

PROTECTING PIPE PRIVACY: HOW SAMPLING WASTEWATER AND UTILIZING BIOLOGICAL DATA TO CONTROL THE SPREAD OF COVID-19 MAY VIOLATE THE RIGHT TO PRIVACY UNDER THE FOURTH AMENDMENT

Abstract: In response to the deadly COVID-19 pandemic, the U.S. Centers for Disease Control and Prevention, federal agencies, and universities have implemented the National Wastewater Surveillance System to detect Coronavirus 2 (SARS-CoV-2) ribonucleic acid in wastewater. By monitoring wastewater for SARS-CoV-2, authorities can identify the presence of COVID-19 before individuals display symptoms or have a positive clinical test result in populations ranging in size from colleges to states. The ability to track COVID-19 cases through wastewater monitoring has proven especially useful given the scarcity of clinical tests and high probability that infected individuals will remain asymptomatic for the duration of their infection. Despite its usefulness, this surveillance raises certain legal issues. The U.S. Constitution grants state governments police powers to protect the public health and safety of their citizens. Concurrently, the Fourth Amendment of the Constitution prohibits both federal and state governments from unreasonably infringing on individuals' privacy. Based on the U.S. Supreme Court's historical interpretation of the Fourth Amendment, wastewater testing for SARS-CoV-2 may infringe upon these privacy rights. Although there is no on-point caselaw or pending litigation concerning these issues, such litigation may arise in the future, requiring judges to navigate applying Fourth Amendment jurisprudence to unprecedented circumstances. Ultimately, the sampling and monitoring of wastewater by government agencies to test for molecular markers of SARS-CoV-2 would likely not violate the Fourth Amendment provided that sampling does not become too individualized. It is unlikely that these activities would constitute a search, and, even if they did, they would likely fall under the protection of the special needs doctrine. Conversely, wastewater testing implemented by public schools could very well run afoul of the Fourth Amendment due to the high degree of individualization associated with testing the wastewater of smaller population sizes.

INTRODUCTION

Coronavirus 2 (SARS-CoV-2), the exceptionally infectious virus that caused the COVID-19 pandemic, resulted in over seven hundred million confirmed cases and over six million deaths worldwide as of April 2023 and

brought about the most ubiquitous international public health crisis since the 1918 influenza pandemic.¹ Not only has the COVID-19 pandemic resulted in illness and death, but it has also significantly damaged the world economy by impacting goods production, interrupting global supply chains, and affecting consumer habits.²

The pandemic spurred an unparalleled global effort to lessen these detrimental effects.³ Originally, COVID-19 researchers and U.S. governments focused on fully combating the spread of the virus by effectuating stay-at-home orders, social distancing measures, and testing initiatives in an attempt to “flatten the curve,” or slow the virus’s spread.⁴ Since the initial outbreak, some experts have expressed the belief that COVID-19 will become endemic and, as a result, most areas have abandoned “zero-COVID” strategies.⁵ And, despite a change in the U.S. presidential administration and, in turn, the approach to

¹ Warish Ahmed et al., *SARS-CoV-2 RNA Monitoring in Wastewater as a Potential Early Warning System for COVID-19 Transmission in the Community: A Temporal Case Study*, 761 SCI. TOTAL ENV’T 1, 2 (2021); Steve E. Hrudef et al., *Ethics Guidance for Environmental Scientists Engaged in Surveillance of Wastewater for SARS-CoV-2*, 55 ENV’T SCI. & TECH. 8484, 8484 (2021); *WHO Coronavirus (COVID-19) Dashboard*, WORLD HEALTH ORG., <https://covid19.who.int/> [<https://perma.cc/A486-SGYB>]. The World Health Organization (WHO) Coronavirus Dashboard provides daily updates regarding the number of confirmed cases of and number of deaths from COVID-19. *WHO Coronavirus (COVID-19) Dashboard*, *supra*.

² SHLOMO MAITAL & ELLA BARZANI, *THE GLOBAL ECONOMIC IMPACT OF COVID-19: A SUMMARY OF RESEARCH* 1, 5, 7 (2020).

³ Hrudef et al., *supra* note 1, at 8484.

⁴ Lance Gable, Natalie Ram & Jeffrey L. Ram, *Legal and Ethical Implications of Wastewater Monitoring of SARS-CoV-2 for COVID-19 Surveillance*, 7 J.L. & BIOSCIENCES 1, 2 (2020); see Sarah Mervosh, Denise Lu & Vanessa Swales, *See Which States and Cities Have Told Residents to Stay at Home*, N.Y. TIMES, <https://www.nytimes.com/interactive/2020/us/coronavirus-stay-at-home-order.html> [<https://perma.cc/575J-M2H2>] (Apr. 20, 2020) (providing an overview of which states, in April 2020, adopted stay-at-home orders); Spencer Bokot-Lindell, *Was Your State Ahead of the Coronavirus Curve?*, N.Y. TIMES (Apr. 9, 2020) <https://www.nytimes.com/2020/04/09/opinion/was-your-state-ahead-of-the-coronavirus-curve.html> [<https://perma.cc/9CX8-5MDS>] (describing how the Bay Area set an example for implementing stay-at-home orders and “flattening the curve”).

⁵ Karen Feldscher, *What Will It Be Like When COVID-19 Becomes Endemic?*, HARV. T.H. CHAN SCH. PUB. HEALTH (Aug. 11, 2021), <https://www.hsph.harvard.edu/news/features/what-will-it-be-like-when-covid-19-becomes-endemic/> [<https://perma.cc/628Y-CDX3>]. The point at which endemicity will occur is still unclear and is highly dependent on various factors, including vaccination efficacy and the amount of time immunity lasts following infection. *Id.* As an endemic virus, COVID-19 would still spread, but would not cause large epidemics and would instead follow a “seasonal or transmission pattern”—a pattern that has not yet materialized. *WHO Warns Coronavirus Is Far from Settling into Endemic Situation*, AL JAZEERA (Apr. 14, 2022), <https://www.aljazeera.com/news/2022/4/14/coronavirus-far-from-becoming-endemic-says-who> [<https://perma.cc/BY5H-D2HK>]. And, even if COVID-19 becomes endemic, COVID-19 infections may still greatly endanger the safety of large numbers of people. *Id.*

handling the pandemic, as well as the development of a COVID-19 vaccine, the virus continues to spread.⁶

The United States has explored ways of avoiding unsustainable restrictions, like widely-implemented quarantines, without severely endangering the public's health by easing restrictions.⁷ In trying to achieve this balance, state and local governments have focused on monitoring COVID-19 trends in populations to impose restrictions on a smaller scale, in addition to generally tracking the spread of the virus and exposing COVID-19 "hot spots."⁸ Feasible and accurate testing for the presence of the SARS-CoV-2 virus in communities has proven crucial to these efforts.⁹ Yet, clinical testing has not sufficed in accomplishing these goals due to the lack of accuracy of the tests, barriers to access of clinical tests, and significant costs associated with widespread clinical testing.¹⁰ Moreover, communities particularly vulnerable to the health and economic effects of COVID-19, including, for example, minority populations, experience the most difficulty obtaining clinical tests, thus increasing the inadequacy of using clinical testing as the sole means of managing the pandemic.¹¹

Wastewater surveillance to test human waste for SARS-CoV-2 ribonucleic acid (RNA) to detect the presence of COVID-19 in discrete populations provides a potential solution to this problem.¹² By testing wastewater for molecular indicators of SARS-CoV-2, authorities can track the spread of COVID-19 and identify hot spots more efficiently than they otherwise would by solely relying on clinical testing data.¹³ Different levels of government, as well as private institutions, can employ wastewater testing methodologies to reap these

⁶ Janice Hopkins Tanne, *COVID-19: Biden Launches National Plan Based on "Science and Public Health Alone,"* THE BMJ (Jan. 22, 2021), <https://www.bmj.com/content/372/bmj.n210> [<https://perma.cc/LJD9-GAN3>]; WHO Coronavirus (COVID-19 Dashboard), *supra* note 1.

⁷ Gable et al., *supra* note 4, at 2.

⁸ *Id.*

⁹ *Id.*

¹⁰ *Id.* at 3.

¹¹ Julius M. Wilder, *The Disproportionate Impact of COVID-19 on Racial and Ethnic Minorities in the United States*, 72 CLINICAL INFECTIOUS DISEASES 709, 709, 710 (2021). Minority populations, which for many reasons suffer from particular susceptibility to COVID-19 infection, obviously then require greater care, including access to tests. *Id.* at 710. The opposite has occurred, however, and those most susceptible to infection receive poor treatment. *Id.*; see Yanbai Andrea Wang & Justin Weinstein-Tull, *Pandemic Governance*, 63 B.C. L. REV. 1949, 1952 n.6 (2022) (describing how "African-Americans, Latinos, and Native Americans . . . become infected with COVID-19 at far higher rates than white people," and how "[o]nce infected, rates of both hospitalization and death within these communities also far exceed those of white people" (citing *Risk for COVID-19 Infection, Hospitalization, and Death by Race/Ethnicity*, CDC, <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html> [<https://perma.cc/WYK3-LWRB>] (Apr. 7, 2023))).

¹² Gable et al., *supra* note 4, at 2.

¹³ *Id.* at 1–3.

benefits.¹⁴ Despite the objectively promising evidence that wastewater monitoring has the potential to successfully track COVID-19 to promote public health, the U.S. Supreme Court has historically established that surveillance involving analyzing biological matter to collect medical information may violate individuals' Fourth Amendment right to privacy.¹⁵

Although no person or group has challenged the legality of wastewater surveillance to test for SARS-CoV-2 molecular markers through litigation, COVID-19 wastewater testing, as implemented under certain circumstances, has the potential to violate the Fourth Amendment.¹⁶ As the sampled population shrinks, the medical information retrieved from the sampling process becomes increasingly individualized, rendering the wastewater testing an unconstitutional search.¹⁷ Governments that sample wastewater from sewage treatment plants, therefore, would likely not violate the Fourth Amendment because the surveillance occurs, at its smallest population size, at the municipal level and without the ability to identify individuals.¹⁸ To the contrary, public universities that have implemented wastewater testing protocols likely violate the Fourth Amendment.¹⁹ Not only do universities sample the wastewater of indi-

¹⁴ *Id.* at 6–7. For the purpose of this Note, the private institutions considered will consist primarily of higher educational institutions, although other private institutions, such as assisted living facilities, also utilize wastewater monitoring to track COVID-19 trends. *Wastewater Monitoring for Assisted Living Facilities*, GEOSYNTEC CONSULTANTS, <https://geosyntec.com/COVID-19/covid-19-services-wastewater-monitoring-for-assisted-living> [<https://perma.cc/6NQL-HZLJ>]; see *infra* notes 71–89 and accompanying text (describing how public higher education institutions test for COVID-19 molecular markers in student wastewater).

¹⁵ *Skinner v. Ry. Lab. Execs.' Ass'n*, 489 U.S. 602, 617 (1989). In the 1989 case *Skinner v. Railway Labor Executives' Ass'n*, the Supreme Court held that intrusive medical tests, such as “breath-testing procedures” and blood tests that “can reveal a host of private medical facts about” an individual, “implicate[] privacy interests.” *Id.* at 616–17. Despite the Court’s concern with the violations of privacy accompanying intrusive medical testing, the Court held that the warrantless drug testing of railroad employees’ urine remained reasonable considering the employees’ particularly hazardous occupation. *Id.* at 620.

¹⁶ See *id.* at 617, 620 (holding that individuals have a heightened expectation of privacy over their own bodily waste, but that, under the circumstances, the search proved reasonable); *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (holding that a company does not have a legitimate privacy interest over commercial wastewater that is “flowing irrevocably” to a wastewater treatment plant, but that outside of the commercial context, the interest may stand as legitimate).

¹⁷ Gable et al., *supra* note 4, at 7.

¹⁸ *Id.*

¹⁹ See *id.* (explaining that as wastewater monitoring becomes increasingly narrowed to a small sample size, it becomes more likely that government actors violate the Fourth Amendment); Ryo Honda, Michio Murakami, Akihiko Hata & Masaru Ihara, *Public Health Benefits and Ethical Aspects in the Collection and Open Sharing of Wastewater-Based Epidemic Data on COVID-19*, 20 DATA SCI. J. 1, 2–3 (2021) (describing how the University of Arizona spotted SARS-CoV-2 ribonucleic acid (RNA) in the wastewater of a dormitory of 311 students and, through further clinical testing, singled-out the students infected with COVID-19). The University of Arizona’s testing exemplifies how wastewater monitoring data acquired on school campuses not only tests relatively small numbers of students in their dwellings, but also makes it possible for schools to completely individualize the surveillance by figuring out which students are infected. Honda et al., *supra*.

vidual dormitories that house small numbers of students, inherently making the testing results more individualized, they also utilize sampling data to implement clinical testing efforts to single out the individual students positive for COVID-19.²⁰

Part I of this Note provides an overview of how authorities conduct wastewater monitoring and of Fourth Amendment jurisprudence.²¹ Part II interprets the applicability of the Fourth Amendment to wastewater monitoring by looking at the following three issues: (1) whether wastewater monitoring constitutes a search; (2) whether wastewater monitoring conducted by the government, if considered a search, violates the Constitution; and (3) whether wastewater monitoring by public schools, if considered a search, violates the Constitution.²² Part III of this Note provides an assessment of these three questions.²³

I. WASTEWATER MONITORING TO COMBAT THE COVID-19 PANDEMIC

Although wastewater monitoring provides a viable option for combating COVID-19, it must pass constitutional muster under the Fourth Amendment of the U.S. Constitution in order for authorities to conduct it.²⁴ To pass constitutional muster, a certain action must abide by the parameters set forth in the Constitution such that the action does not violate it.²⁵ Within the context of the Fourth Amendment, passing constitutional muster requires that a given action not violate an individual's privacy interests against "unreasonable searches and seizures."²⁶

Section A of this Part explains the technological logistics of wastewater testing and how it can be utilized to combat COVID-19.²⁷ Section B then discusses the legal framework of the Fourth Amendment and the relevant caselaw regarding when government searches are reasonable in light of public health

²⁰ Honda et al., *supra* note 19, at 2–3.

²¹ See *infra* notes 24–126 and accompanying text.

²² See *infra* notes 127–199 and accompanying text.

²³ See *infra* notes 200–259 and accompanying text.

²⁴ See Gable et al., *supra* note 4, at 7 (providing that even though wastewater monitoring can provide useful information to authorities tracking COVID-19, it might run afoul of the Fourth Amendment, thus rendering it unconstitutional).

