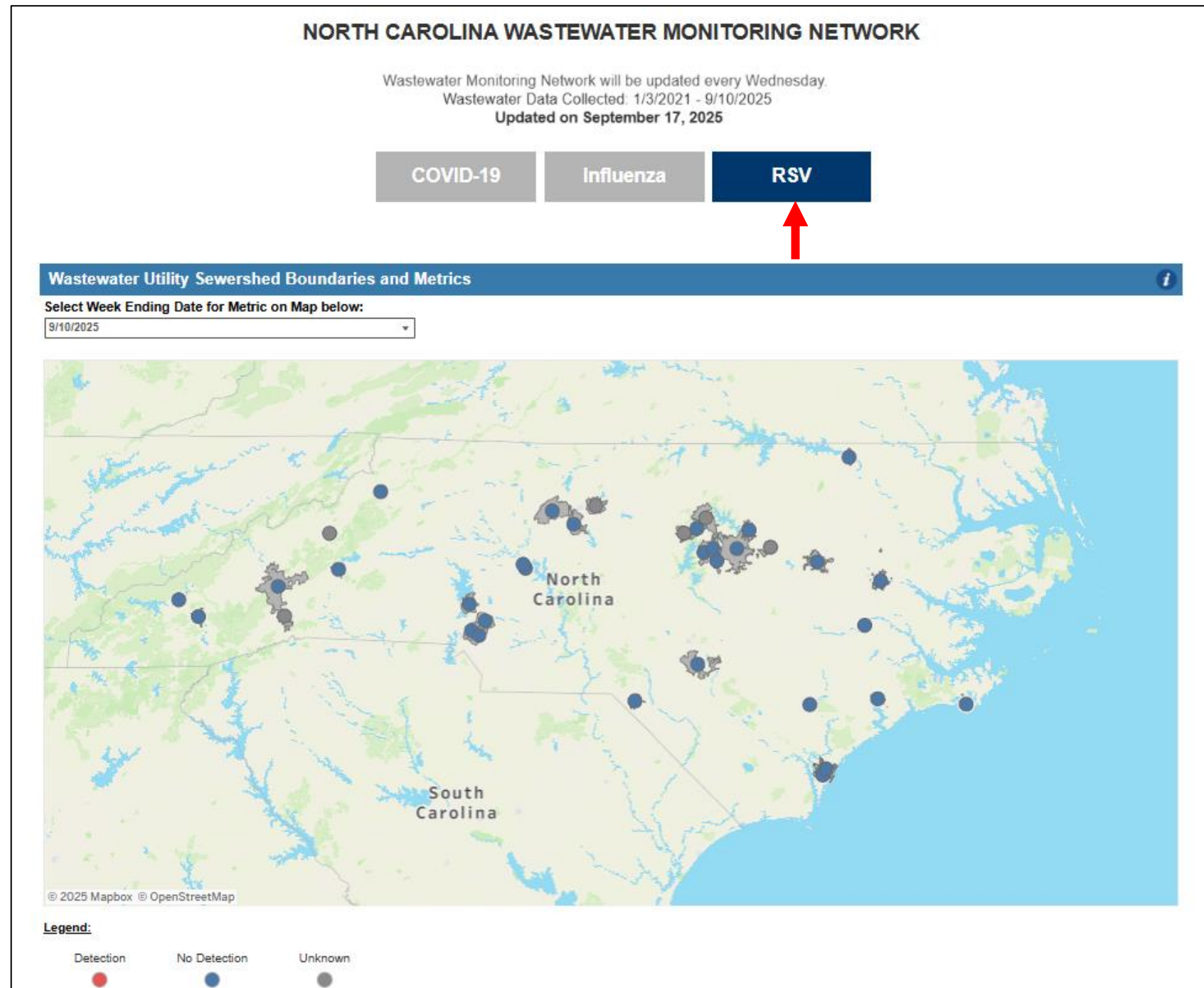
**NEW
DASHBOARD!
FLU B data is
also available
online.**

**There were
no detections
for week ending
09/10/2025.**



**NEW
DASHBOARD!**
RSV data is also
available online.

**There was
one detection
for week ending
09/10/2025.**



Wastewater monitoring data has been added to the NEW CDC Respiratory Illness Data Channel (*updated as of 09/12/2025*)

Respiratory Illnesses Data Channel

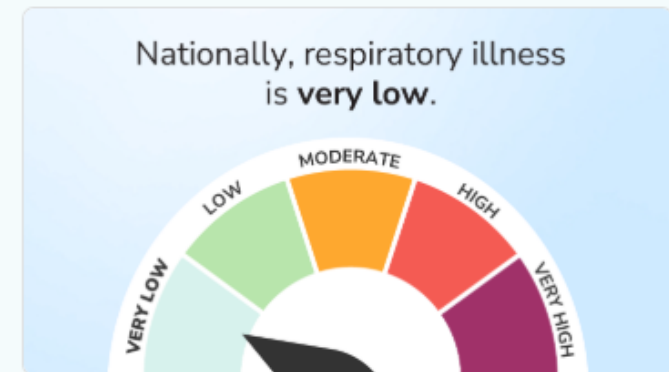
This site is updated on Fridays.



