Fiscal Note

Rule Citation No. 15A NCAC 18D .0206

Board: NC Water Treatment Facility Operator Certification Board

Rule Topic: Requirements for licensed operators to manage and maintain facilities providing public drinking water.

DEQ Division: Division of Water Resources

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Impact Summary:

State government:	Yes
Local government:	Yes
Private entities:	Yes
Federal government:	Yes
Substantial Impact:	Yes

Necessity: It is necessary for public water systems to retain licensed cross-connection control operators to oversee the maintenance and functionality of backflow prevention assemblies, regardless of where the assemblies are physically connected to a distribution system. Such oversight is required to reduce the introduction of contamination into the potable water supply. This requirement will better ensure that public health is protected through a variety of activities performed by the licensed cross-connection control operator, including: (i) identification of potentially hazardous cross connections, (ii) notification and outreach to customers who have installed backflow prevention devices, (iii) inspection of backflow prevention assemblies, especially new installations, (iv) maintaining records to ensure state reporting requirements are met, and (v) creation of standard operating procedures (SOPs) to manage cross-connection risk.

1. Background

Cross connections that require backflow prevention assemblies are common features in most community water systems, and their installation and operation is subject to state building codes. Without adequate and reliable backflow prevention, backpressure or back-siphoning can occur which allows pollutants and/or non-potable water to enter the distribution system (EPA, 2001). There are several conditions that favor backpressure or back-siphoning, including: (i) service connections with

pressure surges greater than that of the distribution system, (ii) relatively high fluid velocity in the pipeline, and (iii) lowered pressure in the main during times of high demand (such as firefighting) or line break events. If back flow prevention systems are not properly installed, tested and maintained, the resulting potential influx of contaminants into the potable water supply can negatively impact public health.

Properly certified personnel are necessary to ensure backflow prevention assemblies are installed and function as they are designed. The state currently recognizes a mechanism for licensure of professional cross-connection control operators, which requires completion of a specialized school approved by the NC Water Treatment Facilities Operator Certification Board (the "Board"), documented work experience within a water system distribution facility, and passing an exam administered by the Department's Operator Certification Program. Currently, there are 820 professionals in the state that hold a cross-connection control license from the Board.

The state's minimum threshold that mandates a water system retain a cross-connection control operator is installation of five backflow prevention assemblies. This requirement has been in effect since 2003 and it is codified in 15A NCAC 18D .0206. In recent years, the question of "who owns the backflow prevention assembly?" has raised issues regarding the interpretation of this rule. By the current rule language, it can be argued that the five assemblies considered for regulation are only those installed and owned by the water system, and thus these assemblies must physically exist within the boundaries of the distribution system. When the rule was originally adopted, the agency did not envision that some water systems would mandate the ownership of backflow prevention devices to their customers, thus avoiding the intent of the rule. Consequently, such an interpretation allows an unlimited number of backflow prevention assemblies to be connected external to the distribution system without requiring a certified operator, as these devices are primarily owned by the water system's customers and are not technically a facility "of the distribution system." Should these devices fail, the risk to public health is the same regardless of where the backflow prevention assembly is physically installed.

The problem with the interpretation discussed above is that customer-owned backflow prevention assemblies may be (and often are) connected to a water system without sufficient oversight to verify that they are properly installed, maintained, tested, and functioning. Additionally, water utilities are hesitant to retain licensed, cross-connection control operators when they are uncertain if the customer-owned devices are applicable to interpretation of the rule. This situation introduces a potential public health threat because cross connections with service connections related to agriculture, irrigation, industry, and other non-potable uses can provide a direct conduit for contamination, and there is no clear responsible party to ensure such a scenario is avoided.

