

North Carolina Capacity Development Report For Public Water Systems

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1.0 Introduction

The primary objective of the North Carolina Public Water Supply Section is to ensure that water delivered by public water systems is safe for consumption and does not pose a danger to public health. This is accomplished through compliance oversight through the *North Carolina Drinking Water Act* and the federal *Safe Drinking Water Act*, which are represented in 15A NCAC 18C, the *Rules Governing Public Water Systems (Rules)*, copies of which are available online at: <https://deq.nc.gov/about/divisions/water-resources/drinking-water/plan-review/rules-governing-public-water-systems>.

A public water system is a water provider that delivers water for human consumption to at least 15 service connections, or regularly serves an average of at least 25 individuals for at least 60 days of the year.

The Public Water Supply Section serves the public interest and assists public water systems through a multi-faceted approach that includes:

- Enforcement of water sample monitoring requirements and evaluation of analytical results;
- Review and approval of engineering infrastructure plans and specifications;
- Comprehensive site visits;
- Development of programs to encourage and support local drinking water protection activities;
- Examination and professional certification of water system operators;
- Technical assistance, training, and outreach; and
- Other initiatives designed to facilitate compliance with the *Rules*.

1.1 Definition of Capacity

The 1996 *Safe Drinking Water Act Amendments* obligated states to ensure that all new community water systems and non-transient non-community water systems, beginning operation after Oct. 1, 1999, demonstrate technical, managerial and financial capacity. In response, the Public Water Supply Section developed a Capacity Development Program to meet the state's specific needs. The goal of the program is to require technical, managerial, and financial planning of new and existing community and non-transient non-community water systems that will improve systems' service and sustainability. Therefore, "capacity," as used in this report, refers to the technical, managerial and financial capabilities of a water system to comply with the provisions of the *Safe Drinking Water Act*.

The U.S. Environmental Protection Agency (EPA) required the Public Water Supply Section to develop milestones as part of its Capacity Development Program. The milestones were published in the *Public Water System Capacity Development Guidance Document* (March 2000), and they are available online at <https://ncdenr.s3.amazonaws.com/s3fs-public/Water%20Quality/capacitydevguide.pdf>. The milestones primarily include tracking the number of projects that have completed the engineering infrastructure approval and certification requirements. Section 3.0 of this report discusses these milestones.

The milestones, while valuable and reflective of the increase in capacity of water systems in North Carolina, do not provide a comprehensive view of overall capacity gains across the state, nor do they reflect the combined efforts of Public Water Supply Section employees in the central and regional offices to improve capacity in water systems across the state. A more comprehensive view of the program's dedication to improving public water systems' capacity is realized when the milestones are considered in conjunction with:

- Improvements in compliance trends (Section 2.0),
- Assistance provided to water systems by regional office staff (Section 4.0),
- Assistance provided to water systems by the Compliance Services Branch (Section 5.0),
- Support provided to the Division of Water Infrastructure (Section 6.0),
- Statewide drinking water protection programs (Section 7.0), and
- Examination and certification of competent water system operators by the N.C. Operator Certification Program (Section 8.0).

2.0 Assessing Water System Capacity through Compliance with Drinking Water Rules

Water system compliance with all drinking water protection rules can be challenging. Regulations are typically developed contaminant by contaminant, and the types of treatment or response necessary to reduce one contaminant below a regulatory threshold may lead to an exceedance of another. Fundamental tension exists between some rules, often called simultaneous compliance issues. For example, deaths from pathogenic organisms plummeted after the advent of disinfection, but over time we learned that disinfection can lead to the creation of disinfection by-products, which can cause cancer over many years of exposure. As water systems adjusted treatment to control disinfection by-products, we learned that the necessary chemistry changes at times increased the corrosivity of the water, which led to leaching of lead from household plumbing. There are often narrow ranges within which a supplier of water can operate and remain in compliance. Common changes in the raw water quality, which may occur after events such as rainfall or drought, require vigilant oversight by capable water system personnel to respond quickly and appropriately. Some consumers equate safety with zero risk; however, as this example illustrates, the fundamental disconnect between treatment approaches often requires a balancing of competing priorities to maximize public health protection. EPA considers these factors and more during rule development.

Systems are required to monitor water samples for contaminants regulated through the *National Primary Drinking Water Regulations*, created under the *Safe Drinking Water Act*. Those regulations have been adopted by reference in North Carolina. Water systems collect water samples according to EPA-mandated monitoring schedules, and compare sample results to contaminant-specific maximum contaminant levels. Systems base the locations and frequency of required samples on the population served, water system type, source water type, and prior analytical results. In accordance with EPA requirements, the Public Water Supply Section issues a notice of violation for each missed or incorrectly collected sample, which are considered “monitoring violations.” The EPA also requires that systems with contaminants detected above the maximum contaminant level (MCL) receive a notice of violation for each exceeding contaminant. These violations are referred to as MCL violations.

The Public Water Supply Section uses monitoring and MCL compliance rates as indicators of water system capacity. An evaluation of the water system capacity includes: the percentage of noncompliant systems, the population served by compliant systems, the performance of new public water systems, and the performance of systems that have been active since the beginning of the Capacity Development Program.

2.1 Overall Compliance Rates of Water Systems

Figure 1 (page 3) provides compliance information for public water systems in North Carolina regarding federal and state drinking water regulations. Data from 1999 are included as the baseline for comparison since the Capacity Development Program began on October 1, 1999. The percentage of systems receiving monitoring notices of violation has decreased significantly since 1999, while the percentage of systems receiving MCL notices of violation has remained relatively stable. These results are significant considering federal requirements have become more stringent during the same period and that an increasing number of systems are completing all their monitoring requirements.

Figure 1: Percentage of Public Water Systems Receiving at Least One Monitoring or MCL Violation Since 1999

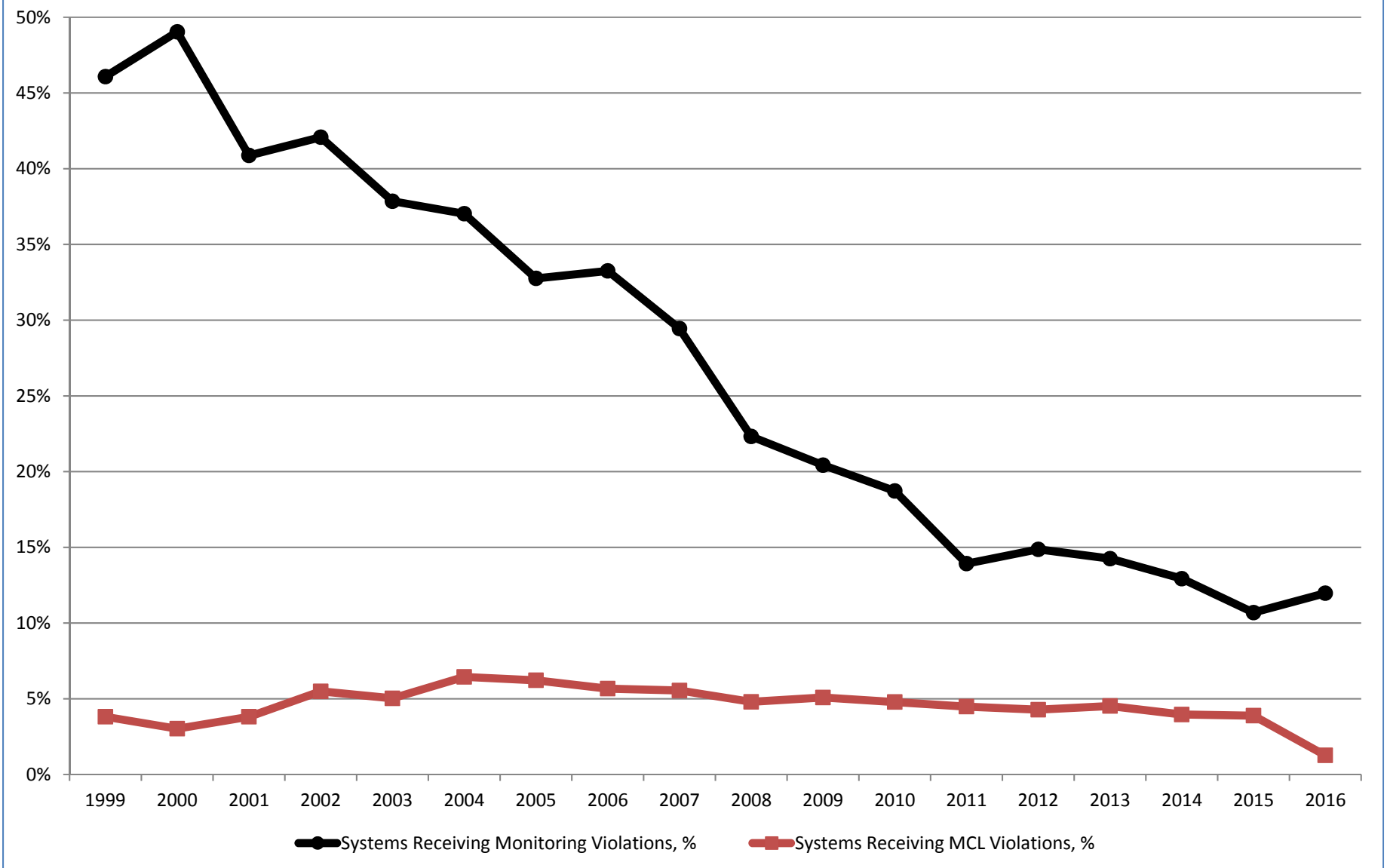


Table 1 (page 6) shows the number of water systems with at least one MCL or monitoring violation received in a calendar year. Calendar year 1999 is included as the baseline year, followed by data from recent years. Systems are categorized by type and size of population served. Table 1 also shows the percentage of systems that received a notice of violation as compared to the total number of active water systems within each system category.

Monitoring violations occur when a water system fails to collect a required sample or to complete analytical tests within the required monitoring period. A typical community system monitors at least monthly and must conduct a significant number of required tests. A public water system missing a single analytical test during a given year would appear on the table as having a monitoring violation.

Maximum contaminant level violations indicate the number of systems with at least one contaminant exceeding permissible levels during the given year. Maximum contaminant level violations can be either acute, meaning the exceedance poses an immediate health risk, or chronic, meaning the exceedance poses a health risk if exposure continues for an extended amount of time. A typical system has many opportunities to test various contaminant levels throughout the year. Most systems receiving bacteriological MCL violations return to compliance by their next compliance period. A public water system receiving at least one violation during the year will appear in Table 1.