²⁵ See William C. Heffernan, *Fourth Amendment Privacy Interests*, 92 J. CRIM. L. & CRIMINOLOGY 1, 68, 124 (2001) (using interchangeably, in the context of government inducements, the phrase "constitutional muster" and "constitutionally acceptable"). The Fourth Amendment is "grounded in an explicit concern for reasonable expectations of privacy"—a concern the Supreme Court has reevaluated many times as new potential privacy violations come to light. *Id.* at 2–3.

²⁶ See *id.* at 2 n.1, 3, 68 (quoting U.S. CONST. amend. IV) (describing how the Fourth Amendment is based on concerns about a reasonable expectation of privacy and how passing Fourth Amendment constitutional muster requires not violating the privacy protections of the Fourth Amendment); U.S. CONST. amend. IV ("The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated . . .").

²⁷ See *infra* notes 31–89 and accompanying text.

concerns.²⁸ Finally, Section C discusses Fourth Amendment jurisprudence and the relevant doctrinal framework for assessing searches conducted by public schools.²⁹

A. Wastewater Testing for COVID-19: How It Works, and Who Uses It

Assessing the constitutionality of wastewater testing and surveillance requires a foundational understanding of how this type of testing and surveillance functions.³⁰ Subsection 1 of this Section therefore provides a background of how authorities can detect SARS-CoV-2 RNA in wastewater and how other government bodies have utilized wastewater monitoring in the past in response to viral outbreaks.³¹ Subsection 2 then describes the logistics of how government bodies can test wastewater for SARS-CoV-2 RNA, and Subsection 3 details how higher educational institutions implement their own methods to test dormitory wastewater to identify outbreaks of COVID-19 on campus.³²

1. Monitoring Human Pathogens in Wastewater

Although authorities have only recently started monitoring wastewater for SARS-CoV-2 RNA in the context of the COVID-19 pandemic, authorities have monitored wastewater for pathogens previously as a means of monitoring virus trends in human populations.³³ The majority of patients sickened with a

²⁸ See *infra* notes 90–116 and accompanying text.

²⁹ See *infra* notes 117–126 and accompanying text.

³⁰ See *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (determining that whether wastewater sampling and analysis violates the Fourth Amendment depends on testing methodology).

³¹ See *infra* notes 33–54 and accompanying text.

³² See *infra* notes 55–89 and accompanying text.

³³ See Andrew F. Brouwer et al., *Epidemiology of the Silent Polio Outbreak in Rahat, Israel, Based on Modeling of Environmental Surveillance Data*, 115 PROC. NAT'L ACAD. SCI. E10625, E10625 (2018) (discussing how the Israeli government used wastewater testing to quell Israel's polio resurgence); Maria Hellmér et al., *Detection of Pathogenic Viruses in Sewage Provided Early Warnings of Hepatitis A Virus and Norovirus Outbreaks*, 80 APPLIED & ENV'T MICROBIOLOGY 6771, 6771 (2014) (discussing how wastewater testing has tracked norovirus and Hepatitis A); Giusy Lofrano & Jeanette Brown, *Wastewater Management Through the Ages: A History of Mankind*, 408 SCI. TOTAL ENV'T 5254, 5255 (2010) (discussing the accuracy of wastewater testing). Various other viruses aside from SARS-CoV-2 have been successfully detected in wastewater effluent, including the Hepatitis A virus and the Hepatitis B virus. Ryan G. Sinclair, Christopher Y. Choi, Mark R. Riley & Charles P. Gerba, *Pathogen Surveillance Through Monitoring of Sewer Systems*, 65 ADVANCES APPLIED MICROBIOLOGY 249, 251, 264 (2008). Studying sewer water in communities for pathogens is relatively common and is a technique often used to detect pathogens in wastewater before an outbreak commences. *Id.* at 250. Individuals shed pathogens through human waste that regularly enters the sewage stream, enabling public health officials to detect these pathogens in wastewater. *Id.*; see *National Wastewater Surveillance System (NWSS)*, CDC, <https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance/wastewater-surveillance.html#> [<https://perma.cc/V4WA-FU69>] (Mar. 14, 2023) (describing the CDC's implementation of the National Wastewater Surveillance System (NWSS) to manage the COVID-19 pandemic).

virus that affects gastrointestinal epithelial cells shed the virus in their stool for the duration of their infection and do so often before or after they become symptomatic.³⁴ Using wastewater monitoring as a tactic in following virus trends has additionally proven beneficial because wastewater testing will detect the virus in even a small percentage of a large population.³⁵

One of the most well-known and successful implementations of wastewater monitoring for pathogens occurred in Israel between 2013 and 2014.³⁶ Israel, previously deemed by the World Health Organization to have been rid of polio for a significant period of time, suffered a polio outbreak in 2013.³⁷ Israel, in its polio eradication efforts, successfully sustained a sewage-based environmental surveillance system to test wastewater for the virus.³⁸ This practice of regular wastewater monitoring made it possible for Israel to discover the emergence of the polio virus early on in the outbreak and respond to it effectively by instituting a robust vaccination operation.³⁹ As a result, Israel successfully quashed the outbreak by the beginning of 2014.⁴⁰

Facially, wastewater surveillance does not seem a feasible option in detecting COVID-19 outbreaks in discrete populations because of the virus's respiratory nature.⁴¹ The most common and widely publicized symptoms of the SARS-CoV-2 virus, such as fever and cough, qualify as respiratory and tend to surface between two days and two weeks following exposure, though up to forty-five percent of COVID-19 patients may never show symptoms.⁴² Various clinical tests can detect the SARS-CoV-2 virus in lab samples, including sputum, nasopharyngeal swabs, and blood samples.⁴³

Approximately one-half to two-thirds of COVID-19 positive individuals also release the SARS-CoV-2 virus in their stool because the virus infects human gastrointestinal epithelial cells.⁴⁴ This can result in gastrointestinal issues in some patients.⁴⁵ In turn, authorities can use wastewater to track SARS-CoV-2 RNA entering treatment plants in order to show virus levels over time in in-

³⁴ Hellmér et al., *supra* note 33, at 6771.

³⁵ *Id.*

³⁶ Brouwer et al., *supra* note 33, at E10625.

³⁷ *Id.*

³⁸ *Id.*

³⁹ *Id.*

⁴⁰ *Id.*

⁴¹ See Ahmed et al., *supra* note 1, at 2 (describing COVID-19 as entirely respiratory).

⁴² *Id.*

⁴³ *Id.* Healthcare providers commonly use a molecular COVID-19 test or polymerase chain reaction (PCR) test. Carrie MacMillan, *Which COVID-19 Test Should You Get?*, YALE MED., <https://www.yalemedicine.org/news/which-covid-test-is-accurate> [<https://perma.cc/ZGM2-EYES>] (Jan. 20, 2022). PCR tests provide more accurate results than antigen COVID-19 tests because the latter demand a greater amount of virus for a positive result. *Id.*

⁴⁴ Ahmed et al., *supra* note 1, at 2.

⁴⁵ *Id.*

fectured populations through a methodology now designated as water-based epidemiology (WBE).⁴⁶

There are numerous notable benefits to using WBE to track SARS-CoV-2.⁴⁷ First, WBE can identify the virus in populations of asymptomatic individuals, whereas the effectiveness of other forms of testing depends upon the severity of a given COVID-19 case, thus leading to false negatives.⁴⁸ Second, patients shed SARS-CoV-2 in their stool for a longer period of time than in their sputum, making WBE, as opposed to clinical testing, a more accurate method of tracking infections over time.⁴⁹ Third, approximately eighty percent of households in the United States are connected to municipal sewage collection systems.⁵⁰ This makes it possible to surveil the waste of large volumes of people who otherwise might not have received a clinical test.⁵¹

The totality of these benefits indicates that WBE provides a more effective long-term strategy than clinical testing for discovering COVID-19 in populations.⁵² WBE may also allow for earlier discovery of COVID-19 variants.⁵³ Accordingly, there has been an international effort to develop and implement WBE methodologies to track SARS-CoV-2 on a larger scale, and many of these efforts have proved successful.⁵⁴

⁴⁶ *Id.*

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ *Id.* SARS-CoV-2 can be observed in stool for approximately nine to sixteen days after symptoms commence, but nasopharyngeal swabs detect the virus for only six to eleven days after symptoms commence. *Id.*

⁵⁰ *National Wastewater Surveillance System (NWSS)*, *supra* note 33.

⁵¹ *Id.* Even though insurers and states claim to offer free clinical tests, these clinical tests can result in unanticipated medical bills regardless of insurance status, forcing those who cannot afford clinical tests to opt out. Sarah Kliff, *Coronavirus Tests Are Supposed to Be Free. The Surprise Bills Come Anyway.*, N.Y. TIMES, <https://www.nytimes.com/2020/09/09/upshot/coronavirus-surprise-test-fees.html> [<https://perma.cc/6VWE-BDSR>] (Sept. 15, 2020). Many people often find that even at-home COVID-19 tests, which are marketed as convenient and relatively cheaper alternatives to clinic testing, are difficult to obtain or prohibitively expensive. Yuki Noguchi, *Why Rapid COVID Tests Are in Short Supply in the U.S.*, NPR, <https://www.npr.org/sections/health-shots/2021/12/10/1062700278/how-the-u-s-got-on-the-slow-track-with-at-home-covid-tests> [<https://perma.cc/TQ7A-DBDW>] (Dec. 27, 2021). The government does not subsidize at-home COVID-19 tests, unlike clinical PCR tests or COVID-19 vaccines, and private insurers generally do not cover the cost. *Id.*

⁵² Ahmed et al., *supra* note 1, at 2. Data in one study concerning COVID-19 cases in the northeast United States showed higher case numbers based on wastewater data compared to case numbers based only on conventional testing data. *Id.*

⁵³ Honda et al., *supra* note 19, at 2.

⁵⁴ *Id.* Various examples exist of implementations of water-based epidemiology (WBE) in countries other than the United States. *Id.* For example, in the Netherlands and Milan, Italy, wastewater testing revealed the existence of SARS-CoV-2 RNA in wastewater within a few days of the countries' first positive tests. Ahmed et al., *supra* note 1, at 2. Similar examples of successful implementations of WBE occurred in Brisbane, Australia; Yamanashi Prefecture, Japan; and Murcia, Spain. *Id.* Early reports of SARS-CoV-2 RNA using WBE methodology occurred in Louisiana, United States; Dubai, United Arab Emirates; Gujarat, India; Gothenburg, Sweden; and Southeast England, United Kingdom. *Id.* Wastewater monitoring for COVID-19 has even infiltrated popular culture as a promising new method of combatting

2. Government Use of Wastewater Testing for COVID-19

WBE conducted in the United States (as well as in the European Union) has provided a reliable method for tracking the presence of SARS-CoV-2 in wastewater in light of clinical testing shortages and the high percentage of infected asymptomatic individuals.⁵⁵ The U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Department of Health and Human Services (HHS) have taken advantage of WBE, and, in collaboration with other federal agencies, initiated the National Wastewater Surveillance System (NWSS) to better understand the spread of the virus and combat its effects.⁵⁶ The CDC implemented NWSS with the intention of working with state, tribal, local, and territorial health departments to combine wastewater surveillance data and create a national database.⁵⁷ Wastewater surveillance would designate a specific region or population serviced by (or in the “catchment” of) a specific wastewater treatment plant.⁵⁸ Authorities could then ultimately use the data to, in part, take public health action in response to virus trends.⁵⁹ For example, in the event of a COVID-19 outbreak in a community identified by wastewater monitoring, community leaders could implement mandatory quarantine orders or place restrictions on businesses.⁶⁰

The CDC put forth a plethora of online resources that provide in-depth information on (1) the feasibility of WBE for a community, and (2) how to adopt

the pandemic. See Dr Comilla (@drsasson1), #Greenscreen Fighting #COVID19 One #Poop at a Time!, TIKTOK (Feb. 5, 2022), <https://www.tiktok.com/@drsasson1/video/7061087138888142127> [https://perma.cc/G3KL-5B7B] (explaining how sewage can provide valuable COVID-19 data).

⁵⁵ Mohamed Hamouda et al., *Wastewater Surveillance for SARS-CoV-2: Lessons Learnt from Recent Studies to Define Future Applications*, 751 SCI. TOTAL ENV'T 1, 1 (2021).

⁵⁶ *National Wastewater Surveillance System (NWSS)*, *supra* note 33; see *COVID Data Tracker: Wastewater Surveillance*, CDC, <https://covid.cdc.gov/covid-data-tracker/#wastewater-surveillance> [https://perma.cc/99UQ-BLDQ] (tracking COVID-19 levels obtained from NWSS).

⁵⁷ *National Wastewater Surveillance System (NWSS)*, *supra* note 33.

⁵⁸ Honda et al., *supra* note 19, at 2, 3.

⁵⁹ *Id.* at 3. Resources are available for the public to follow the trends in SARS-CoV-2 presence in wastewater through, for example, the Massachusetts Water Resources Authority (MWRA) “Wastewater COVID-19 Tracking” site. *Wastewater COVID-19 Tracking*, MASS. WATER RES. AUTH., <https://www.mwra.com/biobot/biobotdata.htm> [https://perma.cc/47K9-LYMJ] (Apr. 21, 2023). The site provides regular updates on the test results from MWRA’s study tracking wastewater at the Deer Island Plant. *Id.* The site offers a series of graphs showing trends of SARS-CoV-2 in sampled wastewater over time, as well as a map of the Greater Boston Area displaying the data geographically. *Id.*

⁶⁰ Gable et al., *supra* note 4, at 9; Honda et al., *supra* note 19, at 3; see WHITE HOUSE, NATIONAL COVID-19 PREPAREDNESS PLAN 63 (2022), <https://www.whitehouse.gov/wp-content/uploads/2022/03/NAT-COVID-19-PREPAREDNESS-PLAN.pdf> [https://perma.cc/UHL5-NJC8] (specifying that “emergency departments” shall utilize COVID-19 wastewater surveillance data to “develop updated recommendations and standards that consistently reflect the current disease threats in the United States”). Government-driven COVID-19 community safety measures may include quarantine or isolation. NATIONAL COVID-19 PREPAREDNESS PLAN, *supra*, at 63.