The proposed rule revision described herein eliminates the ambiguity regarding ownership of the backflow prevention assemblies and revives the rule's original intent: that a public water system with five or more backflow prevention assemblies would have a licensed cross-connection control operator

to manage the risk. Regardless of where such devices are physically connected to a public water supply distribution system, their oversight is recognized as necessary to protect public health, and the state's licensed cross-connection control operators are the primary resource capable of providing the oversight needed. Therefore, proposed revisions to 15A NCAC .0206 (d) will require a licensed cross-connection control operator by any public water system that has requirements for five or more backflow prevention assemblies (as specified in 15A NCAC .0406(b)). The revised requirement is independent of the exact physical location of where the device is connected to a utility's distribution system and is consistent with the original spirit and intent of the rule.

2. Estimating Economic Impact

There are approximately 5,800 public water supply systems in the state (NC DEQ, 2017), the majority of which will likely not have the five backflow prevention assemblies making them subject to the proposed rule revision. Of those water systems that may be subject, many already retain a licensed cross-connection control operator, and will deemed compliant without increased economic impact. It is believed that the majority of water systems subject to the revised rule will exist within the water system categories of community (C) and non-transient noncommunity (NTNC). An estimate of the expected fiscal impact on the regulated community is provided below, and it is based on factors that include: system type, system ownership, system size (e.g., population served), and type of connections. Data used in this analysis was obtained from NC's Safe Drinking Water Information System (SDWIS), which is continually updated and meets federal EPA requirements regarding the state's management of such information.

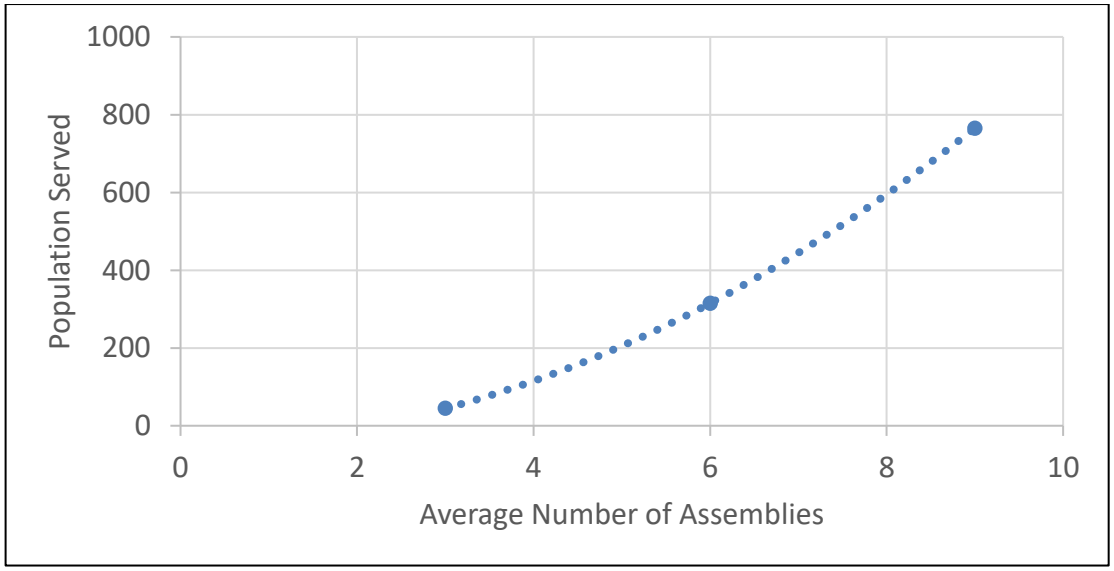
Cost estimates for this analysis were primarily derived from a peer-reviewed study published by Pontius and Evans in the Journal of the American Water Works Association (AWWA Journal, 2008). The study provides a comprehensive review of all costs associated with maintaining backflow prevention assemblies. As per the analysis, cross connections that require backflow prevention assemblies are directly correlated to system size, which can be categorized by the population served (Table 1).