2.2 Population Served by Compliant Community Water Systems

Another method of evaluating capacity, compliance, and public health protection is to examine the number of people served by compliant public water systems. Table 2 (page 7) provides the population served by compliant community water systems as a percentage of the total population served by community water systems. The EPA's strategic measures goal, as found in the *FY 2014-2018 EPA Strategic Plan*, is for 92 percent of community water systems to provide drinking water that meets all applicable health-based drinking water standards by 2018. As shown in Table 2, the percentage of the total population served by community water systems that are compliant with all applicable health-based drinking water standards in North Carolina has exceeded this 92 percent goal over the last four years. In fact, the percentage of the total population served by compliant community water systems in North Carolina has not dropped below 95 percent from 2013 through 2016. Figure 2 (page 8) also demonstrates the population served by compliant community water systems, using a graphical format. Large water systems serve greater percentages of the population than smaller systems, and even one violation received by a large system disproportionately decreases overall population compliance percentages. For example, the largest water system in North Carolina received one monitoring violation in 2004 and one MCL violation in 2005, leading to swings in the overall trends. This same swing in the trend occurred again in 2015, when the two largest water systems in the state both received one monitoring violation. As new rules are implemented the Public Water Supply Section expects to see an adjustment period of increased violations. One example of this adjustment occurred in 2004 when the Disinfection Byproducts Rule expanded to almost every community system. See Appendix A for a schedule of new rule implementation.

In 2016, systems with no MCL violations served approximately 97 percent of the state's community water system service population, and systems with no monitoring violations served 88 percent of the service population. The community water system service population with no monitoring violations improved greatly in 2016, after the state's two largest water systems both received monitoring violations in 2015. Water systems that received more than one MCL violation served approximately 0.7 percent of the population. Two community systems, comprising 0.007 percent of the population, received MCL violations for acute contaminants. Acute contaminants differ from chronic contaminants because they can cause an immediate health risk.

2.3 New System Performance

The Public Water Supply Section evaluates performance of new public water systems by tracking compliance rates following their initial date of operation. Table 3 (page 9) compares new and “found” system performance to the performance of all systems during the period from 2014 through 2016. Found systems started operations without the knowledge or approval of the Public Water Supply Section and were discovered by regional office staff while conducting fieldwork. Found systems did not complete the plan review process and thus have not completed the capacity development milestones. These systems are often improperly constructed and system owners have little or no understanding of compliance requirements. The Public Water Supply Section staff work with these systems to either stop operations or to prepare them for compliance oversight. These data show that new non-transient non-community and transient water systems exhibit better compliance with monitoring requirements than found systems. It should also be noted that new community and non-transient non-community systems do as well or better with compliance than existing systems, which shows the benefit of their completion of the capacity development milestones, as well as the benefit of Public Water Supply staff outreach.

Table 4 (page 10) shows the beginning year of new systems and the historic compliance trends of those systems that have remained active. In general, these systems exhibit improving compliance rates as time increases, meaning that the longer a system is in operation, the better able it is to comply with state and federal regulations. This implies that the planning inherent in the capacity development process, the technical assistance delivered by the Public Water Supply Section during the process, and increased familiarity and experience can help improve the compliance of new water systems. However, the compliance trends displayed also show remaining room for improvement, which the Public Water Supply Section will continue to seek in its effort to increase the capacity of all systems.

Table 1: The Number of Public Water Systems with Maximum Contaminant Level (MCL) and Monitoring (MR) Violations

Calendar Year	Population	Community					Non-Transient Non-Community					Transient Non-Community					Totals				
		Systems	MCL	%	MR	%	Systems	MCL	%	MR	%	Systems	MCL	%	MR	%	Systems	MCL	%	MR	%
1999 (baseline)	< 500	1700	44	3%	483	28%	541	23	4%	174	32%	6038	265	4%	3322	55%	8279	332	4%	3979	48%
	500 - 9,999	555	9	2%	154	28%	132	1	1%	28	21%	87		0%	34	39%	774	10	1%	216	28%
	10,000 - 49,999	92	4	4%	15	16%											92	4	4%	15	16%
	≥ 50,000	24	1	4%	2	8%											24	1	4%	2	8%
	Totals	2371	58	2%	654	28%	673	24	4%	202	30%	6125	265	4%	3356	55%	9169	347	4%	4212	46%
2013	< 500	1448	40	3%	153	11%	338	12	4%	42	12%	3543	177	5%	562	16%	5329	229	4%	757	14%
	500 - 9,999	479	29	6%	68	14%	58	1	2%	7	12%	59	7	12%	11	19%	596	37	6%	86	14%
	10,000 - 49,999	105	5	5%	13	12%											105	5	5%	13	12%
	≥ 50,000	28	2	7%	5	18%											28	2	7%	5	18%
	Totals	2060	76	4%	239	12%	396	13	3%	49	12%	3602	184	5%	573	16%	6058	273	5%	861	14%
2014	< 500	1427	32	2%	119	8%	325	7	2%	43	13%	3452	152	4%	512	15%	5204	191	4%	674	13%
	500 - 9,999	479	31	6%	63	13%	58	3	5%	10	17%	56	3	5%	5	9%	593	37	6%	78	13%
	10,000 - 49,999	105	5	5%	10	10%											105	5	5%	10	10%
	≥ 50,000	28	2	7%	4	14%											28	2	7%	4	14%
	Totals	2039	70	3%	196	10%	383	10	3%	53	14%	3508	155	4%	517	15%	5930	235	4%	766	13%
2015	< 500	1417	28	2%	100	7%	316	7	2%	30	9%	3384	158	5%	411	12%	5117	193	4%	541	11%
	500 - 9,999	478	27	6%	55	12%	57	0	0%	9	16%	56	0	0%	4	7%	591	27	5%	68	12%
	10,000 - 49,999	106	7	7%	11	10%											106	7	7%	11	10%
	≥ 50,000	29	0	0%	4	14%											29	0	0%	4	14%
	Totals	2030	62	3%	170	8%	373	7	2%	39	10%	3440	158	5%	415	12%	5843	227	4%	624	11%
2016	< 500	1405	16	1%	89	6%	307	2	1%	26	8%	3324	24	1%	512	15%	5036	42	1%	627	12%
	500 - 9,999	480	24	5%	39	8%	58	0	0%	5	9%	53	1	2%	6	11%	591	25	4%	50	8%
	10,000 - 49,999	108	5	5%	10	9%											108	5	5%	10	9%
	≥ 50,000	29	1	3%	3	10%											29	1	3%	3	10%
	Totals	2022	46	2%	141	7%	365	2	1%	31	8%	3377	25	1%	518	15%	5764	73	1%	690	12%

Table 2: Population Served by Compliant Community Public Water Systems

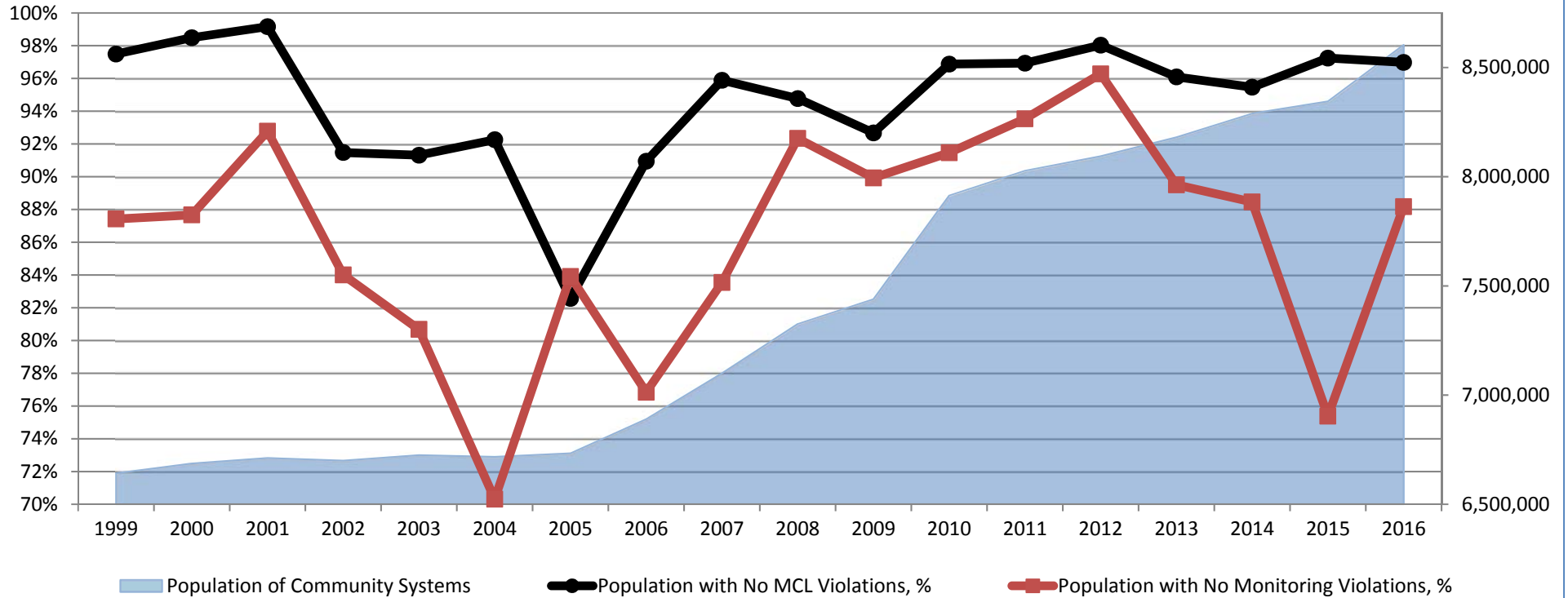
Year	Citizens Served by Community Public Water Systems having No MCL* Violations		Citizens Served by Community Public Water Systems having No MR† Violations		Total Service Population
	Population‡	Percent	Population	Percent	
1999 (baseline)	6,475,188	97.5	5,806,471	87.4	6,641,864
2013	7,861,037	96.1	7,322,188	89.5	8,180,600
2014	7,913,670	95.5	7,332,811	88.5	8,289,739
2015	8,114,838	97.2	6,290,530	75.4	8,344,870
2016	8,344,311	97.0	7,586,462	88.2	8,604,093

* "MCL" means a violation with regards to the maximum permissible contaminant level in water delivered by a public water system.

† "MR" means a failure to monitor for required water quality tests as defined by federal and state regulations and for 1999 through the first half of 2005 includes systems that failed to report on time.

‡ 1999 population data is based on last available record prior to Oct. 1, 2005.