WBE to detect SARS-CoV-2 and track COVID-19 trends.⁶¹ The CDC recommends that governments implement wastewater surveillance on a state, tribal, local, and territorial level to address the public health requirements of those specific areas.⁶² Sampling demands significant participation by wastewater treatment plants, and the CDC suggests that communities develop sampling strategies based on their capabilities.⁶³ State, tribal, local, or territorial governments assess their wastewater monitoring capabilities by involving experts in the area, including experts in environmental microbiology and wastewater systems.⁶⁴ Governments then work to narrow down the specifics of where, how often, what, and how to sample.⁶⁵

On the question of where communities should sample, the CDC recommends choosing several wastewater treatment plants for consistent monitoring of SARS-CoV-2 RNA based on the particular health requirements of the community serviced by the plants, the features of the plants, and what remains economically and practically feasible for the area.⁶⁶ By sampling from certain wastewater treatment plants, communities can gather data on populations particularly vulnerable to COVID-19, gain access to COVID-19 trends in regions that have less access to clinical testing, and obtain data from multiple interconnected sewersheds in highly populated areas.⁶⁷

Finally, per the CDC, communities should tailor their sampling schedule to their purposes for collecting the data.⁶⁸ If a community wants to track SARS-CoV-2 levels for an extended period, it must engage in consistent sam-

⁶¹ *National Wastewater Surveillance System (NWSS)*, *supra* note 33; *Developing a Wastewater Surveillance Sampling Strategy*, CDC, <https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance/developing-a-wastewater-surveillance-sampling-strategy.html> [<https://perma.cc/ZX24-BCMD>] (Jan. 26, 2022). The CDC also maintains a COVID Data Tracker that provides information on current SARS-CoV-2 RNA levels in wastewater in different regions in the United States in real time. *COVID Data Tracker: Wastewater Surveillance*, *supra* note 56. A viewer can narrow data results by selecting a state, territory, or county, with the option to view data from major cities. *Id.* The website offers data in graphic form using a map of the United States and in a downloadable tabular form. *Id.*

⁶² *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61.

⁶³ *Id.*

⁶⁴ *Id.*

⁶⁵ *Id.*

⁶⁶ *Id.*

⁶⁷ *Id.* A sewershed forms the geographic area from which wastewater produced by buildings, as well as runoff from sidewalks and streets, enters sewage infrastructure that leads to a wastewater sewage treatment plant. NEWTOWN CREEK ALL., WATERSHED & SEWERSHED 4, <http://www.newtowncreekalliance.org/wp-content/uploads/2018/08/4-Watershed-Sewershed-worksheets.pdf> [<https://perma.cc/RX57-WVPP>].

⁶⁸ *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61.

pling.⁶⁹ Simply detecting the existence of COVID-19 in a community requires less frequent testing.⁷⁰

3. Public Universities' Use of Wastewater Testing for COVID-19

The COVID-19 pandemic significantly and negatively impacted education and the ability of students to attend in-person classes.⁷¹ Colleges and universities in all areas of the United States have suffered from COVID-19 surges.⁷² The consequences of these outbreaks have ranged from requiring certain students to isolate to closing down campuses and moving classes online.⁷³ College students are particularly susceptible to contracting COVID-19, and academic institutions are especially vulnerable to outbreaks due to the shared student residence accommodations many universities offer.⁷⁴ Moreover, college students often partake in group activities that increase the risk of them contracting COVID-19.⁷⁵

Some academic institutions have tracked and combatted COVID-19 outbreaks on campus by utilizing their own versions of the CDC's NWSS.⁷⁶ For instance, faculty at Colorado College, a private institution located in Colorado Springs, collect wastewater from student dorms to audit trends in the spread of COVID-19 on campus.⁷⁷ Indeed, at Colorado College a mathematics professor

⁶⁹ *Id.* To gather enough data to sufficiently identify COVID-19 progression in a community, sampling at a wastewater treatment plant must occur at least three times over a given timeframe. *Id.* Eight days is the shortest amount of time over which a sampler could identify a pattern. *Id.*

⁷⁰ *Id.* The CDC provides that “[o]ne-time sampling will not provide actionable data beyond [the] presence of SARS-CoV-2 infection within the sewershed,” but that “[s]ingle samples or very infrequent . . . sampling” may help in “establishing [the] presence of COVID-19 in a community.” *Id.*

⁷¹ Elissa Nadworny, *Colleges Turn to Wastewater Testing in an Effort to Flush Out the Coronavirus*, NPR (Oct. 26, 2020) <https://www.npr.org/2020/10/26/925831847/colleges-turn-to-wastewater-testing-in-an-effort-to-flush-out-the-coronavirus> [<https://perma.cc/53R2-ZKDE>]. COVID-19 forced many university campuses to go into “lockdowns” and to make classes virtual. *Id.* Indeed, in the spring of 2020, most colleges and universities closed their campuses and held classes virtually. ANDREW P. KELLY & ROONEY COLUMBUS, *COLLEGE IN THE TIME OF CORONAVIRUS: CHALLENGES FACING AMERICAN HIGHER EDUCATION* 1 (2020). The switch to online learning for students had myriad undesirable effects, and students overwhelmingly favor in-person learning. *Id.* Students who struggle academically with an online learning system or lack certain financial resources may fall behind in their studies, and online learning requires dependable internet access—a resource some students may not have access to or cannot afford. *Id.* at 4, 15. Further, long-term online learning may result in financial harm to the institutions themselves. *Id.* at 1. Enrollment and student retention rates in an online learning environment may dwindle. *Id.* at 4. This could result in the permanent closure of some higher education institutions. *Id.* at 1.

⁷² Nadworny, *supra* note 71.

⁷³ *Id.*

⁷⁴ *Id.*

⁷⁵ *Id.*

⁷⁶ *Id.*

⁷⁷ *Id.* Although this Note primarily explores the testing and monitoring of student wastewater on public university campuses, it mentions Colorado College, a private college, to provide an example of a methodology that a college has chosen to utilize to test student wastewater for SARS-CoV-2 RNA.

took it upon herself to monitor the virus.⁷⁸ Biweekly, this professor ladles effluent from pipes running from dorm buildings into a disposable cup and brings the wastewater she collects to a lab for testing.⁷⁹ Though this professor's efforts seem makeshift and inadequately experimental on a larger scale, many institutions across the country employ their own wastewater sampling methodologies.⁸⁰ In fact, by October 2020, sixty-four other U.S. academic institutions reported testing student wastewater to track COVID-19 trends on campus.⁸¹ And, universities have already utilized this data in preventing the virus's circulation.⁸² At the University of Arizona, administrators identified SARS-CoV-2 RNA in a dorm through wastewater testing and used this information to conduct clinical testing and ultimately identify infected asymptomatic students.⁸³ The University of Virginia, the Rochester Institute of Technology, and Colorado State University (CSU) have also utilized wastewater testing since the fall of 2020 and have had success in following COVID-19 trends at their respective schools and detecting outbreaks.⁸⁴

CSU, which tests all wastewater samples collected from dorm buildings on-site, cannot identify individual students through wastewater analysis, nor can any administration that engages in this type of COVID-19 monitoring.⁸⁵ Data results also cannot identify the number of students infected—only that

See id. (noting that Colorado College is a private institution and describing a professor's wastewater testing method); *infra* notes 221–244 and accompanying text (describing whether school wastewater monitoring qualifies as a search and, if it does, whether the monitoring violates the Fourth Amendment). Some public higher educational institutions that have implemented wastewater monitoring systems include University of Colorado Boulder and Eastern Michigan University. Geoff Larcom, *Eastern Michigan University to Conduct Wastewater Testing for Presence of COVID-19 Virus Markers in Campus Residences*, E. MICH. UNIV. (Sept. 17, 2020), <https://today.emich.edu/story/story/11523> [<https://perma.cc/S5P7-UUDG>]; Kelsey Simpkins, *How Sampling Campus Wastewater Aims to Keep COVID-19 in Check*, UNIV. COLO. BOULDER (Aug. 27, 2020), <https://www.colorado.edu/today/2020/08/27/how-sampling-campus-wastewater-aims-keep-covid-19-check> [<https://perma.cc/NJ32-THBC>].

⁷⁸ Nadworny, *supra* note 71.

⁷⁹ *Id.*

⁸⁰ *Id.*

⁸¹ *Id.*

⁸² *Id.* Not only do many universities implement these monitoring systems, but news outlets and universities publicize monitoring as a promising new way to control COVID-19 on campuses. Emily Anthes, *From the Wastewater Drain, Solid Pandemic Data*, N.Y. TIMES, <https://www.nytimes.com/2021/05/07/health/coronavirus-sewage.html> [<https://perma.cc/6NV4-FXUZ>] (May 11, 2021). For example, the *New York Times* has reported on the monitoring methods universities have employed as evidence that wastewater testing may work to combat the pandemic on a larger scale. *Id.* Some universities have also published information about their wastewater sampling methods online. *See* Larcom, *supra* note 77 (providing information on Eastern Michigan University's wastewater monitoring for COVID-19); Simpkins, *supra* note 77 (describing University of Colorado Boulder's wastewater monitoring efforts).

⁸³ Nadworny, *supra* note 71.

⁸⁴ *Id.*

⁸⁵ *Id.* Some colleges contract labs to conduct the testing of their samples. *Id.*

COVID-19 molecular markers exist in the wastewater effluent of a dorm building.⁸⁶ Nonetheless, the data provided to academic administrations can present useful trends in COVID-19 in dorms such that institutions can test students in a particular dorm where SARS-CoV-2 molecular markers exist in wastewater.⁸⁷ The administration can require those students who subsequently test positive for COVID-19 to isolate.⁸⁸ Colleges credit these testing efforts in quelling COVID-19 outbreaks and keeping education in-person.⁸⁹

B. Fourth Amendment Jurisprudence: When Has a Search Occurred and When Are Government Searches Reasonable Considering Public Health Concerns?

The Fourth Amendment of the U.S. Constitution governs the legality of government wastewater testing for SARS-CoV-2 RNA.⁹⁰ The text of the Amendment provides that “[t]he right of the people to be secure in their persons[,] houses, papers, and effects, against unreasonable searches and seizures, shall not be violated”⁹¹ The Fourth Amendment serves primarily to protect individuals against trespass by government actors.⁹² This protection covers a wide variety of elements—notably, one’s “persons[,] houses, papers, and effects.”⁹³

Subsection 1 of this Section specifies the elements of Fourth Amendment searches and the circumstances in which such searches may qualify as unreasonable violations of individual privacy.⁹⁴ Subsection 2 defines the special needs doctrine, which provides the government greater power to conduct searches in emergency situations, and its scope.⁹⁵

⁸⁶ *Id.*

⁸⁷ *Id.*

⁸⁸ *Id.*

⁸⁹ *Id.*

⁹⁰ See *California v. Greenwood*, 486 U.S. 35, 40 (1988) (holding that one does not retain a reasonable expectation of privacy over garbage left on the street); *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 66 (1st Cir. 2004) (creating wastewater surveillance precedent by stating that an industrial plant does not have a reasonable expectation of privacy over its wastewater); *United States v. Spain*, 515 F. Supp. 2d 860, 867 (N.D. Ill. 2007) (disagreeing with the contention that a chemical company has a reasonable expectation of privacy with respect to its wastewater); *United States v. Hajduk*, 396 F. Supp. 2d 1216, 1235 (D. Colo. 2005) (holding that there is no reasonable expectation of privacy over wastewater that is “flowing irretrievably” into a sewage system); *People v. Elec. Plating Co.*, 683 N.E.2d 465, 469 (Ill. App. Ct. 1997) (noting that a company does not have a reasonable expectation of privacy over its wastewater).

⁹¹ U.S. CONST. amend. IV.

⁹² *United States v. Jones*, 565 U.S. 400, 406 (2012).

⁹³ *Id.*

⁹⁴ See *infra* notes 96–106 and accompanying text.

⁹⁵ See *infra* notes 107–116 and accompanying text.

1. The Components of a “Search”

The Fourth Amendment aims to protect individuals from “unreasonable searches” conducted by the government.⁹⁶ The government conducts a Fourth Amendment search when it infringes on an individual’s actual expectation of privacy that society validates as reasonable.⁹⁷ Conversely, a Fourth Amendment search does not take place where there exists no reasonable purported expectation of privacy.⁹⁸

This two-pronged approach originated in 1967, in *Katz v. United States*, where the U.S. Supreme Court held that the government’s placement of an audio recorder on the outer wall of a phone booth to listen to the defendant’s conversation constituted a search.⁹⁹ Even though the phone booth did not fall within the plain language of the Fourth Amendment, the Court held that the government’s conduct still constituted a search because the defendant reasonably depended on the privacy of the booth as society would expect.¹⁰⁰

Conversely, in 1988, in *California v. Greenwood*, the Court held that a defendant does not have a reasonable expectation of privacy over garbage left on the street to be collected by a third party.¹⁰¹ Therefore, anyone, including government officials, could legally examine the defendant’s garbage without implicating the Fourth Amendment’s protections.¹⁰²

Not all searches, however, are unreasonable.¹⁰³ The Supreme Court has consistently held that reasonableness serves as the fundamental factor in determining the constitutionality of a search.¹⁰⁴ An unreasonable search, as opposed to a constitutionally permissible one, lacks a warrant and probable cause and does not have an exception—such as extraordinary need—that makes ob-

⁹⁶ *Kyllo v. United States*, 533 U.S. 27, 31 (2001).

⁹⁷ *Id.* at 33 (first citing *Katz v. United States*, 389 U.S. 347, 361 (1967) (Harlan, J., concurring); and then citing *California v. Ciraolo*, 476 U.S. 207, 211 (1986)). The Supreme Court has frequently referred back to Justice Harlan’s concurrence in *Katz* as the standard for Fourth Amendment analyses. *See id.* (describing Justice Harlan’s concurrence as “oft-quoted” to describe when “a Fourth Amendment search occurs”).

⁹⁸ *Id.*

⁹⁹ 389 U.S. 347, 353, 359 (1967).

¹⁰⁰ *Id.* at 353. Importantly, the Court specified that “the Fourth Amendment protects *people*—and not simply ‘areas’—against unreasonable searches and seizures . . .” *Id.* (emphasis added). The Court noted that its holding served as a departure from traditional jurisprudence on seizures. *Id.* Still, the Court deemed it necessary to broaden the legal scope of “seizure” from merely the “seizure of tangible items” to the seizure of information, such as “oral statements[] overheard” even in the absence of material seizure. *Id.*

¹⁰¹ 486 U.S. 35, 40 (1988).

¹⁰² *Id.*

¹⁰³ *See United States v. Bah*, 794 F.3d 617, 627 (6th Cir. 2015) (stating that the Fourth Amendment only protects individuals against “*unreasonable* searches and seizures”).

