

A DROP IN THE BUCKET: NORTH CAROLINA'S NEGLECTED PROBLEM OF PRIVATE WELL WATER CONTAMINATION*

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In the U.S., an estimated 42.5 million people—about 13% of the nation's population—obtain their drinking water from private wells. While the Safe Drinking Water Act protects those served by public water systems from unsafe levels of contamination in their water, limited legal protection exists for private well users, leaving them susceptible to adverse effects from this contamination. This problem pervades North Carolina, which contains one of the largest populations of private well users out of all states and has few laws or rules addressing private well contamination. To examine private well contamination in North Carolina and inform possible solutions to this issue, we outline the scientific and social context of private well ownership in the state; discuss both federal and state drinking water legislation and rules; and compare North Carolina's private well regulations to those of New Jersey, a state noted for having strong private well policy relative to other areas of the country. Based on these findings, we recommend that: 1) the North Carolina General Assembly create a tiered system of financial support to give all private well owners the option to test, maintain, and treat their wells; 2) the

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North Carolina General Assembly, administrative agencies, and local health departments improve well owner education and outreach; 3) communities on the outskirts of municipalities excluded from public water service receive dedicated assistance; and 4) the North Carolina General Assembly require lessors to periodically test wells, report results to current and prospective tenants, and mitigate discovered contamination. Implementing these recommendations will help give all North Carolinians access to safe drinking water.

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INTRODUCTION

On its website, the Centers for Disease Control and Prevention (CDC) proclaims that “[t]he United States is fortunate to have one of the safest public drinking water supplies in the world.”¹ Public water systems, which can generally be described as systems providing drinking water that serve at least twenty-five people or have at least fifteen service connections,² have become heavily regulated and monitored since the passage of the Safe Drinking Water Act (“SDWA”) of 1974.³ Although there are notable exceptions, such as the recent Flint, Michigan, water crisis,⁴ public water systems have dramatically

1. *Public Water Systems*, CDC, <https://www.cdc.gov/healthywater/drinking/public/index.html> (last reviewed Mar. 30, 2021).

2. 42 U.S.C. § 300f(4)(A).

3. *See* 42 U.S.C. §§ 300f–300j.

4. In 2014, as part of a cost-saving measure, Flint began using the Flint River as the city’s water source. Over the next couple of years, *Escherichia coli*, total coliform bacteria, disinfection byproducts, and—most significantly—extremely high lead levels were detected in the city’s water. These findings resulted in the discovery that Flint’s children had elevated blood lead levels likely caused by Flint’s water source change. Various criminal charges (including false pretenses, conspiracy, involuntary manslaughter, obstruction of justice, misconduct in office, tampering with evidence, and violating Michigan’s SDWA) have been brought against sixteen city and state officials since 2016. For several reasons, including the acceptance of plea deals by certain officials as well as the prosecution’s decision to restart its investigation in 2019, most of these charges have ultimately been dismissed, though the prosecution team plans to “continue its pursuit of justice for Flint” and appeal recent dismissals that were based on the Michigan Supreme Court’s finding that certain indictments were invalid. Michelle Watson & Amanda Musa, *Criminal Charges Against Former Michigan Gov. Rick Snyder Related to Flint Water Crisis to Be Dismissed*, CNN (Dec. 13, 2022, 12:56 PM), <https://www.cnn.com/2022/12/13/us/flint-michigan-rick-snyder-water-crisis/index.html>; Associated Press, *A Michigan Judge Drops Felony Charges Against 7 People in Flint Water Scandal*, NPR (Oct. 5, 2022, 4:04 AM), <https://www.npr.org/2022/10/05/1126884708/a-michigan-judge-drops-felony-charges-against-7-people-in-flint-water-scandal>; Rebecca Beitsch & Rachel Frazin, *Prosecutors Drop Flint Water Charges, Restart Investigation*, THE HILL (June 13, 2019, 2:30 PM), <https://thehill.com/policy/healthcare/state-issues/448419-prosecutors-drop-flint-water-charges-restart-investigation/>; Paul Egan, *These Are the 15 People Criminally Charged in the Flint Water Crisis*, Detroit Free Press (June 14, 2017, 5:34 PM),

improved since the SDWA's enactment.⁵ However, the SDWA does not protect the estimated 42.5 million people—about 13% of the U.S. population—that obtain their drinking water from private wells.⁶ Rather than a comprehensive regulatory system, domestic drinking water wells are frequently governed by a patchwork of state and local rules and guidelines that often do little, if anything, to protect those who rely on them.

Private well users in North Carolina face this lack of regulation and protection. Despite North Carolina having one of the largest populations—both as a percentage and in total—that utilizes private wells for drinking water out of any state,⁷ well owners receive little support or guidance in properly maintaining and addressing problems with their wells. There were virtually no regulations pertaining to private well water in the state until after 2006, when North Carolina passed needed legislation on the construction and testing of new private drinking wells.⁸ However, this legislation addresses only one small part of well ownership. North Carolinians remain vulnerable to domestic well water contamination and the health threats associated with that contamination.

<https://www.freep.com/story/news/local/michigan/flint-water-crisis/2017/06/14/flint-water-crisis-charges/397425001/>; Merrit Kennedy, *Lead-Laced Water In Flint: A Step-By-Step Look At The Makings Of A Crisis*, NPR (Apr. 20, 2016, 6:39 PM), <https://www.npr.org/sections/thetwo-way/2016/04/20/465545378/lead-laced-water-in-flint-a-step-by-step-look-at-the-makings-of-a-crisis>; Mona Hanna-Attisha, Jenny LaChance, Richard Casey Sadler, & Allison Champney Schnepf, *Elevated Blood Lead Levels in Children Associated With the Flint Drinking Water Crisis: A Spatial Analysis of Risk and Public Health Response*, 106 AM. J. PUB. HEALTH 283, 283, 285 (2016).

5. See Richard Weinmeyer, Annalise Norling, Margaret Kawarski, & Estelle Higgins, *The Safe Drinking Water Act of 1974 and Its Role in Providing Access to Safe Drinking Water in the United States*, 19 AMA J. ETHICS 1018, 1021–22 (2017) (“Before the passage of the SDWA, many parts of the country did not have safe drinking water whereas now Americans enjoy some of the safest drinking water in the world”); see also Alan Roberson, *The Middle-Aged Safe Drinking Water Act*, 106 J. AM. WATER WORKS ASS'N 96, 99–100 (2014); Joseph A. Cotruvo, *The Safe Drinking Water Act: Current and Future*, 104 J. AM. WATER WORKS ASS'N 57, 57, 60 (2012).

6. CHERYL A. DIETER, MOLLY A. MAUPIN, RODNEY R. CALDWELL, MELISSA A. HARRIS, TAMARA I. IVAHNENKO, JOHN K. LOVELACE, NANCY L. BARBER, & KRISTIN S. LINSEY, USGS, ESTIMATED USE OF WATER IN THE UNITED STATES IN 2015, at 22 (2018), <https://doi.org/10.3133/cir1441>.

7. *Id.* at 23.

8. See North Carolina Well Construction Act, 2006 N.C. Sess. Laws 202 (codified as amended at N.C. GEN. STAT. § 87-97 (2022)).

This paper aims to review private well contamination, usage, and policies in North Carolina and offer possible statutory and administrative solutions to begin addressing the problems facing North Carolina's domestic well users. Part I outlines the science of water contamination in North Carolina's private wells and examines the historic and current landscape of private well usage in the state. Part II explores the federal statutory and regulatory protections for public water supplies and compares them to current North Carolina statutes, rules, and guidelines related to private well ownership. Part III offers a brief case study of New Jersey, a state that is widely considered to have some of the strongest private well water regulations in the country.

Finally, Part IV provides several recommendations on how North Carolina can alter its regulatory framework to improve protections for residents who rely on private well water. These suggestions include: 1) expanding the current financial support offered to private well users; 2) improving education and outreach related to proper well maintenance; 3) offering dedicated aid to communities on the outskirts of municipalities excluded from public water service; and 4) amending the state disclosure and private well management laws to protect tenants from contamination. Private well water contamination is a pervasive but largely under-discussed threat in North Carolina. To ensure all North Carolinians can understand the contents of their water, access safe drinking water, and avoid the potential adverse health effects of contaminated water consumption, the North Carolina General Assembly must bring this issue into the public focus and act to improve North Carolina's statutory structure.

I. BACKGROUND

A. *Public and Private Water Systems in the U.S.*

Purification and regulation of the water supplied by public water systems, particularly municipal water systems, have long been associated with significant public health benefits. Shortly after the adoption of clean water and sanitation technologies in urban areas in the early 1900s, there was a sharp reduction in disease-related mortality in cities across the U.S. that can largely be attributed to the introduction of these new technologies.⁹ Today,

9. David Cutler & Grant Miller, *The Role of Public Health Improvements in Health Advances: The Twentieth-Century United States*, 42 DEMOGRAPHY 1, 13–14 (2005) (finding

U.S. residents served by public water systems are also protected by the SDWA of 1974 and its 1986 and 1996 amendments.¹⁰ Under the SDWA, the U.S. Environmental Protection Agency (“EPA”) is authorized to set national, health-based standards for drinking water known as maximum contaminant levels (“MCLs”).¹¹ The EPA has implemented these enforceable drinking water standards for over 90 contaminants.¹² Water suppliers must regularly test water systems to ensure these contaminants are not present in excess of their MCLs, and the EPA, states, and water suppliers also conduct various protective measures to help prevent future contamination of public water supplies.¹³ When water systems do not meet safety standards, water suppliers must notify customers and take corrective action.¹⁴

Unlike communities served by public water systems, the SDWA does not protect communities that obtain their drinking water from private wells,¹⁵ which extract groundwater from underground layers of water-bearing permeable rock called aquifers.¹⁶ While domestic wells can provide high-quality drinking water if cared for properly, a substantial percentage of private wells may contain harmful levels of contaminants. State and national surveys over the past three decades have shown that, depending on the region and contaminants of study, 23–58% of private wells exceed at least one health-based drinking water standard.¹⁷ Municipal, agricultural, industrial,

that clean water technologies reduced mortality by 13% from 1900 to 1936 and that reduction in mortality from infectious disease accounted for about 75% of this decline).

10. See 42 U.S.C. § 300f.

11. See *id.* at § 300g-1(b)(1)(A).

12. *Regulation Timeline: Contaminants Regulated Under the Safe Drinking Water Act*, EPA 2 (2015) [hereinafter *Regulation Timeline*], https://www.epa.gov/sites/production/files/2015-10/documents/dw_regulation_timeline.pdf (last updated Sept. 2015).

13. Jacqueline MacDonald Gibson & Kelsey J. Pieper, *Strategies to Improve Private-Well Water Quality: A North Carolina Perspective*, 125 ENV'T HEALTH PERSPS. 076001-1, 076001-1 (2017); *Understanding the Safe Drinking Water Act*, EPA (June 2004), <https://www.epa.gov/sites/default/files/2015-04/documents/epa816f04030.pdf>.

14. *Id.*

15. See 42 U.S.C. § 300g; *Understanding the Safe Drinking Water Act*, *supra* note 13.

16. *Aquifers and Groundwater*, USGS, <https://www.usgs.gov/special-topics/water-science-school/science/aquifers-and-groundwater> (last updated Oct. 16, 2019).

17. LESLIE A. DESIMONE, USGS, QUALITY OF WATER FROM DOMESTIC WELLS IN PRINCIPAL AQUIFERS OF THE UNITED STATES, 1991–2004, at 1, 55 (2009), <https://pubs.usgs.gov/sir/2008/5227/> (reporting that, in an analysis of samples collected from 1,389 domestic wells nationwide during 1991–2004, about 23% of wells had at least one contaminant present at a concentration greater than an MCL or a USGS Health-Based

and residential activities can each contribute to groundwater pollution that may then result in contaminated domestic wells.¹⁸ Fertilizer and road salt runoff, waste disposal (including wastes from septic systems, landfills, and mines), and acid rain are just a few sources of anthropogenic pollution that can leach into groundwater; improperly stored or handled hazardous materials that leak or spill can also contribute to elevated groundwater contaminant levels.¹⁹ However, not all groundwater contamination is the result of human activities. Different types of geological materials are associated with specific groups of contaminants, such as arsenic and other heavy metals, that may permeate groundwater, and sickness-causing microorganisms from wildlife and soils may migrate into groundwater after accumulating in surface runoff.²⁰

B. *Groundwater Contamination in North Carolina*

North Carolina's geology shapes the naturally occurring private well water contamination across the state. North Carolina is divided into three physiographic provinces, each containing characteristic landforms and, often,

Screening Level (HBSL); out of 214 contaminants sampled, 154 had MCLs or HBSLs available for comparison); Lynda Knobloch, Patrick Gorski, Megan Christenson, & Henry Anderson, *Private Drinking Water Quality in Rural Wisconsin*, 75 J. ENV'T HEALTH 16, 17–18 (2013) (reporting that, in a 2007–2010 survey of 3,868 Wisconsin private wells tested for 16 contaminants with health-based water quality standards, 47% of wells exceeded at least one standard); Bryan R. Swistock, Stephanie Clemens, & Shawn Rummel, *Water Quality and Management of Private Drinking Water Wells in Pennsylvania*, 75 J. ENV'T HEALTH 60, 62 (2013) (reporting that, in a 2006–2007 survey of 701 Pennsylvania private wells tested for seven contaminants with health-based drinking water standards, 41% of wells exceeded at least one standard); Kelsey J. Pieper, Leigh-Anne H. Krometis, Brian L. Benham, Daniel L. Gallagher, & Marc Edwards, *Incidence of Waterborne Lead in Private Drinking Water Systems in Virginia*, 13 J. WATER & HEALTH 897, 900–01 (2015) (finding that, in an analysis of about 2,146 samples collected predominantly from Virginia private wells during 2012–2013 and tested for seven contaminants with MCLs, 58% of samples exceeded at least one MCL).

18. DMA 2000 HAZARD MITIGATION PLAN UPDATE – SUFFOLK COUNTY, NEW YORK, Section 5.4.6: Risk Assessment – Natural Groundwater Contamination 5.4.6-1 (April 2014), <https://www.southamptontownny.gov/DocumentCenter/View/3286/05-Section-546---Natural-Groundwater-Contamination-PDF>.

19. *Id.* at 5.4.6-1 to -2.

20. *Id.* at 5.4.6-2.

geology: the Coastal Plain, the Piedmont, and the Blue Ridge (Figure 1A).²¹ The state is also divided into smaller geologic belts (Figure 1B), regions with similar rock types and geologic histories.²² The specific geologic characteristics of these provinces and belts produce patterns in groundwater contamination. For example, the Carolina Slate Belt and Triassic Basins, both belts located in the Piedmont Province, are associated with wells that have detectable levels of arsenic.²³ Groundwater and private wells in these regions can contain arsenic concentrations over the MCL of 10 micrograms per liter ($\mu\text{g/L}$);²⁴ at times, arsenic levels may surpass 100, or even 500, $\mu\text{g/L}$.²⁵ Out of all belts, the Carolina Slate Belt and Triassic Basins were also found to have the highest probabilities—54% and 60%, respectively—of exceeding an arsenic concentration of 0.5 $\mu\text{g/L}$ in groundwater.²⁶ Although this concentration is lower than the current EPA enforceable standard, it is above arsenic’s EPA maximum contaminant level goal (MCLG) of 0 $\mu\text{g/L}$ —a level that is not enforceable but represents the contaminant concentration at which there is no expected health risk.²⁷ Consumption of well water with quantities of arsenic between the MCLG and MCL is still a public health concern. While long-term exposure to concentrations of arsenic above the MCL is associated

21. Rachel M. Coyte & Avner Vengosh, *Factors Controlling the Risks of Co-occurrence of the Redox-Sensitive Elements of Arsenic, Chromium, Vanadium, and Uranium in Groundwater from the Eastern United States*, 54 ENV’T SCI. & TECH. 4367, 4368 (2020).

22. *Id.* at 4368–69.

23. Dohyeong Kim, Marie Lynn Miranda, Joshua Tootoo, Phil Bradley, & Alan E. Gelfand, *Spatial Modeling for Groundwater Arsenic Levels in North Carolina*, 45 ENV’T SCI. & TECH. 4824, 4824–25 (2011); Alison P. Sanders, Kyle P. Messier, Mina Shehee, Kenneth Rudo, Marc L. Serre, & Rebecca C. Fry, *Arsenic in North Carolina: Public Health Implications*, 38 ENV’T INT’L 10, 15 (2012); *see id.* at 4369–70.

24. One microgram, symbolized as μg , is equal to one millionth of a gram (0.000001 g). One microgram per liter, symbolized as $\mu\text{g/L}$, is equal to 1 part per billion (ppb)—or about one drop of water in a swimming pool.

25. *See* Coyte & Vengosh, *supra* note 21, at 4369 (showing in Figure 2 the sampling sites with concentrations of arsenic above 10 $\mu\text{g/L}$ grouped in the Carolina Slate Belt and Triassic Basins); Lauren A. Eaves, Alexander P. Keil, Julia E. Rager, Andrew George, & Rebecca Fry, *Analysis of the Novel NCWELL Database Highlights Two Decades of Co-Occurrence of Toxic Metals in North Carolina Private Well Water: Public Health and Environmental Justice Implications*, 812 SCI. TOTAL ENV’T 1, 6–7 (2022).

26. The Triassic Basin dataset had limited observations compared to other datasets. Coyte & Vengosh, *supra* note 21, at 4370.

27. *National Primary Drinking Water Regulations*, EPA, <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations> (last updated Jan. 9, 2023).

with various health effects (including cancer, circulatory system problems, and skin damage),²⁸ any amount of exposure to carcinogens like arsenic could present a cancer risk,²⁹ and negative effects of chronic exposure to levels of arsenic below the MCL have been documented.³⁰

28. Dona Sinha & Priyanka Prasad, *Health Effects Inflicted by Chronic Low-Level Arsenic Contamination in Groundwater: A Global Public Health Challenge*, 40 J. APPLIED TOXICOLOGY 87, 88, 106, 108 (2020).

29. *Chemical Contaminant Rules*, EPA, <https://www.epa.gov/dwreginfo/chemical-contaminant-rules> (last updated Nov. 15, 2022); Coyte & Vengosh, *supra* note 21, at 4373.