Table 1. Average number of backflow prevention assemblies in community (C) and non-Transient noncommunity (NTNC) water systems

System Population	Population Midpoint	# Assemblies (C)	# Assemblies (NTNC)
<100	50	3	3
100-500	300	6	6
501-1000	750	9	9
1001-3300	2150	15	12
3301-10,000	6650	31	15

To estimate a regulatory threshold applicable in NC, sample data was assumed to be uniformly distributed within each category, thus allowing a simple interpolation to estimate the population threshold corresponding to water systems likely to have five or more backflow prevention assemblies. The result suggests that public water systems having more than 216 consumers will, on average, have at least five backflow prevention assemblies, making them subject to revisions in this rule. Conversely, on average, water systems with populations of 216 or less will likely not meet the regulatory threshold. Note that the same threshold applies to both community water systems as well as non-transient noncommunity water systems. This is because the average number of back prevention assemblies for both system types does not diverge until population exceeds 1,001 consumers, and the average number of assemblies at the point of divergence is already more than the state's existing regulatory threshold of five backflow prevention assemblies. The relevant data common to both system types (e.g., pre-divergence) is displayed in Figure 1, which shows the relationship between the average number of backflow prevention assemblies and water system size.

Figure 1. Number of back flow prevention assemblies as related to population served.