¹⁰⁴ *Ohio v. Robinette*, 519 U.S. 33, 39 (1996) (citing *Florida v. Jimeno*, 500 U.S. 248, 250 (1991)).

taining a warrant and probable cause unfeasible.¹⁰⁵ In *Katz*, for example, the search conducted by the government—which involved installing the listening device on the phonebooth without a warrant, probable cause, or an exception—violated the Fourth Amendment because the caller enjoyed a reasonable expectation of privacy over his phone conversation while in the phonebooth.¹⁰⁶

¹⁰⁵ *Skinner v. Ry. Lab. Execs.' Ass'n*, 489 U.S. 602, 619 (1989).

¹⁰⁶ 389 U.S. 347, 356–57 (1967); see *Kyllo v. United States*, 533 U.S. 27, 34–35 (2001) (holding particularly dispositive, in its Fourth Amendment analysis, the government's use of a thermal imaging device in obtaining "information regarding the interior of the home"); *Greenwood*, 486 U.S. at 39–40 (giving weight to society's views and "common knowledge" in making a determination as to whether one maintains a reasonable expectation of privacy over garbage left on the street). In the two cases *Silverman v. United States* and *Katz*, the Supreme Court grappled with Fourth Amendment privacy concerns that arose due to advancing technology. See *Silverman v. United States*, 365 U.S. 505, 509–11 (1961) (determining that law enforcement's attachment of a listening device to a home's heating duct to form a "giant microphone, running through the entire house" violated the Fourth Amendment); *Katz*, 389 U.S. at 353–54 (further extending the meaning of "search" beyond merely the government's "seizure of tangible items" to "oral statements[] overheard" in the absence of a physical trespass). In *Silverman*, the Court took particular issue with the government's control over "an integral part of the premises occupied by the petitioners . . . without their knowledge and without their consent." 365 U.S. at 511. The physical attachment of the microphone to the dwelling, in addition to the government's ability to overhear otherwise private conversations, led to the Court to conclude that the attachment ran afoul of the Fourth Amendment's "very core"—that one has the right to "retreat into his own home and there be free from unreasonable governmental intrusion." *Id.* The Court subsequently relied on this reasoning to conclude in *Katz* that the government violated the Fourth Amendment by attaching a listening device to a phone booth to overhear the caller's conversation. 389 U.S. at 356–57. The Court rejected the government's notion that it had not violated the Fourth Amendment because the booth "was constructed partly of glass" such that one outside the booth could view callers within it. *Id.* at 352. The Court instead determined that despite the caller's physically public position, the individual had called from the closed phone booth with the intent of warding off the "uninvited ear" so as to keep his conversation private. *Id.* Regardless of the lack of a physical intrusion into the booth, the Court held that the caller's expectation of privacy inside a public phonebooth qualified as reasonable. *Id.* In 2001, the Court again held in *Kyllo v. United States* that the government's warrantless use of a "device that is not in general public use," in this case, "to explore details of the home that would previously have been unknowable without physical intrusion," violated the Fourth Amendment. 533 U.S. at 40. The government did not persuade the Court with its argument that the thermal imager used to observe the dwelling's occupants merely detected heat "radiating from the external surface of the house" and not from *inside* the house. *Id.* at 35. The Court additionally disagreed with the contention that heat waves do not provide the government with "intimate details" of the home, and instead held that any information the government obtained from the home beyond that observable by the naked eye qualified as reasonably private. *Id.* at 37–38. In 1988, the Court made a notable distinction from the reasonable expectation of privacy inside homes and public locations where one may reasonably expect privacy in *Greenwood*, where the Court held that individuals relinquish privacy rights over garbage left on the street. 486 U.S. at 40. Because the respondents had (1) placed their garbage where they could have reasonably expected the public to see it and (2) intentionally transferred possession of their garbage to a third party for collection, the Court determined that the respondents could not claim a privacy expectation in the garbage. *Id.* at 40–42. Consequently, the Court held that the government's warrantless search of the respondents' garbage did not violate the Fourth Amendment. *Id.* at 39.

2. Balancing Individual Privacy and Protecting Public Health: The Special Needs Doctrine

The Fourth Amendment analysis hinges on the reasonableness of the government's action and in doing so weighs two factors: (1) an individual's right to privacy and (2) legitimate governmental interests, including societal welfare.¹⁰⁷ As such, courts must weigh the Fourth Amendment protection against unreasonable governmental searches and seizures of individuals against governments' police power to enable public health departments to assure the safety and welfare of their citizens by tracking a virus's spread.¹⁰⁸

Using the special needs doctrine, first postulated in a concurrence by Justice Harry Blackmun in 1985, in *New Jersey v. T.L.O.*, courts may allow warrantless searches without probable cause where the government has a "special need[]" that eclipses individuals' rights under the Fourth Amendment.¹⁰⁹ The Supreme Court has since held many times that protecting the health of the public is a justifiable special need.¹¹⁰ A court must weigh the compelling govern-

¹⁰⁷ *Silverman*, 365 U.S. at 511; *What Does the Fourth Amendment Mean?*, U.S. CTS., <https://www.uscourts.gov/about-federal-courts/educational-resources/about-educational-outreach/activity-resources/what-does-0> [<https://perma.cc/C4KK-EJ8R>]. The Fourth Amendment primarily serves to safeguard "the right of a man to retreat into his own home and there be free from unreasonable government intrusion." *Silverman*, 365 U.S. at 511 (first citing *Entick v. Carrington* 19 Howell's St. Trials 1029, 1066 (CP 1765); and then citing *Boyd v. United States*, 116 U.S. 616, 626–30 (1886)).

¹⁰⁸ Gable et al., *supra* note 4, at 7–8; Lawrence O. Gostin & James G. Hodge, Jr., *US Emergency Legal Responses to Novel Coronavirus: Balancing Public Health and Civil Liberties*, 323 JAMA 1131, 1131 (2020). States are empowered with public health authority by the Constitution that they can then share with local governments to prevent the spread of diseases or viruses. Gostin & Hodge, *supra*, at 1131.

¹⁰⁹ 469 U.S. 325, 351 (1985) (Blackmun, J., concurring); see Jennifer E. Smiley, Note, *Rethinking the "Special Needs" Doctrine: Suspicionless Drug Testing of High School Students and the Narrowing of Fourth Amendment Protections*, 95 NW. U. L. REV. 811, 813–14 (2001) (recounting the history of the doctrine). To conduct a warrantless search, the special need must not pertain simply to stopping crime and must pertain to the safety of the public. Smiley, *supra*, at 814. Some of the first cases where the Supreme Court applied the special needs doctrine involved building code inspections of homes. *Id.* (first citing *Eaton v. Price*, 364 U.S. 263, 263 (1960); and then citing *Frank v. Maryland*, 359 U.S. 360, 373 (1959), *overruled in part by* *Camara v. Mun. Ct.*, 387 U.S. 523 (1967)). In such cases, the Court determined that the Fourth Amendment did not protect homeowners who denied entry to inspectors. *Id.* The Court concluded that the government could reasonably invade homeowners' privacy given the health concerns associated with not inspecting homes for building code violations. *Id.* at 813–14.

¹¹⁰ See *T.L.O.*, 469 U.S. at 351 (Blackmun, J., concurring) (describing how the government may violate the protections granted by the Fourth Amendment where special needs that do not relate to police objectives exist); Gable et al., *supra* note 4, at 9 (explaining that courts will decide that the state has acted legally where there exists special public health needs that necessitate the violation of individual privacy). The Court's special needs jurisprudence has often arisen in the context of drug testing. Compare, e.g., *Bd. of Educ. of Indep. Sch. Dist. of Pottawatomie Cnty. v. Earls*, 536 U.S. 822, 825 (2002) (permitting the drug testing of high school students participating in school sports), and *Vernonia Sch. Dist. 47J v. Acton*, 515 U.S. 646, 666 (1995) (same), with *Ferguson v. City of Charleston*, 532 U.S. 67, 79–80 (2001) (iterating that public health provides a legitimate reason to conduct special needs searches, but that a program implemented largely to bolster typical police endeavors

ment interest of promoting public health and safety against the privacy interests of U.S. citizens granted by the Fourth Amendment against unreasonable government searches.¹¹¹

The Court's rulings permitting warrantless searches under the special needs doctrine do not, of course, give the government free reign to invade citizens' constitutional rights, especially under circumstances where the invasion of individual constitutional rights does not directly benefit public health.¹¹² In fact, in 1977, the Supreme Court specifically narrowed the reach of the special needs doctrine in *Chandler v. Miller* when it held that drug testing politicians violated the Fourth Amendment without exception.¹¹³ Despite politicians' public-facing roles, the Court held that the duties of a politician lack the element of danger that exists in other occupations that require drug testing.¹¹⁴

Conversely, in 1989, in *Skinner v. Railway Labor Executives' Association*, the Supreme Court determined that conducting drug tests on railroad employees qualified as a reasonable search because there existed a special need to ensure employees remained drug-free for workplace safety purposes.¹¹⁵ There, the Court reasoned that what would have otherwise qualified as an unreasonable warrantless search of the employees became reasonable in light of the extenuating public safety circumstances necessitating the searches.¹¹⁶

C. Fourth Amendment Jurisprudence: Searches Conducted by Public Schools

The Supreme Court has consistently held that students attending public school retain constitutional privacy rights and Fourth Amendment protections while on school grounds.¹¹⁷ Public school staff act as "state agents" such that

should not fall within the special needs doctrine), and *Chandler v. Miller*, 520 U.S. 305, 321–22 (1997) (forbidding the drug testing of politicians in Georgia because the state tested politicians for "symbolic" purposes, and not for the purpose of protecting public health).

¹¹¹ *T.L.O.*, 469 U.S. at 341.

¹¹² *Gable et al.*, *supra* note 4, at 9; see *Ferguson*, 532 U.S. at 79–80 (holding that the special needs doctrine does not excuse violations that occur in the furtherance of typical law enforcement activities); *Chandler*, 520 U.S. at 321–22 (determining that "symbolic" politician drug testing does not qualify a measure that protects public health). For example, if the government were to enforce stay-at-home orders based on wastewater monitoring data, courts would assess the government's actions pursuant to a "strict scrutiny standard[]" *Gable et al.*, *supra* note 4, at 9.

¹¹³ 520 U.S. at 306.

¹¹⁴ *Id.*

¹¹⁵ 489 U.S. 602, 620 (1989).

¹¹⁶ *Id.* The fact that railroad employees engaged in such "safety-sensitive tasks" superseded the government's requirement under the Fourth Amendment to obtain a warrant and have probable cause. *Id.*

¹¹⁷ See *New Jersey v. T.L.O.*, 469 U.S. 325, 333–34 (1985) (schools may conduct reasonable searches of students to promote school safety); *Tinker v. Des Moines Indep. Cmty. Sch. Dist.*, 393 U.S. 503, 506 (1969) (holding generally that students still enjoy their constitutional rights while at school); WENDY WOLF & PERRY MORIEARTY, *SCHOOL SEARCH AND SEIZURE: AN OVERVIEW OF*

they are required to operate within the same parameters as law enforcement with respect to Fourth Amendment searches and seizures.¹¹⁸

The Court, however, has adjusted the Fourth Amendment mandates of obtaining a warrant and probable cause to conduct a search to accommodate the educational environment.¹¹⁹ In 1985, in *T.L.O.*, the Court detailed these adjustments.¹²⁰ There, the Court reasoned that schools have a particular need to preserve orderliness and, thus, concluded that this need obviated public schools from having to acquire warrants or religiously comply with the legal requirement for probable cause.¹²¹ Instead of requiring schools to have probable cause to conduct a search, schools must instead have a reasonable suspicion of illegal activity.¹²² A school search must be both “justified at its inception” and executed within the appropriate bounds of the issue.¹²³ In applying the adjusted standards for public schools, the Court found that searches of students’ belongings conducted by public school officials in *T.L.O.* qualified as reasonable after a school official had observed students smoking marijuana on school grounds.¹²⁴

Moreover, in 2009, in *Safford Unified School District #1 v. Redding*, the Court applied these adjusted standards and came to a different conclusion because the search conducted by the school officials exceeded the severity of the situation.¹²⁵ There, the Court held that a search of the plaintiff’s undergarments conducted by the school proved unnecessarily invasive compared to the potential threat to students’ safety—the plaintiff student’s possession and distribution of naproxen pain relief pills.¹²⁶

II. INTERPRETING THE FOURTH AMENDMENT AND LEGAL PRECEDENT

Addressing the constitutionality of wastewater testing requires determining first, whether wastewater testing constitutes a search, and second, whether the circumstances under which an authority conducts the testing renders the

THE LAW 1 (2010), <https://www.publiccounsel.net/ya/wp-content/uploads/sites/6/2014/08/school-search-and-seizure.pdf> [<https://perma.cc/MZK4-NY9A>] (cataloguing the Court’s jurisprudence on students’ Fourth Amendment rights while in school); *see also* *Commonwealth v. Damian D.*, 752 N.E.2d 679, 681 (Mass. 2001) (holding that schools must conduct reasonable searches and seizures of students depending on the circumstances).

¹¹⁸ *T.L.O.*, 469 U.S. at 334.

¹¹⁹ *Id.* at 340.

¹²⁰ *Id.*

¹²¹ *Id.* at 341.

¹²² *Id.*

¹²³ *Id.* (quoting *Terry v. Ohio*, 392 U.S. 1, 20 (1968)).

¹²⁴ *Id.* at 328, 347–48.

¹²⁵ 557 U.S. 364, 375 (2009).

¹²⁶ *Id.* at 375–76.

search constitutional.¹²⁷ Section A of this Part discusses the first issue with respect to current legal precedent as it relates to wastewater testing under the Fourth Amendment.¹²⁸ Section B addresses the current legal framework under which a court would determine whether, if testing qualifies as a search, government bodies can still constitutionally test wastewater.¹²⁹ Section C of this Part subsequently discusses how public higher education institutions utilize wastewater surveillance to test for and track COVID-19 on campus.¹³⁰

A. General Current Legal Precedent Related to Wastewater Surveillance

The principles of what constitutes a search and subsequently an unreasonable search apply to wastewater monitoring.¹³¹ Courts have overwhelmingly

¹²⁷ See Gable et al., *supra* note 4, at 7–8 (addressing first, whether wastewater testing constitutes a search, and second, whether such searches are reasonable given the extenuating circumstances of potentially encroaching on individuals' privacy to promote public health).

¹²⁸ See *infra* notes 131–179 and accompanying text.

¹²⁹ See *infra* notes 180–185 and accompanying text.

¹³⁰ See *infra* notes 186–199 and accompanying text.