30. Sinha & Prasad, *supra* note 28, at 88–120.

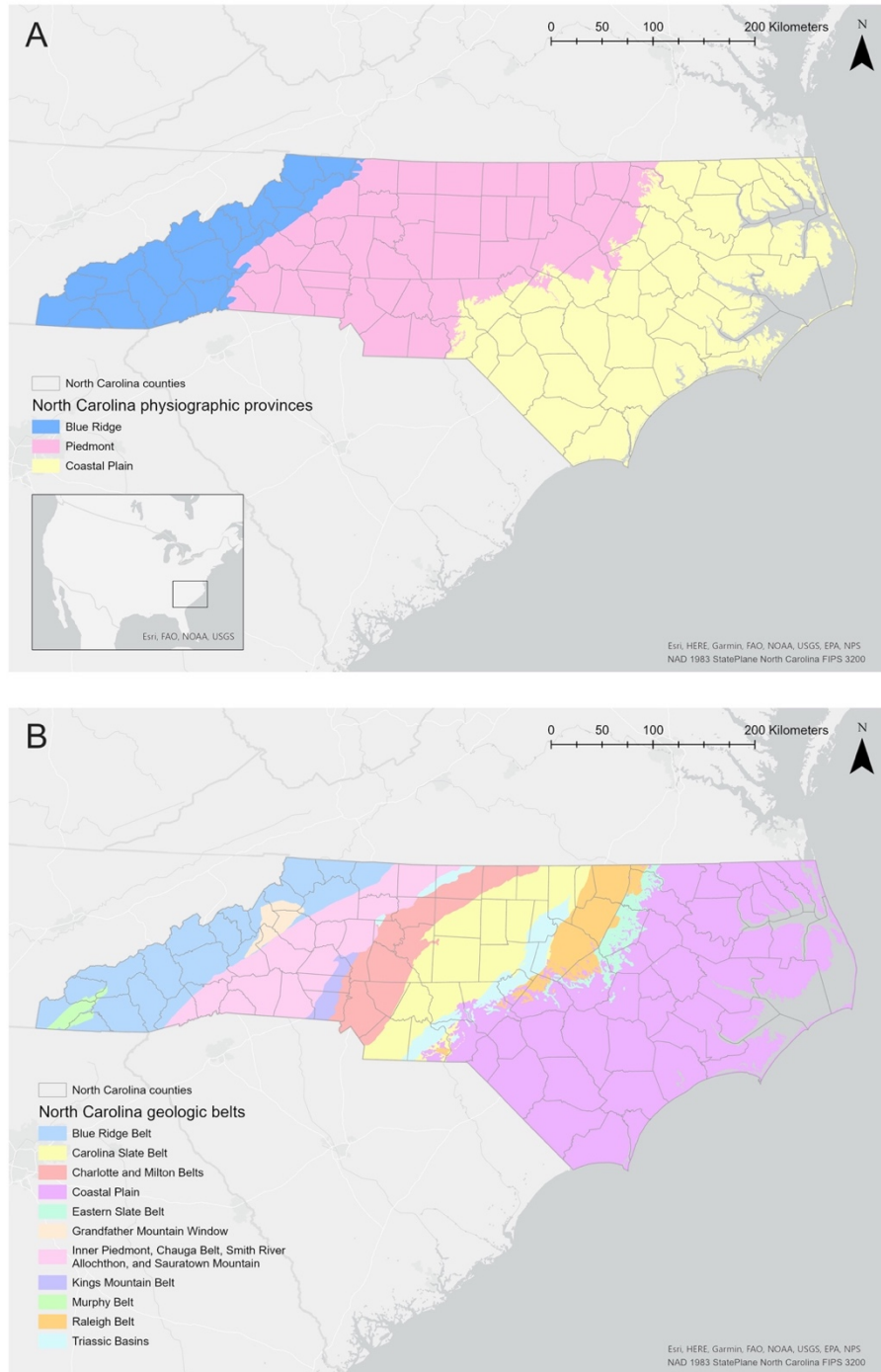


Figure 1 North Carolina's (A) physiographic provinces and (B) geologic belts. Physiographic provinces contain distinctive landforms and, often, geology; geologic belts encompass regions with similar rock types and geologic histories. The characteristics of these areas produce patterns in naturally occurring private well water contamination.

Other groundwater contaminants associated with North Carolina's geologic landscape also pose public health risks. Uranium and the gas into which it ultimately decays, radon, are both present in North Carolina groundwater and can cause serious health complications. Ingestion of high doses of uranium can damage kidneys.³¹ Radon—which can degas from water used for household tasks—can cause an increased risk of lung cancer when inhaled,³² although the EPA has not yet set a radon MCL.³³ There is also some evidence that inhalation or ingestion of radon can elevate stomach cancer risk, though experts do not yet agree on the extent of this risk.³⁴ Approximately 25% of the Piedmont and Blue Ridge Provinces are underlain with rocks associated with elevated waterborne radon, and high radon concentrations in groundwater have been both observed and geostatistically modeled in certain areas of these provinces.³⁵ Parts of the Piedmont Province are also associated with detectable quantities of uranium in groundwater: Groundwater in both the Raleigh Belt and the Triassic Basins was found to have about a 40% probability of exceeding a uranium concentration of 0.5 µg/L,³⁶ a value higher than the EPA MCLG of 0 µg/L.³⁷

Contaminants from anthropogenic sources also threaten the health of North Carolinians. Both microbial contaminants—which include bacteria, viruses, and parasites—and nitrates can leach into groundwater from non-geologic sources and cause deleterious health effects for private well owners. Nearly all 2007–2013 North Carolina emergency department visits for acute gastrointestinal illness attributable to microbial drinking water contamination were found to be associated with private well contamination.³⁸ Meanwhile,

31. Kenneth G. Orloff, Ketna Mistry, Paul Charp, Susan Metcalf, Robert Marino, Tracy Shelly, Eric Melaro, Ann Marie Donohoe, & Robert L. Jones, *Human Exposure to Uranium in Groundwater*, 94 ENV'T RSCH. 319, 319 (2004).

32. Kyle P. Messier, Ted Campbell, Philip J. Bradley, & Marc L. Serre, *Estimation of Groundwater Radon in North Carolina using Land Use Regression and Bayesian Maximum Entropy*, 49 ENV'T SCI. & TECH. 9817, 9817 (2015); *Radon in Well Water*, N.C. DEP'T OF HEALTH & HUM. SERVS., <https://www.ncdhhs.gov/divisions/health-service-regulation/north-carolina-radon-program/radon-well-water> (last visited Jan. 5, 2023).

33. *National Primary Drinking Water Regulations*, *supra* note 27.

34. Messier et al., *supra* note 32, at 9817.

35. *Id.* at 9818, 9822–23.

36. *See supra* note 26.

37. *National Primary Drinking Water Regulations*, *supra* note 27.

38. Nicholas B. DeFelice, Jill E. Johnston, & Jacqueline MacDonald Gibson, *Reducing Emergency Department Visits for Acute Gastrointestinal Illnesses in North Carolina (USA) by Extending Community Water Service*, 124 ENV'T HEALTH PERSPS. 1583,

concentrations of nitrate above its MCL of 10 mg/L in drinking water can cause methemoglobinemia, a potentially fatal condition that reduces the blood's ability to carry oxygen, in infants.³⁹ Exposure to super- and sub-MCL nitrate concentrations may be linked to increased risks of other adverse health effects, such as colorectal cancer and neural tube defects, although more research is needed to confirm these associations.⁴⁰

Septic systems are one possible source of both microbial and nitrate groundwater contamination. Nearly 50% of North Carolina residents have been estimated to use septic systems.⁴¹ Because private wells and septic systems are commonly present in the same communities,⁴² many North Carolinians relying on septic systems likely also obtain drinking water from domestic wells. This link between private wells and septic systems can cause harmful contamination of drinking water: Septic systems can contribute to

1588 (2016) (finding that, of all 2007–2013 North Carolina emergency department visits for acute gastrointestinal illness attributable to microbial drinking water contamination, 99% were associated with private well contamination).

39. Mary H. Ward, Rena R. Jones, Jean D. Brender, Theo M. de Kok, Peter J. Wever, Bernard T. Nolan, Christina M. Villanueva, & Simone G. van Breda, *Drinking Water Nitrate and Human Health: An Updated Review*, 15 INT'L J. ENV'T RSCH. & PUB. HEALTH 1, 2, 7 (2018); Kyle P. Messier, Evan Kane, Rick Bolich, & Mark L. Serre, *Nitrate Variability in Groundwater of North Carolina Using Monitoring and Private Well Data Models*, 48 ENV'T SCI. & TECH. 10804, 10804 (2014).

40. Ward et al., *supra* note 39, at 19.

41. Emily Naylor, Charles Humphrey, Leslie Easter, & Guy Iverson, *Evaluation of Nitrate Concentrations and Potential Sources of Nitrate in Private Water Supply Wells in North Carolina*, 80 J. ENV'T HEALTH 16, 17, 22 (2018).

42. Laurel A. Schaidler, Janet M. Ackerman, & Ruthann A. Rudel, *Septic Systems as Sources of Organic Wastewater Compounds in Domestic Drinking Water Wells in a Shallow Sand and Gravel Aquifer*, 547 SCI. TOTAL ENV'T 470, 471 (2016).

the presence of microbial contaminants and,⁴³ in some cases, increased nitrate concentrations in nearby groundwater and private wells.⁴⁴

Agricultural operations may also cause microbial and nitrate groundwater contamination. The application of commercial nitrogen fertilizers to crops is a potential source of nitrate in groundwater.⁴⁵ In addition, animal wastes—especially those produced from concentrated animal feeding operations (CAFOs), where large quantities of livestock are raised in confined areas and manure is stored in outdoor pits or lagoons before application to agricultural fields as fertilizer—can contaminate nearby groundwater with both nitrate and bacteria.⁴⁶ These impacts are of particular

43. Heather M. Murphy, Shannon McGinnis, Ryan Blunt, Joel Stokdyk, Jingwei Wu, Alexander Cagle, Donna M. Denno, Susan Spencer, Aaron Firmstahl, & Mark A. Borchardt, *Septic Systems and Rainfall Influence Human Fecal Marker and Indicator Organism Occurrence in Private Wells in Southeastern Pennsylvania*, 54 ENV'T SCI. & TECH. 3159, 3161, 3163, 3166 (2020); see Heather M. Murphy, Morgan D. Piroleau, Mark A. Borchardt, & Paul D. Hynds, *Review: Epidemiological Evidence of Groundwater Contribution to Global Enteric Disease, 1948–2015*, 25 HYDROGEOLOGY J. 981, 986, 995 (2017) (identifying septic systems/municipal sewage as one of the main causes of pathogen intrusion into groundwater during both disease outbreaks and non-outbreak conditions in a global review of literature providing epidemiological evidence of the contribution of groundwater consumption to human enteric infection).

44. C. P. Humphrey, Jr., M. A. O'Driscoll, & M. A. Zarate, *Controls on Groundwater Nitrogen Contributions from On-Site Wastewater Systems in Coastal North Carolina*, 62 WATER SCI. & TECH. 1448, 1454–55 (2010); C.P. Humphrey, Jr., M. A. O'Driscoll, N. E. Deal, D. L. Lindbo, S. C. Thieme, & M. A. Zarate-Bermudez, *Onsite Wastewater System Nitrogen Contributions to Groundwater in Coastal North Carolina*, 76 J. ENV'T HEALTH 16, 19–21 (Dec. 2013); Guy Iverson, Michael A. O'Driscoll, Charles P. Humphrey, Jr., Alex K. Manda, & Eliot Anderson-Evans, *Wastewater Nitrogen Contributions to Coastal Plain Watersheds, NC, USA*, 226 WATER, AIR, & SOIL POLLUTION 1, 14 (Oct. 2015); e.g., Naylor et al., *supra* note 41, at 17, 22; see also Schaidler et al., *supra* note 42, at 479.

45. Naylor et al., *supra* note 41, at 21; see Messier et al., *supra* note 39, at 10808 (finding that, in a nonlinear regression model for spatial point-level and time-averaged groundwater nitrate concentrations in North Carolina wells, farm fertilizer was selected as a source of nitrate contamination in both private and monitoring wells); see also K. C. Stone, P. G. Hunt, F. J. Humenik, & M. H. Johnson, *Impact of Swine Waste Application on Ground and Stream Water Quality in an Eastern Coastal Plain Watershed*, 41 TRANSACTIONS ASAE 1665, 1665 (1998) (stating that excess nutrients applied to crops may be lost to the environment and leach into groundwater, especially in North Carolina's eastern Coastal Plain).

46. See Messier et al., *supra* note 39, at 10808 (finding that, in a nonlinear regression model for spatial point-level and time-averaged groundwater nitrate concentrations in North Carolina wells, swine lagoons and swine CAFOs were selected as sources of nitrate contamination in private wells and monitoring wells, respectively); see also Amy R. Sapkota,

concern in North Carolina, where pork is a major industry. The number of hogs in North Carolina increased rapidly from 1991 to 1998, launching the state from sixth to second in U.S. hog production⁴⁷—a rank it held until it was surpassed by Minnesota in 2020.⁴⁸ This explosive growth resulted in the establishment of thousands of CAFOs in North Carolina’s Coastal Plain, where they are most likely to affect poor North Carolinians of color without access to public water supplies: Areas in North Carolina with more poverty, higher percentages of nonwhite residents, and greater dependence on private wells have been found to be home to greater concentrations of CAFOs and hog waste.⁴⁹

While all these contaminants—both those that are naturally occurring, like arsenic, uranium, and radon, and those that may result from anthropogenic practices, like nitrate and microbes—pose threats individually when consumed in drinking water, they may be more dangerous together. Health-based guidelines and regulatory standards for drinking water are developed for single contaminants and often do not evaluate the combined effects of different contaminants.⁵⁰ Although additional systematic research is needed, it is possible that exposure to multiple contaminants can have synergistic negative health effects, resulting in toxicity levels beyond those that would be expected from each contaminant individually.⁵¹

Frank C. Curriero, Kristen E. Gibson, & Kellogg J. Schwab, *Antibiotic-Resistant Enterococci and Fecal Indicators in Surface Water and Groundwater Impacted by a Concentrated Swine Feeding Operation*, 115 ENV’T HEALTH PERSPS. 1040, 1043 (2007) (finding that groundwater located down gradient of a swine CAFO was contaminated with significantly higher levels of bacteria compared with groundwater located up gradient of the swine CAFO); *see also* Stone et al., *supra* note 45, at 1667, 1670.

47. Bob Edwards & Anthony E. Ladd, *Environmental Justice, Swine Production and Farm Loss in North Carolina*, 20 SOCIO. SPECTRUM 263, 264 (2000).

48. U.S. DEP’T OF AGRIC. NAT’L AGRIC. STATS. SERV. & N.C. DEP’T OF AGRIC. & CONSUMER SERV., 2021 NORTH CAROLINA AGRICULTURAL STATISTICS 41 (2021).

49. Steve Wing, Dana Cole, & Gary Grant, *Environmental Injustice in North Carolina’s Hog Industry*, 108 ENV’T HEALTH PERSPS. 225, 229 (2000); Bob Edwards & Anthony E. Ladd, *Race, Class, Political Capacity and the Spatial Distribution of Swine Waste in North Carolina, 1982–1997*, 9 N.C. GEOGRAPHER 51, 64 (2001)

50. *See* Coyte & Vengosh, *supra* note 21, at 4373.

51. *Id.* at 4367.

C. *Challenges to Safe Drinking Water Access*

For most of North Carolina's residents, access to clean drinking water is virtually guaranteed every time they turn on the faucet. Those residents receive their drinking water from heavily regulated municipal water supplies.⁵² However, many North Carolinians obtain their water from sources not regulated by the SDWA. Out of all U.S. states, North Carolina has the fifth-highest total number (about 2.41 million) and the twelfth-highest percentage (about 24%) of residents that rely on private wells for drinking water⁵³—wells regulated not by a comprehensive regulatory regime but by a patchwork of state laws.⁵⁴ For these individuals, consistent water quality monitoring and contamination mitigation are merely recommendations largely unbacked by State financial or technical support.⁵⁵

The large number of North Carolina residents who depend on lightly monitored private groundwater wells is particularly concerning given that the state is impacted by groundwater contamination from its geological landscape as well as its agricultural operations and septic systems.⁵⁶ Yet reliance on a private well is often not a choice but simply a fact of life. North Carolinians who want to receive water supplied by public systems face two primary obstacles to accessing that service: 1) geographical limitations and 2) the racial discrimination that is embedded in municipality structures and development practices.⁵⁷ These barriers, together with other compounding practical, social, and political factors,⁵⁸ have left numerous well users in the state without access to regulated water supplies and without the resources or knowledge to ensure their water is safe.

1. Geographical Limitations

While the benefits of regulated public water supplies are high, so too are the costs. In a survey of local decision-makers and stakeholders in three North Carolina communities lacking access to public water supplies, all participants referenced the high cost of extending water services, and direct

52. *See supra* notes 9–14 and accompanying text; *see also infra* Part II.A.2.

53. DIETER ET AL., *supra* note 6, at 23.

54. *See infra* Part II.B.

55. *See infra* Part II.B.

56. *See supra* Part I.B.

57. *See infra* Parts I.C.1, I.C.2.

58. *See infra* Part I.C.3.

monetary costs and benefits emerged as the leading factor influencing extension.⁵⁹ The farther a water line must be extended, the greater the expense, increasing the number of new fee-paying users required to help offset that expense.⁶⁰ This calculation is particularly unfavorable in rural areas, where lines must travel great distances to reach areas of low population density.⁶¹ North Carolina has the second-largest rural population of any state, so the expense of extending water lines to rural communities is likely partially responsible for the state's prevalence of private wells.⁶² Although some grants and loans are available to help alleviate the financial burden of water service extension, they can require onerous applications, and their receipt is not guaranteed.⁶³ Some officials may recognize the indirect benefits of extended public water services, such as the potential for additional economic development along service lines and reduced public health system costs.⁶⁴ However, these benefits—which are often more long term, less certain, and less quantifiable than the cost of water line construction and revenue from new customers—may not outweigh the expense of service extension for some decision makers, and public health benefits may be especially overlooked.⁶⁵

2. Racial Discrimination

While rural residents make up the majority of North Carolina's population that relies on private wells, about 28% of private well users are located in urban areas.⁶⁶ These North Carolinians often live in communities within blocks of the city water supply yet still do not have access to the clean

59. Julia Maria Naman & Jacqueline MacDonald Gibson, *Disparities in Water and Sewer Services in North Carolina: An Analysis of the Decision-Making Process*, 105 AM. J. PUB. HEALTH e20, e20–21 (2015).

60. *See id.* at e22; *see also* DeFelice et al., *supra* note 38, at 1589.

61. *See* Naman & MacDonald Gibson, *supra* note 59, at e20; DeFelice et al., *supra* note 38, at 1589.

62. *See* MacDonald Gibson & Pieper, *supra* note 13, at 076001-1.

63. *See* Naman & MacDonald Gibson, *supra* note 59, at e22 (“[T]here were barriers to this type of funding that included lack of availability, lengthy applications requiring extensive data, and the cooperation of city or county governments as the grant applicant . . .”).

64. *See* Naman & MacDonald Gibson, *supra* note 59, at e21, e25; DeFelice et al., *supra* note 38, at 1588.

65. *See* Naman & MacDonald Gibson, *supra* note 59, at e21–23, e25.

66. MacDonald Gibson & Pieper, *supra* note 13, at 076001-1.

water that is provided to nearby neighborhoods.⁶⁷ First formally documented in the late 1980s, the systematic exclusion of these majority-Black communities from small, southern municipality boundaries and services is known as “underbounding.”⁶⁸ Underbounded communities are often located in municipality extraterritorial jurisdictions (“ETJs”), areas just outside of municipal limits that remain subject to municipal development and planning regulations.⁶⁹ Municipal governments are not required to provide city services (including water service) to ETJs despite the control they exert over these areas, and ETJ community members are generally barred from voting in municipal elections.⁷⁰ Underbounding knits with other racially discriminatory housing laws and practices—from redlining and mandated racial residential segregation, which were pervasive until the widespread enforcement of the Civil Rights Act of 1964 and the Fair Housing Act, to modern exclusionary zoning ordinances—to fuel persistent racial injustice and segregation in U.S. communities.⁷¹ Segregated and underbounded communities are also vulnerable to other forms of environmental racism

67. Hannah Gordon Leker & Jacqueline MacDonald Gibson, *Relationship Between Race and Community Water and Sewer Service in North Carolina, USA*, 13 PLOS ONE 1, 3 (2018); Jacqueline MacDonald Gibson, Nicholas DeFelice, Daniel Sebastian, & Hannah Leker, *Racial Disparities in Access to Community Water Supply Service in Wake County, North Carolina*, 3 FRONTIERS PUB. HEALTH SERVS. & SYS. RSCH. 3, 4–5 (2014) (“Some unserved African American neighborhoods [in Wake County, North Carolina,] are completely enclosed by municipal boundaries. Further, in some cases, municipal boundaries bypass African American neighborhoods at the edge of town, extending to more distant communities that are not adjacent to town borders.”); Frank Stillo & Jacqueline MacDonald Gibson, *Exposure to Contaminated Drinking Water and Health Disparities in North Carolina*, 107 AM. J. PUB. HEALTH 180, 182 (2017).

68. Charles S. Aiken, *Race as a Factor in Municipal Underbounding*, 77 ANNALS ASS’N AM. GEOGRAPHERS 564, 564–65 (1987); Leker & MacDonald Gibson, *supra* note 67, at 3; MacDonald Gibson et al., *supra* note 67, at 3; Stillo & MacDonald Gibson, *supra* note 67, at 180.

69. Leker & MacDonald Gibson, *supra* note 67, at 3; MacDonald Gibson et al., *supra* note 67, at 3; UNC CTR. FOR CIV. RTS., *THE STATE OF EXCLUSION: AN EMPIRICAL ANALYSIS OF THE LEGACY OF SEGREGATED COMMUNITIES IN NORTH CAROLINA* 6 (2013).