Figure 2: Percent of Population Served by Compliant Community Public Water Systems



Year	Population of Community Systems	Percent of Population with No MCL Violations	Percent of Population with No Monitoring Violations
1999	6,641,864	97%	87%
2000	6,687,094	98%	88%
2001	6,711,693	99%	93%
2002	6,699,981	91%	84%
2003	6,724,862	91%	81%
2004	6,717,416	92%	70%
2005	6,733,306	83%	84%
2006	6,890,114	91%	77%
2007	7,099,817	96%	84%
2008	7,326,060	95%	92%
2009	7,439,647	93%	90%
2010	7,913,896	97%	91%
2011	8,027,685	97%	94%
2012	8,093,809	98%	96%
2013	8,180,600	96%	90%
2014	8,289,739	95%	88%
2015	8,344,870	97%	75%
2016	8,604,093	97%	88%

Table 3: Comparison of Public Water Systems Beginning Operation Between 2014 to 2016 and All Active Public Water Systems During the Last Three Years with Contaminant and Monitoring Violations

System Begins (Years)	Compliance Period (Years)	Community						Non-transient non-community						Transient non-community						TOTALS					
		Systems	SS*	MCL	%	MR	%	Systems	SS	MCL	%	MR	%	Systems	SS	MCL	%	MR	%	Systems	SS	MCL	%	MR	%
All Systems 2014-2016	2014-2016	2,060	70%	172	8%	487	24%	385	85%	28	7%	107	28%	3,590	99%	445	12%	1,283	36%	6,035	88%	645	11%	1,877	31%
New Systems that completed the Capacity Development requirements 2014-2016	2014-2016	23	91%	1	4%	4	17%	3	67%	0	0%	0	0%	0	0%	0	0%	0	0%	26	88%	1	4%	4	15%
Found Systems ^β 2014-2016	2014-2016	0	0%	0	0%	0	0%	1	100%	0	0%	1	100%	99	100%	8	8%	44	44%	100	100%	8	8%	45	45%

* *Small Systems (SS)* indicates percent of systems that serve less than 500 persons and operated during the indicated year.

^β *Found Systems* indicates the number of public water systems identified during this three-year period that were not previously on the PWS Section inventory list. It is anticipated that the number of found systems will increase as PWS Section staff perform more inspections.

Table 4: The Number of Public Water Systems Beginning Operation Between 2009 and 2016 with Contaminant and Monitoring Violations

System Begins (Year)	Compliance Period (Year) ‡	Community						Non-transient non-community						Transient non-community						TOTALS					
		Systems	SS*	MCL	%	MR†	%	Systems	SS	MCL	%	MR	%	Systems	SS	MCL	%	MR	%	Systems	SS	MCL	%	MR	%
2009	2009	7	100%	0	0%	2	29%	5	100%	0	0%	1	20%	50	100%	2	4%	22	44%	62	100%	2	3%	25	40%
	2010	7	100%	1	14%	0	0%	4	100%	0	0%	1	25%	50	100%	3	6%	15	30%	61	100%	4	7%	16	26%
	2011	7	86%	1	14%	0	0%	4	100%	0	0%	2	50%	47	100%	2	4%	10	21%	58	98%	3	5%	12	21%
	2012	7	86%	0	0%	0	0%	3	100%	0	0%	1	33%	46	100%	3	7%	10	22%	56	98%	3	5%	11	20%
	2013	7	86%	1	14%	2	29%	3	100%	0	0%	0	0%	45	100%	3	7%	8	18%	55	98%	4	7%	10	18%
	2014	6	50%	0	0%	1	17%	3	100%	0	0%	0	0%	43	100%	2	5%	11	26%	52	94%	2	4%	12	23%
	2015	6	50%	0	0%	0	0%	3	100%	0	0%	1	33%	42	100%	2	5%	12	29%	51	94%	2	4%	13	25%
	2016	6	50%	0	0%	0	0%	3	100%	0	0%	0	0%	41	100%	1	2%	10	24%	50	94%	1	2%	10	20%
2010	2010	26	85%	0	0%	8	31%	12	75%	1	8%	3	25%	63	100%	1	2%	27	43%	101	93%	2	2%	38	38%
	2011	26	85%	0	0%	3	12%	11	73%	0	0%	3	27%	63	100%	3	5%	14	22%	100	93%	3	3%	20	20%
	2012	25	84%	0	0%	1	4%	9	67%	0	0%	1	11%	56	100%	0	0%	7	13%	90	92%	0	0%	9	10%
	2013	23	87%	0	0%	3	13%	9	67%	0	0%	0	0%	54	100%	2	4%	6	11%	86	93%	2	2%	9	10%
	2014	22	86%	1	5%	2	9%	7	71%	0	0%	0	0%	53	100%	1	2%	8	15%	82	94%	2	2%	10	12%
	2015	22	86%	1	5%	2	9%	7	71%	0	0%	1	14%	52	100%	1	2%	6	12%	81	94%	2	2%	9	11%
	2016	22	86%	1	5%	0	0%	7	71%	0	0%	0	0%	49	100%	0	0%	4	8%	78	94%	1	1%	4	5%
	2011	2011	13	92%	0	0%	3	23%	6	100%	0	0%	1	17%	59	98%	6	10%	23	39%	78	97%	6	8%	27
2012		12	92%	0	0%	2	17%	6	100%	0	0%	1	17%	57	98%	6	11%	14	25%	75	97%	6	8%	17	23%
2013		12	92%	0	0%	0	0%	6	100%	0	0%	1	17%	51	100%	3	6%	7	14%	69	99%	3	4%	8	12%
2014		12	92%	0	0%	0	0%	6	100%	0	0%	0	0%	49	100%	2	4%	3	6%	67	99%	2	3%	3	4%
2015		12	92%	0	0%	1	8%	6	100%	0	0%	1	17%	46	100%	3	7%	1	2%	64	98%	3	5%	3	5%
2016		12	92%	0	0%	0	0%	6	100%	0	0%	0	0%	45	100%	3	7%	2	4%	63	98%	3	5%	2	3%
2012		2012	15	73%	0	0%	5	33%	8	88%	0	0%	4	50%	45	98%	4	9%	21	47%	68	91%	4	6%	30
	2013	15	73%	2	13%	0	0%	8	88%	1	13%	4	50%	45	98%	7	16%	12	27%	68	91%	10	15%	16	24%
	2014	15	73%	0	0%	0	0%	8	88%	1	13%	2	25%	39	97%	3	8%	8	21%	62	90%	4	6%	10	16%
	2015	14	79%	0	0%	0	0%	7	86%	0	0%	1	14%	38	100%	2	5%	7	18%	59	93%	2	3%	8	14%
	2016	14	79%	1	7%	0	0%	7	86%	1	14%	0	0%	37	100%	0	0%	3	8%	58	93%	2	3%	3	5%
	2013	2013	12	83%	0	0%	3	25%	3	67%	0	0%	1	33%	28	93%	4	14%	13	46%	43	88%	4	9%	17
2014		12	83%	0	0%	2	17%	3	67%	0	0%	2	67%	28	93%	1	4%	9	32%	43	88%	1	2%	13	30%
2015		12	83%	2	17%	2	17%	3	67%	0	0%	1	33%	27	93%	1	4%	6	22%	42	88%	3	7%	9	21%
2016		12	83%	1	8%	1	8%	3	67%	0	0%	0	0%	24	92%	2	8%	2	8%	39	87%	3	8%	3	8%
2014	2014	4	75%	0	0%	2	50%	2	50%	0	0%	0	0%	25	100%	2	8%	7	28%	31	94%	2	6%	9	29%
	2015	4	75%	0	0%	1	25%	2	50%	0	0%	1	50%	24	100%	1	4%	4	17%	30	93%	1	3%	6	20%
	2016	4	75%	0	0%	0	0%	2	50%	0	0%	0	0%	23	100%	1	4%	4	17%	29	93%	1	3%	4	14%
2015	2015	5	100%	0	0%	0	0%	2	100%	0	0%	0	0%	31	100%	3	10%	10	32%	38	100%	3	8%	10	26%
	2016	5	80%	0	0%	0	0%	2	100%	0	0%	0	0%	30	100%	0	0%	8	27%	37	97%	0	0%	8	22%
2016	2016	14	93%	1	7%	2	14%	0	0%	0	0%	0	0%	43	100%	0	0%	19	44%	57	98%	1	2%	21	37%

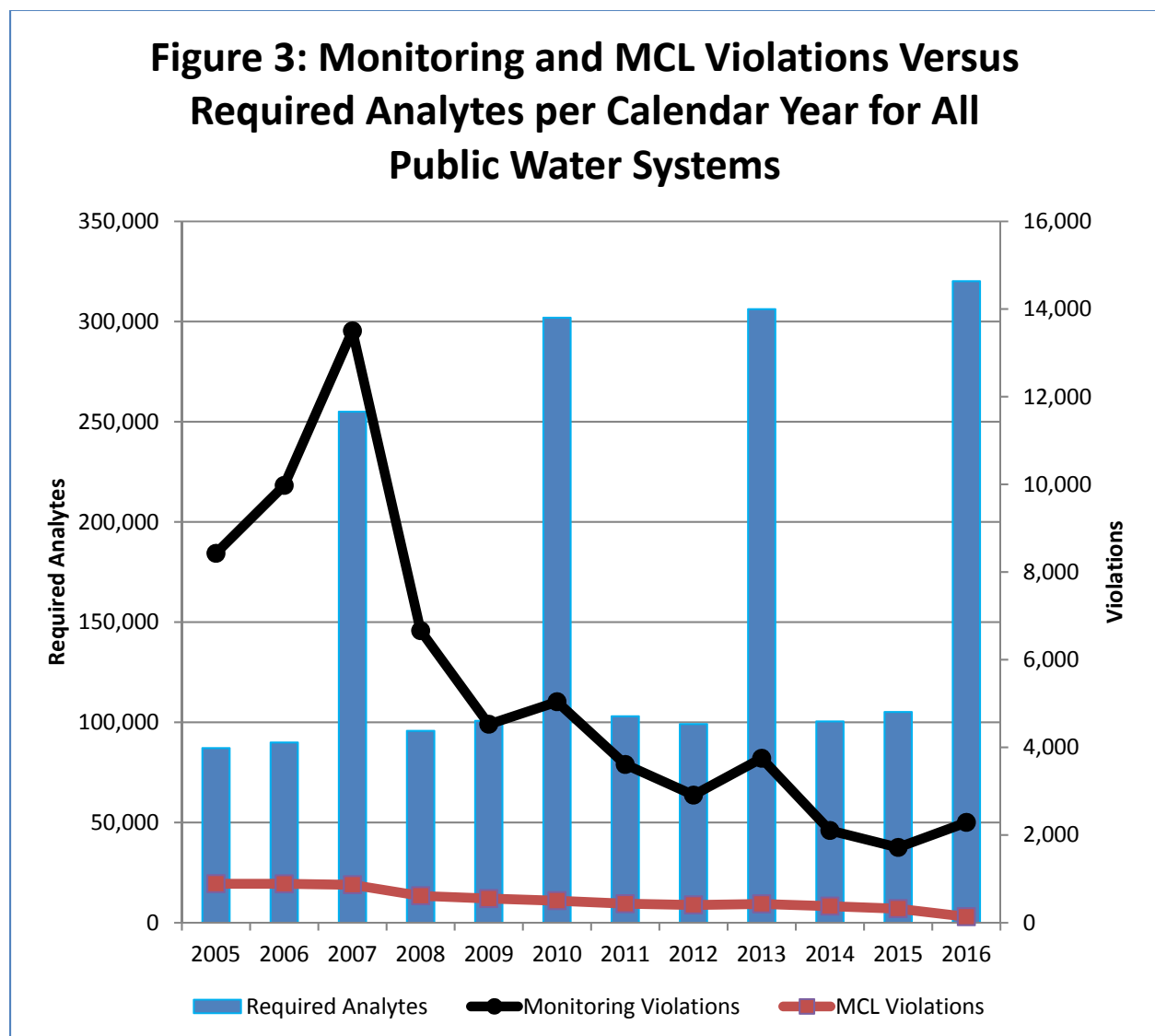
* *Small Systems (SS)* indicates percent of systems that serve less than 500 persons and operated during the indicated year.