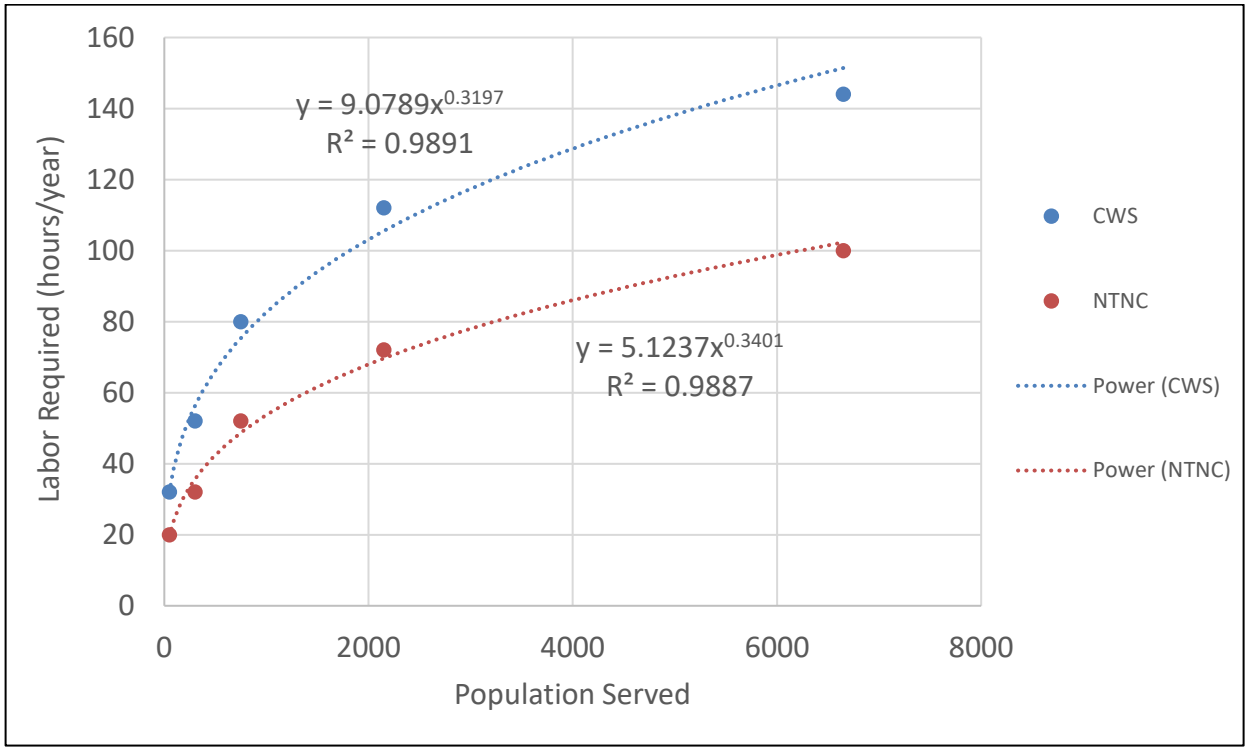


As discussed above, the number of backflow prevention assemblies is necessary to determine how many water systems will likely be subject to the revised rule. However, the number of assemblies is also critical when estimating the labor cost associated with activities of the cross-connection control operator. Pontius and Evans (AWWA Journal, 2008) provide an in-depth analysis of expected labor costs that considers a "multi-element approach" and includes the following subset of activities: (i) identification and inventory of potentially hazardous cross connections, (ii) notification and outreach to customers who have installed backflow prevention devices, and (iii) inspection of backflow prevention assemblies, especially new installations. In addition, the *NC Rules Governing Water Treatment Facility Operators* specifies that licensed operators create standard operating procedures (SOPs) to

address cross-connections. This activity is probably most analogous to developing a "cross-connection control plan" that is often used to guide local ordinances related to backflow prevention. For this analysis, the standard operating procedures published within two cross-connection control plans were examined for scope and content (examples from Tennessee Association of Utility Districts and the Florida Rural Water Association), and the level of detail appears consistent with labor estimates provided by Pontius and Evans.

Labor activities discussed above are directly applicable to operator activities specified in 15A NCAC 18C .0406(b), suggesting that the correlation displayed in Figure 2 is relevant to NC utilities retaining cross-connection control operators for the purpose of complying with provisions of 15A NCAC 18C and 18D. The data demonstrate a correlation that allows a reasonable estimate of labor as a function of system type and system size, with R^2 values of 0.9891 and 0.9887 for community and NTNC systems, respectively. The resulting best-fit power functions provided in Figure 2 were used in this analysis to estimate labor cost for water systems subject to the revised rule. The graph reflects an obvious economy-of-scale where estimated labor costs rise more slowly as the population served by the water system increases. It should also be noted that labor estimated for utilities with populations exceeding 7,000 consumers may be greater than actual due to extrapolation errors. Therefore, the data in Figure 2 likely provide a more conservative estimate of fiscal impact as the population served increases.

Figure 2. Labor estimates as a function of system population and system type



Associating a licensed cross-connection control operator's labor with a utility's dollar cost is assumed to be approximately $22/hour, and this number is derived from published information by EPA (US EPA, 2000). The estimated baseline of $22/hour was calculated after adjusting for inflation using an online calculator from the US Department of Labor, Bureau of Labor Statistics (US Dept. of Labor, 2018). For operators who provide a la carte services via contractual agreements, we have assumed that the water system does not incur an additional cost for employee benefits. However, water systems likely will incur benefit costs for operators that are on-staff, permanent employees. According to the most recent national data from BLS's Employer Costs for Employee Compensation dataset, benefits account for approximately 40% of total compensation for the utilities industry group which includes water system operators. Assuming a base wage of 22/hour, total compensation costs for on-staff operators is estimated to be $37/hour.

2.1 Cost Analysis Assigned to Different Water System Types

In accordance with federal definitions, there are three main types of public water systems. These include community, noncommunity, and non-transient noncommunity systems. For purposes of this analysis, each system type will be independently evaluated.

a) Transient Noncommunity Water Systems

Transient Noncommunity (TNC) systems in NC typically provide water to very small populations, and those populations are considered transient (e.g., the makeup of the population changes) through time. Small convenience stores and rural churches are common examples. It is rare for a water system of this type to have cross connections that rise to the level of requiring a backflow prevention assembly. Consequently, exposure to any potential contaminants is low, which implies a reduced risk to public health, especially for contaminants that require chronic exposure to justify a health concern. For purposes of this fiscal analysis, it is believed that the number of noncommunity water systems subject to revised rule .0206 will be rare or even nonexistent, and the resulting fiscal impact will therefore be insignificant in the context of the aggregate evaluation used for this analysis.

b) Non-transient Noncommunity Water Systems

Non-transient noncommunity (NTNC) water systems also serve relatively small populations, but they are on average larger than the TNC systems discussed above. Systems providing water for a business/industry and those providing water for a day care/school are common examples. Some NTNC systems are likely to have backflow prevention assemblies that would make them subject to the revised rule, as per the correlation in Figure 1.