¹³¹ See *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (conducting a Fourth Amendment search analysis with regard to wastewater monitoring and describing a fact-intensive analysis); *United States v. Spain*, 515 F. Supp. 2d 860, 864 (N.D. Ill. 2007) (finding that no search occurred when the U.S. Environmental Protection Agency (EPA) sampled wastewater because the source resided immediately adjacent to and flowing into a public sewer); see also *Kyllo v. United States*, 533 U.S. 27, 31 (2001) (holding that the initial issue in analyzing whether a Fourth Amendment violation has occurred is whether a search occurred); *California v. Greenwood*, 486 U.S. 35, 40 (1988) (holding that the creator of waste abandoned on the sidewalk does not have a reasonable expectation of privacy over that waste); *Katz v. United States*, 389 U.S. 347, 353–54 (1967) (requiring courts to first differentiate in their analyses whether a “search” occurred pursuant to the Fourth Amendment and to then assess whether it was reasonable). In 2004, the U.S. Court of Appeals for the First Circuit in *Riverdale Mills Corp. v. Pimpare* addressed whether a business could have a reasonable expectation of privacy in its wastewater that irretrievably filtered into the public municipal sewer system. 392 F.3d at 63. In *Riverdale Mills Corp.*, two EPA agents sampled wastewater from Riverdale, a manufacturing plant, without a warrant for Riverdale's property. *Id.* at 56, 57. The company president approved the first search, and two high-level company personnel accompanied the EPA agents while they did their sampling, however, the company did not agree to the second search. *Id.* at 57–58. The court explained that whether a search occurred and whether the company had a reasonable expectation of privacy over its wastewater depended on several considerations, such as the type of wastewater sampled and whether the EPA conducted the search on residential or commercial property. *Id.* at 63, 64. The court's holding that the EPA had not conducted a search or violated Riverdale's Fourth Amendment rights relied on the fact that Riverdale's wastewater would surely enter the public water system close by. *Id.* at 63. The First Circuit analogized Riverdale's wastewater to garbage left on a curb, over which the producer of the garbage would not have a reasonable expectation of privacy because the garbage producer had purposely discarded it. *Id.* at 64. Therefore, the public could search this garbage without a warrant and without violating the producer's privacy rights. *Id.* In 2007, in *United States v. Spain*, the U.S. District Court for the Northern District of Illinois relied heavily on the First Circuit's opinion in *Riverdale Mills Corp.* in addressing very similar issues with a similar fact pattern. 515 F. Supp. 2d at 867. In *Spain*, a chemical manufacturer alleged that three samplings conducted by the EPA on the manufacturer's property constituted searches contrary to the manufacturer's Fourth Amendment right to privacy. *Id.* at 863, 864. The court used the First Circuit's *Riverdale Mills Corp.* reasoning in deciding that the EPA did not conduct searches within the meaning

found that sampling wastewater does not qualify as a search under the Fourth Amendment because reasonable expectations of privacy in wastewater are abandoned when waste is permitted to filter “irretrievably” into a public sewer.¹³² Importantly, however, courts have explicitly acknowledged that there may be a reasonable expectation of privacy associated with wastewater sampling in certain contexts.¹³³ Accordingly, courts consider a number of factors to determine whether a search occurred.¹³⁴

First, with regard to wastewater, the source from which the tested wastewater originated is a significant factor in determining whether wastewater surveillance constitutes a search.¹³⁵ For example, with industrial waste, where a government agency tests the wastewater flowing from a manufacturing facility, the facility has a lower expectation of privacy.¹³⁶ Conversely, where an authority tests wastewater flowing directly from a residence, the resident may have a higher expectation of privacy such that the testing might constitute a search under the Fourth Amendment.¹³⁷ Other considerations include the type of matter analyzed in the wastewater and the analysis conducted on the waste.¹³⁸ Specifically, tests that analyze private data in wastewater, such as biological or medical statistical data, as opposed to levels of industrial chemicals, may be more likely to qualify as a search under the Fourth Amendment.¹³⁹

Next, courts will also consider the size of the population from which the wastewater originates.¹⁴⁰ Even though sampling wastewater from a municipal wastewater sewage treatment plant serving a large population poses no consti-

of the Fourth Amendment because the manufacturer did not have a reasonable expectation of privacy when discharging its wastewater into a public sewer system. *Id.* at 867.

¹³² *Riverdale Mills Corp.*, 392 F.3d at 64; *Spain*, 515 F. Supp. 2d at 867; *United States v. Hajduk*, 396 F. Supp. 2d 1216, 1235 (D. Colo. 2005); *People v. Elec. Plating Co.*, 683 N.E.2d 465, 470 (Ill. App. Ct. 1997); Gable et al., *supra* note 4, at 7.

¹³³ *Riverdale Mills Corp.*, 392 F.3d at 63; *see Dow Chem. Co v. United States*, 476 U.S. 227, 238 n.5 (1986) (providing that cases involving potential Fourth Amendment privacy violations “must be decided on the facts of each case, [and] not be extravagant generalizations”).

¹³⁴ *See Riverdale Mills Corp.*, 392 F.3d at 63 (describing how the court must consider the location from which the sampling occurred as well as whether the waste is human waste or industrial waste).

¹³⁵ *Id.*; Gable, *supra* note 4, at 7.

¹³⁶ *Riverdale Mills Corp.*, 392 F.3d at 64.

¹³⁷ *Id.* at 63.

¹³⁸ *Id.* Courts consider whether the type of waste being sampled, for example, is industrial waste or residential wastewater. *Id.* at 63, 64.

¹³⁹ *Id.* at 63; *see also Skinner v. Ry. Labor Execs.’ Ass’n*, 489 U.S. 602, 617 (1989) (determining that conducting a urinalysis test constitutes a search under the Fourth Amendment because a person’s biological waste and biological data associated with that waste demand a reasonable expectation of privacy).

¹⁴⁰ *Riverdale Mills Corp.*, 392 F.3d at 63; Gable et al., *supra* note 4, at 7; *see Christopher L. Hering, Note, Flushing the Fourth Amendment Down the Toilet: How Community Urinalysis Threatens Individual Privacy*, 53 ARIZ. L. REV. 741, 741 (2009) (arguing that analyzing a residence’s wastewater for the presence of illegal drugs in urine qualifies as a search under the Fourth Amendment).

tutional risk due to the inherent anonymity of contributing a relatively small amount of data into a large data pool, as the size of the population from which samples are taken decreases, anonymity likewise decreases.¹⁴¹ Therefore, courts consider the degree of individualization in wastewater sampling in determining whether such sampling constitutes a search.¹⁴²

In 2018 in *Carpenter v. United States*, the Supreme Court also addressed the concept of voluntariness and how it impacts whether an unreasonable search has occurred.¹⁴³ In *Carpenter*, law enforcement secured the phone records of Timothy Carpenter from his wireless carrier after police suspected that Carpenter had participated in a series of robberies.¹⁴⁴ Carpenter moved to exclude from the record the cell phone data on the basis that the government had seized this data without a warrant based on probable cause, thus violating the Fourth Amendment.¹⁴⁵ The Court agreed with Carpenter, holding that even though individuals might willingly provide sensitive information to third parties, their doing so does not constitute a relinquishment of their reasonable expectation of privacy.¹⁴⁶ The Court concluded that a modern lifestyle necessitates owning a cell phone and that owning a cell phone requires individuals to provide third parties with certain information.¹⁴⁷

The Court has also explored, in determining whether the government has violated the Fourth Amendment, the length of time that the government monitored.¹⁴⁸ In the 2012 Supreme Court case *United States v. Jones*, Justice Alito concurred with the majority opinion that the government's attachment of a GPS device to a vehicle qualified as a search.¹⁴⁹ He specifically addressed the issue of how long the government surveilled the individual—emphasizing in

¹⁴¹ Gable et al., *supra* note 4, at 7.

¹⁴² See *Riverdale Mills Corp.*, 392 F.3d at 63 (noting that whether a search occurs rests somewhat on how many people the government monitors); Gable et al., *supra* note 4, at 7 (suggesting that wastewater monitoring on a smaller scale would more likely constitute a search under the Fourth Amendment).

¹⁴³ 138 S. Ct. 2206, 2210 (2018).

¹⁴⁴ *Id.* at 2212.

¹⁴⁵ *Id.*

¹⁴⁶ *Id.* at 2210.

¹⁴⁷ *Id.*; see *California v. Greenwood*, 486 U.S. 35, 55–56 (1988) (6-2 decision) (Brennan, J., dissenting) (disagreeing with the Court in part because local governments require all city residents to leave their garbage on the street). Justice Brennan adopted a similar approach to Fourth Amendment analyses by considering whether an individual had voluntarily relinquished control over information. *Greenwood*, 486 U.S. at 55–56 (Brennan, J., dissenting). In the 1988 Supreme Court case *California v. Greenwood*, Justice Brennan believed that, because the government legally required the defendant to place his garbage on the street, and because the defendant enclosed his garbage in a bag, the defendant retained a reasonable expectation of privacy over his trash. *Id.*

¹⁴⁸ See *United States v. Jones*, 565 U.S. 400, 425 (2012) (9-0 decision) (Alito, J., concurring) (explaining that the amount of time over which the government monitored an individual bears on whether the government violated the Fourth Amendment).

¹⁴⁹ *Id.* at 419.

this case that the prolonged period of surveillance proved essential to the Fourth Amendment analysis.¹⁵⁰

Historically, early Fourth Amendment jurisprudence restricted the Amendment's application to physical property and stopped short of extending protection to physical waste.¹⁵¹ In 1967, the Supreme Court, in *Katz v. United States*, extended Fourth Amendment protections to individuals, not simply tangible property.¹⁵² *Katz* may therefore incorporate wastewater as a protected matter under the umbrella of the Fourth Amendment even if the monitoring of wastewater does not amount to a traditional trespass.¹⁵³ According to *Katz*, the monitoring of wastewater may violate the Fourth Amendment because it intrudes upon a person's reasonable expectation of privacy even though no trespass ensues.¹⁵⁴

Nonetheless, some courts have expressed a more narrow view of what constitutes a search for the purposes of the Fourth Amendment.¹⁵⁵ The cases related to wastewater searches that support this view focus primarily on the testing of industrial wastewater to detect chemical concentration as opposed to the testing of bodily waste to collect personal medical information.¹⁵⁶ These courts reason that the seizing of trash or other types of emissions does not qualify as a search in part because it involves collecting the waste of commercial activities as opposed to the waste of residences.¹⁵⁷ Courts agree that the sampling of industrial waste from commercial activity does not amount to a search because commercial enterprises can reasonably expect, and the gov-

¹⁵⁰ *Id.* at 431.

¹⁵¹ See *Greenwood*, 486 U.S. at 39 (declining to hold that an individual maintained a privacy expectation over garbage left on the street); *Silverman v. United States*, 365 U.S. 505, 510–11 (1961) (describing how the Court considered “a physical invasion” to serve as a “vital factor” in older Fourth Amendment cases).

¹⁵² See 389 U.S. 347, 353 (1967) (providing that Fourth Amendment protections apply beyond the traditional concepts of property and physical trespass on a person's land).

¹⁵³ See *id.* (holding that the Fourth Amendment does not only protect items under traditional property law).

¹⁵⁴ *Id.*

¹⁵⁵ See *Skinner v. Ry. Labor Execs.' Ass'n*, 489 U.S. 602, 617 (1989) (holding that individuals have a reasonable expectation of privacy over their bodily waste); *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (explaining that depending on the circumstances wastewater monitoring might constitute a search); *United States v. Spain*, 515 F. Supp. 2d 860, 867 (N.D. Ill. 2007) (holding that the EPA's sampling of wastewater flowing from a chemical manufacturer was not a search); *People v. Elec. Plating Co.*, 683 N.E.2d 465, 466, 470 (Ill. App. Ct. 1997) (holding that the testing of a plating company's wastewater by the Metropolitan Water Reclamation District did not amount to a search).

¹⁵⁶ See *Riverdale Mills Corp.*, 392 F.3d at 66 (concerning commercial wastewater); *Spain*, 515 F. Supp. 2d at 861 (concerning wastewater from multiple sources); *United States v. Hajduk*, 396 F. Supp. 2d 1216, 1221 (D. Colo. 2005) (concerning a company's expulsion of industrial wastewater); *Elec. Plating Co.*, 683 N.E.2d at 466 (same).

¹⁵⁷ See *Riverdale Mills Corp.*, 392 F.3d at 63, 66 (deciding that a commercial plant did not have a reasonable expectation of privacy over industrial wastewater).

ernment entitles them to, less privacy than a residence.¹⁵⁸ Yet, COVID-19 wastewater surveillance does not target industrial waste for chemical concentrations, but rather human waste for medical data.¹⁵⁹

As a result, the most relevant cases concluding that government wastewater sampling does not violate the Fourth Amendment fail to provide sufficient information as to whether wastewater monitoring for SARS-CoV-2 RNA constitutes a search.¹⁶⁰ The First Circuit Court of Appeals in the 2004 case *Riverdale Mills Corp. v. Pimpare* refused to conclude, as the U.S. Environmental Protection Agency (EPA) asked it to, that all sampling of wastewater does not violate the Fourth Amendment.¹⁶¹ The First Circuit, in fact, emphasized that where the government seizes a sample of human waste, there exists a greater reasonable expectation of privacy.¹⁶²

The Supreme Court's decision in 1989, in *Skinner v. Railway Labor Executives' Ass'n*, provides greater insight into whether the testing of bodily waste amounts to a search, though it does not attend to the specific issue of sampling bodily waste in wastewater.¹⁶³ The Supreme Court in *Skinner* recog-

¹⁵⁸ *Id.*; see *Dow Chem. Co. v. United States*, 476 U.S. 227, 237–38 (1986) (stating that industrial areas generally do not have the same privacy protections as residential dwellings).

¹⁵⁹ See *supra* notes 55–89 and accompanying text (describing how governments and academic institutions test resident and student waste to determine COVID-19 prevalence and identify infected individuals).

¹⁶⁰ See *Dow Chem. Co.*, 476 U.S. at 237–38 (distinguishing only between the Fourth Amendment implications associated with commercial versus residential surveillance); *Riverdale Mills Corp.*, 392 F.3d at 63 (refusing to adopt a bright-line rule as to whether wastewater monitoring constitutes a search because this legal question rests largely on the circumstances of the situation); *Spain*, 515 F. Supp. 2d at 867 (forming its decision based on previous wastewater Fourth Amendment cases without further analyzing when monitoring wastewater would constitute a search); *Hajduk*, 396 F. Supp. 2d at 1226 (focusing on the fact that the inability to retrieve wastewater flowing through a municipal sewer system made it such that a company does not retain a reasonable expectation of privacy over its wastewater); *Elec. Plating Co.*, 683 N.E.2d at 469 (holding that because the plaintiff was a business it did not have a reasonable expectation of privacy over its wastewater).

