APPLICATION OF WASTEWATER-BASED EPIDEMIOLOGY TO TRACK COMMUNITY DISEASE

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Annemarie Pillsbury (MS)

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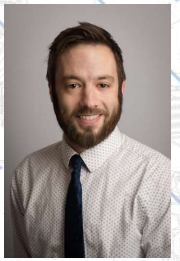

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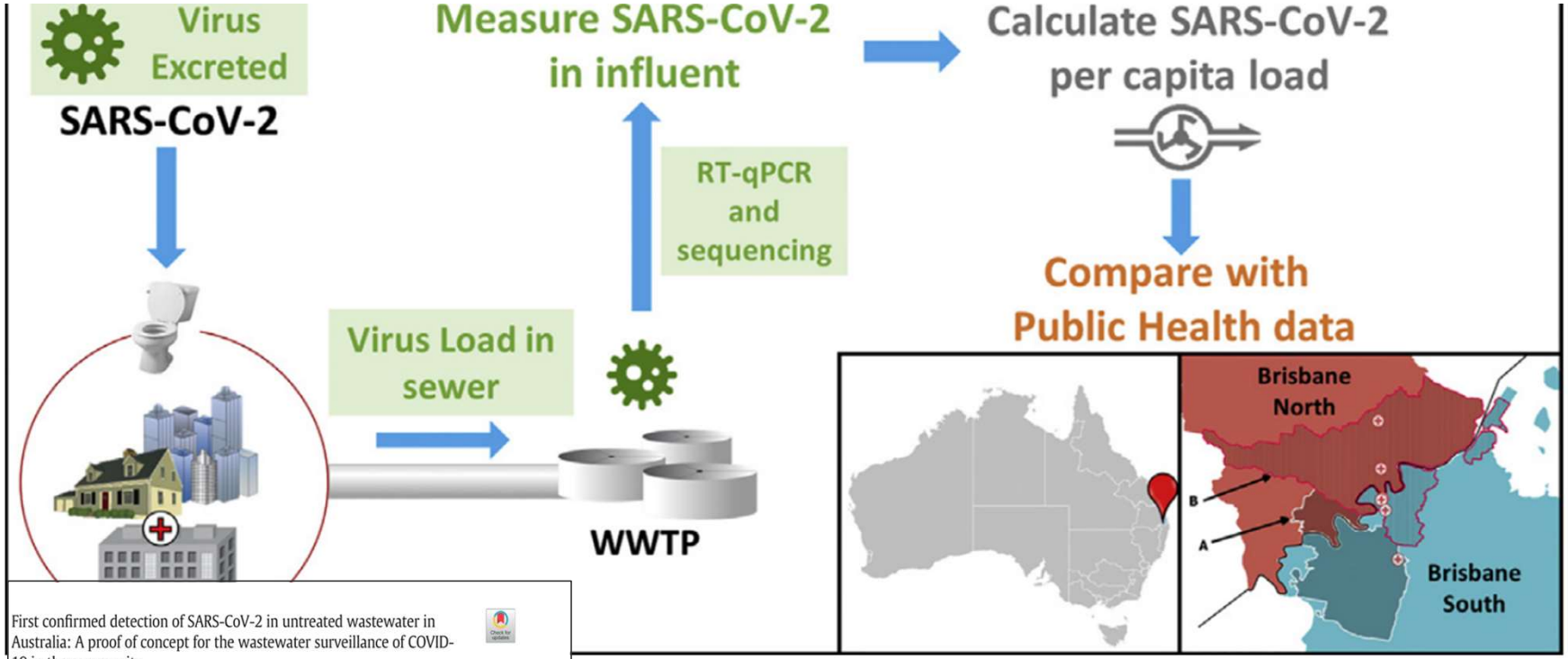
Wastewater Based Epidemiology (WBE)

"Any substance that is **excreted by humans** and is **stable in wastewater** can be used to **back-calculate** the original concentration excreted by the **serviced population**"



First confirmed detection of SARS-CoV-2 in untreated wastewater in Australia: A proof of concept for the wastewater surveillance of COVID-19 in the community

Warish Ahmed [a,*], Nicola Angel [b], Janette Edson [b], Kyle Bibby [c], Aaron Bivins [c], Jake W. O'Brien [d], Phil M. Choi [d], Masaaki Kitajima [e], Stuart L. Simpson [f], Jiaying Li [d], Ben Tscharke [d], Rory Verhagen [d], Wendy J.M. Smith [g], Julian Zaugg [b], Leanne Dierens [b], Philip Hugenholtz [b], Kevin V. Thomas [d], Jochen F. Mueller [d]

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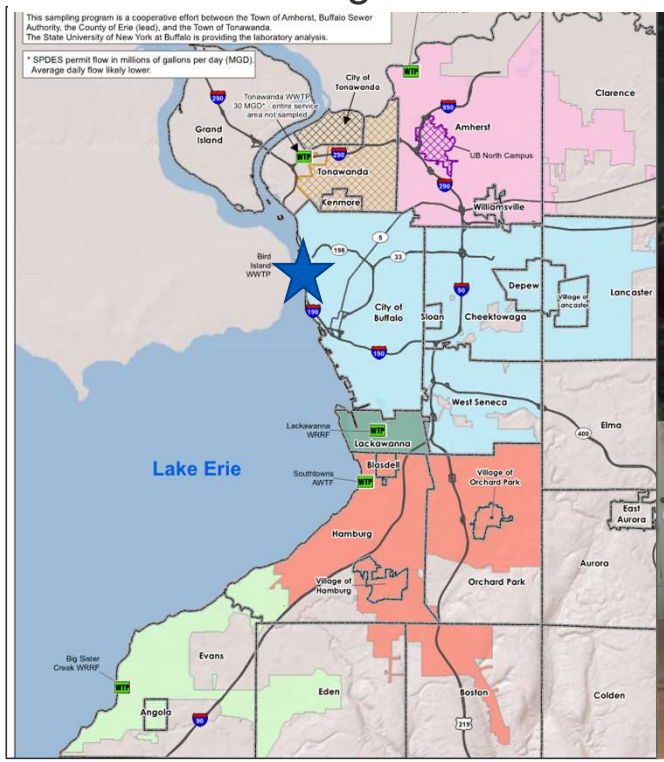

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Wastewater sampling at the point of treatment can give us a community “pooled” sample

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

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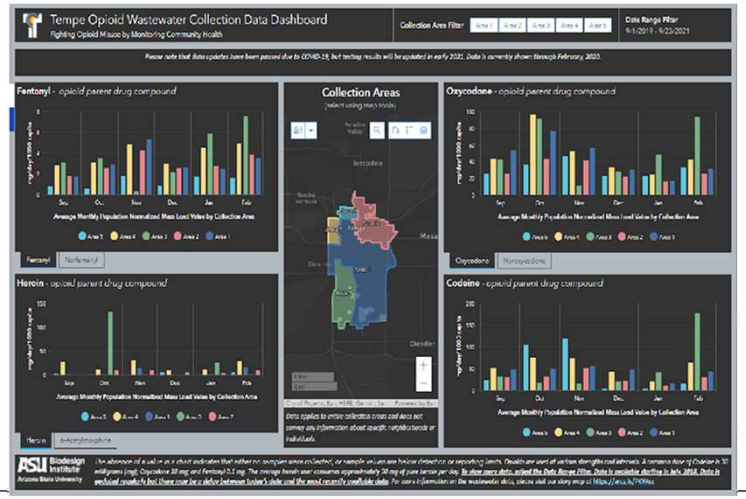
[f] CSIRO Land and Water, Lucas Heights, NSW 2234, Australia
[g] CSIRO Agriculture and Food, Bioscience Precinct, St Lucia, QLD 4067, Australia