For Everyone
SEPT. 12, 2025

WHAT TO KNOW

- As of September 12, 2025, the amount of acute respiratory illness causing people to seek health care is at a very low level.
- COVID-19 activity is peaking in many areas of the country with elevated emergency department visits and hospitalizations nationally.
- Seasonal influenza activity is low, and RSV activity is very low.



<https://www.cdc.gov/respiratory-viruses/data/index.html>

Voices from the Community:

Wastewater monitoring data remains useful to our community (with permission to share)

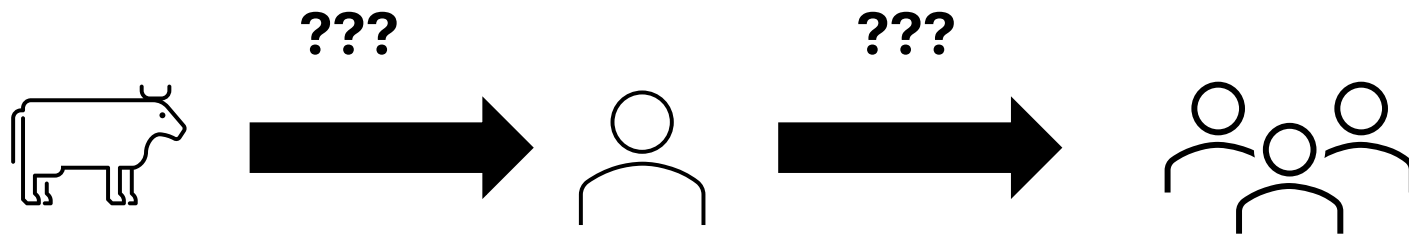
*"As an immunocompromised woman, current wastewater surveillance data is crucial for me ... The NC Wastewater Monitoring Dashboard has been a **trusted bright light** in NC public health the past several years. It is a gem that is not available in every state and I do not take it for granted ... My family uses NC's wastewater surveillance data to **choose when to schedule non-urgent doctor and dentist appointments [and] to decide whether we attend group activities or not.** Knowing the level of community infections is the difference between going blind into a Covid surge or **being armed with correct and current information** to increase measures to stay safe and healthy."*

- Anonymous dashboard user

*"Wastewater surveillance is a **valuable tool for local health departments** to track illnesses like flu and COVID in our communities. We use the information to **inform health messaging and encourage public health action** like vaccination or notifications to local healthcare providers."*

- Ellis D. Matheson, Buncombe County Health Director

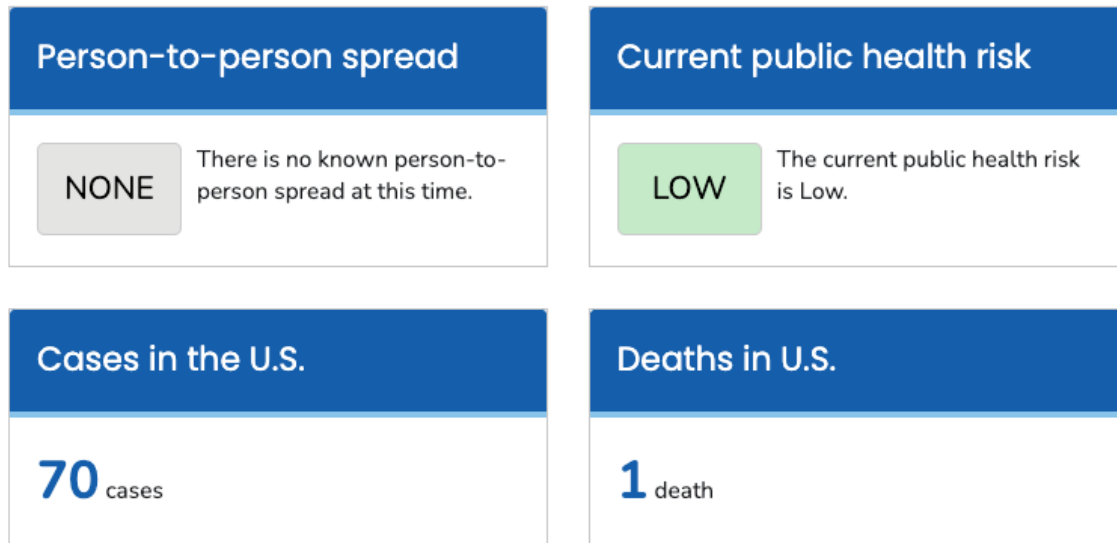
Highly Pathogenic Avian Influenza (H5N1): Using wastewater as a tool to support PH response