† *Compliance Period (Year)* summarizes the number of new systems that remain active and their compliance for each subsequent compliance period. For example, in 2016, only 6 of the 7 community systems that began operation in 2009 were still active.

2.4 Violations Versus Required Contaminant Sampling Events

The Public Water Supply Section analyzed contaminant monitoring schedules from 2005 through 2016 with respect to the total number of analytes, since many contaminant schedules include multiple analytes. Each analyte is a chemical compound, element, or specific biological group required for analysis under state and federal rules, and omission of a single analyte results in a violation. Staff compared the number of analytes required for analysis to the number of monitoring and MCL violations issued for each calendar year during 2005 through 2016.

Figure 3 shows the total number of required analytes as bars (referenced by the scale on the left axis) versus the number of monitoring and MCL violations as lines (referenced by the scale on the right axis) issued to water systems during each calendar year. This figure shows that despite the substantial number of analytes required for analysis, the number of violations has decreased markedly since 2005. Many federal drinking water rules require three-year cyclical sampling to be performed and reported by the end of the three-year compliance periods ending in 2007, 2010, 2013, 2016, etc. The large increases of required analytes in 2007, 2010, 2013, and 2016 are due to these three-year compliance periods. Triennial samples that were not collected in 2007 resulted in the large spike in monitoring violations. The 2010, 2013, and 2016 data do not show as significant of a spike, which implies that activities performed by regional office staff, outreach efforts by central office staff, training events hosted by the Public Water Supply Section, and other programs had a positive effect on monitoring compliance. Note that MCL violations dropped from 889 to 137 over the 12-year period.



2.5 Total Coliform Rule (TCR) and Revised Total Coliform Rule (RTCR) Specific Compliance

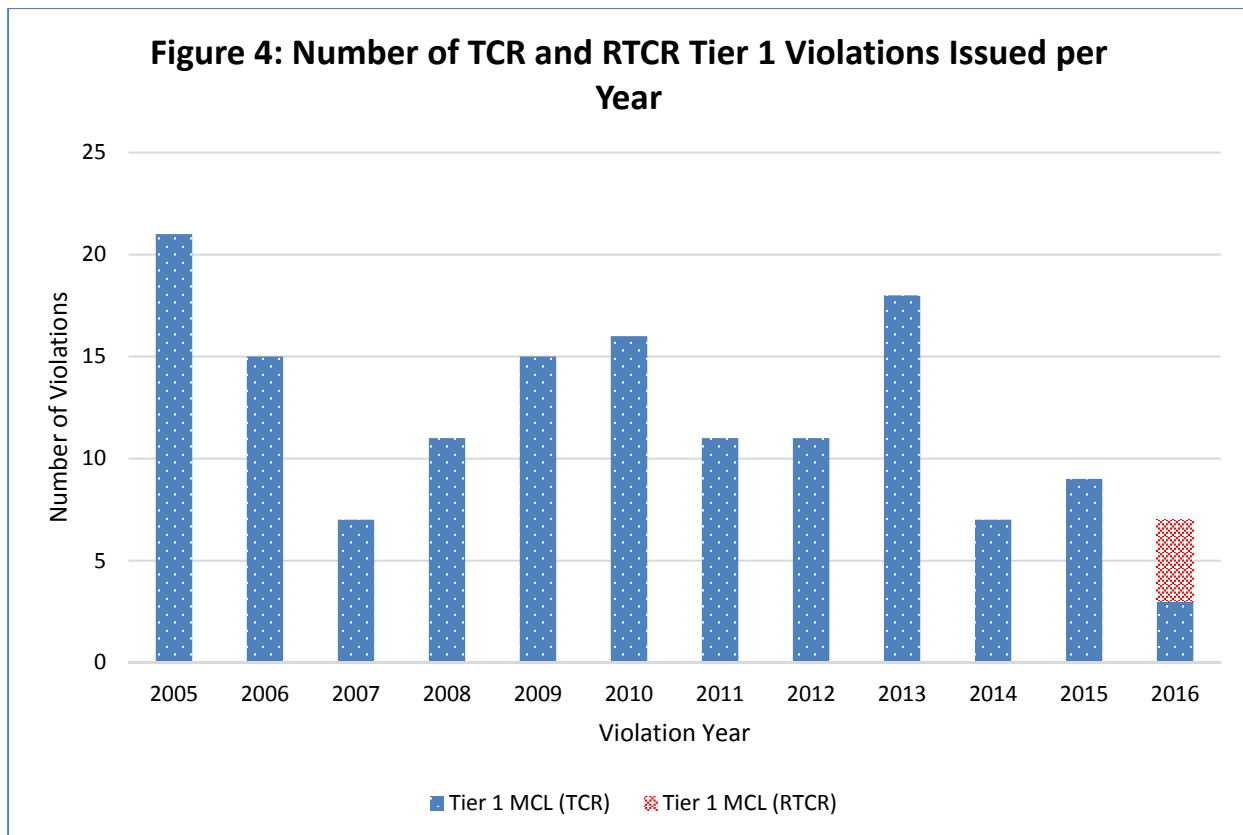
During this reporting period, the Public Water Supply Section analyzed the number of Tier 1 and Tier 2 violations related to both the Total Coliform Rule (TCR) and new Revised Total Coliform Rule (RTCR). Tier 1 refers to required public notification within 24-hours and Tier 2 refers to required public notification within 30-days after a public water system learns of a violation, based on the potential public health impact of the violation. For the purposes of this section of the report, violations requiring Tier 1 public notification will be referred to as Tier 1 violations, and violations requiring Tier 2 public notification will be referred to as Tier 2 violations. Total coliforms are a group of related bacteria that are (with few exceptions) not harmful to humans; however, their presence in drinking water is used as an indicator that other microbiological contaminants (such as pathogenic bacteria, viruses, and parasites) could also be present. In this way, the intent of the TCR and new RTCR is to determine whether the water treatment process and integrity of the distribution system are adequate for the protection of public health.

Compliance for bacteriological samples was based on the TCR from 1990 through the end of March 2016, and compliance under the new RTCR became effective on April 1, 2016. The requirements of both the TCR and RTCR apply to all public water systems in operation, regardless of the water system's type, size, or water source.

The purpose of both the TCR and RTCR is protection of public health by identifying the presence of harmful bacteria. If total coliform is detected, then further testing for fecal coliform (TCR only) or *E. coli* is required and additional follow-up actions are specified. A Tier 1 maximum contaminant level (MCL) violation is considered the highest-risk situation. This occurs when total coliform bacteria is detected in both an initial sample and a repeat sample, and at least one of the positive detects include fecal coliform (TCR only) or *E. coli*. Immediate response and cleanup activities are required under both rules, including notification to the public as soon as practical, but no later than 24 hours after positive results are obtained.

2.5.1 TCR/RTCR Tier 1 MCL Violation Return to Compliance

In analyzing compliance under both the TCR and RTCR, the Public Water Supply Section focused on how quickly water systems are returned to compliance for these high-risk violations. Tier 1 MCL violations are issued for contaminants that have potential for serious adverse effects on human health following short-term exposure and minimal consumption. Figure 4 (page 13) shows the total number of these Tier 1 MCL violations issued under both the TCR and RTCR from 2005 through 2016.

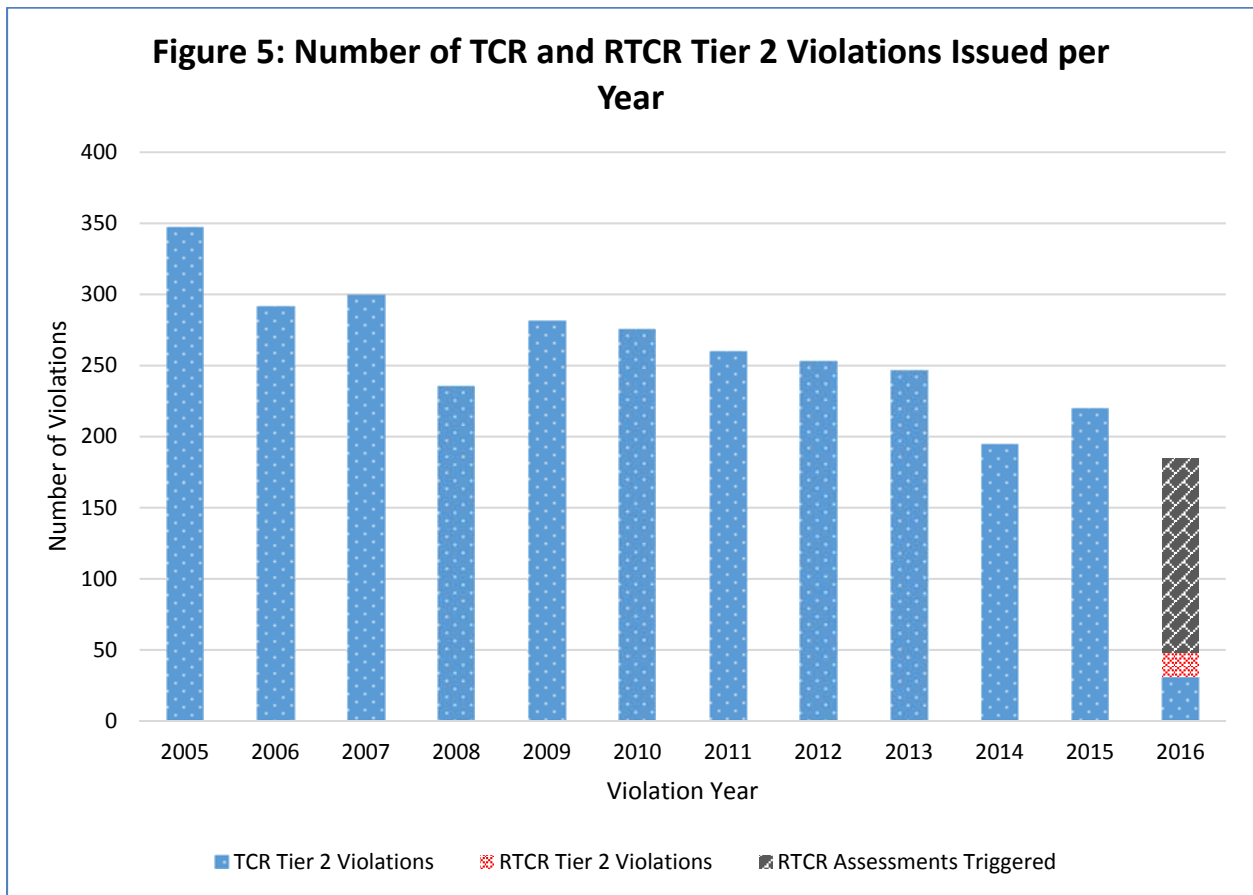


As displayed in Figure 4, the number of Tier 1 MCL coliform violations issued each year demonstrates no discernable trend. The total number of public water systems receiving at least one Tier 1 MCL coliform violation from 2005 through 2016 was 131. Of the 131 public water systems receiving a Tier 1 MCL coliform violation, 117 received the violation only once during the twelve-year period analyzed, while 14 systems received multiple Tier 1 MCL coliform violations during that same period. This result suggests that 89% of the water systems that received a Tier 1 MCL coliform violation from 2005 through 2016 came back into compliance immediately, and then maintained this compliance for an extended period. Consequently, the number of “repeat offenders”, or water systems that exhibit chronic Tier 1 MCL compliance issues, is low.