Applying the regulatory threshold derived above (e.g., population equal to 216) to the state's inventory of NTNC systems suggests that 141 systems will be subject to the revised rule (or 40% of the total number of NTNC systems in the state). These systems will require a cross-connection control operator to perform the duties associated with 15A NCAC 18C and 18D. Six of these systems already retain such an operator, and because the revised regulatory requirement is already satisfied, it is assumed that

no additional costs will further impact these systems. However, the remaining NTNC systems meeting the regulatory threshold (134 systems) will likely incur costs associated with retaining a cross-connection control operator.

NTNC Cost Scenario 1: Use of Contract Operators

Dollar cost estimates for NTNC systems are calculated using the population served and the correlation demonstrated in Figure 2. Calculated results are summarized below (Table 2). Impact of this scenario primarily reflects an actual dollar-cost (versus missed opportunity), and for this analysis assumes that all 134 systems will seek an external, contract operator to comply with the revised rule. The NTCN systems subject to the rule were separated to estimate fiscal impact among local government, private industry, and state-owned NTNC water systems. The total cost estimate via use of contract operators for NTNC systems is estimated to be $128,115.

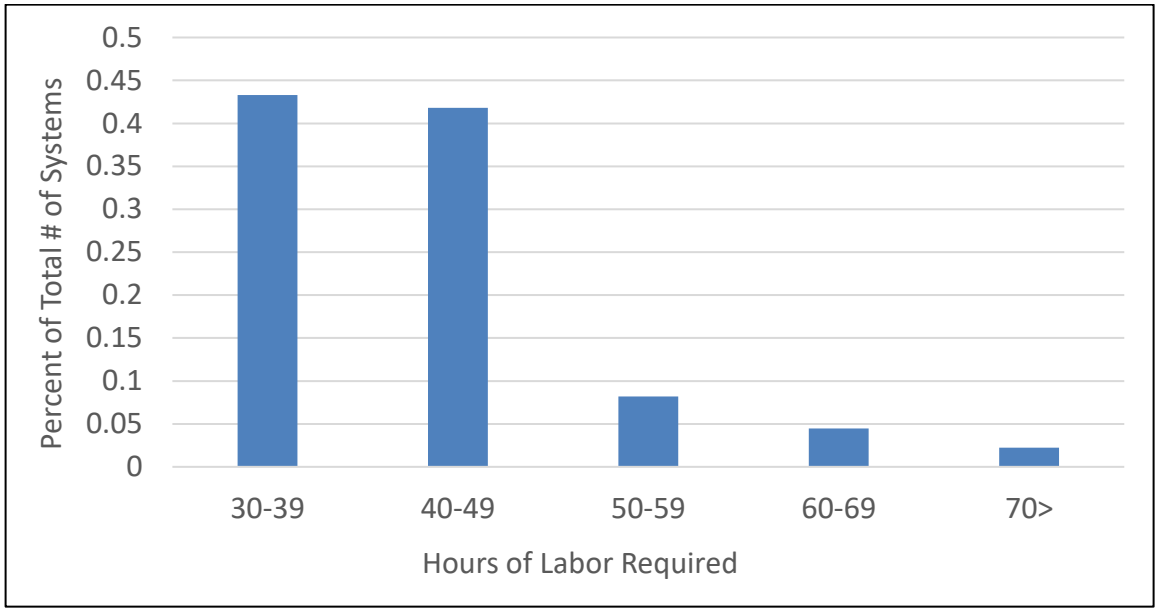
Table 2. Fiscal impact on NTNC systems categorized by owner type (Scenario 1)