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First detection of SARS-CoV-2 in untreated wastewaters in Italy

Giuseppina La Rosa [a,*], Marcello Iaconelli [a], Pamela Mancini [a], Giusy Bonanno Ferraro [a], Carolina Veneri [a], Lucia Bonadonna [a], Luca Lucentini [a], Elisabetta Suffredini [b]

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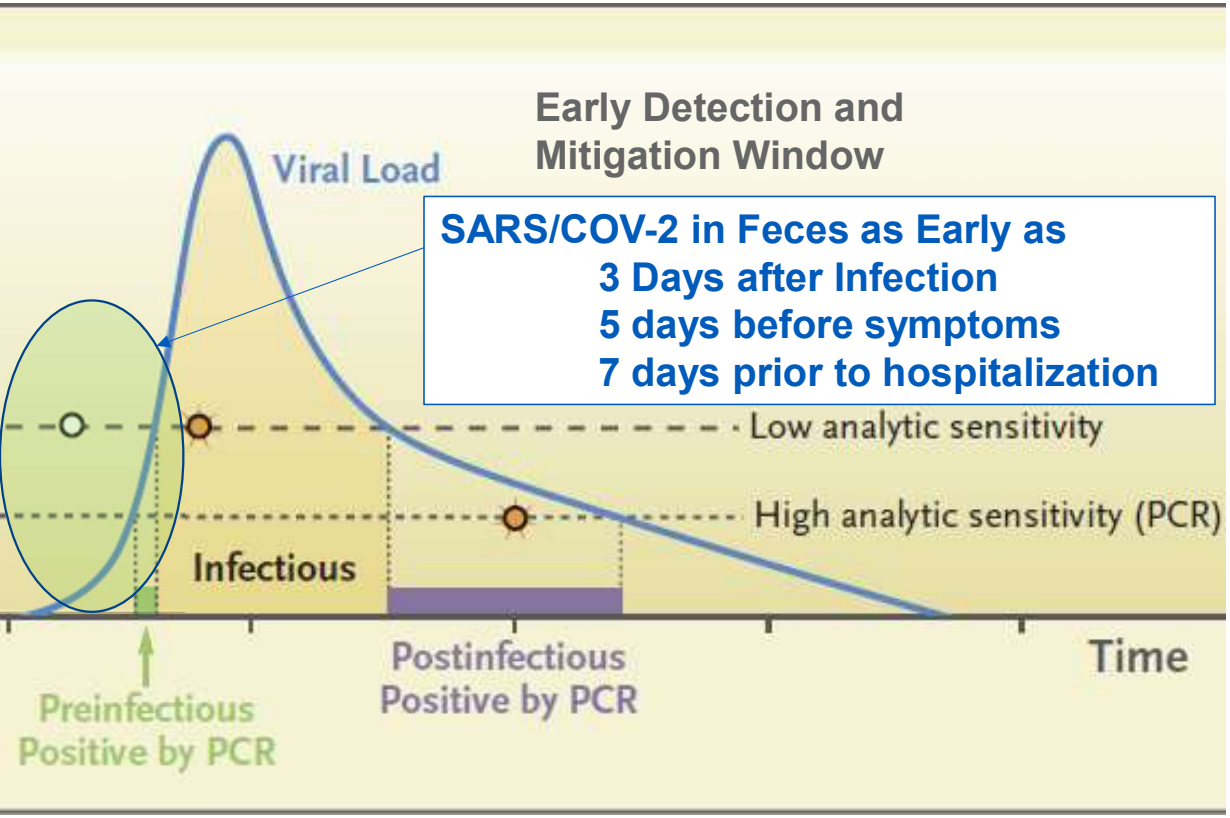
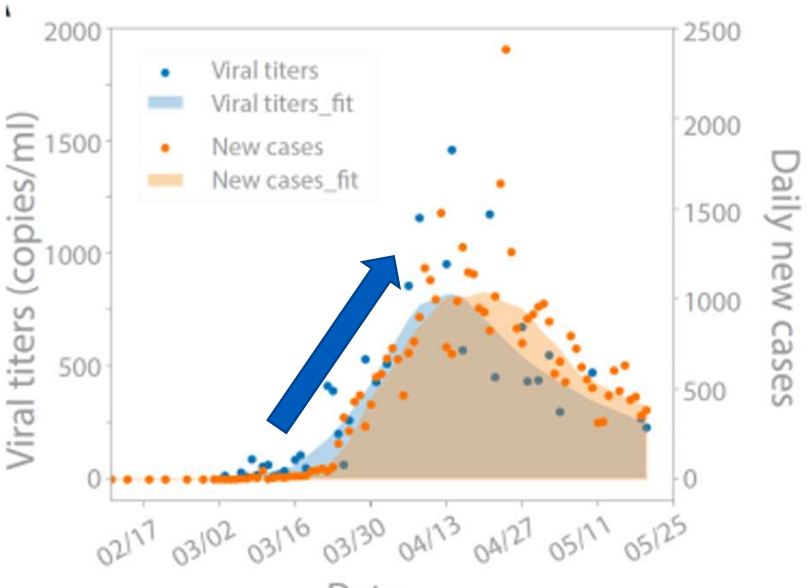
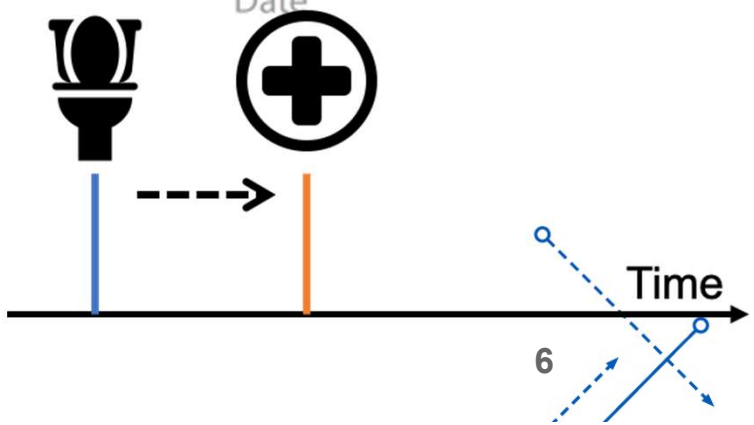
Wastewater Based Epidemiology