The small number of water systems receiving multiple Tier 1 MCL coliform violations suggests that follow-up actions taken by water system personnel and Public Water Supply Section staff to quickly resolve these violations have been very successful. When the Public Water Supply Section learns that a Tier 1 MCL coliform violation will be issued, regional office staff are immediately notified and generally make an onsite visit to the public water system receiving the violation. During these onsite visits, Section staff will help water system personnel in determining the cause of contamination, review bacteriological sampling procedures with system personnel, perform or assist in conducting the required assessments, and give suggestions for corrective actions. With transient ground water systems comprising approximately 75% of the Tier 1 MCL coliform violations received during the twelve-year period analyzed, onsite visits by Section staff members with technical knowledge are important in helping to guide the response of water system personnel, helping them to make informed decisions in resolving their acute contamination issues.

2.5.2 RTCR Tier 2 Violation Changes

The RTCR refined how Tier 2 coliform violations are issued. Under the original TCR, Tier 2 coliform violations were only issued as MCL violations for water systems that received multiple total coliform detections, but were free from the fecal coliform or *E. coli* that would require the issuance a Tier 1 MCL coliform violation. The RTCR changed the requirements so that fecal coliform is no longer considered for compliance, and water system assessments are now required in lieu of issuing a Tier 2 MCL coliform violation. Tier 2 violations are issued under the RTCR only if public water systems fail to complete the required assessments, fail to fix any defects discovered during an assessment, or fail to complete the new RTCR requirement for startup procedures (completed by seasonal water systems only). Figure 5 below shows the total number of these Tier 2 violations issued under both the TCR and RTCR from 2005 through 2016.



As displayed in Figure 5, the number of Tier 2 coliform violations issued to public water systems slowly but steadily declined under the original TCR (2005 through 1st quarter 2016), but dropped significantly in 2016 when the RTCR began and assessments were triggered for what would have been a Tier 2 MCL coliform violation under the original TCR. A total of 220 Tier 2 MCL coliform violations were issued in 2015 under the TCR. There were 31 Tier 2 MCL coliform violations issued in 2016 under the TCR during the first quarter of the year, but only 17 additional Tier 2 violations were issued under the RTCR for the remainder of the year. There were 137 assessments triggered in 2016 under the RTCR that would have resulted in a Tier 2 MCL coliform violation under the original rule, which would bring the difference between 2015 and 2016 down from 172 to 35 if incorporated into violation count. The number of Tier 2 coliform violations may increase over the next year or two, as some water systems that trigger assessments receive violations for failure to complete these assessments or to address defects that were identified during these assessments. Technical assistance to prevent such violations is provided.

3.0 Assessing Capacity through Capacity Development Program Objectives

The August 2000 report, “North Carolina’s Capacity Development Strategy for Existing Public Water Systems,” identified indicators to evaluate the progress of the Capacity Development Program. Below is an excerpt from this report.

The primary component of North Carolina’s Capacity Development Program is an evaluation of technical, managerial and financial capacity during the planning stages of new construction, expansion or system alteration. Therefore, a key indicator of water system capacity is compliance with the requirements specified in Section .0300 of the *Rules Governing Public Water Systems*. Specifically, the Public Water Supply Section uses existing databases to track the following information:

- Number of public water systems with approved plans and specifications,
- Number of public water systems with a completed water system management plan (WSMP),
- Number of public water system projects with a submitted engineer’s certification that documents the system is constructed in accordance with approved plans and specifications,
- Number of public water system projects with an applicant certification that documents the system has an operation and maintenance plan and an emergency management plan
- Number of public water systems that have an appropriate certified operator in responsible charge.

The above information, in addition to compliance information, is used to measure improvements in capacity. It is important to note while reviewing this information that transient water systems are not subject to plan review and therefore, are not subject to the capacity development milestones to which community and non-transient non-community water systems are subject.

In addition, the Public Water Supply Section tracks the number of water supply intakes with state-approved source water protection plans and/or source water assessments as a measure of improved capacity.

Supporting activities for capacity development include, site visits made by regional office staff, compliance and enforcement, source water protection planning and related activities that encourage local participation in drinking water protection activities, operator certification, and water system infrastructure funding. North Carolina’s Capacity Development Program works to facilitate internal coordination between all of these supporting activities in an effort to enhance capacity in all activity areas. An example of this coordination is the Capacity Development Program’s development of a sanitary survey report form for regional staff that prepopulates water system information from the state drinking water database. During site visits, regional offices verify the accuracy of inventory information in the database and mark only the changes for each water system. A variety of other reports that were developed also make important data available. The Public Water Supply Section continues to explore ways in which information from these activities can streamline activities and enhance the capacity of regulated water systems.

3.1 Increases in Systems Completing Capacity Development Measures

Table 5 (page 17) is a summary of the number of systems that have completed the specific Capacity Development Program activities identified in Section 3.0. This table provides the percent completed compared to the total community and non-transient non-community systems.

By program definition, systems that complete the measures depicted in Table 5 increase their capacity. The systems represented in Table 5, with plans approved, have water infrastructure designed in accordance with applicable rules that help to ensure the water is treated and distributed safely. Systems covered by valid water system management plans have acknowledged their water system policies and have certified that their anticipated budget allows the system to remain viable over time. Systems with applicant certifications for projects have operation and maintenance protocols and emergency management plans. These are used for upkeep of the water system and can be applied during water-related emergencies. Systems with final approval have completed all the capacity development measures for at least one project.

Table 5: Capacity Development Measures

10/1/99 through:	Total Number of Community and Non-transient non-community Systems	Systems with Plans Submitted		Systems with Plans Approved		Systems Covered by Complete Water System Management Plans‡		Systems with Engineer’s Certification		Systems with O&M and EM Plans*		Systems with Final Approval**	
		#	%	#	%	#	%	#	%	#	%	#	%
Dec. 31, 2006	2,749	1,399	50.9	1,210	44.0	1,559	56.7	939	34.2	711	25.9	727	26.4
Dec. 31, 2007	2,705	1,477	54.6	1,291	47.7	1,581	58.4	1,076	39.8	995	36.8	954	35.3
Dec. 31, 2008	2,649	1,564	59.0	1,366	51.6	1,605	60.6	1,173	44.3	1,104	41.7	1,077	40.7
Dec. 31, 2009	2,549	1,644	64.5	1,445	56.7	1,592	62.5	1,310	51.4	1,255	49.2	1,247	48.9
Dec. 31, 2010	2,592	1,701	65.6	1,503	58.0	1,622	62.6	1,385	53.4	1,336	51.5	1,328	51.2
Dec. 31, 2011	2,546	1,744	68.5	1,554	61.0	1,628	63.9	1,450	57.0	1,406	55.2	1,398	54.9
Dec. 31, 2012	2,496	1,788	71.6	1,600	64.1	1,634	65.5	1,503	60.2	1,453	58.2	1,452	58.2
Dec. 31, 2013	2,471	1,829	74.0	1,645	66.6	1,647	66.7	1,555	62.9	1,506	60.9	1,508	61.0
Dec. 31, 2014	2,429	1,858	76.5	1,667	68.6	1,640	67.5	1,584	65.2	1,544	63.6	1,539	63.4
Dec. 31, 2015	2,409	1,890	78.5	1,699	70.5	1,639	68.0	1,606	66.7	1,567	65.0	1,563	64.9
Dec. 31, 2016	2,387	1,924	80.6	1,731	72.5	1,646	69.0	1,646	69.0	1,602	67.1	1,598	66.9

*Tank rehabilitation projects do not require an Applicant Certification or a WSMP. A water system may receive final approval for a tank rehabilitation project based on a valid engineer’s certification only.

**It is important to note that not all projects are built during the same year that plans are approved and that an authorization to construct is issued. An authorization to construct is valid for a period of two years. Some projects that receive this authorization are not constructed.

‡ The number of systems covered by complete WSMPs has been updated to include multiple systems under single ownership with a master WSMP. “Systems with Plans Submitted” means the number of systems with at least one set of engineering plans and specifications submitted for review during the indicated period.

“Systems with Plans Approved” means the number of systems with at least one set of engineering plans and specifications reviewed and approved during the indicated period.

“Systems with Water System Management Plan Complete” means the number of systems with at least one WSMP completed during the indicated period.

“Systems with Engineer’s Certification” means the number of systems having at least one engineer’s certification during the indicated period in which a project was constructed according to approved plans and specifications.

“Systems with O&M and EM Plans” means the number of systems having at least one applicant certification during the indicated period that a project had an operation and maintenance plan and an emergency management plan.

“Systems with Final Approval” means the number of systems meeting all our capacity development requirements during the indicated period and for which a permit to operate was issued.

The Capacity Development Program assures that an increasing number of public water systems have evaluated their capacity in accordance with the program's objectives as discussed in Section 3.0 of this report. From Oct. 1, 1999 through the end of 2016, approximately 1,924 systems submitted 29,501 projects for review; 1,598 systems achieved final approval status for 20,644 projects. The Public Water Supply Section sends written correspondence on a monthly basis to systems that have projects approaching their "authorization to construct" deadline and for which no engineer's certification or applicant certification have been received. This correspondence informs the system to submit the required documentation, request an extension of the authorization to construct, or withdraw the application if the project will not be constructed. As of Dec. 31, 2016, approximately 1,646 systems were covered by a water system management plan self-assessment deemed satisfactory by the Public Water Supply Section. Note that one WSMP may include multiple systems under single ownership.