Owner Type	No. systems	Average Cost	Cost Range	Total (Scenario 1)
Local Gov.	93	$930	$711 to $1,597	$86,490
Private	38	$1,029	$706 to $1,983	$39,102
State Gov.	3	$841	$766 to $987	$2,523

NTNC Cost Scenario 2: Mixed Use of Repurposed and Contract Operators

The costs shown in Table 2 represent one scenario and do not necessarily reflect true dollars that will be expended by NTNC systems subject to the revised rule. This is because many water systems already have certified operators on staff who may hold a different type of license, but can readily be repurposed to absorb the activities related to cross-connection control. This approach will likely be preferred by a significant number of NTNC systems, especially considering that the cross-connection control duties will only require a fraction of an FTE per year, with the labor component averaged across all NTNC systems expected to be only 43 hours/year (or approximately 2% of one FTE). In fact, our analysis indicates that the majority of NTNC water systems (85%) will require less than 50 hours of labor per year related to cross-connection control duties (Figure 3). This result suggests that repurposing an existing operator may be a fiscally viable option because: (i) the fiscal impact is primarily missed opportunity cost, and (ii) there is greater flexibility for the water system, as cross-connection control duties are accomplished without the added complexities of retaining external expertise.

Figure 3. Percentage of NTNC systems falling within categories of expected labor.



In the case of operator repurposing, there are related costs that can be estimated. The repurposed operator must seek a cross-connection control license, which requires attending a week-long school and then passing a standardized exam. Current data compiled by NC Water Operators Association allows the dollar cost to repurpose an operator to be itemized (NCWOA, 2018). Estimates include school registration, study materials, lodging, and cost of the exam. The cost of these four components averaged over fall 2017 and spring training sessions in 2018 was $310, $200, $380, and $50, respectively. In addition, we have assumed a missed opportunity cost of $1,480 (e.g., 40 x $37) while the operator is away from his or her regular work activities. Therefore, the total cost to repurpose an operator is estimated to be $2,420. It should be noted that the source data used in this analysis was compiled for well and surface type licenses. It is believed that the estimate also applies to cross-connection control licenses since the only major difference is the academic content provided during the course work.

To estimate statewide fiscal impact of the alternative, "mixed scenario" (Scenario 2), it was assumed that half of the NTNC systems subject to the revised rule will pursue a contract operator and incur straight labor costs, while the other half will repurpose an existing operator to perform the cross-connection operator duties. Applying this assumption allows calculation of a mixed scenario alternative shown below in Table 3. This analysis suggests that total cost of the mixed scenario alternative conveyed to the regulated community of NTNC systems is estimated to be $226,197. For all practical purposes, the cost of the mixed scenario alternative is only slightly lower than the cost of exclusive use of contract operators.

Table 3. A mixed scenario assumption to estimate the cost for NTNC systems

Owner Type	Use of Contract Operators	Use of Repurposed Operators	Total (Scenario 2)
Local Gov.	$43,245	$112,530	$155,775
Private	$19,551	$45,980	$65,531
State Gov.	$1,261	$3,630	$4,891

c) Community Water Systems

Community (C) water systems constitute the largest potential fiscal impact to the regulated community. Systems of this type serve a wide range of populations and include municipal systems, home owners' associations, mobile home parks, etc. In general, community systems provide the primary source of potable water for its consumer base. Therefore, faulty backflow prevention assemblies will potentially have a greater impact on public health for consumers relying on these systems if contaminants enter the potable water supply.

The analysis described previously to estimate a regulatory threshold is also applicable to community systems. This is because the anticipated number of backflow prevention assemblies is the same for both NTNC and community systems at the population-point indicative of five backflow prevention assemblies. Therefore, the regulatory threshold associated with community systems will be based on 216 consumers. Applying this threshold to SDWIS data suggests 953 community systems in the state will likely, on average, have five or more backflow prevention assemblies and be subject to the revised rule. The data can be further filtered by system type. Specifically, mobile home parks comprise a subset of public water systems that primarily include residential service lines, and do not have facilities that require backflow prevention devices (e.g., manufacturing and processing, agribusiness, wastewater, medical facilities, etc.). We consulted with the agency's regional office staff who inspect the state's public water systems. The polling confirmed that mobile home parks in NC do not contain five backflow prevention devices regardless of the population served by the system. Therefore, 39 mobile home park systems with populations exceeding 216 consumers were extracted from the regulatory total. This results in 914 community water systems with potential fiscal impact from revisions to 15A NCAC 18D .0206.