¹⁶¹ 392 F.3d at 63.

¹⁶² *Id.*

¹⁶³ See 489 U.S. 602, 606 (1989) (concerning whether the Federal Railroad Administration ran afoul of employees' Fourth Amendment rights in providing railroads the ability to conduct breathalyzer tests and urinalyses of employees who did not adhere to particular safety procedures). Regarding whether a urine test amounts to a search under the Fourth Amendment, the Court considered what other private information about a person might become available through a urinalysis test. *Id.* at 617. The Court explained that “[i]t is not disputed . . . that chemical analysis of urine, like that of blood, can reveal a host of private medical facts . . . including whether he or she is epileptic, pregnant, or diabetic.” *Id.* The Court concluded that such medical information is confidential and that urinalyses therefore infringe on a person's reasonable expectation of privacy. *Id.* It is important to note that *Skinner*, as well as many similar cases that provide legal doctrine concerning bodily waste and Fourth Amendment searches, did not find that the testing violated individuals' Fourth Amendment rights. See 489 U.S. at 606, 620 (permitting mandatory drug testing of government employee train conductors following a train crash); see also *Vernonia Sch. Dist. 47J v. Acton*, 515 U.S. 646, 649–50, 666 (1995) (holding that schools could subject students who participated in after school sports to drug testing); *Nat'l Treasury Emps. Union v. Von Raab*, 489 U.S. 656, 660, 672 (1989) (allowing customs employ-

nized that “surgical intrusion[s],” such as taking blood and subsequently testing it, qualify as searches.¹⁶⁴ In *Skinner*, which asked whether sampling and conducting chemical analyses on urine was different from bodily intrusions, the Court explained that conducting chemical analyses on urine, similar to a blood draw analysis, exposes a myriad of health conditions.¹⁶⁵ In both instances, individuals can reasonably anticipate a certain amount of privacy with regard to their medical data.¹⁶⁶ Additionally, the Court noted that the actual method of sampling urine can implicate privacy interests.¹⁶⁷ The Court held that urine sampling and analysis breach one’s reasonable expectations of privacy, and, as such, constitute searches.¹⁶⁸ Given the Court’s analysis in *Skinner* and a general legal reluctance to exclude wastewater testing from the category of search, the biological nature of the testing could compel a court to determine that wastewater testing for SARS-CoV-2 by the government is a search.¹⁶⁹

Further, the testing of the relatively small communities the CDC cites as potentially viable areas for which to monitor for SARS-CoV-2 could prove too individualized for constitutionally sound monitoring.¹⁷⁰ The CDC provides information for communities to implement their own surveillance programs by

ees to be drug tested). In these cases, significant safety concerns weighed in favor of on-the-job testing. See *Nat’l Treasury Emps. Union*, 489 U.S. at 660, 672 (holding that the government had special interests in employees’ sobriety based on the nature of their jobs); *Skinner*, 489 U.S. at 620 (holding that testing was appropriate because conductors held positions where drug use would create grave safety concerns).

¹⁶⁴ 489 U.S. at 617.

¹⁶⁵ *Id.*

¹⁶⁶ *Id.*

¹⁶⁷ *Id.* The Supreme Court specifically mentioned that collecting urine samples, for example, can require oversight in some capacity, which itself infringes on the privacy rights of the individual. *Id.*

¹⁶⁸ *Id.*

¹⁶⁹ See *id.* (concluding that the testing of bodily waste constitutes a search); *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63, 66 (1st Cir. 2004) (holding that testing commercial wastewater does not constitute a search, but that some wastewater testing might be a search).

¹⁷⁰ See Gable et al., *supra* note 4, at 7 (providing that in circumstances under which wastewater testing of deeply personal medical information proves too individualized, testing may overstep individual privacy rights protected by the Fourth Amendment); *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61 (instructing governments on how to create wastewater monitoring methods); *National Wastewater Surveillance System (NWSS)*, *supra* note 33 (informing governments of any and all sizes on how to implement wastewater testing to document COVID-19 levels). The CDC’s online materials on NWSS only refer to wastewater monitoring occurring at a “community” level and leave vague the size of the population that the CDC targets. *National Wastewater Surveillance System (NWSS)*, *supra* note 33. The CDC notes that “[s]tate, local, tribal, and territorial health departments” can establish wastewater monitoring systems to contribute to NWSS, but provides no clear number as to the amount of people such a wastewater monitoring system might service. *Id.* The CDC, in its guidelines, adds that wastewater monitoring should occur by “sewershed,” which it defines as “the community area served by a wastewater collection system.” *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61. Still, the CDC does not indicate how big, or, more importantly, how small, a sewershed can or should be. *Id.*

testing untreated wastewater at wastewater treatment plants within the treatment plant's sewershed.¹⁷¹

Yet, the unofficial legal consensus remains that because individuals abandon their waste and wastewater runs "irretrievably" into public sewer systems, the government's sampling of wastewater does not amount to a search.¹⁷² The CDC's wastewater testing protocols suggest testing wastewater when it reaches wastewater treatment plants, which certainly renders the wastewater "irretrievable[e]."¹⁷³ This even remains true for sampling conducted on private property by the government because individuals likely legally abandon their wastewater and their waste will inevitably reach a public sewer system.¹⁷⁴

Moreover, testing wastewater when it reaches a wastewater treatment plant does not result in a high degree of individualization.¹⁷⁵ *Riverdale Mills Corp.*, though concluding on its particular facts that the wastewater sampling conducted by the EPA did not constitute a search, addresses the issue of individualization, noting that if collection and analysis of samples become too individualized, the sampling could qualify as a search.¹⁷⁶ The court uses a relatively extreme example to demonstrate this concept—explaining that the collection and analysis of wastewater flowing from a dwelling occupied by a single person would likely qualify as a search.¹⁷⁷ This person not only has a valid expectation of confidentiality over her biological matter, but can also be easily identified as the only source of the tested substance.¹⁷⁸ The wastewater sampled from a wastewater sewage treatment plant, however, would include the wastewater of many different residences, as well as other commercial build-

¹⁷¹ *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61. The CDC has made this information easily available for communities to access online and outlines the monitoring process in significant detail, such as providing the temperature at which communities should ship samples for laboratory testing. *Id.*

¹⁷² *Riverdale Mills Corp.*, 392 F.3d at 66; *United States v. Spain*, 515 F. Supp. 2d 860, 867 (N.D. Ill. 2007); *United States v. Hajduk*, 396 F. Supp. 2d 1216, 1226 (D. Colo. 2005).

¹⁷³ *Riverdale Mills Corp.*, 392 F.3d at 66 (describing how wastewater becomes "irretrievable[e]" once it enters a public sewage system); *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61; *National Wastewater Surveillance System (NWSS)*, *supra* note 33. Based on the standard set forth in *Riverdale Mills Corp.*, one could not recover wastewater once it reaches a municipal treatment plant. *Riverdale Mills Corp.*, 392 F.3d at 66.

¹⁷⁴ *See Riverdale Mills Corp.*, 392 F.3d at 66 (opining that testing industrial wastewater running into a public sewer system on private land is not a search); *Spain*, 515 F. Supp. 2d at 867 (emphasizing that the fact that the company had not taken measures to assert privacy over its wastewater resulted in the wastewater's abandonment); *Hajduk*, 396 F. Supp. 2d at 1226 (stating that a company does not retain privacy protections over wastewater "flowing irretrievably into a public sewer" system).

¹⁷⁵ *See Riverdale Mills Corp.*, 392 F.3d at 63 (articulating that monitoring the wastewater directly from a one-person residence would create more significant legal issues under the Fourth Amendment than would the monitoring of industrial wastewater flowing from a commercial plant).

¹⁷⁶ *See id.* (giving an example of an instance where monitoring would qualify as illegally individualized).

¹⁷⁷ *Id.*

¹⁷⁸ *Id.*

ings, thereby decreasing the degree of individualization such that the testing probably would not qualify as a search.¹⁷⁹

B. Current Legal Precedent Relating to Government Surveillance of Wastewater

As noted, the special needs doctrine may apply where a warrantless search occurred in violation of the Fourth Amendment so long as the search is conducted to benefit the health of the public.¹⁸⁰ Should a court find wastewater monitoring a warrantless search, a persuasive argument in favor of its legality would contend that pursuant to the special needs doctrine, the government conducted the monitoring with the purpose of combating the spread of COVID-19.¹⁸¹

This argument, however, fails to consider the potentially significant negative public health effects of wastewater monitoring.¹⁸² Where wastewater monitoring precipitates the implementation of stay-at-home orders and mandatory quarantines, these protective measures can have significant negative economic effects on relatively small populations of people.¹⁸³ Excluding from the labor force those who cannot afford to miss work or those who cannot work from home presents its own public health issues.¹⁸⁴ Given these negative consequences, courts would need to weigh the benefit to public health of tracking COVID-19 using wastewater monitoring methods against the harmful impacts of mandating “stay-at-home orders” based on wastewater data.¹⁸⁵

C. Public Higher Education Institutions’ Utilization of Wastewater Surveillance to Test for and Track COVID-19 on Campus

The wastewater tests conducted by public universities to test student wastewater for SARS-CoV-2 RNA may also constitute Fourth Amendment

¹⁷⁹ See Gable et al., *supra* note 4, at 7 (describing how sampling from an entire “catchment area” differs significantly from an individual residential sampling, with the latter having a potentially unconstitutional result).

¹⁸⁰ *Id.* at 8–9.

¹⁸¹ *Id.*

¹⁸² See *id.* at 2 (describing how stay-at-home orders can have negative socioeconomic repercussions).

¹⁸³ *Id.*

¹⁸⁴ Wilder, *supra* note 11, at 709; see Hillary Hoffower, *60% of Millennials Earning Over \$100,000 Say They’re Living Paycheck to Paycheck*, BUS. INSIDER, <https://www.businessinsider.com/high-earning-henry-millennials-six-figure-salaries-feel-broke-2021-6#:~:text=In%20a%20survey%20this%20June,middle%20class%20in%20the%20US> [https://perma.cc/UR3Q-MGNV] (Sept. 16, 2021) (explaining that many workers cannot afford to miss a paycheck). The pandemic heightened the unfortunate effects that socioeconomic position has on public health, and stay-at-home orders preventing individuals from working worsen these issues. Wilder, *supra* note 11, at 709.

¹⁸⁵ Gable et al., *supra* note 4, at 2, 9. Although the special needs doctrine could easily apply in legalizing the government’s monitoring of wastewater, imposing “broad restrictive measures” on large populations of people may cause financial hardship. *Id.*

searches.¹⁸⁶ The Supreme Court has addressed what qualifies as a search within the context of the school environment and what search measures the Fourth Amendment legally grants school officials.¹⁸⁷ The caselaw concerning school searches conducted on school grounds suggests that schools would not violate students' Fourth Amendment rights by conducting searches without warrants or probable cause.¹⁸⁸ In the 1985 Supreme Court case *New Jersey v. T.L.O.*, the Court emphasized that schools enjoy a more lenient standard than the typical probable cause standard in order to protect the safety of students and staff and to promote order.¹⁸⁹ Given COVID-19's significant impact on the operation of colleges and universities, conducting searches of students' wastewater might qualify as reasonable under these circumstances.¹⁹⁰

The relevant caselaw, however, falls short of the current issue.¹⁹¹ The Court in *T.L.O.* held that searches conducted by school officials had to properly weigh governmental and private interests in order to not violate students' Fourth Amendment rights.¹⁹² Yet, the analysis dictated by the Court in *T.L.O.* and other similar cases involved the search of a student's person and belong-

¹⁸⁶ Honda et al., *supra* note 19, at 3; see *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (describing how testing fewer numbers of people in their residences may qualify as a search).

¹⁸⁷ See *Safford Unified Sch. Dist. #1 v. Redding*, 557 U.S. 364, 370 (2009) (holding that a school official can execute a search with only "reasonable suspicion"); *New Jersey v. T.L.O.*, 469 U.S. 325, 340–41 (1985) (holding that a school official can only search a student without a warrant if the situation supports the search and the search remains within the severity of the situation).

¹⁸⁸ See *Redding*, 557 U.S. at 370, 375 (stating that searches in public schools need only abide by a reasonableness standard); *T.L.O.*, 469 U.S. at 340–41 (holding that a school official's search of a student without a warrant or probable cause is constitutional so long as the situation rationalizes the search and the search is within the radius of the circumstance).

¹⁸⁹ 469 U.S. at 342–43; see also *Redding*, 557 U.S. at 377.

¹⁹⁰ See *T.L.O.*, 469 U.S. at 341–42 (setting forth the lenient reasonable search standard for schools); Nadworny, *supra* note 71 (describing the harms of the COVID-19 pandemic on higher educational institutions, including the closure of campuses and isolation of students).

¹⁹¹ See *Redding*, 557 U.S. at 375 (addressing only the Fourth Amendment as it related to a school's search of a student's belongings and person that was conducted in response to student wrongdoing and not necessarily illness). The 2009 Supreme Court case *Safford Unified School District #1 v. Redding* concerned a search conducted by school staff of a thirteen-year-old girl. *Id.* at 368. Under suspicion that the student was in possession of and was distributing (legal) pain-relief medication that was not allowed on school grounds, the school assistant principal conducted a search of the student's belongings, uncovering no medication. *Id.* The student was then brought by the assistant principal and school administrative assistant to the nurse's office, where the student was required to undress to her undergarments for a more thorough search. *Id.* at 369. No medication was discovered. *Id.* The student's mother sued the school district, in addition to those responsible for the searches, alleging that the defendants infringed on the student's Fourth Amendment rights by making her undress. *Id.* The Supreme Court held that the search conducted by the school nurse violated the student's Fourth Amendment rights because the invasiveness upon the student's body (and accompanying circumstances, such as her young age) rendered the search unreasonable. *Id.* at 375–76.