The Public Water Supply Section has received an average of approximately 1,711 project plans per year since the inception of the Capacity Development Program. Section staff either approves the plans or issues comments for plans that do not meet minimum rule requirements. The Public Water Supply Section does not approve all plans submitted. Approximately 6 percent of plans are withdrawn by the applicant or recycled by the Public Water Supply Section due to the applicant's lack of response to comments after an extended period. Section staff sends reminder letters to applicants and provides an opportunity to respond to comments prior to closing the project.

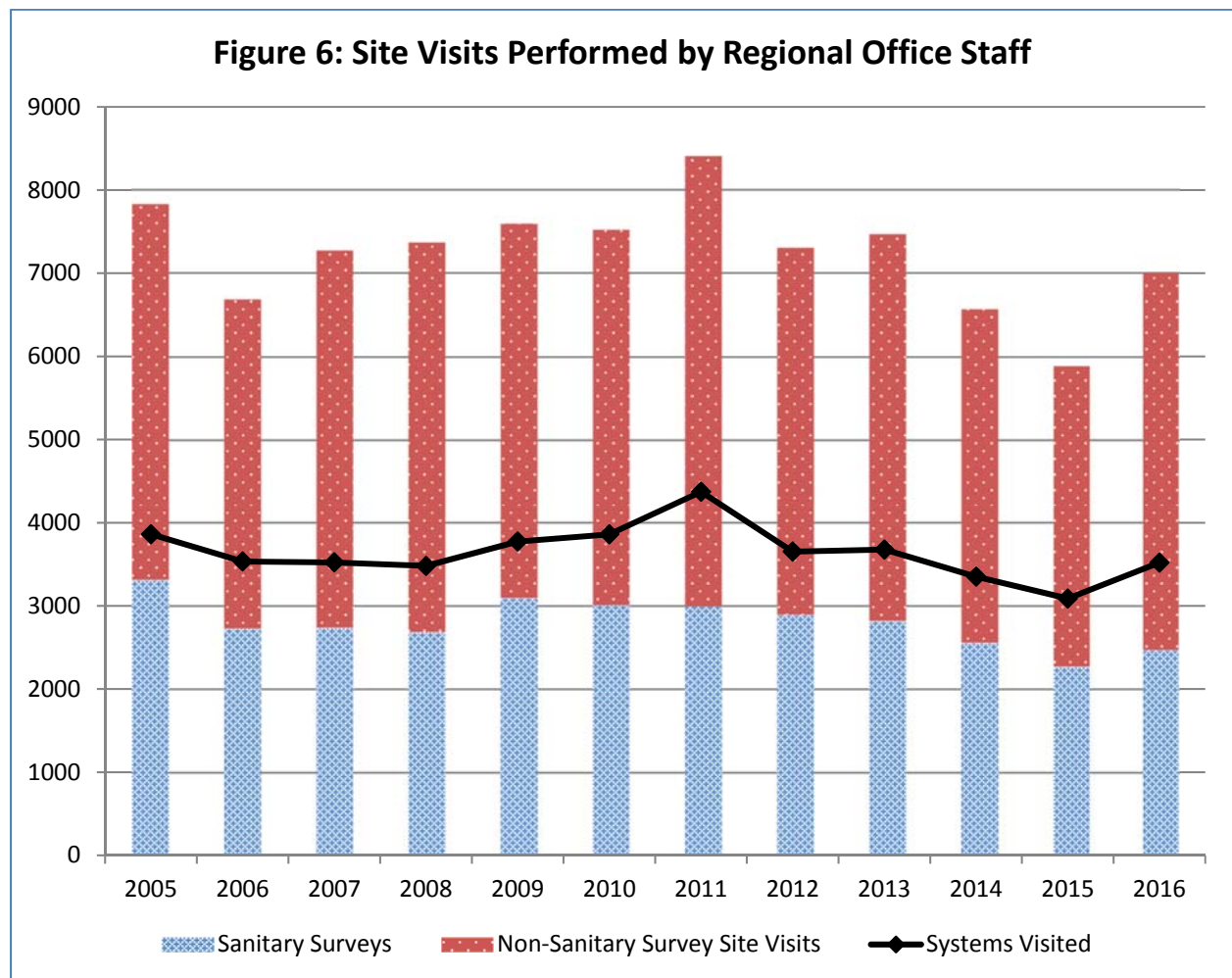
Completion of the Capacity Development Program requirements indicates that a public water system has completed both operation and maintenance plans and emergency management plans. These plans are valuable tools for the proper maintenance of the water system and provide incentive for the system to prepare for emergency and disaster events. With this requirement, the Public Water Supply Section has built a strong foundation regarding recent security concerns and federal requirements for vulnerability assessments and disaster preparedness for public water systems. A potential weakness, however, may be the lack of a requirement to update these plans on a set frequency.

4.0 The PWS Section Regional Offices

The Public Water Supply Section regional offices play a vital role in supporting and maintaining water system capacity throughout the state. Regional office staff provide services that are crucial to increasing water system capacity through better compliance with sampling and engineering infrastructure requirements, detailed system inspections, and through assistance in addressing contamination issues. Regional office staff also provide input to improve system management, operations, and operator compliance.

4.1 Site Visits

The seven regional offices provide support primarily through direct, onsite interaction with water systems. The most common reasons for visits are to perform sanitary surveys, provide technical assistance, perform informal and construction inspections, perform investigations regarding violations or complaints, and to provide compliance assistance. Most regional office staff members complete the training and examination to become certified operators to ensure that they hold the technical knowledge necessary for these tasks. As seen in Figure 6, the Public Water Supply Section regional office staff performed approximately 6,999 visits to water systems in 2016, of which 2,463 were sanitary surveys. The solid line depicts the number of systems visited annually and the stacked columns depict the number and type of visits performed per year.



Many site visits focus on providing customer service and assistance regarding technical and regulatory concerns. For example, staff perform system assessments triggered under the revised total coliform rule for some water systems, as they have the technical knowledge that small water systems without certified operators would not have if they completed assessments on their own. Public Water Supply Section regional staff often make several visits to a given system during the year to help solve site-specific problems. Of the 3,520 water systems visited in 2016, 1,553 were community systems, which serve nearly 8 million consumers.

4.1.1 Sanitary Surveys

The sanitary survey is the most comprehensive site visit the regional offices perform. Sanitary surveys are EPA-mandated site visits performed by regional staff to identify deficiencies in technical and managerial capacity. Public Water Supply Section staff evaluate the following aspects of a water system during the sanitary survey:

- Source water,
- Water treatment,
- Distribution system,
- Finished water storage,
- System pumps,
- Monitoring and reporting data verification,
- Management and operations, and
- Operator compliance.

During the sanitary survey, the Public Water Supply Section staff member inspects the water system for approximately 190 potential deficiencies that can exist within the aspects listed above. The deficiency classifications range from significant deficiencies to minor deficiencies to recommendations. All significant and minor deficiencies are rule-based, whereas recommendations represent preferred practice. The regional staff assist water systems by providing technical assistance to correct any deficiencies that exist. Technical and managerial capacity issues are identified and corrected, because of these surveys. Additionally, section staff are able to recommend improvements that have the potential to benefit the water system and improve capacity.

Public Water Supply Section staff perform sanitary surveys at the minimum frequency of once every three years for community ground water systems and once every five years for non-community systems. Sanitary surveys for surface water systems are completed approximately once per year.

4.1.2 Non-Sanitary Survey Site Visits

In addition to sanitary surveys, regional office staff perform other types of visits to assist water systems in a variety of ways. Staff assess technical solutions resulting from onsite discussions among water system owners and service providers, and the resulting insight and guidance from regional office staff enhances the owner's ability to make informed decisions on matters that impact the viability of the water system. Described below are the most common types of non-sanitary survey site visits.

- Technical Assistance – Staff provide assistance with technical issues that require industry knowledge and expertise. Examples of technical assistance visits include evaluating leaks, well water pump and storage issues, treatment adjustments, and cross connection control.
- Informal System Inspection – These inspections vary in scope and can include updating ownership information, testing residual disinfectant concentration, collecting new well information, reviewing rules with the owner or operator to facilitate compliance and other tasks.

- Construction Inspection – Staff periodically inspect projects under construction to confirm they are constructed in accordance with the approved plans and specifications. Any non-approvable variations noted during construction will have the opportunity to be corrected prior to completion of the project, which helps ensure that approved projects can be placed into service as quickly as possible.
- Investigation – Staff may perform an investigation when a water system receives a violation or if a customer has issued a complaint regarding water service or quality. In the event of a coliform violation, regional staff may help collect samples to determine if the coliform contamination has been abated. Public Water Supply Section staff provide instruction if the water remains positive for coliform. Regional staff provide training to water system representatives for response to other violations. If there are customer complaints, regional staff communicate with the complainant and may collect and analyze water samples if warranted.
- Compliance Assistance – Regional staff provide education and materials to water system representatives to facilitate a return to compliance.

Visits performed by regional office staff help systems improve compliance with sampling and engineering infrastructure requirements, as well as with management, operations and operator compliance concerns.

5.0 The PWS Section Compliance Services Program

The Public Water Supply Section has developed several initiatives that promote improvement of water system compliance with monitoring and reporting. Some of the core initiatives include data tracking, evaluation of compliance with drinking water requirements, and issuing the violations described in Section 2.0 of this document. Additional initiatives aimed at program improvement include training and software development. The Public Water Supply Section emphasizes customer service, explains monitoring and other compliance requirements to the regulated community, and helps them resolve any violations that may occur. When necessary, the program also issues penalties to water systems that fail to meet state and federal drinking water requirements.

Administrative Orders are issued to systems that violate Maximum Contaminant Levels (MCLs). Quarterly updates are required if the violation extends past one quarter. Section staff meet quarterly to discuss the progress that these water systems are making towards returning to compliance. Each system with an Administrative Order which has expired for an MCL violation is reviewed, where factors such as length of time out of compliance, proposed changes to treatment and operation, and recent sampling results are considered. If during the review it is determined that a water system is not on the path to compliance, that system will be issued a “last chance letter”, indicating that an action plan must be provided to the Public Water Supply Section within a specified timeframe, to avoid a penalty. Before a penalty is issued, an additional letter will be mailed to the water system, indicating that the penalty process has been initiated, and that a penalty will be assessed upon the issuance of an additional violation.

Section staff are frequently invited to give trainings for the benefit of engineers, laboratories, and public water system owners and operators. Training events include seminars and webcasts facilitated by the Public Water Supply Section, those sponsored by water associations such as American Water Works Association (AWWA) and North Carolina Waterworks Operators Association (NCWOA), the Association of State Drinking Water Administrators (ASDWA), and US EPA-sponsored trainings. Seminars and webcasts are a primary means for system owners and operators to learn of new regulations, changes to existing regulations, and refamiliarize themselves with existing regulations. In 2016, staff were invited to speak at the 13th Annual US EPA Drinking Water Workshop, and at EPA's data management users conference (DMUC). At EPA's DMUC, staff presented information on use of key software tools and emphasized their importance to the Public Water Supply Section's compliance operations.