H5N1 is a type of avian influenza A virus that occurs mainly in birds (and is highly pathogenic to BIRDS!)

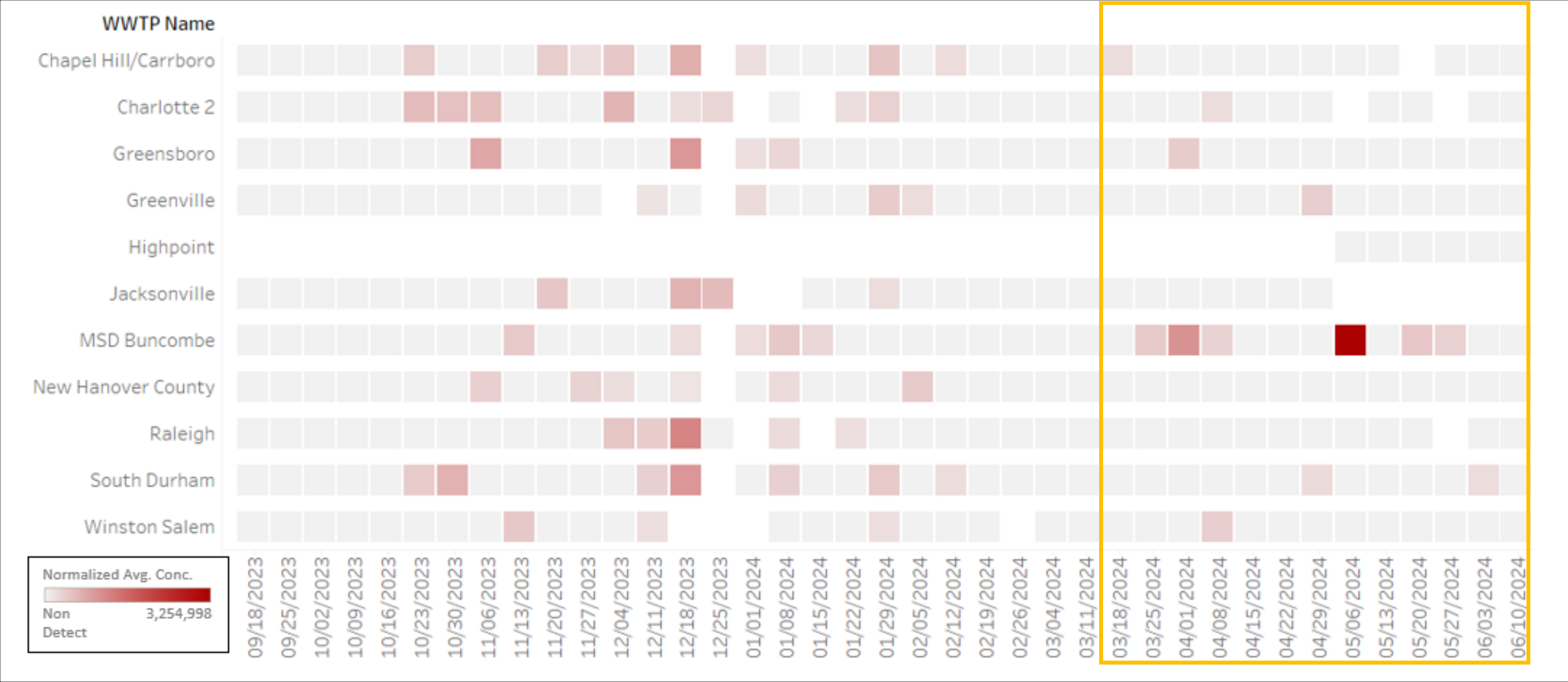
Current situation

National situation summary



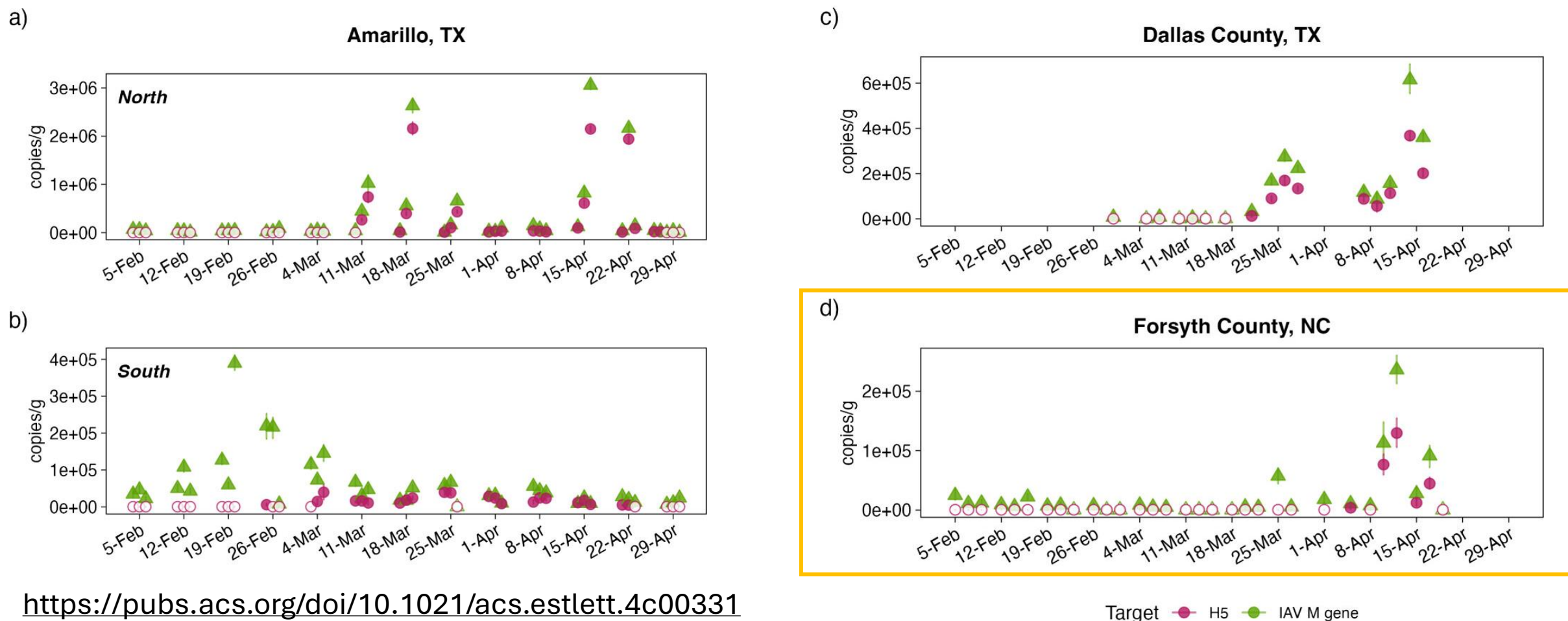
- In 2024 it spread to U.S. dairy cows, a new and unexpected host of the virus.
- Several human cases have occurred in U.S. dairy workers since then.
- The current public health risk is low, but the potential for the virus to spread in new or different ways between animals and people poses public health challenges and the situation is being closely watched.

After 4 weeks of non-detects in late winter 2024, we began to see Influenza A detections across multiple sites



Detection of Hemagglutinin H5 Influenza A Virus Sequence in Municipal Wastewater Solids at Wastewater Treatment Plants with Increases in Influenza A in Spring, 2024

Marlene K. Wolfe, Dorothea Duong, Bridgette Shelden, Elana M. G. Chan, Vikram Chan-Herur, Stephen Hilton, Abigail Harvey Paulos, Xiang-Ru S. Xu, Alessandro Zulli, Bradley J. White, and Alexandria B. Boehm*



In the news...