70. Leker & MacDonald Gibson, *supra* note 67, at 3; UNC CTR. FOR CIV. RTS., *supra* note 69, at 6.

71. See UNC CTR. FOR CIV. RTS., *supra* note 69, at 4–8; Michele Okoh, *Forgotten Waters*, 111 GEO. L.J. (forthcoming Apr. 2023); James H. Johnson, Jr., Allan Parnell, Ann Moss Joyner, Carolyn J. Christman, & Ben Marsh, *Racial Apartheid in a Small North Carolina Town*, 31 REV. BLACK POL. ECON. 89, 89–92 (2004).

besides exclusion from regulated water supplies.⁷² For example, they may be targeted as sites for locally unwanted land uses, such as highway construction projects, municipal landfills, and power plants—structures and facilities that can endanger public health and decrease quality of life.⁷³ Additionally, these communities frequently do not have access to public sewer services and rely on septic systems, which can contribute to private well contamination.⁷⁴

Recent research provides statistical evidence that Black ETJ communities in North Carolina have been systematically denied access to municipal water services. While controlling for confounding variables like property value and population density, North Carolina studies have found that the higher the percentage of an ETJ community's population that is Black, the less likely that community is to have access to public water services.⁷⁵ For example, the results of Leker and MacDonald Gibson's statewide analysis demonstrated that ETJ areas with low (between 0 and 22%) Black population percentages had 85% higher odds of water service than census blocks that were 100% Black.⁷⁶ Meanwhile, communities with medium (between 22 and 50%) and high (between 50 and 100%) percentages of Black residents had odds of water service about 40% higher than 100% Black census blocks.⁷⁷ A study of Wake County, North Carolina, ETJs discovered that "every 10% increase in the African American population proportion within a census block increases the odds of exclusion from municipal water service by 3.8%."⁷⁸ The racial composition of neighboring municipalities also affects ETJ access to city services: Leker and MacDonald Gibson calculated that, "as the percent of the population that is white in the adjacent municipality increases, the odds of access to . . . [water and sewer] services in neighboring ETJs decrease."⁷⁹ Predominantly white municipalities in the

72. See UNC CTR. FOR CIV. RTS., *supra* note 69, at 6, 17; Johnson et al., *supra* note 71, at 89–92.

73. See UNC CTR. FOR CIV. RTS., *supra* note 69, at 6, 17–21; Johnson et al., *supra* note 71, at 91.

74. See MacDonald Gibson et al., *supra* note 67, at 5; Naman & MacDonald Gibson, *supra* note 59, at e20, e23–25; Stillo & MacDonald Gibson, *supra* note 67, at 180, 184; Leker & MacDonald Gibson, *supra* note 67, at 2–3, 10, 13–14.

75. Leker & MacDonald Gibson, *supra* note 67, at 1; MacDonald Gibson et al., *supra* note 67, at 3–4.

76. Leker & MacDonald Gibson, *supra* note 67, at 11.

77. *Id.*

78. MacDonald Gibson et al., *supra* note 67, at 2.

79. Leker & MacDonald Gibson, *supra* note 67, at 14.

South have also been found to be less likely to incorporate surrounding Black communities into municipal limits.⁸⁰

These disparities in access to public water systems among communities have real health impacts. A study of majority-Black ETJ communities in Wake County found that “29.2% of 171 private well tap water samples tested positive for total coliform bacteria and 6.43% for *Escherichia coli*, compared with 0.556% and 0.00850%[, respectively,] of municipal system samples.”⁸¹ This bacterial contamination has measurable effects on public health: Of the 2007–2013 North Carolina emergency department visits for acute gastrointestinal illness attributable to microbial drinking water contamination, 99% were found to be associated with private well contamination.⁸² Private well users and members of Black ETJ communities may also have heightened exposure to lead—a neurotoxin that contributes to irreversible cognitive and developmental impairment in children—in drinking water.⁸³ Children in Wake County homes relying on private wells had blood lead concentrations that were 20% higher, on average, than children in houses served by a community water system regulated under the SDWA; these children also had 25% higher odds of having elevated blood lead levels (that is, blood lead levels greater than 5 µg/dL).⁸⁴ Children’s blood lead concentrations also increased with the proportion of Black residents in their neighborhoods, and both blood lead concentrations and the risk of elevated blood lead levels were higher for children in ETJs.⁸⁵ Furthermore, a study of majority-Black ETJ communities in Wake County relying on private wells found that 28% of households and 15.5% of samples contained lead in excess of 15 parts per billion—percentages comparable to those in parts of Flint, Michigan, during the Flint

80. Daniel T. Lichter, Domenico Parisi, Stephen Michael Grice, & Michael Taquino, *Municipal Underbounding: Annexation and Racial Exclusion in Small Southern Towns*, 72 *RURAL SOCIO.* 47, 66–67 (2007).

81. Leker & MacDonald Gibson, *supra* note 67, at 2 (citing Stillo & MacDonald Gibson, *supra* note 67).

82. DeFelice et al., *supra* note 38, at 1588.

83. Jacqueline MacDonald Gibson, Michael Fisher, Allison Clonch, John M. MacDonald, & Philip J. Cook, *Children Drinking Private Well Water Have Higher Blood Lead Than Those With City Water*, 117 *PROC. NAT’L ACAD. SCIS. U.S.* 16898, 16903 (2020) [hereinafter “MacDonald Gibson et al., *Children*”].

84. *Id.* at 16903.

85. *Id.* at 16902–03.

water crisis.⁸⁶ This body of research demonstrates that exclusion from public water supplies caused by present and historic racial discrimination negatively affects the health of Black communities.

Communities dependent on private wells and disproportionately burdened by sources of groundwater contamination may also lack access to resources for well maintenance and contamination prevention. Black ETJ neighborhoods often rely on both septic systems and private wells, which are more likely to be contaminated with microbes and lead than city water systems;⁸⁷ these communities also tend to have lower incomes and home values.⁸⁸ In rural areas, groundwater-contaminating CAFOs and hog waste tend to be concentrated in poor areas of color that rely on private wells.⁸⁹ These overburdened communities may thus also have more difficulty affording septic tank maintenance—which could cause additional well contamination—as well as well testing, maintenance, and filtration.⁹⁰ Furthermore, the health effects of private well contamination disproportionately experienced by poor households, such as alterations in child cognitive development caused by lead exposure, could perpetuate intergenerational poverty.⁹¹

3. Compounding Factors

Several additional challenges compound the problems caused by lack of access to public water supplies and contribute to risks confronting the numerous North Carolina residents who rely on private well water. Three critical compounding factors are: 1) practical obstacles hindering proper well maintenance and inadequate information about private well contamination, 2) homeowners' lack of the political power and collective will necessary to exert a unified push for access to public systems, and 3) the limited national

86. Frank Stillo & Jacqueline MacDonald Gibson, *Racial Disparities in Access to Municipal Water Supplies in the American South: Impacts on Children's Health*, 10 INT'L PUB. HEALTH J. 309, 315, 320 (2018).

87. See *supra* notes 66–86 and accompanying text.

88. Leker & MacDonald Gibson, *supra* note 67, at 13–14; see MacDonald Gibson et al., *Children*, *supra* note 83, at 16898, 16901–02, 16904.

89. See *supra* notes 46–49 and accompanying text.

90. Naman & MacDonald Gibson, *supra* note 59, at e20, e23–25; Stillo & MacDonald Gibson, *supra* note 67, at 180, 184; Leker & MacDonald Gibson, *supra* note 67, at 2–3, 10, 13–14; MacDonald Gibson et al., *Children*, *supra* note 83, at 16904–05.

91. See MacDonald Gibson et al., *Children*, *supra* note 83, at 16904.

attention the issue of private well water contamination receives. These factors also help explain why, despite the health risks associated with untreated private well water consumption, expanding access to municipal water has not been a top priority in the state.

Misconceptions held by current private well water users can lead them to believe their water is safer than empirical evidence has demonstrated. Homeowners who rely on private well water often assume that they can determine the safety of their water through sight, smell, and taste;⁹² if well owners have not experienced an illness they attribute to their water, they may also feel confident in its safety.⁹³ Because homeowners believe that they can use their senses and well-being to monitor water quality, many only test their well water when motivated by sickness or a sensory cue.⁹⁴ Well owners may also forego testing if there is no known contamination in their neighborhood.⁹⁵ These misconceptions combine with concrete well maintenance barriers to cause most well owners to test their well water much less frequently than is recommended by state health officials.⁹⁶ For example, the costs associated with well water testing and possible subsequent necessary treatment; a lack of trusted, accessible resources about how to test, how often to test, and what contaminants to test for; and the inconvenience of testing—some rural homeowners may even have to take time away from work to travel long distances to testing laboratories during operating hours—are all practical impediments of proper well monitoring and maintenance.⁹⁷ Because many of the most harmful contaminants are detectable only through

92. Lucinda Morris, Steve Wilson, & Walton Kelly, *Methods of Conducting Effective Outreach to Private Well Owners – A Literature Review and Model Approach*, 14 J. WATER & HEALTH 167, 170–71 (2016); Chelsea Fizer, Wändi Bruine de Bruin, Frank Stillo, & Jacqueline MacDonald Gibson, *Barriers to Managing Private Wells and Septic Systems in Underserved Communities: Mental Models of Homeowner Decision Making*, 81 J. ENV'T HEALTH 8, 12 (2018); Frank Stillo, Wändi Bruine de Bruin, Catherine Zimmer, & Jacqueline MacDonald Gibson, *Well Water Testing in African-American Communities Without Municipal Infrastructure: Beliefs Driving Decisions*, 686 SCI. TOTAL ENV'T 1220, 1224, 1226 (2019).

93. Morris et al., *supra* note 92, at 172.

94. *Id.* at 170–72; Fizer et al., *supra* note 92, at 12; Stillo et al., *supra* note 92, at 1224, 1226.

95. Morris et al., *supra* note 92, at 171.

96. *See* Stillo et al., *supra* note 92, at 1223, 1225–26; Fizer et al., *supra* note 92, at 11–13; Morris et al., *supra* note 92, at 169, 171–72.

97. Morris et al., *supra* note 92, at 169–172; Stillo et al., *supra* note 92, at 1225–26; Fizer et al., *supra* note 92, at 13.

testing and not via sensory examination, homeowners often believe that their water quality is equal to—or better than—that of publicly supplied water.⁹⁸

These barriers and misconceptions can hinder unification of well-owning communities, which can prevent dissatisfied well users from gaining access to public water services. Viewing their water quality as comparable to or exceeding that of municipal water, some well owners believe that connecting to the public water supply would serve only to increase their monthly bills, decrease their control over their water quality and use, and leave them vulnerable to hypothetical disruptions to the city’s water system.⁹⁹ Although other private well owners desire municipal water, lack of support from neighbors that prefer wells decreases the likelihood that city officials will feel compelled to utilize their limited budget to extend public water services to a community.¹⁰⁰ Gaining access to public water supplies may be especially challenging when the community to be served must first receive approval from the city council to be incorporated into city limits, or annexed.¹⁰¹ The residents set to benefit from annexation are not current constituents of the council members, who may be voting against municipality fiscal interests by approving annexation.¹⁰² And since these residents are not represented in the local government that guides the public water system, they may ultimately need to look to the North Carolina General Assembly to force extension of service.

Although the benefits of public water system access are widely documented, they receive limited national attention. This dearth of attention is highlighted in the U.S. Department of Health and Human Services’ “Healthy People 2030” goals, which fail to include targets concerning public

98. Stillo et al., *supra* note 92, at 1223; Fizer et al., *supra* note 92, at 13; Morris et al., *supra* note 92, at 170–72.

99. Fizer et al., *supra* note 92, at 13; Naman & Gibson, *supra* note 59, at e24.

100. See Naman & Gibson, *supra* note 59, at e24 (“One challenge to community involvement was disagreements within communities between those desiring municipal services and those preferring wells and septic tanks.”).

101. E.g., *Annexations*, RALEIGH, <https://raleighnc.gov/planning/annexations> (last updated Nov. 8, 2022) (stating that the Raleigh, N.C., City Council is responsible for voting on annexation petitions).

102. See Russell M. Smith & Whitney B. Afonso, *Fiscal Impact of Annexation Methodology on Municipal Finances in North Carolina*, 47 GROWTH & CHANGE 664, 674–75, 677 (2016); Naman & MacDonald Gibson, *supra* note 59, at e22.

water supply expansion.¹⁰³ This recently updated initiative, which sets a wide variety of “data-driven national objectives to improve health and well-being over the next decade,” includes objectives to reduce health risks from hazardous sites, decrease arsenic and lead exposure, and increase (from 90.2 to 92.1%) the proportion of people served by community water systems whose water supply meets SDWA standards.¹⁰⁴ Despite the relationship of some goals to private well contamination and the initiative’s focus on further improving public water quality, it does not include any objectives related to improving public water supply access.¹⁰⁵ In addition to this neglect to nationally recognize the health benefits of public water systems, there have been recent high-profile incidents that have brought negative attention to these systems. While the Flint water crisis is the most notable instance of public water system failure,¹⁰⁶ as this paper is being written, there is also an ongoing water crisis in Jackson, Mississippi¹⁰⁷—like Flint, a majority-Black

103. *Environmental Health*, U.S. DEPT. OF HEALTH & HUMAN SERVS., <https://health.gov/healthypeople/objectives-and-data/browse-objectives/environmental-health> (last visited Feb. 3, 2023); *Neighborhood and Built Environment*, U.S. DEPT. OF HEALTH & HUMAN SERVS., <https://health.gov/healthypeople/objectives-and-data/browse-objectives/neighborhood-and-built-environment> (last visited Feb. 3, 2023).

104. *Environmental Health*, *supra* note 103; *Neighborhood and Built Environment*, *supra* note 103.

105. *Environmental Health*, *supra* note 103; *Neighborhood and Built Environment*, *supra* note 103.

106. *See supra* note 4.

107. Jackson’s neglected and aging water system prevents its residents from having consistent access to safe drinking water. High levels of lead remain in Jackson’s drinking water after first being discovered in 2016; in February and March of 2021, freezing temperatures caused water main leaks and breaks that forced some Jackson residents to live without water service for a month; and throughout 2021 and 2022, residents have grappled with service disruption, low water pressure, and numerous boil orders due to various water plant equipment problems. In late August of 2022, the Mississippi governor announced that Jackson’s water system may be beginning to fail and that officials had started “preparing for a scenario where Jackson would be without running water for an extended period.” *See* Alex Rozier & Bobby Harrison, *Jackson Water System is Failing; City Will be with no or Little Drinking Water Indefinitely*, MISS. TODAY (Aug. 29, 2022), <https://mississippitoday.org/2022/08/29/jackson-water-system-fails-emergency/>; Alex Rozier, *Boil and Conserve: Treatment Issues and Hot Weather Put Strain on Jackson Water*, MISS. TODAY (July 7, 2022), <https://mississippitoday.org/2022/07/07/boil-and-conserve-treatment-issues-and-hot-weather-put-strain-on-jackson-water/>; Maya Brown, ‘Water is a Human Right’: City of Jackson Still in Dire Need of Infrastructure Help to Fight Water Crisis, CNN (Apr. 19, 2022), <https://www.cnn.com/2022/04/19/us/jackson-mississippi-water-crisis/index.html>; Alex Rozier, *EPA Sends Jackson Another Notice Over Water*

city with a high poverty rate.¹⁰⁸ Protecting and improving public drinking water safety is critical, but with little acknowledgement of the tremendous benefits of modern public water systems in the U.S., the notoriety of public water system failures can further undermine interest in extending public water supplies. Furthermore, the need to fix existing public water systems and the need to increase the scope of public water service often have a root cause in common: a failure to prioritize the provision of safe, clean drinking water to poor communities of color.

II. REGULATORY OVERVIEW

A. Federal Statutory Framework

1. Water Quality Regulation before the SDWA

Prior to the twentieth century, concerns about drinking water quality focused on disease-causing microbes and cosmetic problems, such as undesirable appearance, taste, and smell.¹⁰⁹ In 1914, the U.S. Public Health Service developed standards for the quality of drinking water primarily to address these concerns.¹¹⁰ Around this same time, the broader use of clean water and sanitation technologies like filtration and chlorination made cleaner water possible and contributed to a steep decline in urban disease-related mortality rates.¹¹¹ By 1962, after several revisions, the Public Health Service standards had expanded to include 28 substances.¹¹² While not

Deficiencies, MISS. TODAY (Jan. 27, 2022), <https://mississippitoday.org/2022/01/27/epa-sends-jackson-another-notice-over-water-deficiencies/>; Julia James, *Jackson Water Crisis Again Impacts Schools*, MISS. TODAY (Jan. 27, 2022), <https://mississippitoday.org/2022/01/27/jackson-water-crisis-again-impacts-schools/>; Alex Rozier, *The EPA Chief Visited Jackson to Talk Water Solutions. Then the Water Went Out.*, MISS. TODAY (Nov. 16, 2021), <https://mississippitoday.org/2021/11/16/epa-michael-regan-visits-jackson-water-solutions/>; Anna Wolfe, *'A Profound Betrayal of Trust': Why Jackson's Water System is Broken*, MISS. TODAY (Mar. 24, 2021), <https://mississippitoday.org/2021/03/24/why-jacksons-water-system-is-broken/>.

108. Brown, *supra* note 107; Kennedy, *supra* note 4; Hanna-Attisha et al., *supra* note 4, at 284, 286.

109. EPA, 25 YEARS OF THE SAFE DRINKING WATER ACT: HISTORY AND TRENDS 1–2 (1999) [hereinafter “25 YEARS OF SDWA”], <https://www.hsdl.org/?abstract&did=449348>.

110. *Id.* at 2.

111. Cutler & Miller, *supra* note 9, at 5–6, 13–14.

112. 25 YEARS OF SDWA, *supra* note 109, at 2.

required, all 50 states adopted these standards either as regulations or guidelines for their public water systems.¹¹³ In the late 1960s, recognition of drinking water quality problems broadened further. New research made both lawmakers and the public aware of the wide variety of possible water contaminants (including those with anthropogenic sources) and the need for stricter enforcement of water quality regulations.¹¹⁴ This heightened awareness eventually produced the SDWA of 1974, which ensures safe drinking water for all those served by public water systems.¹¹⁵ However, partly because of the SDWA's lack of private well regulation, water quality improvement of domestic wells continues to lag.¹¹⁶

2. The SDWA

The SDWA regulates drinking water quality in public water systems through national primary drinking water regulations (“NPDWRs”).¹¹⁷ NPDWRs exist for contaminants that may cause adverse health effects when consumed,¹¹⁸ and each NPDWR contains an MCL for the contaminant to which it applies.¹¹⁹ When developing an NPDWR, the EPA sets a non-enforceable MCLG prior to determining the MCL.¹²⁰ According to the SDWA, the MCLG should be established “at the level at which no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety.”¹²¹ To set the MCLG at this specified level, the EPA considers only public health, reviewing data about the health effects of the contaminant.¹²² The EPA also takes into account vulnerable subpopulations when determining MCLGs. It weighs the effects of a contaminant on infants, children, the elderly, and those with compromised

113. *Id.*

114. *Id.*

115. *Id.*

116. *See infra* notes 158–62 and accompanying text.

117. 42 U.S.C. § 300g-1(b)(1)(A).

118. § 300f(1)(B).

119. § 300g-1(b)(4)(B).

120. *See* § 300g-1(a)(3).

121. § 300g-1(b)(4)(A).