The Public Water Supply Section has developed a variety of software tools and uses them extensively. Mature software tools are Lab Data Submittal and Lab-to-State, which laboratories use to electronically submit sampling data to the Public Water Supply Section. The software tools described at DMUC were the Bacti Dashboard and Web Intelligence reporting. Both tools analyze data that the Public Water Supply Section has received and alert users to follow-up actions that may be needed. The Bacti Dashboard alerts staff when positive coliform results are submitted into the database and facilitates communication and follow-up. Web Intelligence is a software package licensed to the Department of Environmental Quality for use in analyzing data. A second DMUC presentation described how Web Intelligence is being used to streamline issuance of special public notices. Program staff are working to set up queries and alerts in Web Intelligence, and will use these queries and alerts to streamline violation letter generation in the future.

Additional software tools to increase compliance program efficiency are under development. The lead and copper group is working with Division of Water Resources IT staff on a rule refresher and records update. This tool will put lead and copper rule records online where they can be accessed and reviewed more easily by the public. Compliance Services Program staff and IT staff have also been working on a tool that will allow water systems to electronically submit and certify certain documents online. These documents include Consumer Confidence Reports, public notices, special public notices, lead consumer notices, and public education materials on lead.

6.0 PWS Section Support for Water System Infrastructure Funding

The Department of Environmental Quality, through the Drinking Water State Revolving Fund (DWSRF), has increased the capacity of water systems by providing funding mechanisms for capital improvement projects. DWSRF funding is available through low-interest and principal forgiveness loans. Since July 1, 2013, the DWSRF Program resides in the Division of Water Infrastructure (DWI). The Public Water Supply Section and the DWSRF Program cooperate to ensure that funding enhances the capacity of public water systems.

The Public Water Supply Section's role in funding is to:

- Provide input to Drinking Water State Revolving Fund prioritization;
- Determine technical and managerial capacity of applicants for funding;
- Provide additional system specific input to the DWSRF program on request;
- Provide data for Drinking Water State Revolving Fund reporting;
- Participate in the Drinking Water State Revolving Fund Needs Survey by delivering requests and providing technical assistance to water systems; and
- Utilize the 2 percent, 10 percent, and 15 percent set-asides to support capacity development activities as described in the Drinking Water State Revolving Fund Intended Use Plan.

The Drinking Water State Revolving Fund role is discussed further in Section 9.1 of this document.

7.0 Drinking Water Protection

The Public Water Supply Section offers services to assist in the voluntary protection of local drinking water sources. Water systems may participate to improve their current and long-term capacity by implementing proactive steps to reduce potential contamination. The program offers technical assessments of the state's more than 9,000 drinking water sources, and it maintains financial incentives through a network of collaborating state agencies.

7.1 N.C. Drinking Water Protection Program

The Public Water Supply Section continued to improve and implement North Carolina's drinking water protection strategy during the reporting period. The Drinking Water Protection Program evaluates the susceptibility to contamination and initiates protective strategies for the state's public drinking water resources. It is the only statewide program with an exclusive concentration on proactive drinking water source protection. Activities include delineation and assessment of drinking water sources, wellhead and surface water protection, coordination with other state agencies, and initiation of programs designed to encourage local drinking water protection efforts. These activities encourage public water systems to protect their water sources by supporting a multi-barrier approach to drinking water protection. Systems that maintain drinking water sources that are less susceptible to contamination may achieve greater financial and technical capacity because fewer resources may be expended for water treatment.

Partnership arrangements with other agencies and programs are a major component of the Public Water Supply Section's drinking water protection strategy. Specifically, other agencies integrate Drinking Water Protection Program data into their agendas and funding priorities. The Section maintains relationships with agencies that fund agricultural best management practices, stormwater best management practices, land conservation, and stream restoration projects. Additionally, the Public Water Supply Section continued to facilitate a statewide collaborative that includes representatives from university programs, government agencies, non-profit organizations, professional associations, and regional councils of government. This diverse and semi-autonomous group has agreed to provide expertise and resources to implement strategies that encourage drinking water protection.

In 2016, the N.C. Source Water Collaborative continued its source water protection awards program. The awards program has fostered new partnerships with two well established watershed-focused organizations. Awards are presented at the organizations' joint spring conference. Four source water protection awards were presented in 2016, representing four of the six award categories. The website was updated to acknowledge and provide further information regarding award winning projects. Such examples serve as templates to other communities planning source water protection activities. The awards program continues on an annual basis.

The Public Water Supply Section improved the functionality of its GIS mapping applications, which exist to assist local governments, water system owners, volunteer organizations and other agencies with information vital to protect drinking water. Susceptibility ratings and associated assessment results are critical components of this data and are summarized in technical reports made available via the Public Water Supply Section's geographic information application. Additionally, agencies enlisting drinking water protection as a priority item within their own environmental programs use the Public Water Supply Section's GIS applications to help locate and prioritize environmental projects.

The Section promotes and provides technical expertise to assist communities with local source water protection planning. The program uses a successful seven-step process across the state to protect both ground and surface water sources. To date, the Public Water Supply Section has approved ten local surface water protection plans, which serve to protect drinking water for approximately 384,000 people. The source water protection planning process empowers local stakeholders to define and achieve long-term, proactive drinking water protection goals.

In 2014, state legislation (House Bill 894) was passed, amending G.S. 130A-320 to mandate surface water protection planning. Due to its existing voluntary surface water protection planning process, the Drinking Water Protection Program was assigned the task of implementing the legislation. The regulation mandates the development and implementation of surface water protection plans for public water systems treating and furnishing water from surface supplies. A voluntary stakeholder team of over 70 professionals has met multiple times to provide guidance and recommendations regarding standardized surface water protection planning formats and to help identify mandatory provisions for implementation. The team has also critiqued draft rule language. Stakeholders represent professional associations, non-profit organizations, councils of government, local government and local utilities, state and federal agencies, and industry representatives. Staff are currently revising draft rule language and assessing economic impact.

7.2 N.C. Wellhead Protection Program

The Safe Drinking Water Act Amendments of 1986 established requirements for states to develop wellhead protection programs. Congress intended these programs to be a key part of a national groundwater protection strategy, which prevents contamination of groundwater used for public drinking water. North Carolina's EPA-approved Wellhead Protection Program is part of this national strategy. The Wellhead Protection Program is a voluntary pollution prevention and management program designed to protect groundwater sources of public drinking water supply. Public water systems that choose to participate in the program develop and submit a local wellhead protection plan to the Public Water Supply Section for review and approval.

In North Carolina, development of a local wellhead protection plan is viewed as a valuable supplement to existing state groundwater protection programs. The Public Water Supply Section's Wellhead Protection Program is for public water systems that decide to provide added protection to their local groundwater supplies. Public water systems that desire to develop a wellhead protection plan may ask to receive technical assistance from Public Water Supply Section staff or from the North Carolina Rural Water Association, through their contract with the Public Water Supply Section, as described in Section 9.3 of this document. Upon implementation, the local wellhead protection plan reduces the susceptibility of wells to contaminants. The reduction of susceptibility to contamination increases the capacity for water systems to provide compliant drinking water by reducing the need to install costly treatment options to remove contaminants.

The Public Water Supply Section approved 9 wellhead protection plans comprising 9 water systems during the current reporting period. Of these plans, five were renewals of previously approved plans. At the end of the current reporting period, there were 145 active wellhead protection plans covering 162 public water systems with 930 public water supply wells that serve approximately 951,000 people.

In addition to the review of completed wellhead protection plan submittals, the Wellhead Protection Program reviewed draft wellhead protection area delineations submitted by public water systems in the early stages of plan development. This allows the systems to receive tentative approval of their wellhead protection areas prior to proceeding with development of the remaining plan components (*i.e.*, potential contamination source inventory, management plan, etc.), which could be impacted by changes to the wellhead protection areas.

The Wellhead Protection Program continued to provide support to the state's Source Water Assessment Program and the Drinking Water Protection Program. Program support included review of work products and analysis relevant to delineation and assessment activities participation in the Source Water Collaborative, as well as assisting in the generation of Source Water Assessment Program reports.

8.0 Operators Certification Program

The N.C. Water Treatment Facility Operators Certification Board has authority to oversee the examination of water system operators and the certification of their competency to operate drinking water system facilities. The N.C. Operator Certification Program, located within the Public Water Supply Section of the Division of Water Resources, provides support to serve the Board and implement its policies. Program staff perform a variety of functions that include: administering statewide examinations, approving continuing education opportunities, managing database and state records, providing training and outreach, collecting fees, participating in the enforcement of Rules Governing Water Treatment Facility Operators (Title 15A Subchapter 18D), and conducting an annual renewal process. Section staff also teach at the operator schools and provide speakers for continuing education workshops. North Carolina currently has approximately 5,300 certified water system operators with more than 7,500 active certifications.

The N.C. Operator Certification Program continues to increase the capacity of public water systems by influencing the technical training and increasing the competency of public water system operators. Over the past few years, changes were initiated to improve business efficiency and to expand customer services to the state's certified operator community. An online portal to access personal information from the operator database has been welcomed and utilized by many certified operators. Approximately 19 percent of operators paid the annual renewal fee utilizing the web-based electronic payment mechanism. This percentage is expected to increase as operators become more familiar with the portal. A scheduling system and procedures for effective utilization of training and on-demand examination room are being developed. Additionally, significant changes were made to the Operator Certification Program website to allow for a more user-friendly interface and to achieve consistency with other Division of Water Resources websites.

9.0 Partnerships

The Public Water Supply Section engages in voluntary and contractual partnerships to enhance capacity development efforts in North Carolina. Cooperation with the Division of Water Infrastructure (DWI) ensures that federal funds help increase capacity for public water systems. Participation with U.S. EPA's Area-Wide Optimization Program and contracts with the N.C. Rural Water Association and the UNC School of Government Environmental Finance Center serve to augment the already substantial efforts put forth by the Public Water Supply Section.

9.1 Drinking Water State Revolving Fund

The Drinking Water State Revolving Fund is administered by the Division of Water Infrastructure, a sister division to the Division of Water Resources within the North Carolina Department of Environmental Quality. Water systems apply to the DWSRF Program for water infrastructure funding. The Division of Water Infrastructure prioritizes the applications and funds the highest priority projects. The Drinking Water State Revolving Fund Program increases capacity for water systems by promoting the following short-term objectives:

- Provide loans to reduce acute health risks;
- Provide loans to enable water systems with the adequate capacity to consolidate non-viable water systems;
- Provide funding for preventative and efficiency measures, such as replacement of aging infrastructure; and
- Provide technical assistance for small systems.