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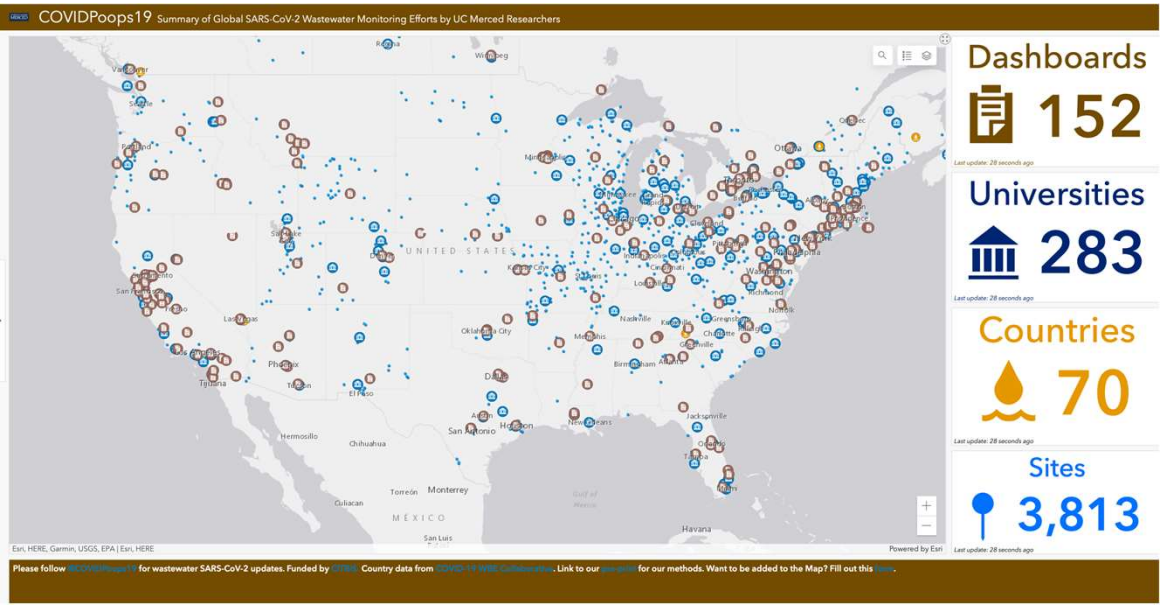
@COVIDPoops

WBE has now expanded to many cities and utilities, and the NWSS was established.



https://ucmerced.maps.arcgis.com/apps/opsdashboard/index.html#/c778145ea5bb4daeb58d31afee389082

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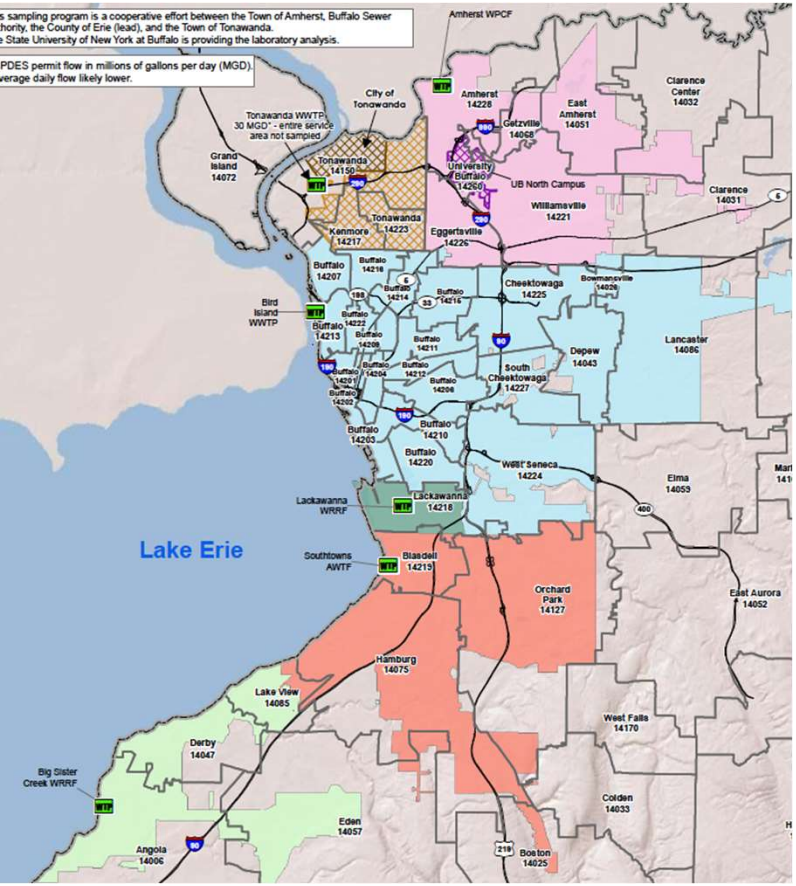
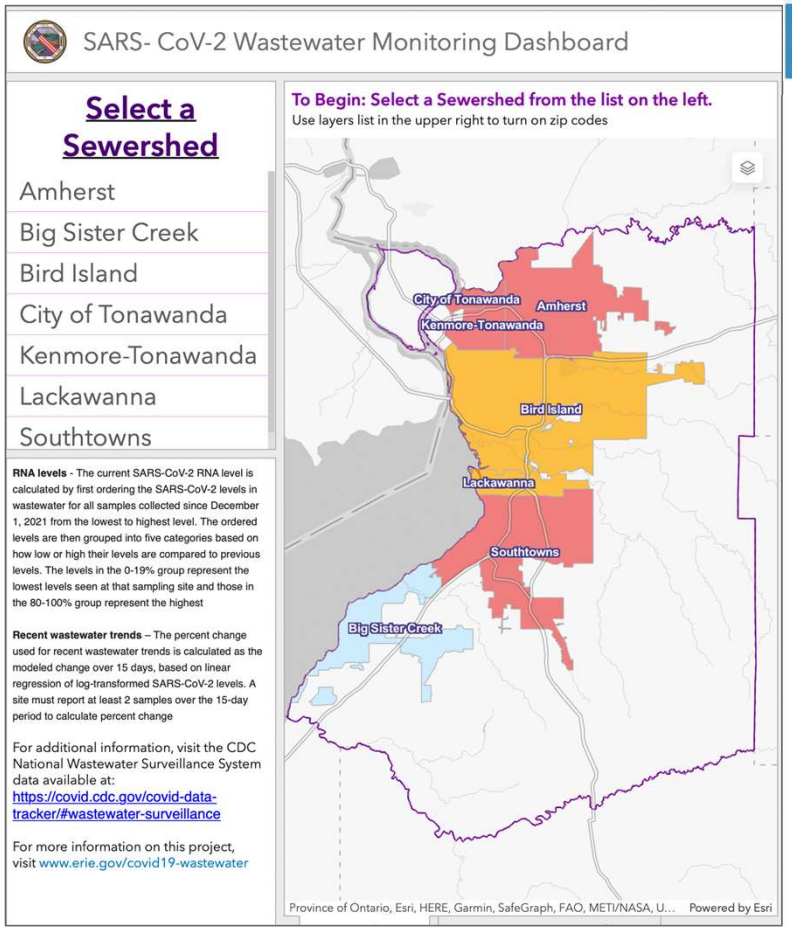
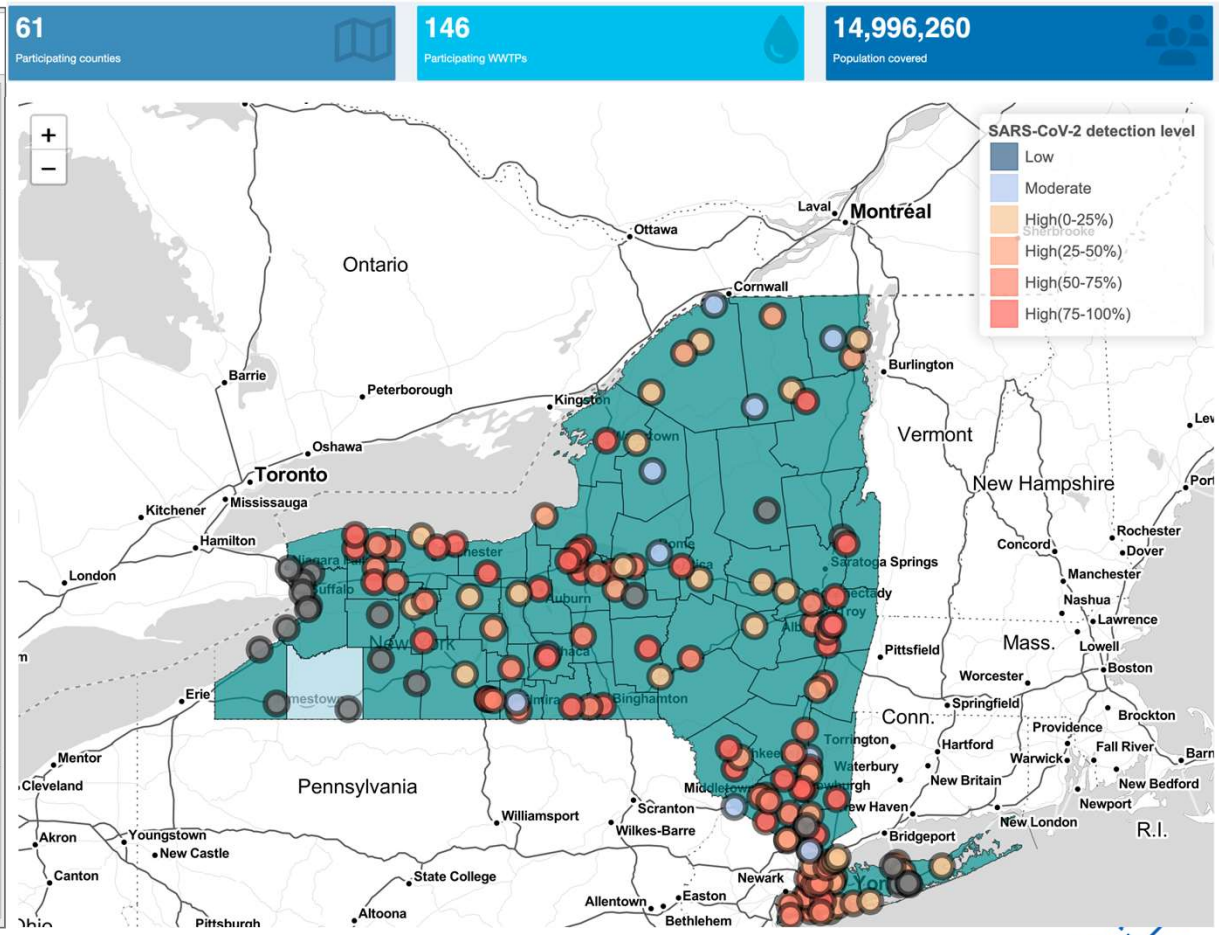
The Erie County WW Surveillance Program has collected data over 2 years throughout the pandemic.