122. *How EPA Regulates Drinking Water Contaminants: Once EPA decides to regulate a contaminant, how does the Agency develop a regulation?*, EPA [hereinafter *How EPA Regulates Drinking Water Contaminants*], <https://www.epa.gov/sdwa/how-epa-regulates-drinking-water-contaminants> (last updated Nov. 2, 2022).

immune systems and chronic diseases.¹²³ The category of contaminant is considered as well: Carcinogenic chemical contaminants without safe doses and harmful microbial contaminants have MCLGs of zero,¹²⁴ while MCLGs of chemical contaminants that can cause non-carcinogenic health effects are set at an amount where lifetime daily exposure is not expected to be harmful.¹²⁵ For example, as carcinogens that are not safe to ingest in any quantity, both uranium and arsenic have MCLGs of 0 µg/L.¹²⁶

Although MCLGs represent the best contaminant concentrations in drinking water from a public health perspective, they are not enforceable standards.¹²⁷ MCLs, on the other hand, are standards that can be enforced: They represent the maximum level of a contaminant in water that is legally allowed to be delivered to any user of a public water system.¹²⁸ The SDWA requires the EPA to set the MCL for each contaminant as close to its MCLG as is feasible with the best technology and treatment techniques.¹²⁹ However, an MCL may be established at a concentration other than this feasible level if the required technology would interfere with the treatment or regulation of other contaminants.¹³⁰ The EPA must also consider cost when setting MCLs.¹³¹ If the EPA determines during its required cost-benefit analysis that the benefits of implementing an MCL are not worth the costs, it may promulgate an MCL that maximizes health risk reduction benefits at a justifiable expense.¹³² MCLs are not in place for all regulated contaminants; if determining an MCL is not economically or technologically feasible, the EPA may instead require the use of specific water treatment techniques.¹³³ Additionally, states that meet EPA requirements have primary enforcement responsibilities under the SDWA and can adopt alternative MCLs—as long

123. *Id.*

124. *Id.* (However, “[i]f a chemical is carcinogenic and a safe dose can be determined, EPA sets the MCLG at a level above zero that is safe.”).

125. *Id.*

126. *Id.*; 40 C.F.R. §141.51(b); 40 C.F.R. §141.55.

127. *How EPA Regulates Drinking Water Contaminants*, *supra* note 122.

128. 42 U.S.C. § 300f(3).

129. § 300g-1(b)(4)(B); § 300g-1(b)(4)(D).

130. § 300g-1(b)(5)(A).

131. § 300g-1(b)(3)(C).

132. § 300g-1(b)(6)(A).

133. § 300g-1(b)(7)(A).

as those MCLs are not less stringent than the MCLs promulgated by the EPA.¹³⁴

The SDWA requires the EPA to review each existing NPDWR at least every six years.¹³⁵ During these “Six-Year Reviews,” the EPA evaluates new data and technology and, if necessary, makes regulatory revisions to NPDWRs.¹³⁶ These revisions must maintain or increase public health protections.¹³⁷ The NPDWRs of some contaminants that could particularly impact North Carolinians have been revised in past years. Prior to 2001, the MCL for arsenic was 50 µg/L.¹³⁸ In 2000, the EPA proposed a new MCL of 5 µg/L, along with an MCLG of 0 µg/L, and accepted public comments on possible alternative MCLs of 3, 10, and 20 µg/L.¹³⁹ Despite arsenic’s carcinogenic effects and low proposed MCLG, the EPA decided to set the MCL at 10 µg/L, higher than the feasible level of 3 µg/L and the originally suggested standard of 5 µg/L.¹⁴⁰ Cost was the primary reason for this choice.¹⁴¹ The EPA concluded that, while the benefits of implementing lower MCLs would not justify the increased expenses, an MCL of 10 µg/L would reduce chronic, low-level arsenic exposure and its associated health risks at a reasonable cost.¹⁴² NPDWRs are also periodically created for new contaminants. Since the SDWA was last amended in 1996, every five years the EPA must list contaminants not currently subject to any NPDWR and evaluate at least five to determine—based on their health effects, occurrence in public water systems, and potential for public health risk reduction through regulation—if they should be regulated.¹⁴³

3. The SDWA and Private Well Ownership

While the SDWA regulates public water systems to protect their customers, private well owners are solely responsible for the caretaking and

134. § 300g-2(a)(1).

135. § 300g-1(b)(9).

136. *Id.*; *How EPA Regulates Drinking Water Contaminants*, *supra* note 122.

137. § 300g-1(b)(9).

138. EPA, TECHNICAL FACT SHEET: FINAL RULE FOR ARSENIC IN DRINKING WATER 1 (2001), <https://nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=20001XXE.txt>.

139. *Id.* at 1–2.

140. *Id.* at 2.

141. *Id.*

142. *Id.*

143. 42 U.S.C. § 300g-1(b)(1)(B).

maintenance of their wells. Although domestic well users do not benefit from the enforcement of MCLs as those served by public water systems do, MCLs still guide private well water safety. Both the EPA and state agencies instruct private well owners to test their wells regularly and compare the results to federal and state MCLs.¹⁴⁴ However, recommended testing frequency as well as the contaminants to include when testing are not always consistent. The EPA encourages private well owners to test their wells annually for total coliform bacteria, nitrates, total dissolved solids, pH levels, and any other contaminants suspected based on water characteristics and local conditions.¹⁴⁵ The North Carolina Division of Public Health (“DPH”), meanwhile, recommends annual testing for total and fecal coliform bacteria; biennial testing for heavy metals, nitrates, nitrites, lead, and copper; and testing every five years for pesticides and volatile organic compounds.¹⁴⁶ DPH also notes that additional minerals or chemicals may be present in well water depending on the surrounding geology and land use.¹⁴⁷ Additionally, well owners are encouraged to reach out to their health departments and other local experts to obtain information about testing procedures and probable contaminants in their groundwater.¹⁴⁸ The discrepancies between federal and state advice, the requirement that private well owners evaluate and determine additional contaminants most necessary to test for, and the responsibility of initiating contact with local authorities placed on well owners are all significant challenges to proper well stewardship.

The complexity and quantity of SDWA standards are also obstacles to domestic well caretaking. With the existence of both state and federal MCLs that are periodically revised, the occasional use of treatment

144. *Protect Your Home’s Water*, EPA, <https://www.epa.gov/privatewells/protect-your-homes-water> (last updated Mar. 16, 2022); e.g., *Private Wells: Test Results*, N.C. DEP’T OF HEALTH & HUM. SERVS., https://epi.dph.ncdhhs.gov/oe/wellwater/understanding_results.html (last modified Nov. 17, 2021); *Test Your Private Well Water Annually*, WIS. DEP’T OF NAT. RES., <https://dnr.wisconsin.gov/topic/Wells/privateWellTest.html> (last visited Jan. 2, 2023); *GAMA - Domestic Well Testing*, CAL. WATER BDS., https://www.waterboards.ca.gov/gama/domestic_wells_testing.html (last updated Sept. 9, 2020).

145. *Protect Your Home’s Water*, *supra* note 144.

146. *Private Wells: Frequently Asked Questions about Testing*, N.C. DEP’T OF HEALTH & HUM. SERVS., <https://epi.dph.ncdhhs.gov/oe/wellwater/faqs.html> (last modified Nov. 18, 2021).

147. *Id.*

148. *Id.*; *Protect Your Home’s Water*, *supra* note 144.

techniques in lieu of MCLs, and the representation of public health goals in the form of MCLGs, private well owners have a convoluted landscape of safety regulations to navigate when testing. For example, if a domestic well user discovers that their water complies with a federal standard but not a more rigid state one, these differing standards could make it difficult for that user to determine if action is necessary. Or perhaps a well owner will examine the gap between an MCL and its corresponding MCLG and question if the health benefits of further reducing a contaminant's concentration justify the expense of water treatment. Furthermore, the number of regulated contaminants has risen from 22 in 1976 to 94 today.¹⁴⁹ While this increase is a positive public health development, it also means that self-regulation of private wells based on these standards has only gotten more difficult. Selecting what contaminants to test for and how frequently is likely challenging for private well owners, even if they do receive local health department guidance. While some health departments may provide testing for free,¹⁵⁰ others do not,¹⁵¹ so preserving the affordability of well care by testing for fewer contaminants may come at the price of safety. Additionally, test results may not indicate whether contaminants exceed state and federal standards.¹⁵² In this case, well owners will need to obtain copies of these standards and manually interpret their results.¹⁵³

Private well water treatment presents well owners with another set of hurdles. If a private well owner finds that the water in their well contains unsafe levels of certain contaminants, they will then need to research, purchase, and possibly personally install a filtration system that effectively removes those contaminants.¹⁵⁴ The well owner must first pay the up-front cost of the filtration system, which can range from approximately \$20 to

149. *Regulation Timeline*, *supra* note 12, at 2.

150. *See Protect Your Home's Water*, *supra* note 144.

151. *See, e.g., Well Water Tests Available Through Wake County*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing/well-water-tests-available-through-wake-county> (last visited Jan. 4, 2023).

152. *See Protect Your Home's Water*, *supra* note 144.

153. *Id.*

154. *See Choosing Home Water Filters & Other Water Treatment Systems: Step 3: Consider how the filter fits your home, lifestyle, and budget.*, CDC [hereinafter *Choosing Home Water Filters*], <https://www.cdc.gov/healthywater/drinking/home-water-treatment/water-filters/step3.html> (last reviewed Feb. 23, 2023).

thousands of dollars, depending on system type.¹⁵⁵ Then, they will need to maintain the filtration system and periodically replace its filters to ensure its consistent effectiveness¹⁵⁶—an additional cost that can amount to more than a hundred dollars per year.¹⁵⁷

The lack of federal private well regulation and the resulting money, time, and labor involved in private well ownership are all barriers to maintaining safe well water. It is thus unsurprising that, although private well owners are instructed to use SDWA regulatory standards as a guide to manage water quality, shifts in these standards may not actually impact contaminant concentrations in wells. A study examining the effects of the arsenic MCL revision, which went into effect in 2006, found that there was no change in the urinary arsenic concentrations of private well users between 2003 and 2014.¹⁵⁸ The urinary arsenic concentrations of public water users, however, significantly decreased during the same period.¹⁵⁹ Additionally, an analysis of waterborne disease outbreaks from 1971 to 2006—the time period when the SDWA was passed (and amended) and its number of regulated contaminants increased from 22 to 94¹⁶⁰—found that the annual proportion of outbreaks in public water systems decreased significantly during this time while the annual proportion of outbreaks associated with individual water systems increased.¹⁶¹ In addition to this evidence that private well water

155. *Id.*; e.g., Chauncey Crail & Lowe Saddler, *How Much Does A Reverse Osmosis System Cost?*, FORBES (Apr. 26, 2022), <https://www.forbes.com/home-improvement/home/reverse-osmosis-system-cost/>.

156. *Choosing Home Water Filters*, *supra* note 154; *Choosing Home Water Filters & Other Water Treatment Systems: Step 4: Maintain your filters.*, CDC, <https://www.cdc.gov/healthywater/drinking/home-water-treatment/water-filters/step4.html> (last reviewed Feb. 23, 2023).

157. *See, e.g.*, Crail & Saddler, *supra* note 155.

158. Anne E. Nigra, Tiffany R. Sanchez, Keeve E. Nachman, David E. Harvey, Steven N. Chillrud, Joseph H. Graziano, & Ana Navas-Acien, *The effect of the Environmental Protection Agency maximum contaminant level on arsenic exposure in the USA from 2003 to 2014: an analysis of the National Health and Nutrition Examination Survey (NHANES)*, 2 LANCET PUB. HEALTH e513, e520 (2017).

159. *See id.* at e518.

160. *Regulation Timeline*, *supra* note 12, at 2; *see supra* note 10 and accompanying text.

161. Gunther F. Craun, Joan M. Brunkard, Jonathan S. Yoder, Virginia A. Roberts, Joe Carpenter, Tim Wade, Rebecca L. Calderon, Jacquelin M. Roberts, Michael J. Beach, & Sharon L. Roy, *Causes of Outbreaks Associated with Drinking Water in the United States from 1971 to 2006*, 23 CLINICAL MICROBIOLOGY REVS. 507, 522 (2010).

quality does not respond to changes in SDWA standards like public water quality, other research documents the high percentage of private wells that do not align with current MCLs and other health-based water quality standards.¹⁶²

B. *North Carolina's Statutory Framework*

In 2013, a bill was introduced in the North Carolina General Assembly that would require local health departments to educate both citizens with new wells and citizens contacting the department regarding testing an existing well about testing requirements, options, and limitations as well as drinking water standards.¹⁶³ In support of this bill, House Bill 396, former North Carolina state representative Rick Catlin began his remarks on the House floor by boldly asserting, “[t]his is a bill that will save lives.”¹⁶⁴ Representative Catlin went on to state that “[u]nfortunately, some of our citizens have contaminated drinking wells, and presently the health department testing does not necessarily identify that problem.”¹⁶⁵ He then explained the personal importance of the bill, sharing that he “know[s] of children and families that have died in North Carolina from drinking contaminated water.”¹⁶⁶ However, Representative Catlin was also quick to point out that “[t]here are no mandatory requirements in this [bill], and there are no state costs.”¹⁶⁷ House Bill 396, or the Private Well Water Education Act, passed without objection in both the House and the Senate.¹⁶⁸

Representative Catlin’s statements effectively encapsulate North Carolina’s methods of private well water regulation. Unlike the SDWA, which mandates strict control and rigorous testing of public water supplies, North Carolina’s approach to regulating private well water is largely one of education and recommendations. DPH, the agency responsible for overseeing

162. *See supra* note 17 and accompanying text.

163. Private Well Water Education Act, 2013 N.C. Sess. Laws 122 (codified as amended at N.C. GEN. STAT. § 87-97(i) (2021)).

164. *House Documents 2013 Audio Archives: 04-08-2013.mp3*, N.C. GEN. ASSEMB., at 42:40 (Apr. 8, 2013), <https://webservices.ncleg.gov/ViewDocSiteFile/6857> (statements by Rep. Rick Catlin in the Second Reading in the House of H.B. 396).

165. *Id.* at 43:09.

166. *Id.* at 43:40.

167. *Id.* at 43:03.

168. *Id.* at 44:43; *H.B. 396*, 2013 GEN. ASSEMB., 2013 Session (N.C. 2013), <https://www.ncleg.gov/BillLookup/2013/h396> (last visited Jan. 3, 2023).

private wells, does not require the continued testing and monitoring of private wells or—more importantly—the provision of assistance with the costs and labor of this well maintenance; for the most part, it merely supplies recommendations as to the frequency and scope of well water testing.¹⁶⁹

1. The North Carolina Well Construction Act

In North Carolina, legal obligations related to private wells primarily affect well owners installing a new well or significantly altering an existing one. Enacted in 1967, Chapter 87 of the North Carolina General Statutes contains the North Carolina Well Construction Act (“NCWCA”).¹⁷⁰ The NCWCA requires that wells “conform to such reasonable requirements as may be necessary to protect the public welfare, safety, health, and groundwater resources.”¹⁷¹ Until 2006, the NCWCA predominantly governed the technical elements of well construction and abandonment.¹⁷² In 2006, House Bill 2873 was enacted to amend the NCWCA to include certain provisions specifically concerning “private drinking water wells,” which are defined as being intended to serve “14 or fewer service connections or . . . 24 or fewer individuals.”¹⁷³

The most significant element of H.B. 2873 was the creation of N.C.G.S. § 87-97, which established mandatory rules for the “[p]ermitting, inspection, and testing of private drinking water wells.”¹⁷⁴ Effective July 1, 2008, each county’s local health department is required to evaluate new private well sites, issue construction and repair permits, inspect completed wells, and test the water of new wells for certain contaminants within 30 days of well completion.¹⁷⁵ Local health departments are also tasked with the role of maintaining a registry of private wells permitted and tested under this program.¹⁷⁶ Additionally, health departments must share test results with new

169. See *Private Wells*, N.C. DEP’T OF HEALTH AND HUM. SERVS., <https://epi.dph.ncdhhs.gov/oec/programs/wellwater.html> (last modified Nov. 8, 2022).

170. N.C. GEN. STAT. §§ 87-83 to 87-98 (2021).

171. *Id.* at § 87-84.

172. See North Carolina Well Construction Act, 2006 N.C. Sess. Laws 202 (codified as amended at N.C. GEN. STAT. §§ 87-83 to 87-98 (2022)) (requiring the permitting, inspection, and testing of new private drinking water wells).

173. *Id.* at sec. 1, § 87-85.

174. *Id.* at sec. 4, § 87-97.

175. *Id.* at secs. 4, 8, § 87-97(d)–(h).

176. *Id.* at sec. 4, § 87-97(k).

private well owners (and, to the extent practicable, leaseholders served by the well at the time of sampling),¹⁷⁷ a provision that the 2013 Private Well Water Education Act ultimately expanded to mandate that health departments also deliver information regarding the scope of compulsory and optional testing with these results.¹⁷⁸ Further amendments to N.C.G.S. § 87-97 were also made in 2012 and 2013,¹⁷⁹ including a directive to adopt rules governing permits issued for private wells on proposed sites within 1,000 feet of a known source of contamination.¹⁸⁰

Under § 87-97, the North Carolina Commission for Public Health¹⁸¹ is responsible for making private well water testing rules;¹⁸² under § 87-87, the North Carolina Environmental Management Commission is charged with making private well permitting and inspection rules.¹⁸³ Each commission has delegated both rulemaking ability and regulatory oversight of private wells to the On-Site Water Protection Branch of the North Carolina Division of Public Health (“OSWPB”).¹⁸⁴ OSWPB coordinates with and assists local health departments in their administration and enforcement of private well permitting, inspection, and testing requirements.¹⁸⁵ To accomplish these tasks, OSWPB “provides statewide regulatory and consultative services related to both the wastewater and private drinking water wells to local health departments[,] . . . builders, developers, land owners, . . . and others.”¹⁸⁶

177. *Id.* at sec. 4, § 87-97(j).

178. Private Well Water Education Act, 2013 N.C. Sess. Laws 122, sec. 2–3, § 87-97(i)–(j), (codified as amended at N.C. GEN. STAT. § 87-97(i)–(j) (2021)).

179. Other 2013 amendments include a requirement for local health departments to issue or deny private well permits within 30 days of application receipt. Act of Aug. 23, 2013, 2013 N.C. Sess. Laws 413, sec. 35, § 87-97(e) (codified as amended at N.C. GEN. STAT. § 87-97(e) (2021)). A 2012 amendment provided considerations for the North Carolina Commission of Public Health in the event they choose to initiate rulemaking to require testing for certain volatile organic compounds. Act of July 16, 2012, 2012 N.C. Sess. Laws 187, sec. 12.(b), § 87-97(i) (codified as amended at N.C. GEN. STAT. § 87-97(i)(2021)).

180. Act of Aug. 23, 2013, 2013 N.C. Sess. Laws 413, § 35 (codified at N.C. GEN. STAT. § 87-97(e1)).

181. At the time of House Bill 2873’s passage, the North Carolina Commission for Public Health was named the North Carolina Commission for Health Services. *See* North Carolina Well Construction Act, 2006 N.C. Sess. Laws 202.

182. N.C. GEN. STAT. § 87-97(i) (2021).

183. *Id.* § 87-87(7).

184. *See On-Site Water Protection Branch*, N.C. DEP’T OF HEALTH & HUM. SERVS., <https://ehs.ncpublichealth.com/oswp/> (last updated Sept. 15, 2022).

185. *Id.*

186. *Id.*

Significantly, pursuant to § 87-97, OSWPB has promulgated rules requiring that permits issued for private wells show the location of potential contamination sources, reference documentation of known contamination sources within 1,000 feet of proposed well sites, and identify risks of well construction related to these findings.¹⁸⁷ Its rules also direct local health departments to provide well owners or lease holders with information about contaminants exceeding MCLs in samples and “the need for exposure limitation, remediation, or future sampling.”¹⁸⁸

Although H.B. 2873 contains provisions related to new and modified private wells that can help reduce contamination risk, it is clear from the legislative history of the bill that these provisions were intended to be placed in a different context. Initially, H.B. 2873 framed private well water contamination as a serious threat to public health.¹⁸⁹ Reflecting this framing, the filed bill sought to incorporate the proposed statute into N.C.G.S. § 130A, the chapter of the code that covers public health.¹⁹⁰ This new statute was to be given the short title, “North Carolina Safe Drinking Water from Wells Act.”¹⁹¹ This suggested title is significant given that the statute was to appear shortly before the “North Carolina Drinking Water Act”—the statute that codifies North Carolina’s compliance with the SDWA.¹⁹² By the second draft of the bill, however, the statute had moved from the chapter on public health to Chapter 87, the chapter governing contractors.¹⁹³ Rather than being a stand-alone act, the section would be incorporated into the North Carolina Well Construction Act.¹⁹⁴

This change in location has both symbolic and practical impacts. Symbolically, through its proposed location in § 130A, protection of private drinking water would have been codified as an issue of public health. By placing the new language in the chapter governing contractors, the North Carolina General Assembly sent the message that private well water contamination is an issue that can be resolved solely with front-end

187. 15A N.C. ADMIN. CODE 02C.0304(b) (2023).