 MENU

WXII 

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 73° WEATHER

 SEARCH

Winston-Salem, NC 27101 73° Cloudy 0% [Change](#) 

MORE >

< 1 / 1 > 

Bird flu fragments found in Forsyth County wastewater by Stanford University research group

 MENU

WXII 

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 73° WEATHER

 SEARCH

Winston-Salem, NC 27101 73° Cloudy 0% [Change](#) 

MORE >

< 1 / 1 > 

Forsyth County public health director wants public to 'be aware, not fearful' after bird flu fragments found in wastewater

NC NEWSLINE

STATE, LOCAL GOVT. EDUCATION ENVIRONMENT COURTS, JUSTICE COMMENTARY PODCASTS NATIONAL

AGRICULTURE ENVIRONMENT

Avian influenza gene found in Forsyth County wastewater discharge; dairy cattle suspected source

Detection “doesn’t mean there is infectious H5N1 virus in wastewater,” county health officials say

BY: LISA SORG - MAY 29, 2024 12:52 PM



Public Health Action Toolkits:

Integrating wastewater monitoring results into public health response

- **NWSS Checklists and Talking Points Pathogen specific Wastewater Talking Points** (*in collaboration with the NCDHHS Comms Office*)
- **Public Health Action Decision Making Trees** (*in collaboration with Communicable Disease and Immunization Branches*)
- **Healthcare Provider Memo Template WW Notification Letter Template** (*sent to LHDs and wastewater treatment plants*)
- **Press Release Templates/Literature Repository**(*se/sp, shedding, assay design, validation, etc.*)
- **Wastewater Scan Materials** (*FAQs, pilot results*)

Dear colleagues,

We are writing to inform you that influenza A(H5) virus was detected during routine wastewater (sewage) monitoring in your area. Wastewater monitoring for influenza A(H5) is relatively [new](#) and we are still learning about what H5 detections in wastewater mean. Wastewater data cannot determine the source of influenza A(H5) viruses, which could come from a human or from an animal source. Influenza A(H5) wastewater data is published publicly and can be found [here](#) and [here](#).

What is wastewater monitoring?

Wastewater monitoring is a form of environmental monitoring where wastewater (sewage) is tested for the presence of disease. It is widely used for surveillance of several other diseases, including COVID-19. Wastewater monitoring tests a composite sample made up from multiple samples collected over the collection timeframe from the millions of gallons of wastewater flowing through wastewater treatment plants every day and allows public health officials to obtain insight into disease trends in the community. While H5 specific wastewater monitoring is relatively new and more information is needed about how to interpret the results, studies have shown wastewater testing provides information about overall trends and geographic spread of many viruses.

What does this mean?

A positive detection of influenza A(H5) virus in wastewater suggests that there are, or have recently been, infections in the community or environment served by the [sewershed](#) (the community area served by a wastewater collection system) where the wastewater sample was taken. A [sewershed](#) map has been provided as an additional attachment. Wastewater data cannot determine the source of influenza A(H5) viruses, which could come from a human or from an animal (like a bird) or an animal product (like milk from an infected cow). A positive detection of influenza A(H5) virus in wastewater cannot be translated into prevalence of influenza A(H5) virus in a community.