Treatment Plant	Permit Flow (MGD)	Rural, Suburban, or Urban	Estimated Population (2018 Census)	Sewer Type (S/C)
Amherst	48	Suburban	140,324	S
Big Sister Creek	7.7	Rural	29,853	S
Lackawanna	4.5	Suburban/Rural	17,859	S
Southtowns	16	Suburban/Rural	94,616	S
City of Tonawanda	2.5-5	Suburban	14,873	SC
Kenmore-Tonawanda	25	Suburban	70,470	S
Bird Island	180	Urban	437,357	C

NYSDOH has implemented a State-wide surveillance network, which is continuing to expand.





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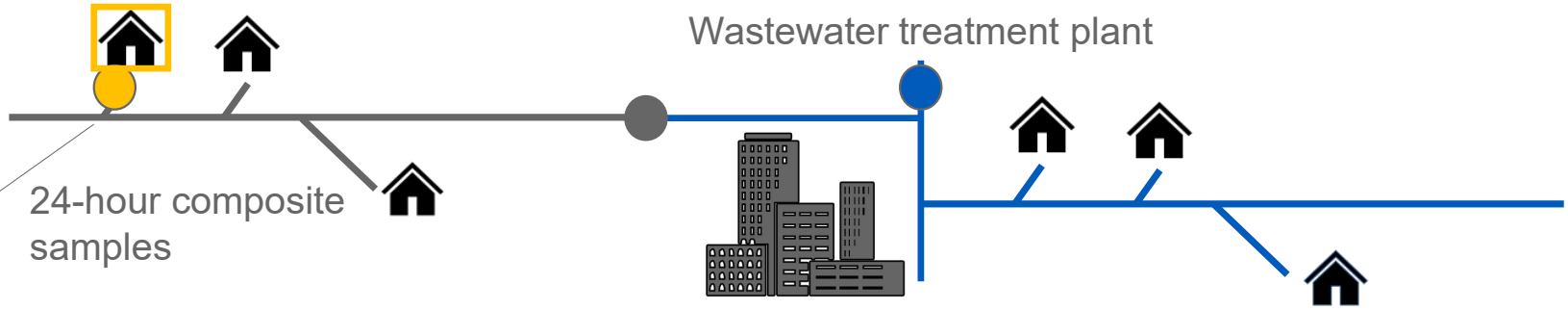
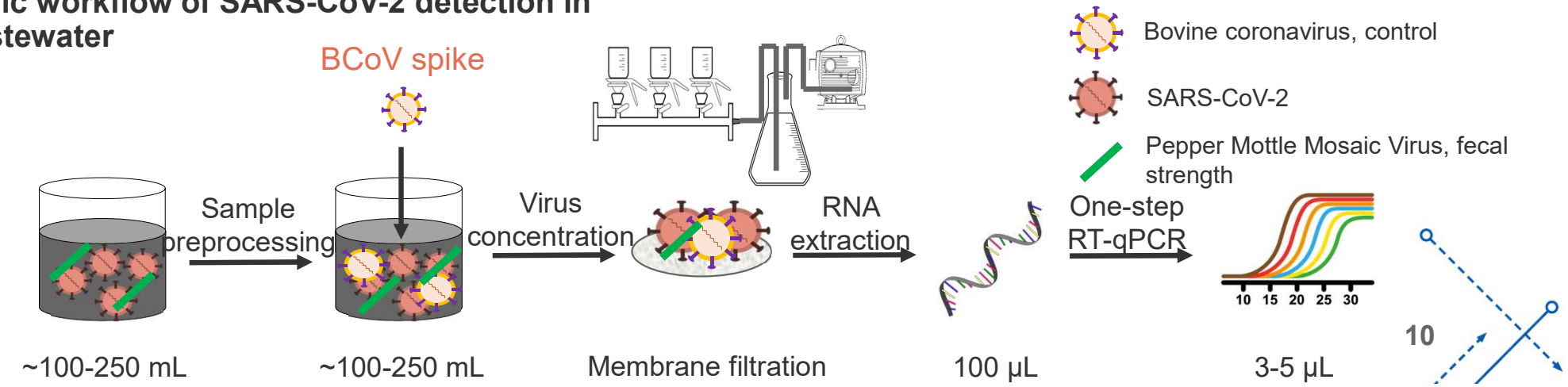
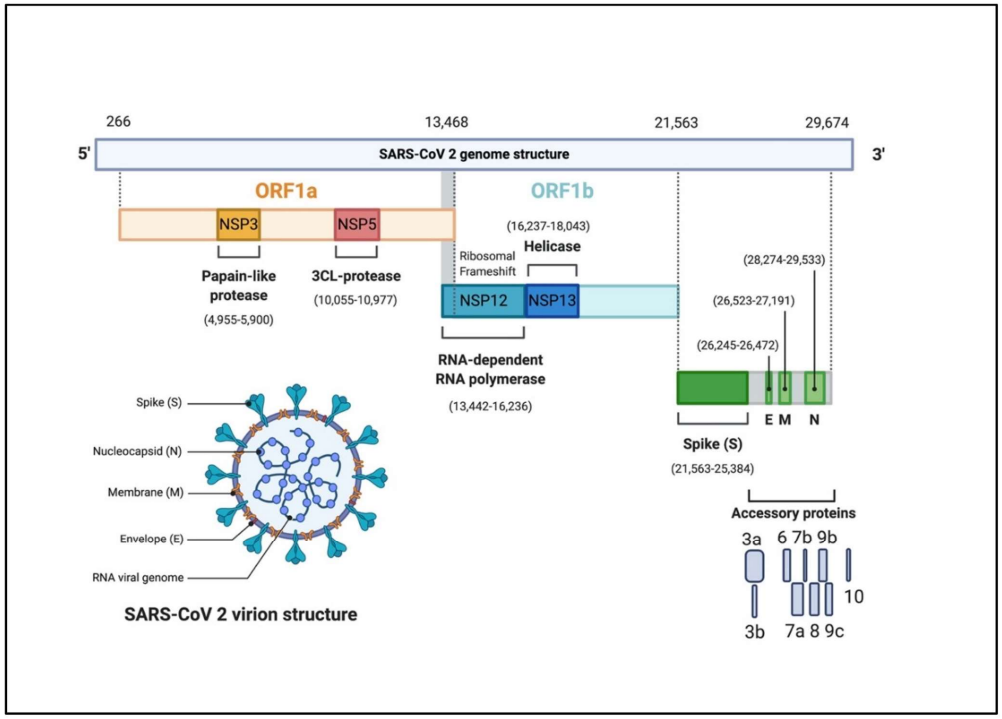
Monitoring genes in wastewater could track disease presence and burden in the community

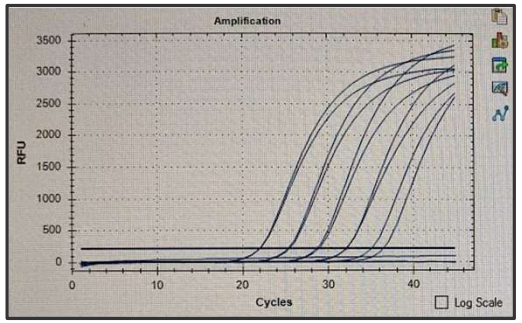


Basic workflow of SARS-CoV-2 detection in wastewater



RT-qPCR is done with N gene followed by BCoV (recovery) and PMMoV (fecal strength).





Standard curve of SARS-CoV-N gene positive control

N1 and N2

BCoV

PMMoV (historical)