The 914 community systems identified above comprise approximately 67% of the total number of community systems (1369) in the state. Many of these systems (336) already retain a cross-connection control operator. These systems are deemed compliant with the operator requirement without further significant financial impact. However, the remaining 578 community water systems will likely incur costs associated with retaining a cross-connection control operator.

A meaningful cost analysis for community water systems is more complex than that calculated for NTNC systems. Unlike NTNC systems, a significant number of community water systems are consolidated and managed under centralized ownership. The two largest system owners in the state, Aqua America, Inc. and Utilities, Inc. own and operate a combined 253 of the 578 community water systems believed to be subject to the revised rule. These corporate owners already have in place procedures to assign and repurpose operators as needed to meet the state's compliance requirements. Therefore, it is highly unlikely that external, contract operators will be sought for the subset of 253 corporately-owned water systems. Consequently, the cost analysis for community water systems will be more accurately determined via revised versions of the mixed scenario methodology discussed earlier for NTNC systems: The estimates for alternate scenarios were calculated as follows: (i) mixed scenario use of contract operators in all cases except those systems managed by the two largest corporate owners (Scenario 1), and (ii) a mixed scenario of using both contract and repurposed operators (50/50 split) in all cases except those systems managed by the two largest corporate owners (Scenario).

Community System Cost Scenario 1: Mixed Scenario

Dollar cost estimates for community systems are calculated using the population served and the correlation provided in Figure 2. Calculated results are summarized below in Table 4. The Scenario 1 estimate likely represent a conservative true dollar-cost because: (i) many water systems prefer the advantages of a dedicated, on-site licensed operator versus "a la carte" operator services via contractual agreements, and (ii) a repurposed operator typically implies missed opportunity cost versus actual dollars expended.

In the case of repurposing an operator in corporately-owned systems, there are related costs that can be estimated. The repurposed operator must seek a cross-connection control license, which requires attending a week-long school and then passing a standardized exam (as discussed above for NTNC systems). Data compiled by NC Water Operators Association remains applicable to this analysis of community water systems (NCWOA, 2018). Estimates include school registration, study materials, lodging, and cost of the exam. The average cost of these components was $310, $200, $380, and $50, respectively. In addition, we have assumed a missed opportunity cost of $1,480 (e.g., 40 x $37) while the operator is away from his or her regular work activities. Therefore, the total cost to repurpose an operator is estimated to be $2,420.

The community systems subject to the rule were separated to estimate fiscal impact among local government, private industry, and federally-owned community water systems (Table 4). In conclusion, the total cost for compliance through the mixed scenario, high-range estimate is $1,244,125.