¹⁹² 469 U.S. at 340–41.

ings, and not a student's trash or discarded material.¹⁹³ Further, the test provided in *T.L.O.* for determining whether a school acted reasonably in its search of a student applies contextually to searches carried out in response to a possible disciplinary or legal infraction.¹⁹⁴ Consequently, searches conducted by schools where no student has violated a school rule or law might not qualify as reasonable.¹⁹⁵

Furthermore, based on the *Riverdale Mills Corp.* concept of individuality, the sampling of untreated wastewater flowing directly from a student dormitory likely differs legally from the sampling of untreated wastewater from a wastewater treatment plant that services a population of over forty thousand.¹⁹⁶

For example, in the instance of one COVID-19 outbreak at the University of Arizona, SARS-CoV-2 RNA molecular markers identified in the wastewater of a student dormitory led to the clinical testing of the dormitory's 311 student residents.¹⁹⁷ The testing made clear which three students had COVID-19.¹⁹⁸ To that end, although the wastewater testing might not have been so individualized that it violated the students' Fourth Amendment rights, the subsequent identification of only three students infected with COVID-19 could run afoul of the *Riverdale Mills Corp.* court's concern with individualization.¹⁹⁹

¹⁹³ *Id.* at 328. In *T.L.O.*, a teacher at a public school identified two students smoking cigarettes, an activity against school policy, in the school bathroom. *Id.* A school administrator subsequently searched one of the student's belongings for evidence of cigarettes—a search that not only yielded a pack of cigarettes, but also marijuana and paraphernalia suggesting that the student had been selling marijuana. *Id.* This case importantly provides that public school students retain their constitutional rights on school grounds. *Id.* at 338. Nonetheless, the case, like *Redding*, only applies to a student's belongings and not to something a student intentionally discarded. *Redding*, 469 U.S. at 375–76; *T.L.O.*, 469 U.S. at 338.

¹⁹⁴ See 469 U.S. at 340 (applying an amended Fourth Amendment reasonableness standard to schools in the context of speculation that students are breaking the law and school rules).

¹⁹⁵ See *id.* at 340–41 (stating that schools may conduct searches when officials rationally believe a student has violated school rules or the law and when the search is not unnecessarily intrusive under the circumstances).

¹⁹⁶ See 392 F.3d 55, 63 (1st Cir. 2004) (describing how, as the government narrows the scope of its testing to smaller numbers of people, the government runs the risk of violating an individual's privacy expectations over wastewater); Nadworny, *supra* note 71 (describing the methodologies higher educational institutions have implemented to test wastewater for SARS-CoV-2 RNA to track COVID-19 on their campuses and identify hot spots); *Newtown Creek Water Pollution Control Plant*, WATER TECH., <https://www.water-technology.net/projects/newtown/> [<https://perma.cc/H5SE-4MEN>] (providing the number of people benefitted by a large wastewater treatment plant located in New York City).

¹⁹⁷ Honda et al., *supra* note 19, at 3.

¹⁹⁸ *Id.*

¹⁹⁹ See 392 F.3d at 63 (articulating individualization concerns with wastewater testing); Honda et al., *supra* note 19, at 3 (describing the implications of wastewater testing in dorms on student privacy).

III. WHETHER WASTEWATER MONITORING AS CONDUCTED BY GOVERNMENTS AND PUBLIC INSTITUTIONS VIOLATES THE FOURTH AMENDMENT

Section A of this Part explains the initial issue of whether wastewater monitoring constitutes a search and argues that government testing does not meet search requirements.²⁰⁰ Section B then assesses whether wastewater monitoring conducted specifically by public colleges and universities would be an unreasonable search in violation of the Fourth Amendment.²⁰¹ Finally, Section C presents suggestions for how schools can avoid violating students' Fourth Amendment rights when conducting wastewater tests.²⁰²

A. Whether Wastewater Monitoring Is a Search

To assess whether wastewater monitoring constitutes a Fourth Amendment search, this Section first assesses when wastewater monitoring constitutes a search when conducted by government bodies and subsequently assesses whether wastewater monitoring when conducted by public schools qualifies as a Fourth Amendment search.²⁰³

1. Whether Wastewater Monitoring Constitutes a Search When Conducted by Government Bodies

The CDC's NWSS initiative and the way in which different levels of government currently implement WBE would not violate individuals' Fourth Amendment rights because government wastewater monitoring would not amount to a search.²⁰⁴ Although the Supreme Court has held that individuals possess a reasonable expectation of privacy over their bodily waste, the CDC's recommended sampling method is more akin to what occurred in 2004, in the First Circuit Court of Appeals' *Riverdale Mills Corp. v. Pimpare* decision and similar cases, because the wastewater "irretrievably" runs into a public sewer system to a treatment plant and contains the wastewater of many different residences.²⁰⁵

²⁰⁰ See *infra* notes 203–237 and accompanying text.

²⁰¹ See *infra* notes 238–244 and accompanying text.

²⁰² See *infra* notes 245–259 and accompanying text.

²⁰³ See *infra* notes 204–220 and 221–237 and accompanying text.

²⁰⁴ See *Riverdale Mills Corp.*, 392 F.3d at 66 (characterizing the sampling of commercial waste in which an authority could not identify individual bodily waste that flows into a public sewer system as not a search); *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61 (detailing how collection occurs once wastewater reaches a wastewater treatment plant); *National Wastewater Surveillance System (NWSS)*, *supra* note 33 (describing how NWSS aims to monitor communities for COVID-19 and not individual people or households).

²⁰⁵ *Skinner v. Ry. Labor Execs.' Ass'n*, 489 U.S. 602, 617 (1989); *Riverdale Mills Corp.*, 392 F.3d at 66 (holding that no expectation of privacy exists over wastewater running directly into a public

In its sampling guidelines, the CDC suggests that community officials test wastewater at sewage treatment plants.²⁰⁶ The wastewater, when it reaches a sewage treatment plant, includes the wastewater from many residences and commercial buildings.²⁰⁷ This provides sufficient anonymity for individuals whose community might monitor wastewater, and they would not have a reasonable expectation of privacy over the wastewater at that point in the treatment process.²⁰⁸ Despite the fact that a sampling of one's bodily waste can qualify as a search, whether or not a search has occurred with regards to wastewater very much depends on the circumstances surrounding the sampling.²⁰⁹ Moreover, although the samples taken from sewage treatment plants may originate from residences, the high number of residences serviced by the plant would render any particular individual unidentifiable.²¹⁰

The public nature of the NWSS's wastewater SARS-CoV-2 RNA information does not necessarily violate the Fourth Amendment, but might have negative impacts on certain communities.²¹¹ The CDC Data Tracker can indicate the amount of SARS-CoV-2 RNA present in wastewater in populations as small as counties.²¹² The CDC's data could never identify an individual, of course, but a community could suffer from public identification as a hotspot for COVID-19.²¹³ This could lead to humiliation and ostracism for populations publicly deemed unclean—a phenomenon that could become more problematic as wastewater monitoring becomes more widely available for increasingly smaller populations of people.²¹⁴

sewer system); *United States v. Spain*, 515 F. Supp. 2d 860, 867 (N.D. Ill. 2007) (same); *United States v. Hajduk*, 396 F. Supp. 2d 1216, 1226 (D. Colo. 2005) (same); *People v. Elec. Plating Co.*, 683 N.E.2d 465, 466 (Ill. App. Ct. 1997) (same); *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61 (providing instructions to communities on how to test wastewater for COVID-19 once wastewater reaches wastewater treatment plants); *National Wastewater Surveillance System (NWSS)*, *supra* note 33 (providing information on how sampling occurs at wastewater treatment plants).

²⁰⁶ *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61.

²⁰⁷ *Id.*

²⁰⁸ *See Riverdale Mills Corp.*, 392 F.3d at 63 (explaining that monitoring the wastewater of one person provides individualized data that might constitute a search).

²⁰⁹ *See Skinner*, 489 U.S. at 617 (holding that testing the bodily fluids of individuals qualifies as a search); *Riverdale Mills Corp.*, 392 F.3d at 63 (describing different circumstances where wastewater sampling might constitute a search).

²¹⁰ *See Honda et al.*, *supra* note 19, at 2 (describing how wastewater surveillance occurs at a “regional” level in the “catchment” of a wastewater treatment plant); Rolf Halden, *Are You Entitled to Privacy Over Your Pee and Poop?*, SLATE (Aug. 28, 2021), <https://slate.com/technology/2021/08/beauty-surge-response-wastewater-epidemiology.html> [<https://perma.cc/95QH-VB55>] (explaining that, although biomarkers exist in feces, identifying specific individuals out of the larger population of a building or community is infeasible).

²¹¹ *Honda et al.*, *supra* note 19, at 4.

²¹² *COVID Data Tracker: Wastewater Surveillance*, *supra* note 56.

²¹³ *Honda et al.*, *supra* note 19, at 4.

²¹⁴ *Id.*

Additionally, considering Justice Alito's 2012 concurrence in *United States v. Jones*, the amount of time over which wastewater monitoring occurs may also bear on whether the monitoring violates the Fourth Amendment.²¹⁵ The NWSS specifically encourages state and local health departments to implement testing methods to track COVID-19 levels in communities long-term.²¹⁶ Researchers have already coordinated continued wastewater testing for other viruses and diseases over the next three to five years.²¹⁷ Thus, the CDC's explicit goal of long-term monitoring would make such monitoring less likely to pass constitutional muster.²¹⁸ And, even if the government's monitoring were to qualify as a search, government monitoring may fall well within the parameters of the special needs doctrine to protect human life.²¹⁹ Regardless, neither a special needs doctrine analysis nor a reasonableness analysis applies under these circumstances because the government action does not constitute a search to begin with.²²⁰

2. Whether Wastewater Monitoring Constitutes a Search When Conducted by Public Schools

Wastewater monitoring conducted by public universities would likely constitute a Fourth Amendment search.²²¹ Although government agents have been taking samples from wastewater sewage treatment plants that service residences and commercial buildings, universities have been sampling wastewater from individual dorms.²²² For example, the testing of wastewater flowing directly from a student dorm of thirty students provides far more individualized data and provides less privacy than the testing for SARS-CoV-2 RNA at a

²¹⁵ See 565 U.S. 400, 431 (2012) (9-0 decision) (Alito, J., concurring) (determining that the long duration of time over which the government surveilled a vehicle contributed to the government's violation of the Fourth Amendment).

²¹⁶ Anthes, *supra* note 82.

²¹⁷ *Id.*

²¹⁸ See *Jones*, 565 U.S. at 431 (Alito, J., concurring) (including the length of time of surveillance as a factor in determining whether a Fourth Amendment violation has occurred).

²¹⁹ See Gable et al., *supra* note 4, at 8–9 (describing the weighing of the public health benefits and economic costs from stay-at-home orders and other COVID-19 safety measures).

²²⁰ See *supra* note 204 and accompanying text (concluding that the government's monitoring methods fall short of wastewater searches that caselaw has indicated may infringe on reasonable expectations of privacy).

²²¹ See *New Jersey v. T.L.O.*, 469 U.S. 325, 333–34 (1985) (holding that public school officials are state actors and, therefore, required to abide by the Fourth Amendment in executing searches); *Tinker v. Des Moines Indep. Cmty. Sch. Dist.*, 393 U.S. 503, 506 (1969) (holding that students on public school grounds have the same constitutional rights as they would off school grounds); *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (describing how, as the government samples the wastewater of increasingly fewer individuals for sensitive biological information, such sampling might constitute a Fourth Amendment search); WOLF, *supra* note 117, at 1 (providing that students have Fourth Amendment rights while on public school grounds).

²²² Honda et al., *supra* note 19, at 3; Nadworny, *supra* note 71.

wastewater sewage treatment plant servicing a population of over forty thousand.²²³ Therefore, wastewater monitoring conducted on individual dormitories more closely resembles the unconstitutional wastewater testing in *Riverdale Mills Corp.*, as well as the testing in the 1989 Supreme Court case *Skinner v. Railway Labor Executives' Ass'n*.²²⁴

Additionally, universities' intentions in wastewater monitoring differ from the government's.²²⁵ The CDC provides that the NWSS intends to monitor the presence of COVID-19 in different regions to create a composite national surveillance system.²²⁶ Accordingly, the government could use wastewater data to take public health action in response to outbreaks.²²⁷ Universities do not share these goals nor do they use the data they receive from testing the same way.²²⁸ Schools test dormitory wastewater not to monitor COVID-19, but to actively identify infected students.²²⁹ This strips students of the privacy that they could reasonably expect in their temporary homes.²³⁰

²²³ Honda et al., *supra* note 19, at 2–3 (describing the difference between the monitoring of an entire catchment area versus the monitoring of dorm wastewater and identifying infected students); *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61 (recommending sampling from a catchment area). Bennington College provides one example of a situation in which wastewater monitoring would likely invade students' privacy. See *Housing*, BENNINGTON COLL., <https://www.bennington.edu/life-bennington/housing> [<https://perma.cc/5L9P-H7X3>] (explaining that students reside in houses with only thirty to forty-five students per house). If, for example, Bennington College implemented a wastewater monitoring system similar to the University of Arizona's, which sampled wastewater directly from separate dormitories, the sampling could be too individualized. See *Riverdale Mills Corp.*, 392 F.3d at 63 (explaining that state actors would more likely violate the Fourth Amendment by testing the wastewater coming from residences where only few individuals reside); Honda et al., *supra* note 19, at 3 (describing University of Arizona's wastewater testing procedures).

²²⁴ See *Skinner*, 489 U.S. 602, 617 (1989) (describing how individuals have privacy rights over their own bodily waste); *Riverdale Mills Corp.*, 392 F.3d at 63 (stating that a hypothetical circumstance wherein the government tested wastewater running from a single residence and, therefore, stripped the occupant of anonymity might implicate the Fourth Amendment).

²²⁵ See Honda et al., *supra* note 19, at 2 (explaining that communities generally aim not to identify infected individuals, but rather to identify the virus in sewer catchment areas to track the spread of the virus and identify new variants); Nadworny, *supra* note 71 (explaining that public universities use wastewater testing to maintain in-person classes).

²²⁶ *National Wastewater Surveillance System (NWSS)*, *supra* note 33.

²²⁷ *Developing a Wastewater Surveillance Sampling Strategy*, *supra* note 61.

²²⁸ See Honda et al., *supra* note 19, at 2–3 (detailing how the University of Arizona used dormitory wastewater data to implement a COVID-19 testing regimen to identify infected students); Nadworny, *supra* note 71 (describing how universities test dormitory wastewater to identify students infected with COVID-19).

²²⁹ Honda et al., *supra* note 19, at 2–3; Nadworny, *supra* note 71. At Colorado State University, after SARS-CoV-2 RNA was identified in the wastewater of a dormitory, the school tested the residents of the dormitory with the intent to find the source of the infection. Nadworny, *supra* note 71.

²³⁰ See *Dow Chem. Co. v. United States*, 476 U.S. 227, 237–38 (1986) (providing that the area around a residence enjoys a privacy expectation that society is willing to accept as reasonable); *Riverdale Mills Corp. v. Pimpare*, 392 F.3d 55, 63 (1st Cir. 2004) (describing how sampling the wastewater of a private residence without a warrant or consent would constitute a search).