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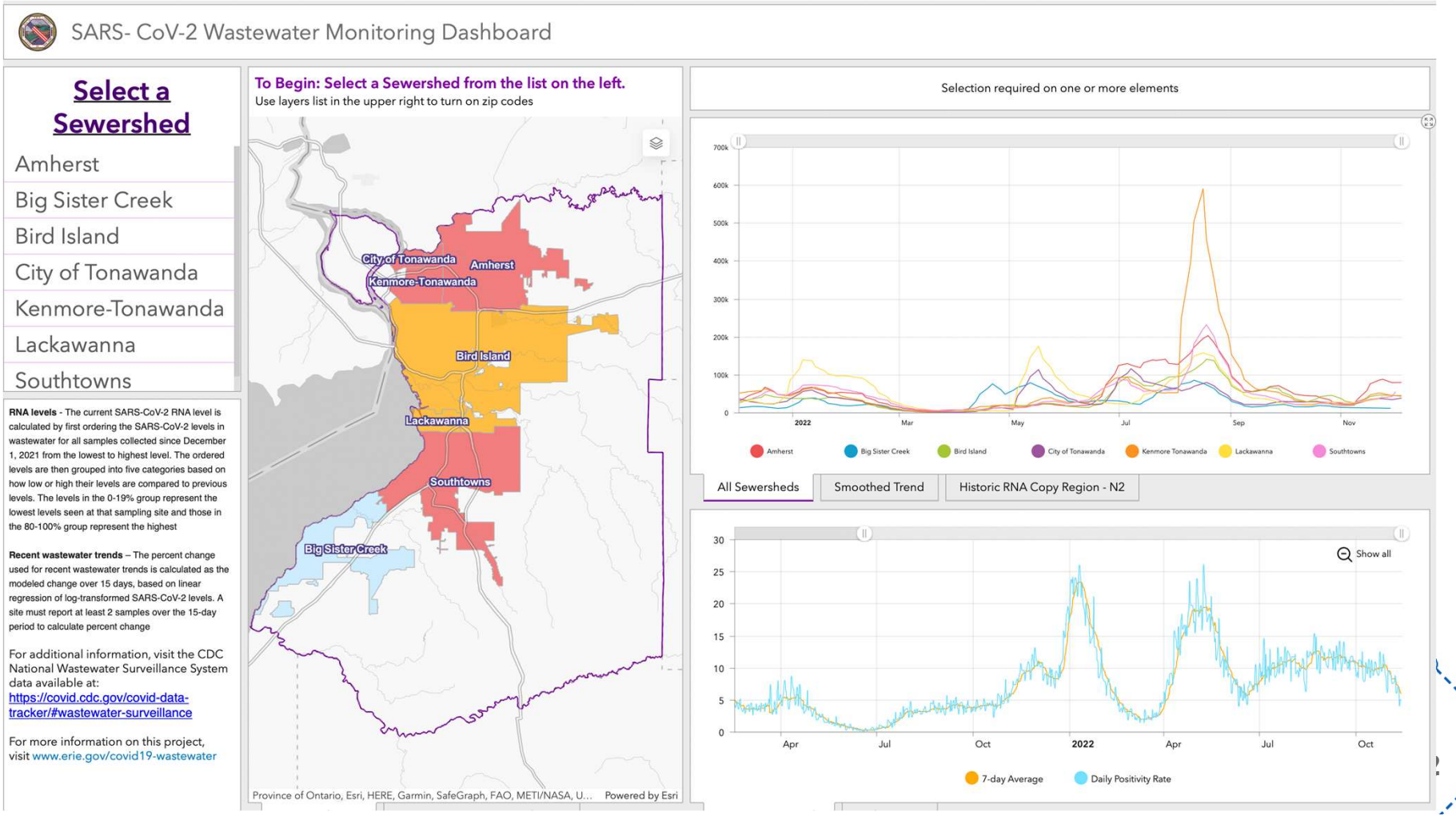
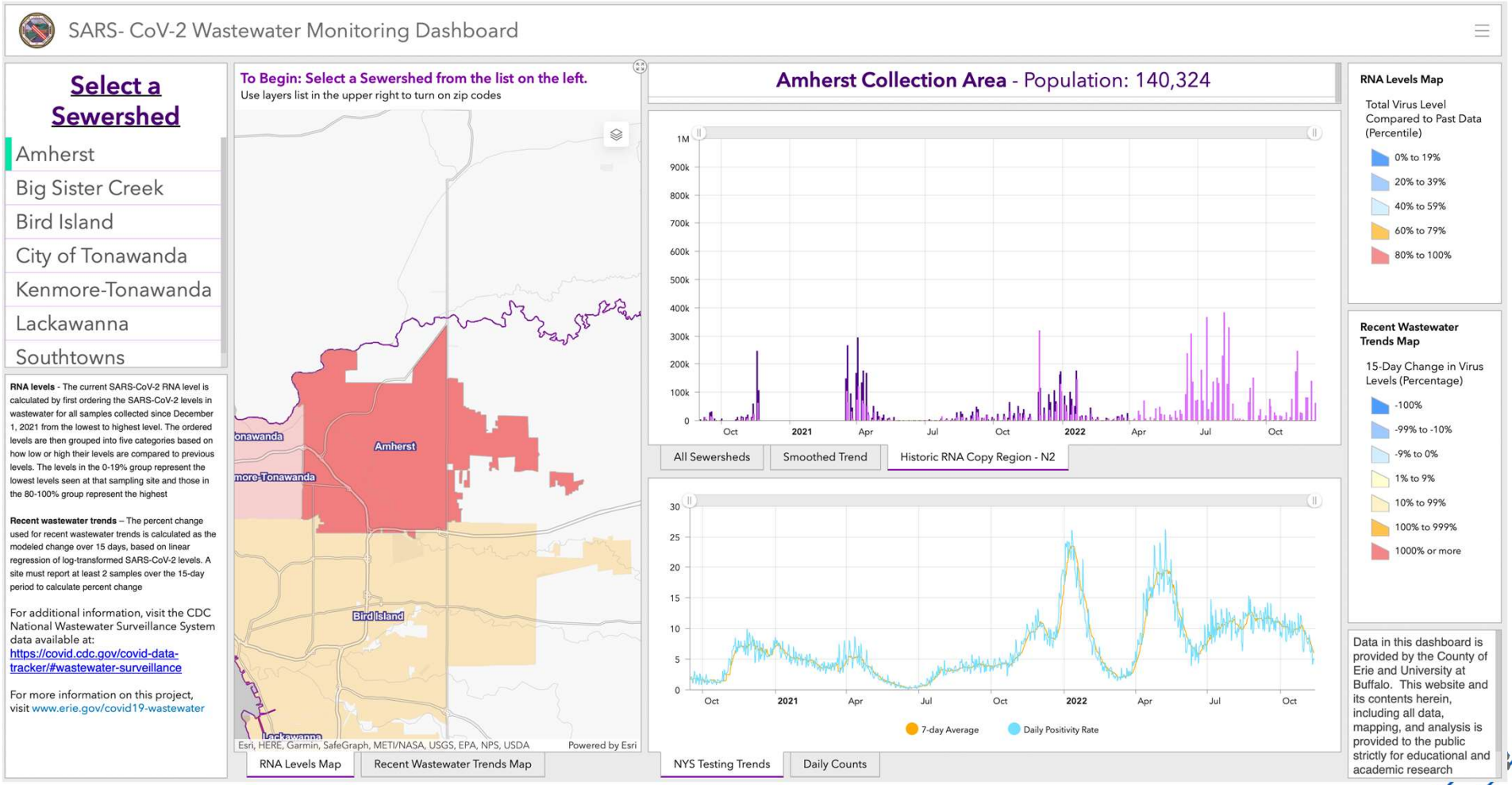
www.erie.gov/covid19-wastewater