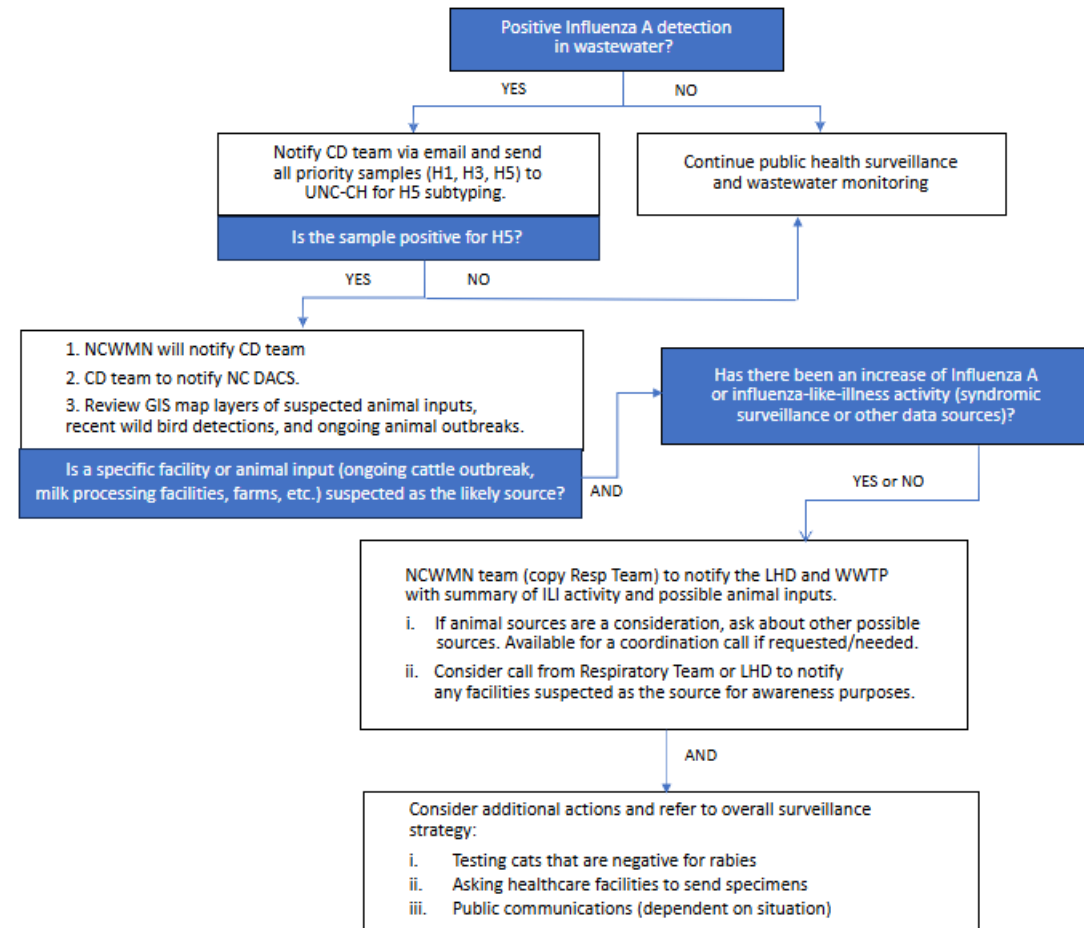
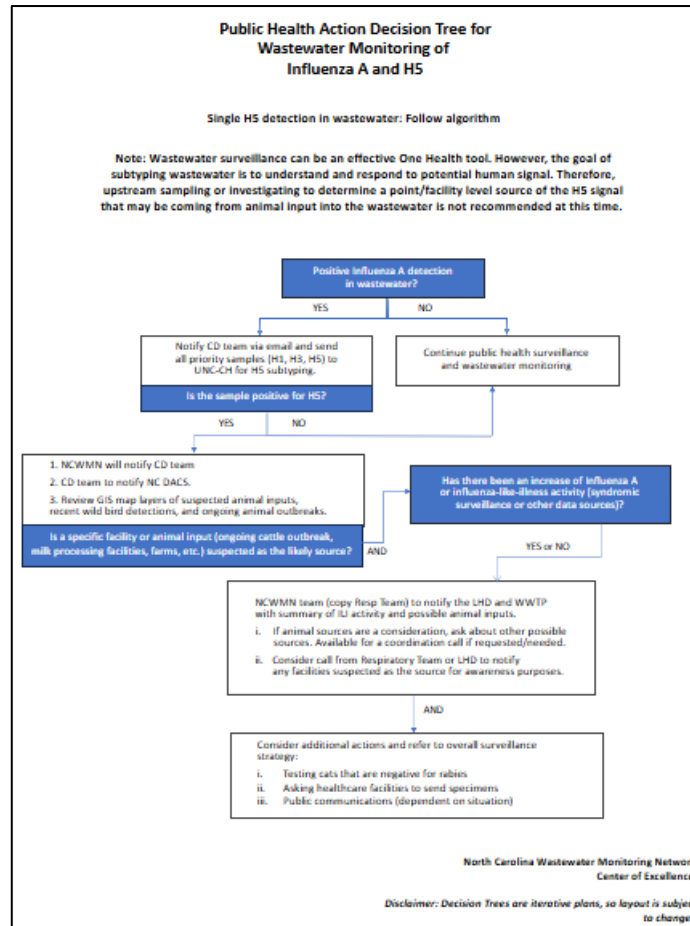
What should we do?

Detection of influenza A(H5) virus in wastewater should be used as an early warning sign that influenza A(H5) virus is present in the community or environment. The NC DHHS team will review syndromic influenza and influenza-like illness data for the county, for one month after the last H5 detection will test all cats from the county be submitted for rabies testing, that test negative for rabies, and gather information about potential animal inputs that contribute to the [sewershed](#) for influenza A(H5) virus testing. Additional upstream sampling or investigation to determine a point or facility level source of the H5 signal is not recommended at this time. Actions may include:

- Notify primary cares, urgent cares, and hospitals in the area to watch for potential cases and to send any positive and [unsubtyped](#) flu A specimens to the North Carolina State Laboratory of Public Health (SLPH) for subtyping until wastewater detections are negative for influenza A(H5) virus two weeks.
- Notify the public, especially high-risk populations, of potential disease risk and encourage seasonal flu vaccination which can protect against co-infections.

The [NC DHHS Flu Website](#) has resources and tools to assist with vaccine, communication, and infection prevention efforts.