188. *Id.* at 18A.3805(b).

189. H.R. DRH30591-LH-294, 2006 Gen. Assemb., 2005 Sess. (N.C. 2006), <https://www.ncleg.gov/Sessions/2005/Bills/House/PDF/H2873v0.pdf>.

190. *Id.*

191. *Id.* § 130A-285.

192. *Id.*; N.C. GEN. STAT. § 130A-311 (2021).

193. H.B. 2873, 2006 Gen. Assemb., 2005 Sess. (N.C. 2006), <https://www.ncleg.gov/Sessions/2005/Bills/House/PDF/H2873v2.pdf>.

194. *Id.*

regulatory compliance and correct construction rather than a problem that can have serious health consequences for any well owner, no matter the age of their well. This implication is supported by the language of the enacted bill, which does not include any requirements pertaining to continued well monitoring and maintenance.¹⁹⁵ Practically, this change in location could affect the way a court interprets the language of the statute. One canon of statutory construction is that, in cases where the language of a statute is ambiguous, a court can seek clarity by examining the surrounding statutes.¹⁹⁶ Rather than being interpreted in the context of public health, the statute now exists in the context of environmental compliance during construction.

Some members of the North Carolina General Assembly had concerns about enacting H.B. 2873. Although local health departments could apply for funds that were appropriated to incentivize the creation of well permitting, inspection, and testing programs, some senators felt the bill placed an unnecessary burden on local governments and homeowners. During the Senate Floor debate, Senator James Forrester stood in opposition to H.B. 2873, explaining that “two of the counties that I represent feel like this . . . is an unfunded mandate to hire new sanitarians. There’s no money in this bill to hire these sanitarians, which are hard to find anyhow.”¹⁹⁷ Referring to fees H.B. 2873 allowed health departments to impose on well owners, he also noted that “[b]ecause this is an unfunded mandate, it would have to be paid with local tax dollars or increasing the fee to the homeowners or the home builder.”¹⁹⁸ Senator Hugh Webster echoed this worry during his speech opposing the bill, stating that “this bill would add \$400 to the cost of building a house.”¹⁹⁹ In response to these objections, Senator Bob Atwater acknowledged that there was room for more support while dispelling misconceptions about local government funding: “I don’t know that we can say that enough money is going to support this bill, but . . . [some of] these

195. *See* N.C. GEN. STAT. § 87-97.

196. CONG. RSCH. SERVICE, STATUTORY INTERPRETATION: THEORIES, TOOLS, AND TRENDS 25, <https://sgp.fas.org/crs/misc/R45153.pdf> (last updated May 18, 2022) (“To gather evidence of statutory meaning, a judge may turn to the rest of the provision, to the act as a whole, or to similar provisions elsewhere in the law.”).

197. N.C. GEN. ASSEMB., *North Carolina Senate Audio Recordings*, N.C. DIGITAL COLLECTIONS, at 24:30 (July 17, 2006), <https://digital.ncdcr.gov/digital/collection/p16062coll23/id/42/rec/41> (statements by Sen. James Forrester in opposition to H.B. 2873).

198. *Id.* at 25:00.

199. *Id.* at 29:46 (statements by Sen. Hugh Webster in opposition to H.B. 2873).

appropriated funds . . . [will] be available as grants to the counties for [around] two years, . . . giv[ing] the county a chance to build up their receipts and fund the position themselves.”²⁰⁰

Ultimately, although the enactment of H.B. 2873 was a step forward in protecting private well water users in North Carolina, it falls far short of providing the comprehensive regulatory guidelines contained within the SDWA. Testing water quality is a critical component of proper well management. Many harmful contaminants, such as arsenic and lead, are not detectable by smell, sight, or taste.²⁰¹ Only through testing can a well owner be sure that they are not consuming contaminated water or discern the actions necessary to avoid exposure to contaminants.²⁰² However, the testing (and permitting and inspection) requirements in § 87-97 only apply to wells built after July 1, 2008.²⁰³ Thus, in addition to the lack of state-regulated monitoring over a new well’s lifespan, there is no state regulatory oversight of older wells. In the five years following the statute’s enactment, only 16,138 wells—roughly 1.2% of self-supplied domestic wells in the state—were tested.²⁰⁴ This limited amount of mandated well testing, coupled with evidence that few North Carolina well owners routinely test their wells voluntarily,²⁰⁵ suggests many of the North Carolinians using private wells are likely unaware of their water’s quality. Furthermore, contamination may continue to affect well users made aware of it: Treatment in response to failed § 87-97 test results is not required,²⁰⁶ and knowledge of private well

200. *Id.* at 34:18 (statements by Sen. Bob Atwater in response to questions about H.B. 2873).

201. *Arsenic in Well Water*, MINN. DEP’T OF HEALTH, <https://www.health.state.mn.us/communities/environment/water/wells/waterquality/arsenic.html> (last visited Jan. 3, 2023) (“You cannot taste, see, or smell arsenic in your water.”); *Lead in Drinking Water*, CDC, <https://www.cdc.gov/nceh/lead/prevention/sources/water.htm> (last reviewed Feb. 28, 2023) (“You cannot see, taste, or smell lead in drinking water.”).

202. *See supra* notes 92–98 and accompanying text; *see, e.g., Understanding Test Results*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing/understanding-test-results> (last visited Jan. 3, 2023).

203. Act of July 19, 2006, 2006 N.C. Sess. Laws 202, sec. 4 (effective July 1, 2008) (codified as amended at N.C. GEN. STAT. § 87-97 (2021)).

204. MacDonald Gibson and Pieper, *supra* note 13, at 076001-5.

205. *See supra* note 96 and accompanying text.

206. *See* 15A N.C. ADMIN. CODE 18A.3805 (2008).

contamination alone may not prompt voluntary action.²⁰⁷ Because financial support for well treatment and continued testing is only available to some well users experiencing particular types of contamination,²⁰⁸ even those who plan to address contamination found through post-construction testing may have no avenue of recourse. Given the narrow scope of the provision and the fact that it relies heavily on local health departments while providing them with limited resources to ensure compliance, it is not surprising that H.B. 2873 has had a minimal impact.

2. Water Contamination Disclosure Requirements for Property Owners

Testing is a crucial step private well owners can take to protect themselves from water contamination. However, testing is only helpful if it has been performed recently and results are provided to all water consumers. Both tenants and prospective buyers of property supplied with private well water are at an informational disadvantage when it comes to discovering whether property owners know of any contamination. Currently, North Carolina's disclosure requirements afford some protection to prospective buyers but largely leave tenants uninformed and unprotected.

a) N.C.G.S. § 87-97 Protections for Tenants

Bound only by the requirements of § 87-97, which applies exclusively to newly constructed wells,²⁰⁹ landlords and property owners in North Carolina have a limited duty to both test for private well water contamination and disclose it to their tenants. Local health departments are responsible for testing completed wells and, if possible, reporting those test results to tenants.²¹⁰ However, the initial drafters of § 87-97 envisioned broader and more absolute requirements for post-construction test result disclosure. The first draft of H.B. 2873 mandated that “[c]opies of the results . . . be provided to the local health department, the property owner, and the user of the well.”²¹¹ The enacted bill used narrower language, directing local health

207. See *infra* notes 330–41 and accompanying text.

208. See *infra* Part II.B.3.

209. See N.C. GEN. STAT. § 87-97 (2021).

210. *Id.* § 87-97(j).

211. H.R. DRH30591-LH-294, § 130A-285.10(a), 2006 Gen. Assemb., 2005 Sess. (N.C. 2006), <https://www.ncleg.gov/Sessions/2005/Bills/House/PDF/H2873v0.pdf>. This draft also required owners of wells installed after July 1, 2008 to “disclose the most recent

departments to “provide test results to the owner of the newly constructed private drinking water well and, to the extent practicable, to any leaseholder of a dwelling unit or other facility served by the well at the time the water is sampled.”²¹² This limiting language has two impacts. First, “to the extent practicable” incorporates a reasonableness standard in the disclosure requirement, changing what could have been read as an absolute requirement of disclosure to all users of the well.²¹³ Second, adding “served by the well at the time the water is sampled” makes it clear that test result disclosure is not a recurring requirement.²¹⁴ Thus, under the current law, copies of post-construction test results do not have to be provided to subsequent leaseholders. Taken together, these changes make it unlikely that future—and, depending on feasibility, current²¹⁵—tenants will see the initial test results for the water they are drinking.

b) Disclosure Statements to Property Buyers

The primary statute aside from the NCWCA that addresses the disclosure of private well water quality is N.C.G.S. § 47E.²¹⁶ This statute, also known as the Residential Property Disclosure Act (“RPDA”), applies to “transfers of residential real property consisting of not less than one nor more than four dwelling units, whether or not the transaction is with the assistance of a licensed real estate broker or salesman”²¹⁷ The RPDA governs the disclosures that a seller must provide to a buyer of applicable real property in

results of well testing of any kind to the prospective purchaser at the time of sale of the property where the well is located,” but this requirement was not present in the enacted bill (North Carolina Well Construction Act, 2006 N.C. Sess. Laws 202). *Id.* § 130A-285.10(c).

212. North Carolina Well Construction Act, 2006 N.C. Sess. Laws 202, sec. 4 (codified as N.C. GEN. STAT. § 87-97(j) (2022)).

213. *See Coal. to Save Our Child. v. State Bd. of Educ.*, 90 F.3d 752, 760 (3d Cir. 1996) (“[W]e underscore that the phrase ‘to the extent practicable’ implies a reasonable limit . . .”).

214. N.C. GEN. STAT. § 87-97(j) (2021).

215. However, rules promulgated under N.C. GEN. STAT. § 87-97 require local health departments to “provide information to the well owner or respective lease holder concerning chemical and biological contaminants exceeding public drinking water MCLs and the need for exposure limitation, remediation, or future sampling.” 15A N.C. ADMIN. CODE 18A.3805 (2023).

216. N.C. GEN. STAT. § 47E (2021).

217. *Id.* § 47E-1.

North Carolina through the use of a “Residential Property and Owners’ Association Disclosure Statement” (“Disclosure Statement”).²¹⁸

This Disclosure Statement, which is developed and updated by the North Carolina Real Estate Commission,²¹⁹ asks the seller to disclose “the characteristics and condition[s] of the property . . . of which the owner has actual knowledge”²²⁰ The RPDA requires that the Disclosure Statement include questions about the property water supply as well as the presence of environmental contamination.²²¹ The current version of the Disclosure Statement meets these requirements by asking a seller about the dwelling’s water supply source, if there is “any problem, malfunction or defect with the dwelling’s water supply (including water quality . . .),” and if there are “any environmentally hazardous conditions (such as contaminated soil or water, or other environmental contamination) located on or which otherwise affect the property.”²²² In an attempt to ensure honesty from sellers in these Disclosure Statements, the North Carolina Real Estate Commission built in a rule that a seller who lies on a Disclosure Statement—that is, who states that they have no actual knowledge of any problem when they are aware of one—can be held liable for making an intentional misstatement.²²³ While this rule does provide buyers with some protection, the high bar of “actual knowledge” means that a seller need not disclose any contamination that is merely suspected.

The Disclosure Statement required by the RPDA would seem to ensure that every prospective buyer receives enough information about a property’s water quality to make an informed purchase. In reality, however, the RPDA’s requirements may have a limited impact—primarily because a seller may choose to answer “No Representation” to any question on the Disclosure Statement.²²⁴ A seller may select this option even if they have “actual knowledge of [the condition] or should have known of [the condition].”²²⁵ For example, if a seller answers “No Representation” in response to a question related to private well water quality, the burden

218. 21 N.C. ADMIN. CODE 58A.0114 (2023); *see* N.C. GEN. STAT. § 47E-4.

219. N.C. GEN. STAT. § 47E-4(b) (2021).

220. § 47E-4(a)(1).

221. § 47E-4(b)(1), (6).

222. 21 N.C. ADMIN. CODE 58A.0114.

223. *Id.* at 58A.0114(a)(2)(b); *see* *Cummings v. Carroll*, 379 N.C. 347, 866 S.E.2d 675 (2021).

224. N.C. GEN. STAT. § 47E-4(a)(2), (b).

225. 21 N.C. ADMIN. CODE 58A.0114(a)(2)(c).

switches fully to the buyer to take one of the following actions: negotiate for representation or assessment of the water quality by the seller; conduct a water quality test themselves prior to the sale; or accept the risks of acquiring the property without any knowledge of the water quality. If the buyer selects the third option and ultimately discovers contaminated well water, the buyer would be precluded from bringing a suit against the seller under the RPDA on the grounds that the buyer had failed to exercise reasonable diligence, even if the seller had knowledge of the contamination before the sale.²²⁶ Sellers who fail to disclose known contamination in their well water, however, may still encounter legal troubles. North Carolina “has long recognized that ‘[w]here a material defect is known to the seller, and he knows that the buyer is unaware of the defect and that it is not discoverable in the exercise of the buyer’s diligent attention or observation, the seller has a duty to disclose’ and may be held liable for failing to do so.”²²⁷

c) Requirements for Real Estate Brokers

While a seller may decide not to make a representation about the quality of their property’s well water on their Disclosure Statement, that discretion does not extend to any real estate broker assisting in the sale of the property.²²⁸ The front page of the Disclosure Statement, as required by the North Carolina Administrative Code, informs property owners that a “broker must disclose any material facts about your property which he or she knows or reasonably should know, regardless of your responses on the Statement.”²²⁹ In line with this requirement, the North Carolina Real Estate Commission has issued guidelines that a broker must disclose the presence of known bacteria or toxins in well water “even if the seller has taken steps to resolve or reduce the problem(s).”²³⁰ Disclosure even after attempted resolution is necessary “due to the potential harm of these defects and the fact that there may not have been sufficient time or ability to determine if the

226. *See* Stevens v. Heller, 836 S.E.2d 675, 679 (N.C. App. 2019).

227. Everts v. Parkinson, 555 S.E.2d 667, 672 (N.C. App. 2001); *see* Cummings v. Carroll, 379 N.C. 347, 866 S.E.2d 675 (2021).

228. 21 N.C. ADMIN. CODE 58A.0114(a)(3).

229. *Id.*

230. Stephen L. Fussell, *Handling Inspections: Guidelines for Brokers*, N.C. REAL ESTATE COMM’N (Feb. 2016), <https://bulletins.ncrec.gov/handling-inspections-guidelines-for-brokers/>.

repair truly fixed the problem.”²³¹ Yet, even when a broker is involved, there is no requirement that private well water be tested during real estate transactions in North Carolina.²³² Instead, the Real Estate Commission recommends that brokers “advise and encourage their clients to order inspections, tests and surveys for properties they wish to buy or lease”²³³

3. Bernard Allen Memorial Emergency Drinking Water Fund

While the Commission for Public Health, OSWPB, and local health departments bear most of the oversight responsibility of private well water, the North Carolina Department of Environmental Quality (“DEQ”) plays an important role in assisting private well owners. In 2005, the North Carolina General Assembly amended Chapter 87 of the General Statutes to add a section authorizing an “Emergency Drinking Water Fund.”²³⁴ The Emergency Drinking Water Fund, which was later renamed the “Bernard Allen Memorial Emergency Drinking Water Fund” (commonly referred to as the Bernard Allen Fund or “BAF”),²³⁵ gives the State resources to assist low-income households that suspect contamination in their private drinking water.²³⁶ Initially, the statute authorizing the BAF was a mere four paragraphs long,²³⁷ and those paragraphs provided little detail or direction as to fund use, limitations, and recipient qualifications.²³⁸ Today, the statute has over twenty paragraphs of guidance and restrictions for DEQ to follow when administering the BAF.²³⁹ Generally, funds may be used to: notify residents and businesses using private drinking wells of nearby groundwater contamination, test private wells for contamination, and provide alternative drinking water supplies (which include connection to public water supplies

231. *Id.*

232. *See id.*

233. *Id.*

234. Act of Aug. 23, 2006, 2006 N.C. Sess. Laws 255, sec. 5.2 (codified as amended at N.C. Gen. Stat. § 87–98 (2021)).

235. N.C. GEN. STAT. § 87–98.

236. *Id.*

237. 2006 N.C. Sess. Laws 255, sec. 5.2 (codified as amended at N.C. Gen. Stat. § 87–98 (2021)).

238. *Id.*

239. *See generally* N.C. GEN. STAT. § 87–98.

or well repair, filtration, or replacement) in the case of private well contamination.²⁴⁰

DEQ must disburse money from the BAF based on financial need and public health risk while also adhering to specific protocols that depend on fund use.²⁴¹ For example, the BAF may only be used to test a resident's water once every three years unless there is evidence of worsening contamination.²⁴² For providing alternative water supplies, the statute delineates a number of limits, conditions, and preference orders. With exceptions for some substances, alternative water supplies can only be provided to households with incomes equal to or less than 300% of the federal poverty line.²⁴³ Additionally, to qualify for alternative water supplies, a well must contain at least one contaminant in a concentration exceeding its federal MCL.²⁴⁴ DEQ is instructed to give funding preference to permanent replacement, rather than temporary, water supplies and to avoid installing a filtration system if its maintenance would be cost prohibitive for the well user.²⁴⁵ When providing alternative water supplies by extending water lines, DEQ is limited to spending \$50,000 per household.²⁴⁶ The statute further limits provision of alternative water supplies to cases where "the . . . persons who are responsible for the contamination of the private drinking water well . . . are not financially viable or cannot be identified or located . . ."²⁴⁷ Within those cases, DEQ must also find that either the contamination is naturally occurring or the current property owner did not cause, contribute, control, or consent to the contamination.²⁴⁸ However, DEQ is instructed to prioritize nonnatural contamination over natural contamination.²⁴⁹

While the BAF provides some private well owners in North Carolina with critical resources and support, it leaves many more without much-needed assistance. In recent years, the BAF has received \$400,000 in

240. *See* § 87-98(b).

241. § 87-98(c).

242. § 87-98(b)(2).

243. § 87-98(c).

244. *Id.*

245. § 87-98(c1).

246. § 87-98(c2). This is an increase from an earlier limit of \$10,000 per household. Act of July 26, 2013, 2013 N.C. Sess. Laws 360, sec. 14.14, § 87-98(c2) (codified as amended at N.C. GEN. STAT. § 87-98(c2)(2021)).

247. § 87-98(c3).

248. *Id.*

249. § 87-98(c7).

appropriations annually.²⁵⁰ During the 2020–2021 fiscal year, DEQ used these funds to sample 434 wells and provide 52 households with alternative water supplies.²⁵¹ DEQ typically ends each year with excess funds, which roll over to the next year.²⁵² One possible reason that the BAF has been able to operate with an annual surplus is that DEQ does not provide alternative water supplies to households experiencing natural private well contamination.²⁵³ The BAF is under the purview of the Inactive Hazardous Sites Branch of DEQ,²⁵⁴ which deals primarily with nonnatural contamination and conceivably lacks the administrative competence to address contamination from non-anthropogenic sources.²⁵⁵ Given the prevalence of naturally

250. N.C. DEP'T OF ENV'T QUALITY, ANNUAL REPORT TO THE NORTH CAROLINA GENERAL ASSEMBLY: BERNARD ALLEN EMERGENCY DRINKING WATER FUND 5 (2021) [hereinafter DEQ, 2021], <https://deq.nc.gov/media/24623/open>; N.C. DEP'T OF ENV'T QUALITY, ANNUAL REPORT TO THE NORTH CAROLINA GENERAL ASSEMBLY: BERNARD ALLEN EMERGENCY DRINKING WATER FUND 5 (2020) [hereinafter DEQ, 2020], <https://deq.nc.gov/media/17110/open>; N.C. DEP'T OF ENV'T QUALITY, ANNUAL REPORT TO THE NORTH CAROLINA GENERAL ASSEMBLY, BERNARD ALLEN EMERGENCY DRINKING WATER FUND 5 (2019) [hereinafter DEQ, 2019], <https://deq.nc.gov/media/14650/download>; N.C. DEP'T OF ENV'T QUALITY, ANNUAL REPORT TO THE NORTH CAROLINA GENERAL ASSEMBLY, BERNARD ALLEN EMERGENCY DRINKING WATER FUND 5 (2018) [hereinafter DEQ, 2018], <https://deq.nc.gov/media/12068/download>; N.C. DEP'T OF ENV'T QUALITY, ANNUAL REPORT TO THE NORTH CAROLINA GENERAL ASSEMBLY, BERNARD ALLEN EMERGENCY DRINKING WATER FUND 5 (2017) [hereinafter DEQ, 2017], <https://deq.nc.gov/media/11371/download>; N.C. DEP'T OF ENV'T QUALITY, ANNUAL REPORT TO THE NORTH CAROLINA GENERAL ASSEMBLY, BERNARD ALLEN EMERGENCY DRINKING WATER FUND 5 (2016) [hereinafter DEQ, 2016], <https://deq.nc.gov/media/8218/download>.