Wastewater data collect over the last two years mirrors each wave of the pandemic



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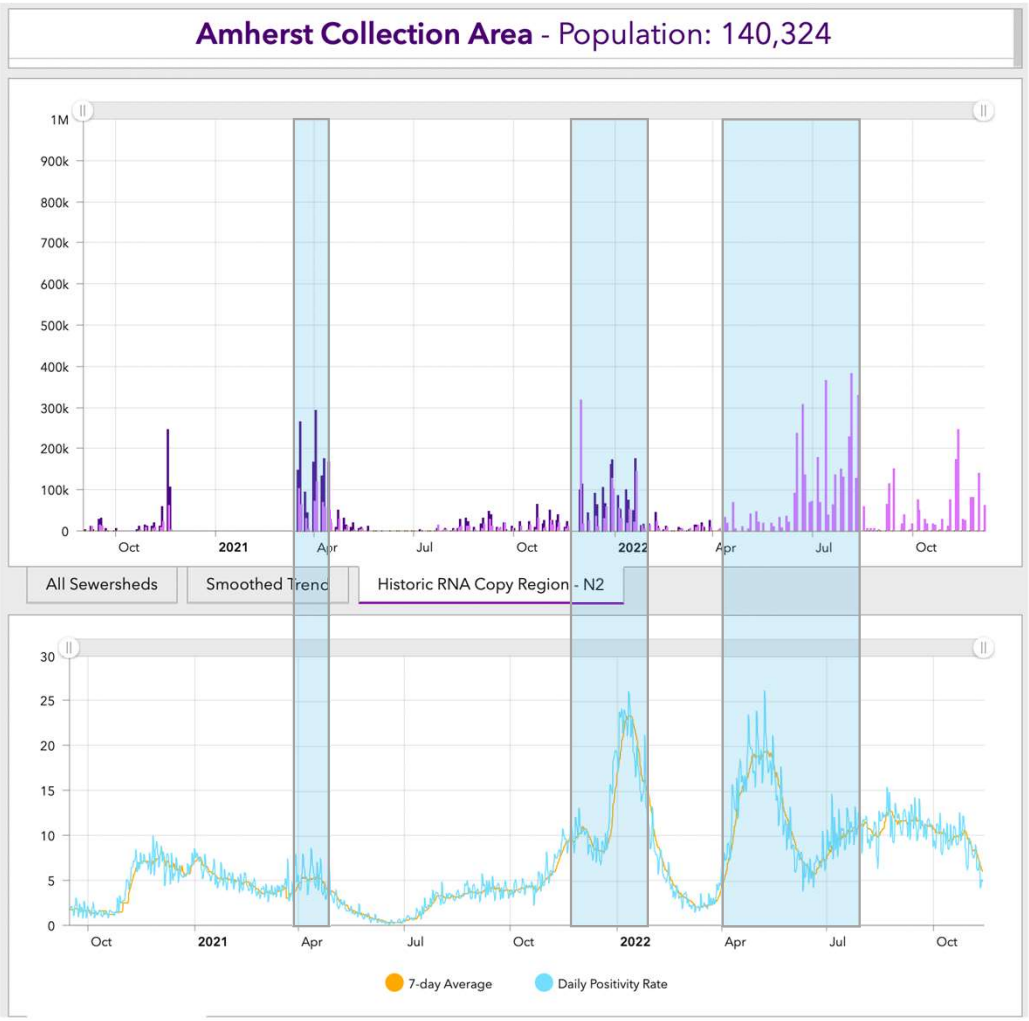