A court, therefore, when deciding whether the wastewater monitoring conducted by a public school violates students' Fourth Amendment rights, should conclude that such monitoring constitutes a search.²³¹ Schools step outside the constitutional limits provided in *Riverdale Mills Corp.* on wastewater testing by making the process entirely individualized.²³²

The Supreme Court's incorporation of voluntariness as an important factor in its Fourth Amendment analysis also affects the legality of the wastewater monitoring conducted by schools.²³³ Society requires students to make use of university campus sewage systems much like it requires individuals to release cell phone data to wireless carriers.²³⁴ The State of Michigan, for example, has made the littering of infectious waste a felony.²³⁵

Justice Alito's *Jones* concurrence also applies to wastewater testing conducted by public schools in that it identifies a temporal component in determining whether monitoring qualifies as a search.²³⁶ As with government monitoring, school monitoring over an extended period would increase the degree of intrusion on individual privacy and thereby make the school's monitoring less constitutionally sound.²³⁷

²³¹ See *Skinner v. Ry. Labor Execs.' Ass'n*, 489 U.S. 602, 617 (1989) (providing that individuals have heightened privacy rights over their bodily waste); *Dow Chem. Co.*, 476 U.S. at 237–38 (describing how individuals have a reasonable expectation of privacy over the curtilage of their residences); *New Jersey v. T.L.O.*, 469 U.S. 325, 333 (stating that schools must adhere to certain reasonableness standards when conducting searches on students); *Tinker v. Des Moines Indep. Cmty. Sch. Dist.*, 393 U.S. 503, 506 (holding that students retain their constitutional rights while on school property); *Riverdale Mills Corp.*, 392 F.3d at 63 (describing how testing the wastewater of individual residences could constitute a Fourth Amendment search).

²³² See 392 F.3d at 63 (suggesting that the monitoring of wastewater flowing from a residence could qualify as a Fourth Amendment search); *Honda et al.*, *supra* note 19, at 3 (describing how the University of Arizona used its wastewater data to locate COVID-19-positive students using medical information these students provided to the school). This concern does not exist for private schools, however. See *Commonwealth v. Considine*, 860 N.E.2d 673, 676, 678 (Mass. 2007) (explaining that private school administrators are not government actors and, thus, not subject to Fourth Amendment constraints), *abrogated by* *Commonwealth v. Smith*, 28 N.E.3d 385 (Mass. 2015).

²³³ See *Carpenter v. United States*, 138 S. Ct. 2206, 2210 (2018) (holding that an individual does not abandon a reasonable expectation of privacy over certain personal information despite providing such information to a third party if they are involuntarily providing that information).

²³⁴ See *id.* (holding that owning a cell phone and using wireless carrier services is necessary to live a modern lifestyle); *States with Littering Penalties*, NAT'L CONF. STATE LEGISLATURES, <https://www.ncsl.org/research/environment-and-natural-resources/states-with-littering-penalties.aspx> [<https://perma.cc/YG2A-36T6>] (Mar. 21, 2022) (listing the many states that prohibit littering).

²³⁵ *States with Littering Penalties*, *supra* note 234; see *Infectious Waste/Biological Waste*, CASE W. RSRV. UNIV., <https://case.edu/ehs/waste-disposal/infectious-wastebiological-waste> [<https://perma.cc/US5S-X69L>]. Infectious waste includes bodily fluids. *Infectious Waste/Biological Waste*, *supra* (defining infectious waste).

²³⁶ See 565 U.S. 400, 431 (2012) (9-0 decision) (Alito, J., concurring) (identifying a positive correlation between the length of time over which the government conducts monitoring and the likelihood that such monitoring is a search).

²³⁷ See *id.* (concluding that "lengthy monitoring" may "intrude on a constitutionally protected sphere of privacy").

B. Whether Wastewater Monitoring Conducted by Public Schools, if a Search, Violates the Fourth Amendment

If the testing of wastewater conducted by a school on a student dormitory qualifies as a search, such a search is likely unreasonable within the meaning of the Fourth Amendment.²³⁸ Notably, the relatively lenient parameters for what constitutes a reasonable search in the public school setting, set forth in the 1985 Supreme Court decision *New Jersey v. T.L.O.*, exist to promote the safety and security of the school.²³⁹ Although COVID-19 certainly creates a safety concern for students and staff, the *T.L.O.* test applies to legal or disciplinary violations, not illnesses.²⁴⁰

Additionally, the breadth of the search in relation to the danger of COVID-19 might render the search unreasonable.²⁴¹ The Supreme Court's 2009 holding in *Safford Unified School District #1 v. Redding* provides an example of when the potential danger of a situation did not warrant the invasiveness of the search the school conducted.²⁴² Here, the danger of COVID-19 relative to the invasive nature of the search renders the search unreasonable.²⁴³ Under *Skinner*, where the Court characterized the testing of bodily waste as particularly intrusive, public universities thus exceed the scope of reasonableness in testing student wastewater for SARS-CoV-2 RNA.²⁴⁴

²³⁸ See *Carpenter*, 138 S. Ct. at 2210 (holding that an individual does not abandon a reasonable expectation of privacy over personal information given to a third party involuntarily); *Safford Unified Sch. Dist. #1 v. Redding*, 557 U.S. 364, 370 (2009) (providing that if a school employee conducts an unnecessarily invasive search on a student, the search violates the Fourth Amendment); *Skinner v. Ry. Execs.' Ass'n*, 489 U.S. 602, 617 (1989) (stating that people have a heightened expectation of privacy over their bodily waste); *New Jersey v. T.L.O.*, 469 U.S. 325, 341 (1985) (holding that schools must conduct searches in a manner that is not overly intrusive to the student and that falls within the severity of the circumstances).

²³⁹ See 469 U.S. at 341 (stating that "the accommodation of the privacy interests of schoolchildren with the substantial need of teachers and administrators for freedom to maintain order in the schools does not require strict adherence to the requirement that searches be based on probable cause . . .").

²⁴⁰ See *id.* at 340 (creating a standard for reasonable searches in the context of school code or legal violations).

²⁴¹ See *Redding*, 557 U.S. at 396 (disallowing searches that prove overly invasive); *Skinner*, 489 U.S. at 617 (describing the testing of bodily waste as an intrusive act); *T.L.O.*, 469 U.S. at 341 (allowing schools to search students so long as the searches are not overly intrusive).

²⁴² 557 U.S. at 376.

²⁴³ See *id.* (stating that the school's search of the student's person proved too invasive in comparison to the low degree of danger associated with naproxen).

²⁴⁴ See *id.* (holding that schools must not perform searches on students that are overly prodding); *Skinner*, 489 U.S. at 617 (holding that the testing of bodily waste is inherently intrusive); Honda et al., *supra* note 19, at 2–3 (describing how a public university tests the bodily waste of its students to help identify students positive for COVID-19).

C. Protecting Public Health While Protecting Privacy

To avoid future litigation, schools should standardize the ways in which they conduct wastewater monitoring for SARS-CoV-2 RNA.²⁴⁵ Universities currently conduct their monitoring in significantly different ways—from university professors collecting wastewater into disposable cups for their own edification to more formal administrative efforts to contain the virus.²⁴⁶ Some samples are sent off-campus to be tested whereas other universities analyze the samples themselves.²⁴⁷ Because wastewater can be tested for many different viruses and diseases, as well as other sensitive medical information, schools should implement policies and procedures regarding what specific tests they are permitted to perform on the samples they collect.²⁴⁸ Additionally, testing should be conducted not by professors interested in the data for intellectual purposes, but by school administrations.²⁴⁹

Skinner exemplifies this issue.²⁵⁰ Despite the fact that urine samples were to only be tested for illicit substances, the Court took into consideration the different health conditions that could also be identified in a urine sample.²⁵¹ The nature of the sample, then, and the confidential medical information it might expose, has the potential to render a test unconstitutional.²⁵² Therefore,

²⁴⁵ See Honda et al., *supra* note 19, at 2–3 (showing how schools can abuse the ability to test student wastewater for SARS-CoV-2 RNA by divulging the private medical information of individual students); Nadworny, *supra* note 71 (describing how some universities rely on cities or other universities to assist with certain steps in their wastewater monitoring methods, but largely implement testing programs independently without support).

²⁴⁶ See Honda et al., *supra* note 19, at 2–3 (detailing a wastewater monitoring program implemented by a university administration to methodically use wastewater data before clinical testing); Nadworny, *supra* note 71 (describing an individual professor’s wastewater sampling process).

²⁴⁷ Nadworny, *supra* note 71.

²⁴⁸ See *Skinner*, 489 U.S. at 617 (categorizing the testing of bodily waste as a search and bodily waste as containing confidential medical information); Honda et al., *supra* note 19, at 2–3 (providing an example of a methodology to combat COVID-19 on campuses that violates students’ Fourth Amendment rights).

²⁴⁹ See *Skinner*, 489 U.S. at 617 (characterizing the testing of bodily fluids as invasive). Currently, multiple schools employ wastewater monitoring techniques that are carried out by professors and students. Nadworny, *supra* note 71; see Simpkins, *supra* note 77 (describing how at University of Colorado Boulder students and professors conduct the testing of student waste to track COVID-19 trends). Differently, the school administration at Eastern Michigan University heads the efforts to monitor COVID-19. Larcom, *supra* note 77. Administrations, as opposed to independent researchers and students themselves, should control the testing of student waste due to the sensitivity of the data. See *Skinner*, 489 U.S. at 617 (describing the testing of bodily waste as invasive and data collected from bodily waste as sensitive information).

²⁵⁰ See 489 U.S. at 617 (characterizing bodily waste as sensitive information and the testing of bodily waste as a Fourth Amendment search).

²⁵¹ *Id.* at 617, 620.

²⁵² See *id.* at 617 (characterizing bodily waste as containing confidential information and the testing of bodily waste as a Fourth Amendment search).

schools should implement strict guidelines on the types of tests allowed to be conducted on wastewater samples.²⁵³

Additionally, schools should avoid using wastewater data to seek out students who are positive for COVID-19.²⁵⁴ Although, after identifying SARS-CoV-2 RNA in a dorm, schools might take certain measures to keep the identities of those students who tested positive for COVID-19 private, it is unlikely that the students' identities could be kept entirely private from their peers and professors.²⁵⁵ To address this issue, schools could initiate clinical nasopharyngeal testing for a dormitory without expressly acknowledging that dormitory wastewater showed molecular markers of SARS-CoV-2 RNA.²⁵⁶ Alternatively, schools could mandate a dormitory-wide quarantine without requiring that students receive clinical tests.²⁵⁷

A court could certainly use the analysis set forth in the 1988 Supreme Court case *California v. Greenwood*, especially in conjunction with the precedent set forth in *Skinner*, to determine that students retain a certain expectation of privacy over their waste, even though they willingly abandon it.²⁵⁸ Students have little choice other than to utilize the sewage infrastructure offered on the university campus, and a school could be found to have violated students' reasonable expectation of privacy by testing their wastewater.²⁵⁹

²⁵³ See *id.* (construing the testing of bodily waste as a Fourth Amendment search).

²⁵⁴ See Gable et al., *supra* note 4, at 7 (arguing that sampling wastewater in a way that can expose an individual's testing status is unconstitutional).

²⁵⁵ See Nadworny, *supra* note 71 (providing that students who are positive for COVID-19 must be moved to separate housing or isolation). Therefore, identifying the person or people who have tested positive and are being forced to quarantine would likely be easy. *Id.*

²⁵⁶ See Honda et al., *supra* note 19, at 3 (detailing a methodology of using student wastewater data that would violate the Fourth Amendment). Schools could still conduct wastewater testing for COVID-19 as the University of Arizona does, but should not then conduct nasopharyngeal clinical tests on students in a dormitory to single out who has COVID-19. *Id.*

²⁵⁷ See *id.* (exemplifying the differing approach the University of Arizona took in using student wastewater data in response to evidence of a COVID-19 outbreak).

²⁵⁸ *Skinner*, 489 U.S. at 617; *Greenwood*, 486 U.S. 35, 40–41 (1988) (describing how those who place their garbage on the street do not have a reasonable expectation of privacy because they could reasonably expect that the public would have access to the garbage). Looking to *Greenwood*, in contrast with trash left on the sidewalk, students on a university campus would not have the expectation that the public would have access to their sewage. *Greenwood*, 486 U.S. at 40–41. The principle in *Skinner* heightens this differentiation from *Greenwood* because the waste in question consists of bodily waste and not simply household trash. See *Skinner*, 489 U.S. at 617 (holding that individuals have a heightened expectation of privacy over their bodily waste); *Greenwood*, 486 U.S. at 40–41 (declining to find that individuals have a reasonable expectation of privacy over their garbage left on the sidewalk).

²⁵⁹ See *Carpenter v. United States*, 138 S. Ct. 2206, 2210 (2018) (holding that people retain a reasonable expectation of privacy over personal information if a person provides that information to a third party involuntarily); *Greenwood*, 486 U.S. at 54–55 (6–2 decision) (Brennan, J., dissenting) (opining that the plaintiff did not voluntarily abandon his trash on the street for the public to see and that the plaintiff retained a reasonable expectation of privacy over his garbage).

CONCLUSION

Although implementing wastewater monitoring protocols to detect Coronavirus 2 (SARS-CoV-2) RNA, the virus responsible for causing the COVID-19 pandemic, has myriad significant benefits, doing so under certain circumstances may violate individuals' Fourth Amendment privacy rights. The CDC, in its initiative to encourage communities to implement their own wastewater monitoring systems, risks encouraging wastewater monitoring where data becomes too individualized in communities with small populations. Courts have addressed the issue of whether commercial wastewater testing by the government for industrial chemicals constitutes a search and violates the Fourth Amendment, and have overwhelmingly agreed that it does not. Courts have not yet addressed whether testing wastewater specifically for human pathogens would yield the same result, but have noted that individuals have a reasonable expectation of privacy over their bodily waste. The special needs doctrine, given the benefits wastewater monitoring offers in terms of maintaining public health, might shield the government from Fourth Amendment violations. Wastewater monitoring in communities does not likely violate individuals' Fourth Amendment rights because of the low degree of individualization for such monitoring given the large population serviced by wastewater treatment plants. Conversely, public universities, in monitoring student dormitory wastewater, significantly heighten this individualization to the degree that it likely violates students' privacy. In addressing this issue, schools should implement strict sampling protocols and take measures to protect students' identities in the process. Provided the government and universities address these concerns, wastewater monitoring may continue to serve as a useful tool in tracking and combating the spread of the COVID-19 pandemic.

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