Influenza A and H5N1 Decision Tree to integrate wastewater monitoring results into the overall public health response



Weekly reporting to local health departments, wastewater treatment plants, hospital-based epidemiologists, and academic partners

NCWMN_FLU_RSV_06042025...
749 KB

Good Afternoon,

We have updated the wastewater report for Influenza A (Flu A), Influenza B (Flu B), and Respiratory Syncytial Virus (RSV) through 05/28/2025. Here are the highlights for the last two weeks:

- There were 0 detections for Flu A.
- There was 1 detection for Flu B: Cary 3 (05/28/2025).
- There were 0 detections for RSV.

The complete report, which summarizes results from 10/01/2024 to 05/28/2025 are attached. This report has also been added to the [Internal NCDHHS Wastewater Monitoring Dashboard](#).

Note that these results, as well as influenza subtyping results by week, can be found on the public [NCDHHS Wastewater Monitoring Dashboard](#).

We welcome any questions you may have about these and any of our reports. Please do not hesitate to reach out.

Your NCWMN Team

Nicole L. Snyder, PhD, MPH

Public Health Epidemiologist

Occupational and Environmental Epidemiology Branch

North Carolina Wastewater Monitoring Network Team

Division of Public Health

North Carolina Department of Health and Human Services

North Carolina Wastewater Monitoring Network Report: Influenza A (Flu A), Influenza B (Flu B) and Respiratory Syncytial Virus (RSV) Levels Measured in Wastewater

Updated on 06/04/2025

Summary: In September 2023, the North Carolina Wastewater Monitoring Network (NCWMN) began measuring Influenza A (Flu A), Influenza B (Flu B), and Respiratory Syncytial Virus (RSV) levels in wastewater influent samples across 10 initial sites. In June 2024, testing for these pathogens transitioned from our academic partners at the University of North Carolina at Chapel Hill (UNCCH) to the State Lab for Public Health (SLPH). The SLPH is currently testing for FluA, FluB, and RSV at 29 sites. Additional testing is being conducted at 6 sites by Verily via CDC contract that started in December 2023. This report shows sampling beginning with October 2024 (6 months). This data, along with the FluA subtyping, is available in an interactive format on the [NCWMN Wastewater Dashboard](#).

NC Wastewater Monitoring Locations for Flu A, Flu B, and RSV Sampling



FLU A Detections at 29 Sites

WWT Name	10/01/2024	10/08/2024	10/15/2024	10/22/2024	10/29/2024	11/05/2024	11/12/2024	11/19/2024	11/26/2024	12/03/2024	12/10/2024	12/17/2024	12/24/2024	12/31/2024	01/07/2025	01/14/2025	01/21/2025	01/28/2025	02/04/2025	02/11/2025	02/18/2025	02/25/2025	03/04/2025	03/11/2025	03/18/2025	03/25/2025	04/01/2025	04/08/2025	04/15/2025	04/22/2025	04/29/2025	05/06/2025	05/13/2025	05/20/2025	05/27/2025	
Cary 1																																				
Cary 2																																				
Cary 3																																				
Chapel Hill - Carrboro																																				
Charlotte 1																																				
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Charlotte 4																																				
City of Wilson																																				
Greensboro																																				
Greensboro 2																																				
Hendersonville																																				
Highpoint																																				
Johnstonville																																				
Laurensburg																																				
Marion																																				
Mid of Brunswick																																				
New Hanover																																				
Raleigh 1																																				
Raleigh 2																																				
Raleigh 3																																				
Roanoke Rapids																																				
South Durham																																				
Town of Beaufort																																				
Turkeyville																																				
Wilmington City																																				
Winston Salem																																				