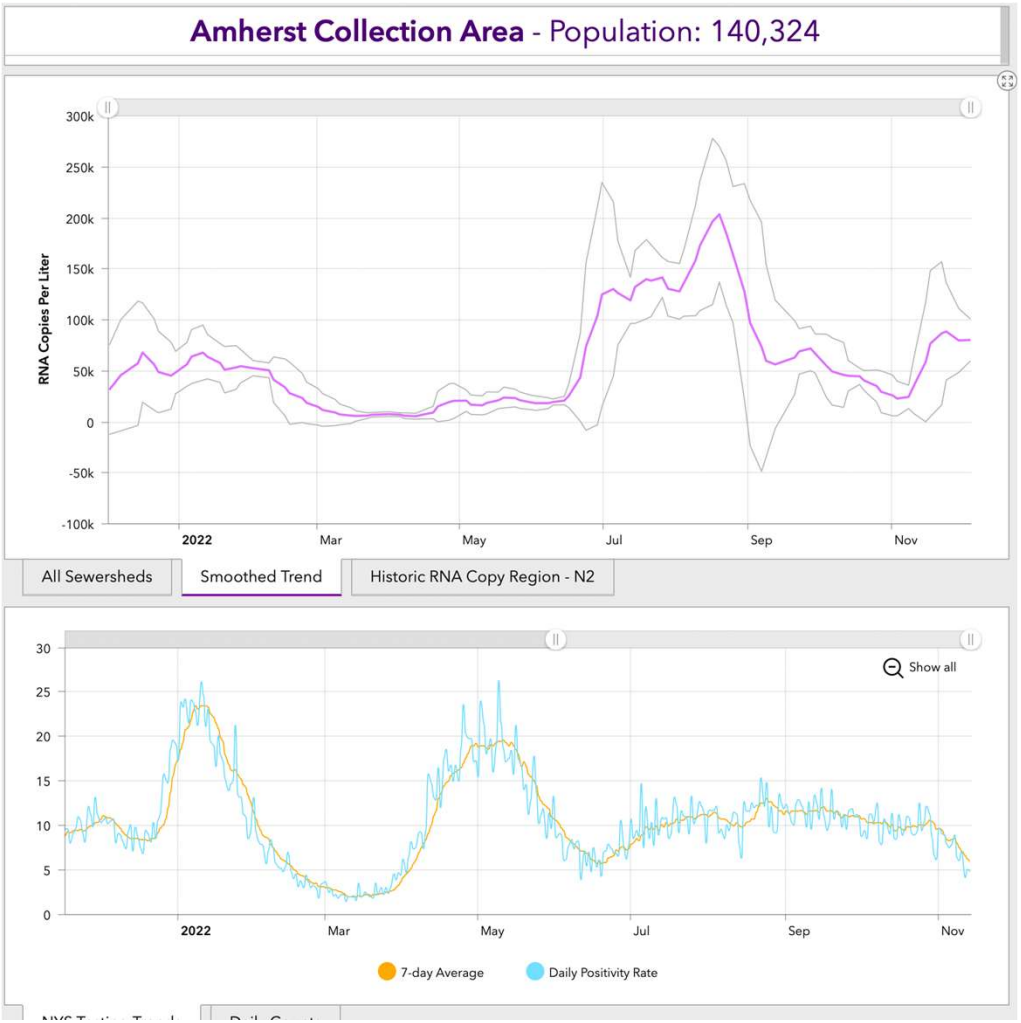

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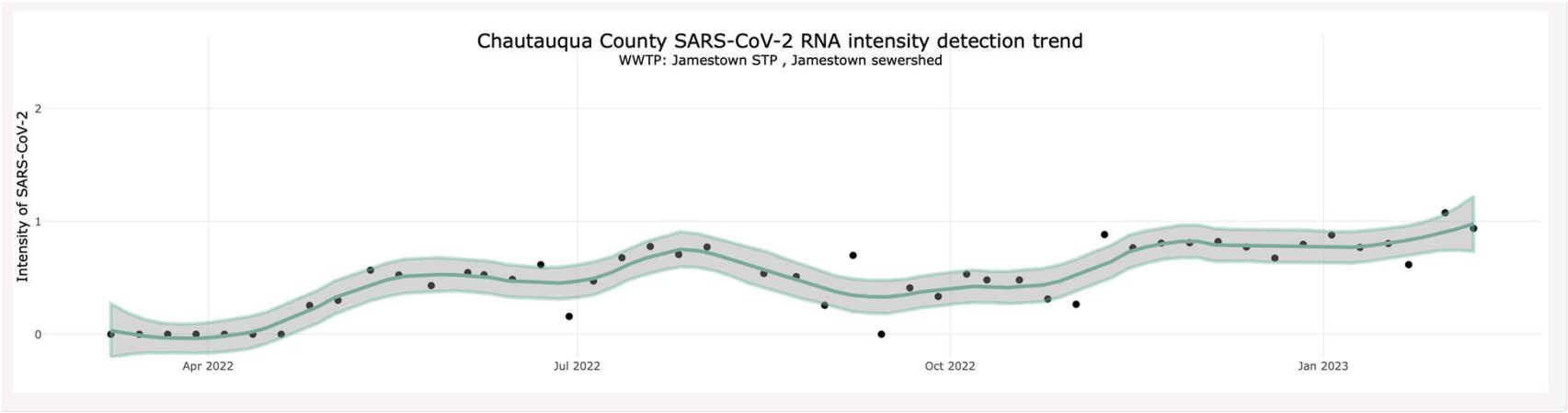
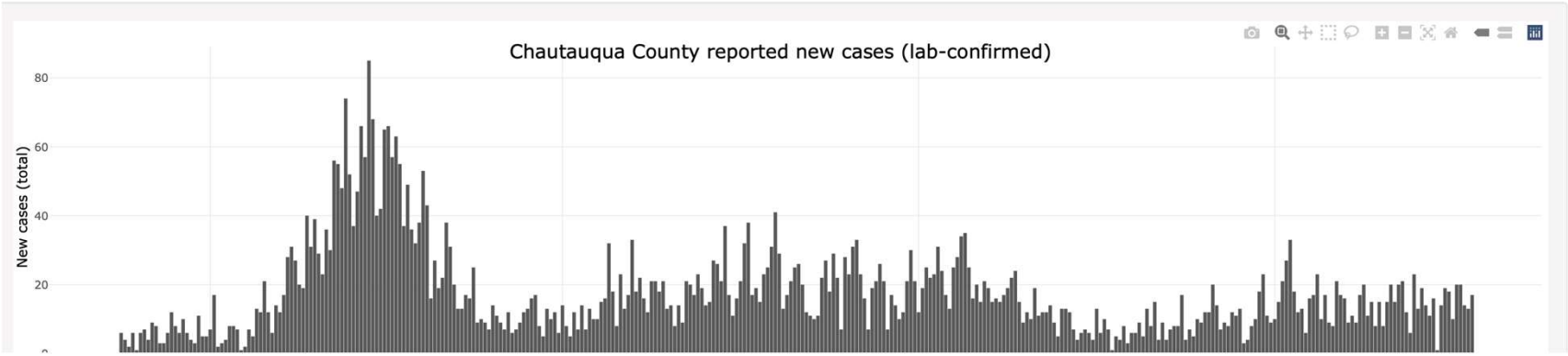