251. DEQ, 2021, *supra* note 250, at 1.

252. DEQ, 2021, *supra* note 250, at 5 (ending the year with an effective cash balance of \$184,615.84); DEQ, 2020, *supra* note 250, at 5 (ending the year with an effective cash balance of \$45,284.31); DEQ, 2019, *supra* note 250, at 5 (ending the year with an effective cash balance of \$130,696.85); DEQ, 2018, *supra* note 250, at 5 (ending the year with an effective cash balance of \$59,966.22); DEQ, 2017, *supra* note 250, at 5 (ending the year with an effective cash balance of \$146,434.94); DEQ, 2016, *supra* note 250, at 5 (ending the year with an effective cash balance of \$146,195.51).

253. RACHEL VELEZ, CHRISTINE DIAZ, & VERONICA OAKLER, ADVANCING WELL USER PROTECTIONS THROUGH POLICY 7–8 (2022), <https://cwfnc.org/wp-content/uploads/2022/03/CWFNC-POLICY-REPORT.pdf>.

254. *Inactive Hazardous Sites Program*, N.C. DEP'T OF ENV'T QUALITY, <https://deq.nc.gov/about/divisions/waste-management/superfund-section/inactive-hazardous-sites-program> (last visited Jan. 4, 2023).

255. *Id.* (outlining the types of contamination the IHSP covers).

occurring groundwater contamination caused by North Carolina's geologic landscape,²⁵⁶ though, this policy likely precludes numerous North Carolinians from receiving needed financial assistance for private drinking water contamination. While DEQ has the authority to give preference to households affected by nonnatural contamination when replacing water supplies,²⁵⁷ the policy to never provide alternative water supplies to households with naturally contaminated well water is arguably in violation of its broader statutory authority.²⁵⁸ However, even if DEQ did not have this policy in place, many private well users would nevertheless be left without aid; the current funding level of the BAF would likely be insufficient to provide assistance to all those who would qualify for it. Additionally, even DEQ's current operations under the BAF may soon expand and become more costly: Despite its typical annual surplus, DEQ has indicated that it expects BAF demand to rise and that the legislature may need to increase its funding.²⁵⁹

4. Beyond Regulation: Example of Local Efforts in Wake County

Private well contamination in Wake County, North Carolina, has a long and sordid history.²⁶⁰ Past research has discussed Wake County's private drinking water contamination—particularly lead and bacterial contamination—and racial disparities to public water access.²⁶¹ In addition to these issues documented in the scientific literature, Wake County estimates that one in five private wells in the eastern part of the County have dangerous levels of uranium, radon, or radium.²⁶² To combat these public health

256. *See supra* notes 21–37 and accompanying text.

257. N.C. GEN. STAT. § 87-98(c7).

258. Given that § 87-98(c3)(1) explicitly authorizes DEQ to use funding from the BAF to provide alternative drinking water to residents with naturally occurring private well contamination, refusing to do so without promulgating an administrative rule on the matter may violate the N.C. Administrative Procedure Act. *See* N.C. GEN. STAT. § 150B-18.

259. DEQ, 2021, *supra* note 250, at 6; DEQ, 2020, *supra* note 250, at 6; DEQ, 2019, *supra* note 250, at 6; DEQ, 2018, *supra* note 250, at 6; DEQ, 2017, *supra* note 250, at 6; DEQ, 2016, *supra* note 250, at 6.

260. *See supra* Part I.C.2.

261. *Id.*

262. *Naturally Occurring Contamination, WAKE COUNTY*, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing/naturally-occurring-contamination> (last visited Jan. 4, 2023); Anna Johnson, *Wake County Notifying Thousands About Possibly Unsafe Drinking*

problems, Wake County has attempted to take a multi-pronged approach that emphasizes testing, outreach, and education.²⁶³ The Groundwater Protection and Wells section of Wake County Environmental Services' website lays out detailed information on well water testing—along with other well-related topics, like common well problems and well permitting—using accessible language.²⁶⁴ It also includes a link to a tool that generates a report of recommendations based on test results.²⁶⁵ Despite the availability of these resources, testing may still be challenging for many private well owners: Wake County's standard testing prices can be hundreds of dollars depending on the contaminants tested,²⁶⁶ although the County does offer discounts to economically disadvantaged residents.²⁶⁷ Households at or below the federal poverty level can receive testing for the most common contaminants for a flat rate of seventy-three dollars.²⁶⁸ Households up to 2.5 times the federal poverty level can purchase the same testing package for \$182.50.²⁶⁹ To qualify for discounted testing, a resident must have a notarized affidavit attesting that they are within the respective earnings range.²⁷⁰ They also must mail their full payment without knowledge of their application status and wait up to two weeks for the County to confirm its acceptance of their materials.²⁷¹

Water in Private Wells, NEWS & OBSERVER (June 24, 2019), <https://www.newsobserver.com/news/local/article231893893.html>.

263. *Groundwater Protection and Wells*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells> (last visited Jan. 4, 2023).

264. *See Well Water Testing*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing> (last visited Jan. 4, 2023).

265. *Understanding Test Results*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing/understanding-test-results> (last visited Jan. 4, 2023).

266. *Well Water Tests Available Through Wake County*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing/well-water-tests-available-through-wake-county> (last visited Jan. 4, 2023).

267. *Programs to Help with Your Septic Repairs, Well Repairs, Water Treatment & Well Testing*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/programs-help-your-septic-repairs-well-repairs-water-treatment-well-testing> (last visited Jan. 4, 2023).

268. *Id.*

269. *Id.*

270. *Id.*

271. *See id.*

Wake County also engages in outreach and education, suggests funding options for private well owners, and works to advance local water management and infrastructure. The County has participated in National Groundwater Awareness Week by disseminating educational materials and encouraging proper well maintenance,²⁷² and it conducts additional outreach by distributing an approximately biannual newsletter to interested residents who use wells or septic systems.²⁷³ Wake County’s website also lists sources of funding that could be used for well repair or treatment—though most are not specifically intended to assist private well owners, and some are low-interest loans rather than grants.²⁷⁴ The USDA Rural Development’s Single Family Housing Repair Loans and Grants Program²⁷⁵ and the Southeast Rural Community Assistance Project’s Individual Household Well and Septic Loan Program²⁷⁶ provide aid at a national or regional level. Local options include the Wake County Emergency Grant Program, which provides funds to assist low-income Wake County residents with making emergency household repairs.²⁷⁷ Lastly, to more comprehensively evaluate and address local water issues, the Wake County Board of Commissioners established the Wake County Water Partnership in 2016.²⁷⁸ This partnership, which comprises a

272. Wake County, *Groundwater Awareness Week 2017*, YOUTUBE (Mar. 3, 2017), https://www.youtube.com/watch?v=H_YdwJtNIUQ&feature=youtu.be&app=desktop.

273. *Signup for Wells & Septic Residential Newsletter*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/signup-wells-septic-residential-newsletter> (last visited Jan. 4, 2023).

274. *Programs to Help with Your Septic Repairs, Well Repairs, Water Treatment & Well Testing*, *supra* note 267.

275. *Id.*; *Single Family Housing Repair Loans & Grants*, U.S. DEP’T AGRIC., <https://www.rd.usda.gov/programs-services/single-family-housing-programs/single-family-housing-repair-loans-grants> (last visited Jan. 4, 2023).

276. *Programs to Help with Your Septic Repairs, Well Repairs, Water Treatment & Well Testing*, *supra* note 267; *Programs and Services for Homeowners*, SE. RURAL CMTY. ASSISTANCE PROJECT, <https://sercap.org/about/who-we-serve/programs-and-services-homeowners> (last visited Jan. 4, 2023).

277. *Programs to Help with Your Septic Repairs, Well Repairs, Water Treatment & Well Testing*, *supra* note 267; *Find Services*, WAKE COUNTY, <https://www.wakegov.com/departments-government/housing-affordability-community-revitalization/find-services> (last visited Jan. 4, 2023).

278. *Wake County Water Partnership*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/wake-county-water-partnership> (last visited Jan. 4, 2023) (“Mission Statement: To facilitate collaboration to promote leadership in water management and sustainability and promote health by providing high quality water throughout Wake County.”).

wide range of stakeholders, “acts in an advisory capacity to identify new water[-]related opportunities and challenges that impact the County.”²⁷⁹ Recent undertakings include partnering with the U.S. Geological Survey and community organizations to study local groundwater resources.²⁸⁰

III. CASE STUDY: PRIVATE WELL REGULATIONS IN NEW JERSEY

The private well policy landscape in the U.S. is heterogeneous. While all 50 states have policies governing the drilling or construction of new private wells, other state requirements vary significantly.²⁸¹ In addition to these policy disparities, the agency that has the authority to regulate private wells differs among states, and sometimes multiple agencies are responsible for well regulation.²⁸² Out of all the states, New Jersey is consistently recognized in science and policy literature as having strong private well rules.²⁸³ Both New Jersey and North Carolina have policies in place

279. *Id.* (outlining the development of Wake County’s “One Water Approach,” which includes a “50-year water supply plan”).

280. *Comprehensive Planning, WAKE COUNTY*, <https://www.wakegov.com/departments-government/water-quality-programs/wake-county-water-partnership/comprehensive-planning> (last visited Jan. 4, 2023).

281. *See* Jacob D. Petersen-Perlman, Sharon B. Megdal, Andrea K. Gerlak, Mike Wireman, Adriana A. Zuniga-Teran, & Robert G. Varady, *Critical Issues Affecting Groundwater Quality Governance and Management in the United States*, 10 WATER 1, 11 (2018); Kristina Bowen, Tara Krishna, Lorraine Backer, Kate Hodgins, Lance A. Waller, & Matthew O. Gribble, *State-Level Policies Concerning Private Wells in the United States*, 21 WATER POL’Y 428, 430–431 (2019).

282. Bowen et al., *supra* note 281, at 431.

283. *See, e.g.*, Brenda O. Hoppe, Anna K. Harding, Jennifer Staab, & Marina Counter, *Private Well Testing in Oregon from Real Estate Transactions: An Innovative Approach Toward a State-Based Surveillance System*, 126 PUB. HEALTH REPS. 107, 112–113 (2011) (discussing potential improvements to Oregon’s policy requiring private well testing at the point of a real estate transaction based on the strengths of New Jersey’s corresponding legislation); Heather Chappells, Louise Parker, Conrad V. Fernandez, Cathy Conrad, John Drage, Gary O’Toole, Norma Campbell, & Trevor J. B. Dummer, *Arsenic in private drinking water wells: an assessment of jurisdictional regulations and guidelines for risk remediation in North America*, 12 J. WATER & HEALTH 372, 375, 380, 381 (2014) (highlighting several exceptional New Jersey water and private well policies, including: its low arsenic MCL; availability of loans for well water treatment; and required testing for contaminants, including arsenic, in well water during real estate transactions); Yan Zheng & Sara V. Flanagan, *The Case for Universal Screening of Private Well Water Quality in the U.S. and Testing Requirements to Achieve It: Evidence from Arsenic*, 125 ENV’T HEALTH PERSPS. 085002-1, 085002-1, 085002-4 (2017) (highlighting several exceptional New Jersey water

addressing private well permitting;²⁸⁴ drilling, construction, and design;²⁸⁵ maintenance and repair;²⁸⁶ disinfection;²⁸⁷ abandonment and decommissioning;²⁸⁸ and data and recordkeeping.²⁸⁹ However, New Jersey has also implemented private well regulations that North Carolina, along with most other states, lacks. To examine possible gaps in North Carolina private well policy and understand the regulatory framework of a state with relatively robust private well laws, we compared New Jersey’s private well regulations to those of North Carolina.

A. *The New Jersey Safe Drinking Water Act*

Unlike the North Carolina Drinking Water Act—which only applies to public water systems²⁹⁰—the New Jersey SDWA allows for the regulation of nonpublic water systems,²⁹¹ a category that includes private wells.²⁹² Perhaps the most significant result of this allowance is that primary and secondary drinking water standards promulgated under the New Jersey

and private well policies, including: its low arsenic MCL; availability of loans for well water treatment; and required testing for contaminants, including arsenic, in well water during both construction and real estate transactions); Bowen et al., *supra* note 281, at 430 (showing in Figure 1 that New Jersey has regulations in place addressing eight of the nine private well policy categories examined in this study).

284. 15A N.C. ADMIN. CODE 02C.0105, 0303–0304 (2019); N.J. ADMIN. CODE §§ 7:9D-1.11–1.14, 1.16 (2018).

285. 15A N.C. ADMIN. CODE 02C.0100, 0301(b); N.J. ADMIN. CODE § 7:9D.

286. 15A N.C. ADMIN. CODE 02C.0112; N.J. ADMIN. CODE §§ 7:9D-2.2–2.3.

287. 15A N.C. ADMIN. CODE 02C.0111; N.J. ADMIN. CODE §§ 7:10-12.11, 12.32.

288. 15A N.C. ADMIN. CODE 02C.0113, 0309; N.J. ADMIN. CODE §§ 7:9D-3.

289. 15A N.C. ADMIN. CODE 02C.0114, 0307; N.J. ADMIN. CODE §§ 7:9D-1.15, 7:10-12.22.

290. N.C. GEN. STAT. § 130A-314(a) (1983).

291. N.J. REV. STAT. § 58:12A-4(a)(3) (1999) (providing the Commissioner of Environmental Protection with the authority to regulate nonpublic water systems).

292. *Compare* N.J. REV. STAT. § 58:12A-3(p) (defining nonpublic water system as “a water system that is not a public water system”), 58:12A-3(s) (defining water system as “a system for providing potable water to any person”), and N.J. ADMIN. CODE § 7:10-1.3 (providing a more detailed definition of nonpublic water system as “any water system providing potable water to individual dwellings, and any water system regularly serving fewer than 15 service connections and fewer than 25 individuals”), *with* N.C. GEN. STAT. § 87-85(10a) (defining private drinking water well as “any excavation that is . . . constructed to obtain groundwater for human consumption and that serves or is proposed to serve 14 or fewer service connections or that serves or is proposed to serve 24 or fewer individuals”).

SDWA apply to private wells in addition to public water systems.²⁹³ However, it is up to local boards of health to establish monitoring requirements for nonpublic water systems.²⁹⁴ When private wells exceed New Jersey MCLs—or exceed secondary drinking water standards and cause adverse health effects—local health agencies must require well owners to treat their water.²⁹⁵ While some testing requirements may thus vary locally, regulations promulgated under the New Jersey SDWA mandate the testing of newly constructed wells.²⁹⁶ Owners of new New Jersey wells must test for 31 contaminants and other parameters, including various harmful contaminants (such as nitrates, lead, and arsenic);²⁹⁷ testing for additional contaminants may be required depending on a well’s location.²⁹⁸ After submitting copies of test results to the local board of health for review,²⁹⁹ owners may be required to physically or chemically treat their water.³⁰⁰ New Jersey SDWA rules also contain requirements for the submission of applications by well owners for the certification of new, altered, or replaced private wells.³⁰¹ However, the issuance of certifications by local health agencies is not necessarily based on the results of an inspection,³⁰² and uncertified wells are apparently not prohibited from being used.³⁰³

Although the North Carolina Drinking Water Act does not govern private wells, N.C.G.S. § 87-97 and its rules contain some requirements similar to those of the New Jersey SDWA. Both New Jersey and North Carolina are part of the minority group of states that require testing private wells upon construction:³⁰⁴ Under N.C.G.S. § 87-97(h), local health departments are required to test newly constructed North Carolina wells for 19 contaminants.³⁰⁵ Additionally, N.C.G.S. § 87-97(i) gives the North

293. See N.J. ADMIN. CODE §§ 7:10-5.1, 7:10-7.1.

294. See *id.* §§ 7:10-5.1, 7:10-7.3. Investigation of these local requirements was outside the scope of this paper.

295. See *id.* § 7:10-12.30(h)–(i).

296. See *id.* § 7:10-12.30(a), (c).

297. See *id.*

298. See *id.* § 7:10-12.30(c), (c)(11)–(12).

299. *Id.* § 7:10-12.30(a), (d).

300. *Id.* § 7:10-12.30(a)(1), (e), (h)–(i).

301. See *id.* §§ 7:10-12.39–40.

302. *Id.* § 7:10-12.39(g)(1).

303. See *id.* §§ 7:9D-1.15(a)(1)(i), 7:10-12.39–40.

304. Zheng & Flanagan, *supra* note 283, at 085002-3.

305. N.C. GEN. STAT. § 87-97(h) (2017).

Carolina Commission for Public Health the authority to adopt rules governing private well testing, reporting, and corrective action.³⁰⁶ However, there are no regulations mandating testing at other points in well lifespans or requiring water treatment based on certain test results.³⁰⁷ Instead, local health departments are merely directed to share information about contamination and future action with well users.³⁰⁸ In North Carolina, certification of new or repaired private drinking water wells is contingent upon the results of an inspection by the local health department rather than,³⁰⁹ as in New Jersey, information in an application submitted by the well owner.³¹⁰ Unlike New Jersey wells,³¹¹ new or altered North Carolina private wells cannot be used until a certificate of completion is obtained.³¹²

B. *The New Jersey Private Well Testing Act*

New Jersey is one of the few states that has policies in place addressing the rental or sale of a property with a private well.³¹³ The Private Well Testing Act (“PWTA”) became effective in September of 2002 and requires private well testing periodically for rental properties as well as at the point of real estate transactions.³¹⁴ Unlike in North Carolina and most other states, where well testing is not a condition of property sale,³¹⁵ sale contracts for all properties in New Jersey that are supplied with potable water from a private well must require water testing as a condition of sale.³¹⁶ A sale cannot

306. N.C. GEN. STAT. § 87-97(i) (2017).

307. *See* 15A N.C. ADMIN. CODE 18A.3801–3805 (2019).

308. 15A N.C. ADMIN. CODE 18A.3805(b); *see supra* notes 163–69, 177–78, 188 and accompanying text.

309. N.C. GEN. STAT. § 87-97(g); 15A N.C. ADMIN. CODE 02C.0305–0306 (2023).

310. *See supra* notes 301–02 and accompanying text.

311. *See supra* note 303 and accompanying text.

312. N.C. GEN. STAT. § 87-97(g); 15A N.C. ADMIN. CODE 02C.0306(c).

313. Bowen et al., *supra* note 281, at 429–431 (finding that, as of 2018, ten states aside from New Jersey had private well policies addressing property sale and two states aside from New Jersey had private well policies addressing property rental).

314. N.J. REV. STAT. § 58:12A-27, 32 (2013); THOMAS B. ATHERHOLT, JUDITH B. LOUIS, JOHN SHEVLIN, KAREN FELL, & SANDRA KRIETZMAN, N.J. DIV. OF SCI., RSCH., & TECH., THE NEW JERSEY PRIVATE WELL TESTING ACT: AN OVERVIEW 1 (2009), <https://www.state.nj.us/dep/dsr/research/pwta-overview.pdf>.

315. *See supra* notes 232–33 and accompanying text; Bowen, *supra* note 281, at 430–431.