The Drinking Water State Revolving Fund Program also increases capacity for water systems by promoting the following long-term objectives:

- Increase the percent of population served by safe public water systems;
- Increase the safety of public water systems;
- Promote safe and affordable drinking water by reducing costs associated with capital improvements;
- Assist water systems to remain compliant with increasingly complex rules under the *Safe Drinking Water Act*; and
- Ensure technical integrity of the proposed water system improvements, advocate self-sufficiency, protect water resources from new pollution sources and promote sustainability.

As of the end of Calendar Year 2016, approximately \$665.8 million of Drinking Water State Revolving Fund Program funds were committed to systems in the form of low-interest and principal forgiveness loans. The Drinking Water State Revolving Fund Program continually increases its ability to provide low-interest loans to water systems through federal capitalization grants, the required 20 percent state match and the repayment-funding stream of revolving loans.

9.1.1 Failing System Loans

Some systems, especially small systems, lack the resources to consistently provide safe drinking water to the public as the *Safe Drinking Water Act* requires, resulting in long-term noncompliance. Principal forgiveness loans are available to water systems having adequate capacity that take over such a failing system. In most cases, the project includes connecting the failing system to the rescuing system and replacing the distribution system in the failing system. During the reporting period the Drinking Water State Revolving Fund program closed out one project consolidating two non-viable public water systems serving 349 consumers. Currently, the Drinking Water State Revolving Fund Program is working to consolidate one non-viable public water system serving about 322 consumers. Completion of this consolidation project will give these consumers access to water systems with greater capacity. By these efforts, the Drinking Water State Revolving Fund Program has consolidated 26 failing systems serving about 1,182 consumers since the program's inception in 2004.

9.2 Area-Wide Optimization Program

The Area-Wide Optimization Program is a joint program between the EPA and the states. EPA developed the program to help water systems meet increasingly stringent regulations and simultaneous compliance challenges while achieving higher levels of water quality. The Public Water Supply Section has participated in the Area-Wide Optimization Program since 2000 and works cooperatively with water systems to use existing equipment and treatment processes to improve or optimize water quality.

A typical scenario under the Area-Wide Optimization Program is for Public Water Supply Section employees, Area-Wide Optimization Program participants from other states, regulatory programs, representatives from the EPA, and the water system operators to optimize the water treatment processes of a water system that has volunteered to host the Area-Wide Optimization Program activities. These activities enhance capacity by optimizing the capabilities of the volunteering water system while allowing all Area-Wide Optimization Program participants to share and increase their knowledge of water treatment facilities.

In 2016, Area-Wide Optimization Program team members were involved in many outreach activities at water systems throughout the state. North Carolina Area-Wide Optimization Program staff coordinated a distribution system comprehensive performance evaluation in the Town of Jonesville, and also had the chance to work with Yadkin County's water system along Highway 21 that purchases water from the Town of Jonesville.

The Public Water Supply Section has awarded 51 water treatment facilities the 2016 Area-Wide Optimization Program Award for optimized treatment. Public Water Supply Section regional staff generally present these awards in the presence of the governing body of the water system. The Public Water Supply Section awards water systems each year that demonstrate outstanding turbidity and microbial removal and for meeting performance goals that are more stringent than the state and federal drinking water standards. Water systems meet these goals by increased surveillance, by reducing treatment fluctuations, and by maintaining excellent coagulation and filter performance. By reaching this level of optimized performance, employees of these water systems have demonstrated their dedication to provide their customers with the best possible drinking water quality. Providing public recognition of these awards builds elected officials' support with the utility staff activities and may help expand the number of participating systems.

9.3 N.C. Rural Water Association

The Public Water Supply Section has a contractual agreement with the N.C. Rural Water Association for circuit riders to provide technical assistance to water systems that serve less than 10,000 people. A circuit rider receives system referrals from the Public Water Supply Section and requests for assistance from other sources. During the reporting period, the circuit riders completed 871 contacts to systems with issues such as compliance and treatment, operation and maintenance, water loss and leak detection, management techniques, and emergency response. Circuit riders conduct initial visits to referred water systems to explain monitoring requirements and to enhance the systems' ability to meet all regulatory requirements.

The Public Water Supply Section has a second contractual agreement with the N.C. Rural Water Association to provide assistance to public water supply systems in the development of local Wellhead Protection (WHP) plans. Many of these systems are small systems that lack the technical and financial resources to pursue drinking water protection on their own. Under the condition of the contract, the N.C. Rural Water Association provided on-site technical assistance in the development and implementation of WHP plans that are customized to their community. During the 2016 calendar year, 9 public water systems received Public Water Supply Section approval of their WHP Plans developed with assistance from the N.C. Rural Water Association. Of these plans, five were renewals of previously approved plans. The expectation is that these plans will assist in reducing the susceptibility of these sources of public drinking water to contamination.

10.0 Conclusion

Water system compliance has increased significantly since the Public Water Supply Section started implementing the strategies discussed in this report. During this time, implementation of several federal drinking water rules occurred. This initiated additional sampling requirements and new MCLs, resulting in a more complex regulatory environment for water systems. The Public Water Supply Section continues to add new initiatives to assist water systems in further improving compliance. Compliance with sample collection and monitoring requirements has increased from 55 percent of systems in 1999 to 88 percent of systems in 2016, while compliance with MCLs has remained roughly constant during that period. Efforts by water system personnel, state staff, and the rest of the industry surrounding drinking water protection have led to increasing drinking water safety in North Carolina, far exceeding the EPA's 2018 national target.

The Public Water Supply Section focuses the intent of all activities to increase water system compliance and the protection of public health. Some of these include:

- Regional office site visits;
- Inspections, technical assistance site visits, trainings and outreach activities;
- Providing instruction for operators at state operator schools;
- Review and approval of water system infrastructure plans;
- Certification and training of water system operators; and
- Partnerships with other institutions to increase system outreach activities and develop tools to aid in achieving and maintaining compliance.

These activities result in safer water for consumers throughout the state by providing an ever-growing percentage of systems that meet all monitoring requirements and contaminant standards. These activities will continue to be crucial to achieving and maintaining water system compliance with drinking water rules.

Appendix A

Table A.1: Schedule of New Rule Implementation by EPA

Calendar Year	Rule	New Monitoring Requirements	New Level (MCL or Treatment Technique) Requirements	System Description
2002	Arsenic		MCL lowered from 0.05 mg/l to 0.01 mg/l	CWS, NTNC
2002	Disinfectants and Disinfection Byproducts Rule (DDBP)	THM and HAA quarterly sampling	THM MCL lowered from 0.10 mg/L to 0.080 mg/L as a running annual average (RAA). HAA MCL established at 0.060 mg/L as RAA.	CWS, NTNC Subpart H, population ≥ 10,000
2002	DDBP	Disinfectant residual monthly sampling (with total coliform rule schedule)	Chlorine and chloramines maximum residual disinfectant level established at 4.0 mg/L as RAA.	CWS, NTNC Subpart H, population ≥ 10,000
2002	DDBP	Total organic carbon (TOC) monthly monitoring	Treatment technique for TOC removal; ratio of actual to required removal ≥ 1.00 as RAA.	CWS, NTNC Subpart H, population ≥ 10,000
2002	DDBP	Bromate monthly monitoring	Bromate < 0.010 as RAA.	CWS, NTNC Subpart H using ozone, population ≥ 10,000
2002	Interim Enhanced Surface Water Treatment Rule (IESWTR)	Profiling and benchmarking		All system types Subpart H, population ≥ 10,000
2002	IESWTR	Turbidity	Maximum turbidity level lowered from 5 NTU to 1 NTU. 95% turbidity level lowered from 1 NTU to 0.3 NTU.	All system types Subpart H, population ≥ 10,000
2004	DDBP	THM and HAA quarterly or annual sampling	THM MCL lowered from 0.10 mg/L to 0.080 mg/L as RAA. HAA MCL established at 0.060 mg/L as RAA.	CWS, NTNC Subpart H including populations < 10,000; Groundwater
2004	DDBP	Disinfectant residual monthly sampling (with TCR schedule)	Chlorine and chloramine maximum residual disinfectant levels established at 4.0 mg/L as RAA.	CWS, NTNC Subpart H including populations < 10,000; Groundwater
2004	DDBP	TOC monthly monitoring	Treatment technique for TOC removal; ratio of actual to required removal ≥ 1.00 as RAA.	CWS, NTNC Subpart H including populations < 10000
2004	DDBP	Bromate monthly monitoring	Bromate < 0.010 as RAA.	CWS, NTNC Subpart H including populations < 10,000; Groundwater

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Table A.1 cont'd: Schedule of New Rule Implementation by EPA

Calendar Year	Rule	New Monitoring Requirements	New Level (MCL or Treatment Technique) Requirements	System Description
2005	Long Term 1 Surface Water Treatment Rule (LT1SWTR)	Profiling and benchmarking		All system types Subpart H, populations < 10,000
2005	LT1SWTR	Turbidity	Maximum turbidity level lowered from 5 NTU to 1 NTU. 95% turbidity level lowered from 1 NTU to 0.3 NTU.	All system types Subpart H, populations < 10,000
2008	Radionuclides	Radium 228, monitored at each entry point	Although new radionuclides monitoring requirements do not take effect until 2008, a number of systems began monitoring early in order to grandfather data. Early monitoring led to additional MCL violations.	CWS
2009	Ground Water Rule	Microbial source water monitoring	Introduces source water monitoring requirements and treatment technique requirements for groundwater systems.	All system types Not Subpart H
2012	Stage 2 Disinfectant / Disinfection Byproducts Rule (Schedule 1 and 2 systems)	Location-specific sampling points in the distribution system	MCLs and regulated contaminants do not change but compliance is calculated by locational running annual average. Every sampling site must be compliant with MCL.	CWS and NTNC, populations ≥ 50,000 and purchasing systems
2013	Stage 2 Disinfectant / Disinfection Byproducts Rule (Schedule 3 and 4 systems)	Location-specific sampling points in the distribution system	MCLs and regulated contaminants do not change but compliance is calculated by locational running annual average. Every sampling site must be compliant with MCL.	CWS and NTNC, populations ≤ 49,999
2014	Stage 2 Disinfectant / Disinfection Byproducts Rule (Required <i>Cryptosporidium</i> monitoring systems)	Location-specific sampling points in the distribution system	MCLs and regulated contaminants do not change but compliance is calculated by locational running annual average. Every sampling site must be compliant with MCL.	CWS and NTNC systems required to collect <i>Cryptosporidium</i> samples under §141.701(a)(4) or (a)(6)
2016	Revised Total Coliform Rule (RTCR)	Number of repeat and additional routine samples standardized	Level 1 and Level 2 assessments replace treatment technique violations for the presence of total coliform.	All system types