Wastewater Quality

10/01/2024

10/08/2024

10/15/2024

10/22/2024

10/29/2024

11/05/2024

11/12/2024

11/19/2024

11/26/2024

12/03/2024

12/10/2024

12/17/2024

12/24/2024

12/31/2024

01/07/2025

01/14/2025

01/21/2025

01/28/2025

02/04/2025

02/11/2025

02/18/2025

02/25/2025

03/04/2025

03/11/2025

03/18/2025

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04/15/2025

04/22/2025

04/29/2025

05/06/2025

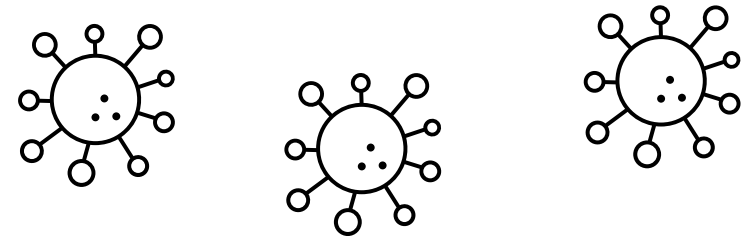
05/13/2025

05/20/2025

05/27/2025

Wastewater worker safety: pathogen viability

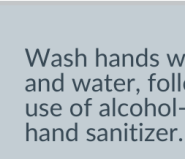
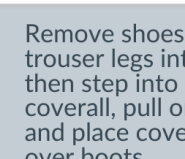
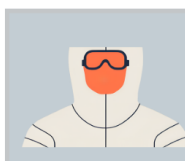
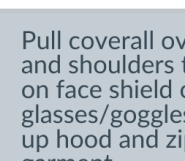
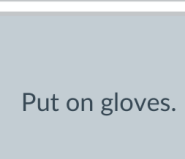
Viability of **H5N1 virus** in wastewater is uncertain. Influenza A virus broadly could feasibly be present in wastewater given its presence in feces and persistence in water matrices, but it has not been confirmed. Recent H5N1 testing of dairy samples showed that RNA positive samples were not positive for viable virus.



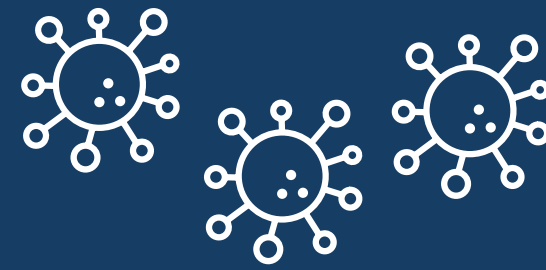
Wastewater worker safety: infection prevention measures

- Stay up to date with seasonal influenza vaccination
- Understand appropriate disinfectant products
 - [EPA list M](#) for H5N1
- Conduct job safety assessments (templates available through WEF)
- Practice good hygiene
- Use personal protective equipment

To reduce pathogen exposure, follow the right steps for donning (putting on) and doffing (removing) personal protective equipment (PPE). Here is a short guide on how to properly don and doff the PPE listed, along with tips on how to remove gloves when not wearing a disposable coverall.

Personal Protective Equipment Used			
 Gloves	 Boots	 Disposable coveralls	 Face shield or safety glasses/goggles
Donning		Doffing	
 Wash hands with soap and water, followed by use of alcohol-based hand sanitizer.	 Unzip coverall to waist and roll back hood, avoiding contact with inside. Pull first arm out by reaching behind your back, removing the glove as your arm comes free.		
 Remove shoes and tuck trouser legs into socks, then step into legs of coverall, pull on boots, and place coverall legs over boots.	 Use ungloved hand (touching only the inside of coveralls) to free second arm and remove second glove. Roll coverall down body, kick off boots, and dispose of coverall—only touching the inside.		
 Pull coverall over arms and shoulders then put on face shield or glasses/goggles and pull up hood and zip up garment.	 Wash hands thoroughly with soap and water, then apply alcohol-based hand sanitizer.		
 Put on gloves.	 Remove face shield or glasses/goggles from behind by lifting band or earpieces, and discard or clean them according to guidelines.		
Alternate Glove Removal Use one gloved hand to grasp the palm of other glove and peel it off, keeping the removed glove in your gloved hand. Then, slide the fingers of your now ungloved hand under the remaining glove at the wrist and peel it off over the first glove. Discard both gloves, wash your hands thoroughly with soap and water, and apply alcohol-based hand sanitizer.			

Summary and Future of NCWMN



- Wastewater monitoring is an important tool for detecting pathogens in wastewater including H5N1.
- Current federal funding covers our program until July 2027
- Prioritizing support for wastewater treatment plants to continue sampling.
- Considering expanding to other pathogens depending on priorities and capacity.
- Continuing to grow our NC Wastewater Monitoring Network team.

Community Testimonials

“As an immunocompromised woman, current wastewater surveillance data is crucial for me. I use it to gauge how much I can safely be out in community. The NC Wastewater Monitoring Dashboard has been a trusted bright light in NC public health the past several years. It is a gem that is not available in every state and I do not take it for granted.”

“My family uses NC's wastewater surveillance data to choose when to schedule non-urgent doctor and dentist appointments. We use that information to decide whether we attend group activities or not. Knowing the level of community infections is the difference between going blind into a Covid surge or being armed with correct and current information to increase measures to stay safe and healthy.”

Photo by: Nicole L. Snyder, Orange Water and Sewer Authority (Chapel Hill/Carborro NC)