316. N.J. REV. STAT. § 58:12A-27(a).

close until the buyer and seller certify in writing that they received and reviewed copies of test results.³¹⁷ Additionally, lessors of properties using private wells must test well water at least once every five years and provide test result copies to each rental unit within 30 days of result receipt.³¹⁸ In North Carolina, on the other hand, landlords are neither required to test at regular intervals nor obligated to share the results of mandated, post-construction well water testing with new tenants.³¹⁹

The PWTA and its rules outline requirements for relatively comprehensive testing and swift result delivery. Certified laboratories must collect private well water samples and,³²⁰ as is required for new private wells under the New Jersey SDWA,³²¹ test for at least 31 contaminants and other parameters.³²² Within five business days of sample analysis completion, laboratories are required to report results to both those who requested testing and the New Jersey Department of Environmental Protection (“NJDEP”).³²³ NJDEP must notify the proper local health authority within five business days of receiving test results failing standards³²⁴—except in the case of elevated nitrate or coliform levels, when laboratories are responsible for directly alerting the people who ordered the test and the proper local health authority within 24 hours.³²⁵ Upon notification that the water quality of a private well is noncompliant with standards, a local health authority may—at its discretion—issue a public notice to property owners within at least 200 feet of the contaminated well and suggest testing for failed parameters.³²⁶ The PWTA also ensures well user and test result confidentiality: Public notices recommending testing must not contain identifying information about the well that failed a water test and prompted the notice,³²⁷ and results are prohibited from being made public except in data compilations that do not

317. *Id.* § 58:12A-27(b).

318. *Id.* § 58:12A-32.

319. *See supra* notes 209–14 and accompanying text.

320. N.J. ADMIN. CODE § 7:9E-2.2 (2018).

321. *See supra* notes 297–98 and accompanying text.

322. N.J. ADMIN. CODE § 7:9E-2.1.

323. *Id.* § 7:9E-3.1(a); N.J. REV. STAT. § 58:12A-30(c).

324. N.J. REV. STAT. § 58:12A-31(a) (2013); N.J. ADMIN. CODE § 7:9E-4.1(b).

325. N.J. ADMIN. CODE § 7:9E-4.1(a).

326. N.J. REV. STAT. § 58:12A-31(a); N.J. ADMIN. CODE § 7:9E-4.2.

327. N.J. REV. STAT. § 58:12A-31(a); N.J. ADMIN. CODE § 7:9E-4.2(a), (d).

include property owner names, addresses, or locations.³²⁸ These confidentiality requirements prevent contaminated wells from impacting sales and property values of nearby homes, thus addressing concerns of property owners and realtor associations.³²⁹

The PWTA guarantees that tenants and prospective property buyers are informed about private well water contamination.³³⁰ However, like North Carolina's testing requirement for new wells³³¹—and unlike the New Jersey SDWA³³²—it does not mandate corrective action in response to failed test results.³³³ When action is optional and unaided, individuals may not attempt, or have the means to attempt, to prevent exposure to known contamination. In a survey of households where arsenic was measured above the state MCL in PWTA-required tests during real estate transactions, only 15% of the 486 respondents reported both use of treatment and appropriate maintenance and monitoring.³³⁴ Meanwhile, 28% were taking no action to reduce arsenic exposure.³³⁵ Although 63% of households reported using treatment systems (half of which were installed by previous owners), many were not following system maintenance or well testing recommendations.³³⁶ Furthermore, while 86% of respondents remembered that their well was tested when purchasing their home, only 60% recalled their test results showing elevated arsenic levels.³³⁷ These results suggest that, while the PWTA often leads households to take mitigating action against private well contamination (at least when elevated concentrations of arsenic are present), lack of remediation requirements and aid will cause some well owners to engage in incomplete or nonexistent treatment, maintenance, and monitoring activities.³³⁸ Similar

328. N.J. REV. STAT. § 58:12A-31(b); N.J. ADMIN. CODE § 7.9E-5.1; *see* N.J. REV. STAT. § 58:12A-30(e), 31(a), 33.

329. Hoppe et al., *supra* note 283, at 112.

330. *See supra* notes 313–18 and accompanying text.

331. *See* 15A N.C. ADMIN. CODE 18A.3805(b) (2023).

332. *See supra* notes 290–303 and accompanying text.

333. N.J. REV. STAT. §§ 58:12A-26–37; N.J. ADMIN. CODE § 7:9E; *see* Sara V. Flanagan, Jessie A. Gleason, Steven E. Spayd, Nicholas A. Procopio, Megan Rockafellow-Baldoni, Stuart Braman, Steven N. Chillrud, & Yan Zheng, *Health Protective Behavior Following Required Arsenic Testing under the New Jersey Private Well Testing Act*, 221 INT'L J. HYGIENE & ENV'T HEALTH 929, 930 (2018).

334. Flanagan et al., *supra* note 333, at 934, 937.

335. *Id.* at 933–934, 937.

336. *Id.* at 933–934.

337. *Id.* at 932.

338. *Id.* at 938–939.

findings in different states, and even in a different country, confirm that testing requirements and result transparency do not guarantee action.³³⁹ Support—including financial assistance—targeting well users navigating government-mandated testing could help reduce barriers to proper well care;³⁴⁰ increase post-test rates of mitigation, maintenance, and monitoring; and improve public health.³⁴¹

C. *NJHMFA Loans and the New Jersey Spill Compensation Fund*

Like North Carolina, New Jersey has programs to financially assist private well owners with contaminated water. NJDEP administers the Water Supply Replacement Trust Fund, a non-lapsing revolving fund which, under various New Jersey SDWA provisions, is used to provide loans that help those experiencing or threatened by contamination of their primary potable water source.³⁴² For example, within this fund’s Water Supply Remediation sub-account, \$3.5 million is allocated to the New Jersey Housing and Mortgage Finance Agency (“NJHMFA”) and dedicated to providing zero-interest loans to owners of single-family residences affected by water contamination.³⁴³ All homeowners whose water supply violates drinking water standards, regardless of contamination source, are eligible to receive loans through this program,³⁴⁴ known as the Potable Water Loan Program.³⁴⁵ Loans may be used to fund the installation of interim or permanent safe water supplies or, alternatively, water treatment technology.³⁴⁶ Loans through the Potable Water Loan Program have zero interest, a term of no more than 10 years, and a maximum amount of \$10,000.³⁴⁷ Within the Water Supply Replacement Trust Fund’s Radium-Contaminated Water Supply sub-account, \$1 million is allocated to NJHMFA to provide similar loans to

339. *Id.* at 937.

340. *See supra* notes 92–98 and accompanying text as well as Part II.A.3 for information about well stewardship barriers.

341. Flanagan et al., *supra* note 333, at 939.

342. N.J. REV. STAT. § 58:12A-22 (2013).

343. *Id.* § 58:12A-22.3(a).

344. *Id.*

345. *Homeowners: Are you an existing borrower and have questions?*, N.J. HOUS. & MORTG. FIN. AGENCY, <https://www.nj.gov/dca/hmfa/consumers/homeowners/> (last visited Jan. 4, 2023).

346. N.J. REV. STAT. § 58:12A-22.3(a).

347. *Id.* § 58:12A-22.3(b).

homeowners affected by radium contamination of their water source.³⁴⁸ The terms of these loans are identical to those of loans issued through the Potable Water Loan Program, except they have a maximum interest rate of 2% and a term of no more than five years.³⁴⁹ Finally, outside of the Water Supply Replacement Trust Fund, homeowners that have private wells contaminated by the discharge of petroleum products or other hazardous substances may be eligible for compensation from the New Jersey Spill Compensation Fund (“Spill Fund”) established by New Jersey’s Spill Compensation and Control Act.³⁵⁰ Well owners who are both receiving assistance through the Potable Water Loan Program and eligible for compensation from the Spill Fund must submit a claim against the Spill Fund and use any money received to repay their loan.³⁵¹

While there are strengths in both North Carolina’s and New Jersey’s assistance programs, it is likely that neither state’s program will fully satisfy the needs of its private-well-using community. Unlike BAF aid,³⁵² neither well user income nor contamination source influences eligibility for NJHMFA support.³⁵³ However, rather than benefiting a larger portion of the well-using population due to reduced eligibility constraints, New Jersey’s assistance programs likely exclude lower-income private well users. Although New Jersey well owners with private wells contaminated by hazardous substance discharge may be eligible for compensation through the Spill Fund, New Jersey’s funding options intended specifically to assist private well users are in the form of loans.³⁵⁴ The BAF covers the cost of

348. *Id.* § 58:12A-22.1(a), (c).

349. *Id.* § 58:12A-22.1(c).

350. *See id.* § 58:10-23.11o; *The NJ Spill Compensation Fund Claims Program (Spill Fund)*, N.J. DEP’T OF ENV’T PROT., <https://www.state.nj.us/dep/srp/finance/eca.htm> (last updated June 29, 2022); *Spill Fund FAQs*, N.J. DEP’T OF ENV’T PROT., https://www.nj.gov/dep/srp/finance/spillfund/spillfund_faqs.htm (last updated Mar. 3, 2010); N.J. DEP’T OF ENV’T PROT., GUIDELINES FOR COMPLETING A SPILL FUND CLAIM APPLICATION FOR CONTAMINATED PRIVATE WELLS 1 (2022) [hereinafter SPILL FUND APPLICATION GUIDELINES], https://www.nj.gov/dep/srp/finance/spillfund_pw.pdf?2022.

351. N.J. REV. STAT. § 58:12A-22.5.

352. N.C. GEN. STAT. § 87-98(c), (c7) (2022); VELEZ ET AL., *supra* note 253, at 7–8.

353. *See* N.J. REV. STAT. §§ 58:12A-22.1–22.4 (2013).

354. *See supra* notes 342–51 and accompanying text; N.J. REV. STAT. § 58:12A-22.3(a) (stating that NJHMFA loans are designed to help homeowners whose source of potable water violates water quality standards but listing examples of NJHMFA loan use focused on resolution of well contamination); *Spill Fund FAQs*, *supra* note 350 (noting that the Spill Fund can also be used for remediation of contaminated sites and compensation for

private well testing,³⁵⁵ but though testing is a prerequisite for Spill Fund claims and NJHMFA loan applications,³⁵⁶ test fee coverage is not available in most cases.³⁵⁷ NJHMFA loan applicants must pay a \$75 application fee and annual 1% loan servicing fee on top of testing costs.³⁵⁸ Additionally, only owners of single-family residences are eligible to receive NJHMFA loans (and only property owners may submit claims against the Spill Fund),³⁵⁹ while home or property ownership is not a precondition of BAF funding.³⁶⁰ Furthermore, DEQ may disburse up to \$50,000 from the BAF when extending public water supplies to a household,³⁶¹ while NJHMFA loans have a maximum amount of \$10,000.³⁶² Though it may be inaccessible to many well users, New Jersey ultimately has state-funded assistance available for private well owners grappling with naturally occurring water contamination, which North Carolina lacks.

NJHMFA loan program applicants and Spill Fund claimants also shoulder more labor than recipients of BAF aid. DEQ locates and notifies at-risk private well users,³⁶³ assesses their eligibility to receive BAF

real and personal property damages and that business and government entities, not just individuals, can also file claims against it).

355. N.C. GEN. STAT. § 87-98(b)(2)–(3) (2022).

356. N.J. REV. STAT. §§ 58:12A-22.1(b)–(c), 22.2(c), 22.3(b) (2013); *Spill Fund FAQs*, *supra* note 350.

357. N.J. REV. STAT. § 58:12A-22.1(b) (stating that NJDEP will fund a second test of a potable water supply to confirm the presence of radium indicated by an initial test (presumably financed by the well owner)); N.J. REV. STAT. §§ 58:12A-22.2–22.3 (mentioning required testing but not test fee coverage); *Spill Fund FAQs*, *supra* note 350 (stating that, of the initial and confirming tests required to submit a claim, only the confirming test fee may be eligible for reimbursement).

358. N.J. HOUS. & MORTG. FIN. AGENCY, POTABLE WATER LOAN PROGRAM 1 (2000), https://nj.gov/dca/hmfa/consumers/docs/ho_potablewater_fs.pdf (“There is a \$75 application fee that covers the cost of a credit/title report and second mortgage reporting fee. Borrowers must pay a 1% per annum servicing fee on the outstanding balance of the loan at the time of the annual loan payment.”).

359. N.J. REV. STAT. §§ 58:12A-22.1(b)–(c), 22.2(c), 22.3(a), 22.4–22.5; SPILL FUND APPLICATION GUIDELINES, *supra* note 350, at 1 (noting that, when submitting a Spill Fund claim related to contaminated potable wells, claimants must indicate on their application when they purchased their property).

360. *See* N.C. GEN. STAT. § 87-98 (2022).

361. *Id.* § 87-98(c2).

362. N.J. REV. STAT. §§ 58:12A-22.1(c), 22.3(b) (2013).

363. VELEZ ET AL., *supra* note 253, at 8.

assistance;³⁶⁴ and determines and executes the best use of BAF funds, prioritizing the provision of permanent replacement water supplies.³⁶⁵ On the other hand, Potable Water Loan Program applicants must determine their potential loan's desired use and provide vendor cost quotes and binding contracts with their applications,³⁶⁶ and Spill Fund claimants must give multiple vendor cost estimates along with various documents and details.³⁶⁷ However, DEQ assuming the responsibility of detecting BAF-eligible private well users means that the BAF lacks a publicly accessible application process, leaving potentially qualifying but uncontacted well users without state-funded assistance options.³⁶⁸

D. Case Study Conclusions

Relative to other states, New Jersey serves as an example of rigorous state-level private well policy. By requiring private well testing at the point of property sale and throughout tenancy in addition to after well construction, all of New Jersey's private wells will likely be tested eventually. The New Jersey SDWA and PTWA also require testing for more contaminants than the NCWCA,³⁶⁹ although both New Jersey and North Carolina are included in the group of five states that requires testing for arsenic at some point in a well's life.³⁷⁰ New Jersey's testing rules, coupled with mandated corrective action based on post-construction test results under the New Jersey SDWA,³⁷¹ require greater information and protection of well owners than North Carolina's policies. However, New Jersey's expanded regulations assign more duties to well owners than their North Carolina counterparts. The language of New Jersey's SDWA rules suggests that well owners are responsible for arranging testing of newly constructed wells and implementing any corrective action mandated.³⁷² PWTA testing is paid for

364. *Id.*

365. N.C. GEN. STAT. § 87-98(c1).

366. N.J. HOUS. & MORTG. FIN. AGENCY, *supra* note 358, at 1.

367. SPILL FUND APPLICATION GUIDELINES, *supra* note 350, at 1; N.J. DEP'T OF ENV'T PROT., SPILL COMPENSATION FUND DAMAGE CLAIM 1-6 (2022), <https://www.nj.gov/dep/srp/finance/spillfund.pdf?2022>.

368. VELEZ ET AL., *supra* note 253, at 8.

369. *See supra* notes 297-98, 305 and accompanying text.

370. Zheng & Flanagan, *supra* note 283, at 085002-4.

371. *See supra* notes 295, 299-300 and accompanying text.

372. N.J. ADMIN. CODE § 7:10-12.30(a), (c)-(e), (h)-(i) (2023).

by buyers or sellers, who negotiate a payment agreement, or landlords.³⁷³ The NCWCA instead tasks local health departments with conducting post-construction testing.³⁷⁴ Additionally, though New Jersey has more comprehensive private well policies overall, North Carolina has more rigorous procedures for the inspection and certification of new wells that also demand less labor from well owners.³⁷⁵ Unlike North Carolina, New Jersey has state-funded financial assistance programs that may help private well owners battling non-anthropogenic water contamination, but these programs likely exclude lower-income well users.³⁷⁶

Despite its less stringent regulations, North Carolina's online resources about private well regulations and management seem to be more numerous, accessible, informative, and easily discoverable compared to those of New Jersey. NJDEP provides relatively thorough publicly available PWTA information³⁷⁷—and an internet search returns many online materials from various sources discussing the PWTA. However, NJDEP's general well-caretaking information is incomplete yet dense,³⁷⁸ and New Jersey SDWA private well requirements are scarcely discussed online outside of the New Jersey Administrative Code.³⁷⁹ Though NJDEP's visualizations of

373. *PWTA - Frequently Asked Questions*, N.J. DEP'T OF ENV'T PROT., https://www.state.nj.us/dep/watersupply/pwta/pwta_faq.htm (last updated July 7, 2022).

374. N.C. GEN. STAT. § 87-97(h)–(j) (2021); 15A N.C. ADMIN. CODE 18A.3802–3805 (2023).

375. *See supra* notes 301–03, 309–12 and accompanying text.

376. *See supra* Part III.C.

377. *See Private Well Testing Act (PWTA)*, N.J. DEP'T OF ENV'T PROT., https://www.state.nj.us/dep/watersupply/pw_pwta.html (last updated July 7, 2022).

378. *Compare General Information on Residential Wells*, N.J. DEP'T OF ENV'T PROT., https://www.state.nj.us/dep/watersupply/pw_general.html (last updated Jan. 27, 2022) (listing links to: documents and webpages that discuss only five contaminants and are typically long and text heavy; missing webpages that should contain well testing information and a list of certified testing laboratories; and other resources, including well treatment and maintenance resources, that are mostly not state specific and/or not current, such as a scanned EPA handout on home water treatment units that was originally published in 1990), *with Private Wells*, *supra* note 169 (providing: handouts discussing more than twenty contaminants that are well formatted and informative but brief; a link to a webpage containing information on when to test, activities and conditions that can cause well contamination, and local health departments and state-certified commercial laboratories; and current, state-specific handouts about well treatment and maintenance that include visuals).

379. *See New Jersey Private Well Testing Act*, N.J. DEP'T OF ENV'T PROT., <https://dep.nj.gov/dsr/pwta/> (last updated Nov. 30, 2022) (“NJDEP regulates the construction of private wells. A newly constructed well is tested once for the presence of the contaminants

2002–2018 PWTA data are superior to DEQ’s tabulation of a subset of NCWCA data,³⁸⁰ North Carolina’s online resources fully and plainly depict state recommendations and requirements for private well users.³⁸¹ North Carolina will make strides in protecting its large population of private well users if it implements additional private well testing and corrective action policies mimicking those of New Jersey; continues requiring government entities, rather than private citizens, to shoulder the bulk of the costs and labor associated with these new regulations; provides a wider variety of financial assistance programs; and maintains its high-quality online resources.

IV. RECOMMENDATIONS

Over the past two decades, North Carolina has attempted to develop a regulatory regime that protects residents who rely on private drinking wells. However, we find that the protection offered by the current statutory and administrative framework has significant gaps. Given the large number of North Carolina residents who rely on private wells, it is imperative that the North Carolina General Assembly act to close these gaps. We have identified four initial areas of focus for the General Assembly and relevant agencies. First, the General Assembly should create a tiered system of financial and

regulated under the Safe Drinking Water Act. Post[-]construction regulation of private wells is the responsibility of individual counties or other local agencies.”); AATHERHOLT ET AL., *supra* note 314, at 1 (“Prior to passage of the PWTA, NJ regulations for private well testing applied only to newly constructed wells In addition to various construction requirements . . . , newly-constructed wells must be tested for the same parameters as required in the PWTA, and treatment of the water is required if any of the standards are exceeded.”); *Wells*, N.J. DEP’T OF ENV’T PROT., <https://www.state.nj.us/dep/watersupply/index.html> (last updated Feb. 13, 2023). Aside from the first two sources in this note, the webpages within the “Wells” index do not mention SDWA requirements for newly constructed wells.

380. *Compare NJ Private Well Testing Act Data Summary*, N.J. DEP’T OF ENV’T PROT., <https://www.arcgis.com/apps/MapSeries/index.html?appid=826ec9fae77543caa582a787d5f088e7> (choose from the tabs at the top of the webpage, which are labeled with a type of data grouping or a specific contaminant, and then click a location on the map to view its data) (last visited Jan. 5, 2023), *with Private Well Information*, N.C. DEP’T OF ENV’T QUALITY, <https://deq.nc.gov/about/divisions/water-resources/groundwater-resources/private-well-information> (last visited Jan. 5, 2023).