Trend graph description show / hide

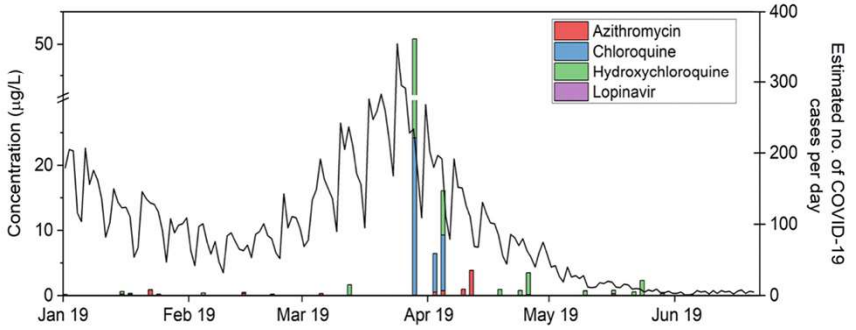
ase data

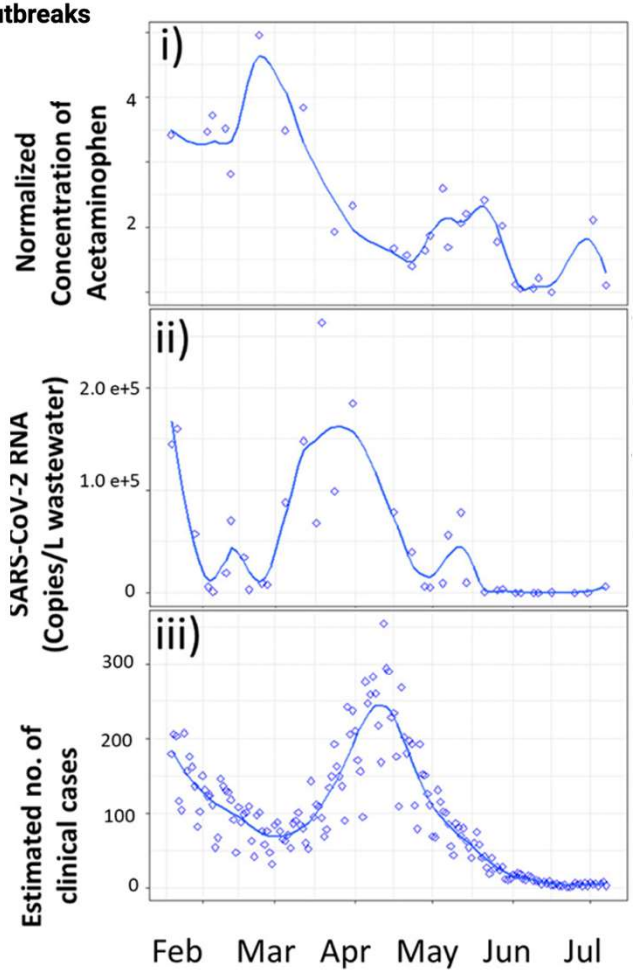


In addition to biological data, we can capture chemical data for comparison

Complementing RNA Detection with Pharmaceutical Monitoring for Early Warning of Viral Outbreaks through Wastewater-Based Epidemiology

Lahiruni M. Halwatura, Isabella S. Mclerran, Daniel L. Weglarski, Zia U. Ahmed, Yinyin Ye, Ian M. Bradley, and Diana S. Aga*





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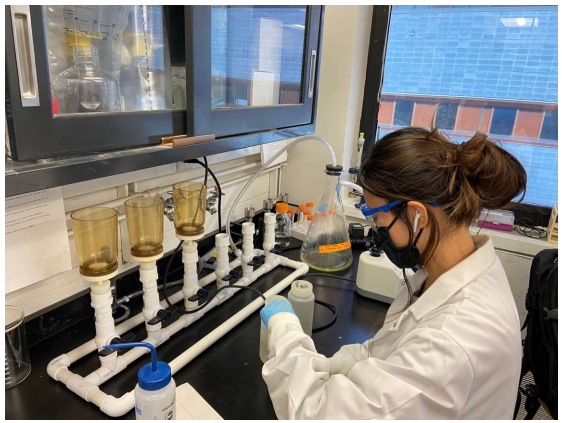
We are testing cost-effective wastewater processing methods to meet various needs of viral analysis.

Electronegative membrane filtration (EMF)



Tangential-flow ultrafiltration (UF) and wastewater solids

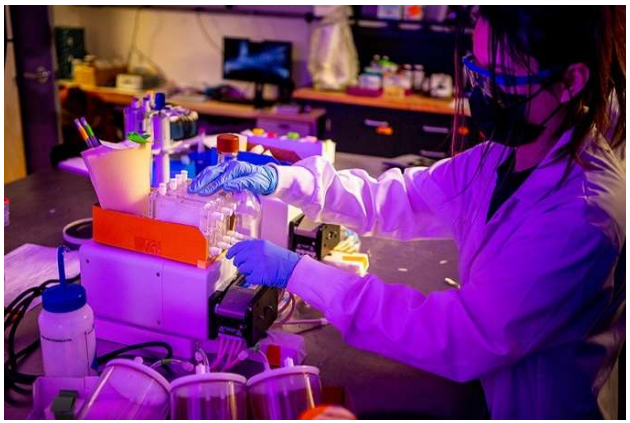


Photo: Douglas Levere

Nanotrap® magnetic beads

CERES NANO

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New York State Wastewater Network: Milagros Neyra, Dustin T. Hill, Lydia J. Bennett, Christopher Dunham, Mohammed Alazawi, Brenden Bedard, Mary Collins, Austin Fehrman, Christopher Gobler, Alejandro Godinez, Hyatt Green, Brianna Hanson, Tabassum Insaf, Haley Kappus-Kron, Daniel Lang, Elliot J. Moran, Dana Neigel, Shailla J. Raymond, David A. Larsen

Erie County collaborators: Joseph Fiegl, Gale Burstein