381. *See supra* note 378; *see, e.g., Private Wells*, *supra* note 169; *Private Wells*, N.C. DEP’T OF ENV’T QUALITY, <https://deq.nc.gov/about/divisions/water-resources/drinking-water/capacity-development/private-wells> (last visited Jan. 5, 2023); *Private Well Information*, *supra* note 380; *On-Site Water Protection Branch*, *supra* note 184.

administrative assistance to ensure that all private well users can test, maintain, and treat their wells. Second, the General Assembly, administrative agencies, and local health departments should arrange a coordinated push to improve private well education and outreach. Third, the General Assembly should fund the comprehensive identification of underbounded communities and the extension of municipal water service or alternative support to these communities. Finally, the General Assembly should propose legislation guaranteeing tenants access to both clean water and consistent information about their private well's water quality. These recommendations will help the state move towards the ultimate goal of ensuring all North Carolinians have access to safe drinking water.

A. *Develop a Tiered System of Financial Support*

To improve the safety of North Carolina drinking water, the State must expand its financial support for private well users. Currently, North Carolina private drinking wells are regulated during only a small portion of their lifespans.³⁸² Additionally, the support that the State currently offers through the BAF is available to a limited number of well users for a narrow range of issues.³⁸³ However, one of the most significant barriers to proper drinking well stewardship is that maintenance, water quality testing, and treatment or filtration must be performed consistently, costing thousands of dollars.³⁸⁴ Considering that poor Black communities on the outskirts of municipalities disproportionately rely on private wells and that poor, private-well-using communities of color across the state are disproportionately burdened by groundwater contamination,³⁸⁵ the steep cost of and limited State support in securing safe private drinking water is particularly troubling.

382. N.C. GEN. STAT. § 87-97 (2021) (covering only the installation and major repair of private wells).

383. See *supra* Part II.B.3. and notes 352–68 and accompanying text.

384. See *Frequently Asked Questions*, CLEAN WATER TESTING LLC, <https://www.cleanwatertesting.com/resources/water-testing-faqs/> (last visited Jan. 5, 2023) (“Costs can vary depending on the number and type of tests you request. Typical tests range from \$25-\$400.”); MacDonald Gibson & Pieper, *supra* note 13, at 076001-5; *Well Water Tests Available Through Wake County*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/groundwater-protection-and-wells/well-water-testing/well-water-tests-available-through-wake-county> (last visited Jan. 5, 2023); *supra* notes 155–57 and accompanying text.

385. See *supra* Part I.C.2.

Building on the State's current regulatory framework and adopting certain policies from both Wake County and New Jersey, North Carolina should develop a tiered system of support that offers individualized financial assistance to different groups of well users so that all who rely on private wells can afford to properly test, maintain, and treat them.

1. Testing

Because any comprehensive solution to private well water contamination must ensure that all well users have access to the necessary information required for prudent decision-making, the first element of this system should focus on equitable access to water quality testing. To broaden testing availability, the State should allocate funding to local governments specifically for providing discounted or no-cost testing to low-income well users. Because routine testing is an important part of well stewardship, it is critical that these reduced-price tests be available regardless of whether a well has suspected contamination. Wake County's system of financial help for water quality testing, which allows for tiered discounts on routine testing based on income level,³⁸⁶ serves as an excellent model for other local governments—though further reducing test prices or increasing the eligible range of income brackets would ease the financial burden of testing for even more well users. To avoid overwhelming local health departments, rules could be established at the state or local level stipulating how often well users can take advantage of these discounted tests.

2. Well Maintenance and Filtration

Increased access to testing alone is insufficient to protect private well water users. Proper well maintenance, such as replacing faulty components and addressing any leaks or cracks, is necessary to help prevent water contamination, and swiftly installing a filtration system upon the discovery or threat of contamination is critical for decreasing short- and long-term

386. *Programs to Help with Your Septic Repairs, Well Repairs, Water Treatment & Well Testing*, WAKE COUNTY, <https://www.wakegov.com/departments-government/water-quality-programs/programs-help-your-septic-repairs-well-repairs-water-treatment-well-testing> (last visited Jan. 4, 2023).

health risks.³⁸⁷ Both repairs and filtration systems can cost hundreds to thousands of dollars.³⁸⁸ The State should thus provide financial assistance for well maintenance and filtration. Although potentially less uniform and straightforward than ensuring discounted testing availability, supplying funding to make proper well maintenance and filtration possible for all well users is perhaps the most crucial step the State can take to reduce private well water contamination and its negative health impacts. To lend this support, North Carolina should adopt a three-tiered regulatory structure based on risk and financial need.

The first tier of this structure should help low-income well users whose water contains at least one contaminant in excess of water quality standards conduct critical repairs or obtain permanent replacement water supplies. Support for qualifying well users under this tier would come in the form of emergency technical and financial assistance from the State. Similar aid is currently available through the BAF, but only for well users experiencing anthropogenic water contamination.³⁸⁹ This first tier of support could thus be established by expanding BAF funding and amending N.C.G.S. § 87-98 to remove the requirement that nonnaturally occurring contamination be prioritized over naturally occurring contamination when disbursing BAF funds.³⁹⁰ Given the prevalence of naturally occurring private well water contamination in the State,³⁹¹ the cost of extending BAF aid to North Carolinians experiencing well water contamination from any source could be significant. However, the health risks caused by natural contamination are too great for the State to ignore any longer. Like anthropogenic contaminants, contaminants from natural sources can have severe immediate and long-term

387. *Well Maintenance: Overview of Maintenance*, CDC, <https://www.cdc.gov/healthywater/drinking/private/wells/maintenance.html> (last reviewed Feb. 23, 2023) (“Regular maintenance of your well is required to ensure the continued safety of your water and to monitor for the presence of any contaminants.”); NAT’L GROUNDWATER ASS’N, WELL OWNER MAINTENANCE PRACTICES (2015), <https://wellowner.org/wp-content/uploads/2021/02/Well-Owner-Maintenance-Practices.pdf>; see *Emergency Well Treatment*, CDC, https://www.cdc.gov/healthywater/drinking/private/wells/emergency_treatment.html (last reviewed Mar. 1, 2023).

388. MacDonald Gibson & Pieper, *supra* note 13, at 076001-5; see, e.g., *Well Pump Cost and Installation Guide*, THIS OLD HOUSE (July 28, 2022, 12:00 AM), <https://www.thisoldhouse.com/plumbing/reviews/well-pump-cost>.

389. See *supra* notes 253–55 and accompanying text.

390. *Id.* § 87-98(c7).

391. See *supra* notes 21–37 and accompanying text.

health effects.³⁹² Ultimately, emergency funding in this tier should be based on financial need and risk, not contamination source, however it is structured.

The second tier of financial support should consist of smaller grants for well users who fall below a certain income level but, because their water quality complies with standards, do not qualify for the first tier of support. These grants would be available for private well repairs or filtration system installation or maintenance. Unlike under the BAF, financially qualifying well users who do not have suspected contamination but are instead simply interested in following State maintenance recommendations would be eligible for this financial support. To ensure that sufficient funds are available to help all who need assistance under this tier, grant amounts could be limited to a certain percentage of the total cost of repairs, installations, and maintenance performed for a well user. This percentage could be based on a sliding scale determined by qualifying well user incomes. Additionally, to avoid overburdening the government unit responsible for administering these grants, this tier (along with the third tier) could provide less technical support than tier one. For example, while DEQ arranges work conducted under the BAF,³⁹³ well users interested in obtaining assistance from other tiers could be required to submit an application containing project details and vendor quotes, similar to prospective recipients of NJHMFA loans.³⁹⁴

For the third tier of support, the General Assembly should follow the example of New Jersey and establish a fund that provides zero- or low-interest loans to private well users of all incomes with contaminated wells. While the first two tiers would aid highest-need well users, these loans, similar to those outlined in N.J.S. § 58:12A-22,³⁹⁵ would be available to those whose income disqualifies them from receiving other tiers' aid but who still require assistance to protect their household from contaminated well water. Although higher-income well users would be eligible to apply for these loans, priority could be given to lower-income well users when selecting loan recipients, and any interest charged could be based on a sliding scale determined by income. Like loans awarded under N.J.S. § 58:12A-22, any interest paid on these loans would then return to the fund to increase the amount of available loans.

392. *Id.* (discussing contaminants that are naturally prevalent in North Carolina and their possible health effects).

393. *See supra* notes 363–65 and accompanying text.

394. *See supra* notes 366–67 and accompanying text.

395. N.J. REV. STAT. § 58:12A-22 (2022).

Building a regulatory structure establishing these three types of aid would create a comprehensive financial support program for private well users that fills most of the large gaps present in New Jersey's and North Carolina's current programs. By providing a range of well user groups the opportunity to engage in proper well stewardship and respond to contamination, this improved program would help protect North Carolina's most vulnerable from the serious health impacts that can be associated with unsafe drinking water.

3. Limitations

The obvious limitation to this recommended regulatory structure of financial support is that it could come with a significant price tag.³⁹⁶ Given the current financial concerns of state and local governments caused by the COVID-19 pandemic, implementing potentially costly programs like these may seem infeasible. However, this increased assistance will return short-term and long-term financial benefits for the State. Safer private drinking water would likely immediately reduce costs for North Carolina's health system: Statewide, emergency department visits for acute gastrointestinal illness potentially attributable to private well contamination cost an estimated \$39.9 million annually.³⁹⁷ Health system savings resulting from reduced exposure to contaminants associated with a plethora of immediate and delayed negative health effects, like arsenic and nitrate,³⁹⁸ would likely emerge over the coming decades. Because childhood reliance on private well water—as well as childhood exposure to lead from any source—increases

396. One possible source of funding—along with an additional option for private well user support—is a private well maintenance subscription service, an idea suggested in MacDonald Gibson & Pieper, *supra* note 13, at 076001-4, 076001-6. If well owners subscribed to such a service, they would be provided with all necessary routine maintenance and testing, assistance with installing and maintaining treatment systems, and help managing other well or water issues that arise. While this service could be provided by a nonprofit or for-profit company, if it was established by a North Carolina state government agency, funds collected from subscription fees not used to perform subscription services could help finance this proposed tiered system of financial support.

397. DeFelice et al., *supra* note 38, at 1590.

398. *See generally* Sinha & Prasad, *supra* note 28; Ward et al., *supra* note 39.

juvenile delinquency risk,³⁹⁹ safer private drinking water could even reduce criminal justice system costs while yielding other community benefits.⁴⁰⁰

If the General Assembly is wary of making too great of an initial investment in a statewide aid program, it could authorize funding for a pilot program in a selection of counties with high contamination rates.⁴⁰¹ This pilot program could provide the State with data it could use to more accurately determine the amount of funding necessary to expand the program to all North Carolina counties. To assist with these funding estimates, DEQ or the Department of Health and Human Services could conduct a statewide survey of private well users to obtain a clear understanding of this population's financial characteristics. Considering data from both the pilot program and study, the agency could then calculate the annual cost of providing tiered financial support to well users.

B. *Improve Education and Outreach*

While establishing equitable access to resources for well caretaking is critical, that access is essentially meaningless if it goes unused. Most well owners likely engage in improper or nonexistent well maintenance as a result

399. Jacqueline MacDonald Gibson, John M. MacDonald, Michael Fisher, Xiwei Chen, Aralia Pawlick, & Philip J. Cook, *Early Life Lead Exposure from Private Well Water Increases Juvenile Delinquency Risk among US Teens*, 119 PROC. NAT'L ACAD. SCI. U.S. 1, 6 (2022).

400. *Id.* at 10.

401. Possible counties include: Wake County (prevalence of uranium, radon, and radium contamination in private well water); Union County (prevalence of arsenic contamination); Brunswick County (high documented PFAS levels in publicly supplied tap water that may also be present in groundwater). *See supra* note 262 and accompanying text (detailing the extent of uranium, radon, and radium contamination in Wake County); Bruce Henderson, *Does Your Water Comes from a Private Well in NC? It Could Have High Levels of Arsenic.*, CHARLOTTE OBSERVER (Oct. 20, 2017, 11:23 AM), <https://www.charlotteobserver.com/news/local/article179929921.html> (“State data shows that 20 percent of wells sampled in Union County . . . have potentially unhealthy arsenic levels.”); Bob Bonner, *Study: Brunswick County Tops National List for PFAS Contamination*, WECT NEWS (Jan. 22, 2020, 8:29 AM), <https://www.wect.com/2020/01/22/brunswick-county-tops-national-list-pfas-contamination/>; *Well Sampling Information for Lower Cape Fear Area Residents*, N.C. DEP'T OF ENV'T QUALITY, <https://deq.nc.gov/news/key-issues/genx-investigation/well-sampling-information-lower-cape-fear-area-residents> (last visited Jan. 5, 2023).

of practical barriers and misconceptions about water contamination.⁴⁰² To address these misconceptions, we suggest that DEQ or DPH and local health departments conduct marketing campaigns that promote correct private well maintenance practices through various channels. For example, information sheets could be mailed to well owners, reminders added to community newsletters, and leaflets given to new property buyers.⁴⁰³ Campaigns could target specific groups that may be especially vulnerable to the effects of contamination, such as caretakers of infants and small children,⁴⁰⁴ and even distribute drinking water test kits or inexpensive but effective filters.⁴⁰⁵ This recommendation aligns with the targeted marketing campaigns proposed during a 2015 summit on North Carolina private well water quality.⁴⁰⁶ Convened by the N.C. Research Triangle Environmental Health Collaborative, this summit, “Safe Water from Every Tap,” identified private well management challenges and produced ten total recommendations in response to those challenges.⁴⁰⁷ Other outreach-focused summit suggestions included the creation of an interactive mapping tool to allow well owners and health departments to identify wells at risk of contamination and the organization of “a state-wide network of professionals that provides information and training on private well issues.”⁴⁰⁸

Beyond these recommendations, the General Assembly should amend N.C.G.S. § 87-97(i) to ensure well users are given information about all aspects of well stewardship, not just testing. Currently, § 87-97(i) directs the Commission for Public Health to adopt rules requiring local health departments to provide residents testing new and existing wells with information about minimum drinking water standards and optional and

402. See *supra* notes 92–98 and accompanying text; Flanagan et al., *supra* note 333, at 938–939.

403. See Jolianne Renaud, Fabien Gagnon, Cécile Michaud, & Sonia Boivin, *Evaluation of the Effectiveness of Arsenic Screening Promotion in Private Wells: A Quasi-Experimental Study*, 26 HEALTH PROMOTIONAL INT’L 465, 467 (2011). Similar activities were part of a community-based intervention to promote arsenic screening in private well water. Significantly more well users tested their water for arsenic after a mass-media campaign followed by a community-based intervention than after a mass-media campaign alone.

404. See MacDonald Gibson & Pieper, *supra* note 13, at 076001-6.

405. See *id.*; MacDonald Gibson et al., *supra* note 399, at 10.

406. MacDonald Gibson & Pieper, *supra* note 13, at 076001-4, 076001-6.

407. See *id.* at 076001-2 to -6.

408. *Id.* at 076001-4, 076001-6.

required testing.⁴⁰⁹ The resulting rules mandate that local health departments “provide information to the well owner or respective lease holder concerning chemical and biological contaminants exceeding public drinking water MCLs and the need for exposure limitation, remediation, or future sampling.”⁴¹⁰ While this information is useful, it only covers one portion of well maintenance and focuses on reactive, instead of proactive, well management. DEQ and DPH should work together with nongovernment stakeholders and local health departments to develop accessible materials that summarize comprehensive well caretaking information—such as local testing recommendations, suggested physical well maintenance, filtration and other contamination mitigation options, and sources of financial support. The General Assembly should then amend § 87-97(i) to expand its required education to include the provision of these documents.

C. *Identify Underbounded Communities and Extend Public Water Supplies or Other Support*

While all qualifying North Carolinians would be able to take advantage of the tiered financial aid program recommended in Part IV.A., underbounded communities underserved by municipal water service should be provided dedicated assistance. Prioritizing support of private well users in underbounded neighborhoods is both a public health and social justice necessity: Systematic exclusion of these Black communities from municipal services has quantifiable negative effects on health and quality of life and must be rectified.⁴¹¹ Furthermore, water line extension, while cost prohibitive for rural areas, may be economically feasible for these neighborhoods precisely because of the closeness to municipal water lines that makes their exclusion from public water supplies so egregious.⁴¹² As recommended by the “Safe Water from Every Tap” summit, the General Assembly should allocate resources to DEQ or DPH for the purposes of identifying underbounded ETJ communities using private wells across North Carolina, estimating the costs of extending water service to these communities, and assessing additional challenges and effects of service extension.⁴¹³ The

409. N.C. GEN. STAT. § 87-97(i) (2021).

410. 15A N.C. ADMIN. CODE 18A.3805(b) (2023).

411. *See supra* Part I.C.2.; *see generally* MacDonald Gibson et al., *supra* note 399.

412. *See* DeFelice et al., *supra* note 38, at 1589.

413. *See* MacDonald Gibson and Pieper, *supra* note 13, at 076001-4 to -5.

General Assembly should then appropriate funds to municipalities that must be used to assist these neighborhoods. Municipalities could prioritize extending water lines but employ alternative strategies to ensure safe water depending on community needs.⁴¹⁴ For example, if most community members prefer well water or have concerns about affording monthly water bills,⁴¹⁵ funds could be used to task a municipal government entity with well caretaking assistance or,⁴¹⁶ if it will ease contamination, repair or replace wells or septic systems. Implementing this recommendation could be expensive, but water line extension is a one-time cost that, like other forms of well user assistance, would likely provide health benefits and municipal savings in coming years.⁴¹⁷

D. *Require Landlords to Periodically Test, Disclose Results to Tenants, and Mitigate Contamination*

It is the responsibility of a property owner to correctly maintain their private well, and property owners who rely on their property's drinking well have an incentive to perform this maintenance because water contamination could impact their household's health. Property owners who lease or rent their property to others lack this personal incentive to care for those properties' wells. Furthermore, a significant power imbalance is often present in landlord-tenant relationships that could discourage a tenant, particularly one without access to other housing options, from asking the property owner to perform well maintenance. Tenants that want to ensure their water's safety may then have to personally conduct or arrange testing. While potentially costly, testing without landlord involvement is logistically possible (water from a house faucet can be sampled and most accurately represents the water consumed by tenants).⁴¹⁸ However, absent bringing a legal claim against the property owner, which can be cost prohibitive and risky, a tenant may be left without any remedy if they cannot convince a property owner to address any contamination discovered.

414. *See id.* at 076001-5.

415. *See id.*

416. *See id.*

417. *See supra* notes 396–400 and accompanying text.

418. Wake County, *How to Collect a Well Water Sample at Home*, YOUTUBE (June 24, 2019), <https://www.youtube.com/watch?v=-c1b30R69x0&t=9s>.

Based on these concerns, the General Assembly should amend the General Statutes to require property owners to inform prospective residents of water contamination. In addition to requiring disclosure at the time of signing, the General Assembly should adopt a provision similar to New Jersey's N.J.S. § 58:12A-32, which mandates that lessors test their rental properties' private well water at least every five years and provide tenants with a copy of the results within 30 days.⁴¹⁹ This provision would give tenants a legal right to disclosure enforceable by private or administrative action. Finally, to avoid burdening tenants with the task of mitigating contamination, the property owner should be required to address contamination levels in excess of water quality standards within a reasonable time period. These additions would help ensure that all tenants, no matter their income level, have the ability and right to obtain information about their water and access clean, safe drinking water.

CONCLUSION

Over the past two decades, North Carolina has made strides in protecting private well water users. However, given the large number of North Carolinians who rely on private drinking wells, the State's prevalence of both natural and anthropogenic groundwater contamination, and the presence of Black communities on the fringes of North Carolina municipalities that have been systematically denied access to public water service, the State cannot afford to delay the expansion and improvement of these protections. By establishing a financial support program to ensure all well owners can care for their wells, improving private well user education and outreach, funding water line extension or alternative support to underbounded neighborhoods, and securing tenants the right to safe private drinking water, North Carolina can become a national example of private well water quality protection. While these recommendations will likely require additional funding from the State, investing in well water protection today will improve well user health and reduce costs to State systems in coming years. Every person should have access to safe water. These changes will help North Carolina begin to make this aspirational statement a reality.

419. N.J. ADMIN. CODE § 58:12A-32 (2023).