Table 4. Annual fiscal impact on community systems categorized by owner type

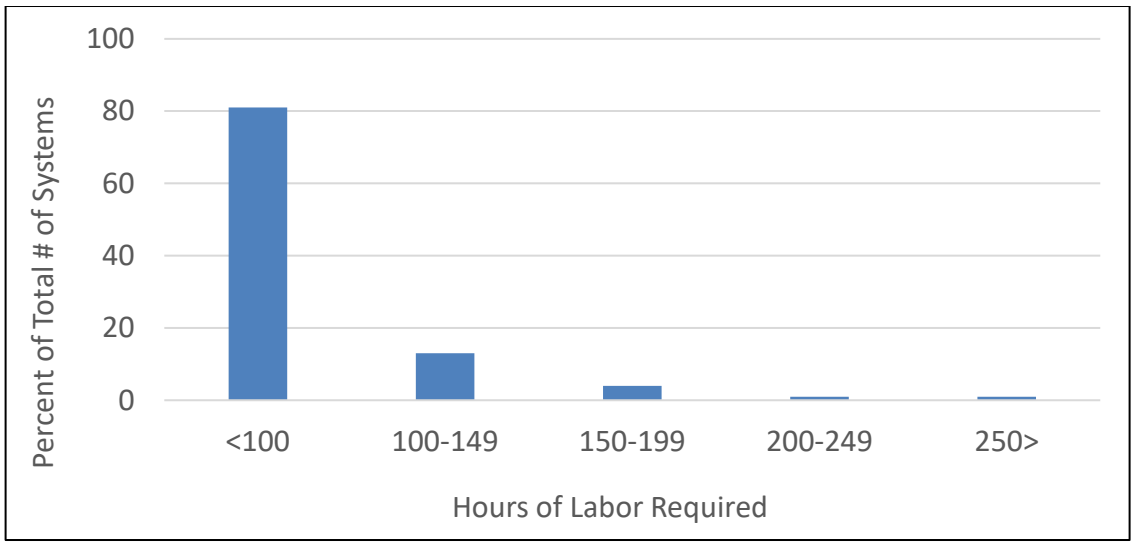
Owner Type	No. systems	Average Cost	Cost Range	Total (Scenario 1)
Local Gov.	217	$2,053	$1,128 to $5,532	$445,501
Private[1]	106	$1,705	$1,128 to $4,011	$180,730
Private[2]	253	$2,420	$1,114 to $4,372	$612,260
Federal	2	$2,817	$1,196 to $4,437	$5,634

[1]Systems not managed by one of the two large corporate owners in the state (contract operators).
[2]Systems managed by one of the two large corporate owners in the state (repurposed operators).

Community Systems Cost Scenario 2: Mixed Use of Repurposed and Contract Operators

The costs shown in Table 4 represent a conservative scenario and do not necessarily reflect true dollars that will be expended by community water systems subject to the revised rule. This is because many water systems already have certified operators on staff who may hold a different type of license, but can readily be repurposed (and duties expanded) to absorb the activities related to cross-connection control. This approach may be preferred by a significant number of community systems, especially considering that the cross-connection control duties will only require a fraction of an FTE per year. The labor component averaged across all community systems is only expected to be 79 hours/year (or approximately 4% of one FTE). In fact, our analysis indicates that the vast majority of NTNC water systems (81%) will require less than 100 hours of labor per year related to cross-connection duties (Figure 4). This suggest that the repurposing of an existing operator may be a fiscally viable option that will result in greater flexibility to the water system.

Figure 4. Percentage of community systems falling within categories of expected labor



To estimate statewide fiscal impact of the low-range approach, we have assumed a mixed scenario of using both contract and repurposed operators (50/50 split) in all cases except those systems managed by the two largest corporate owners. The alternative, mixed scenario estimate is shown below in Table 5. In conclusion, the total Scenario 2 cost estimate conveyed to community water systems is estimated to be $1,321,443.

Table 5. A mixed scenario alternative to estimate the compliance cost for community systems

Owner Type	Use of Contract Operators	Use of Repurposed Operators	Total (Scenario 2)
Local Gov.	$222,751	$262,570	$485,321
Private[1]	$90,365	$128,260	$218,625
Private[2]	$0	$612,260	$612,260
Federal	$2,817	$2,420	$5,237

[1]Systems not managed by one of the two large corporate owners in the state (50/50 split between repurposed and contract operators)

[2] Systems managed by one of the two large corporate owners in the state (repurposed operators)

c) State Government – Operator Certification Program Support

The North Carolina Operator Certification Program has responsibility to manage the licensure process for cross-connection control operators. Activities include compliance tracking, maintenance of data related to licensure, administering examinations, processing payments, and verification of records required for annual renewal.

The proposed revisions to 15A NCAC 18D .0206 are expected to increase the support activities required from limited program staff. Based upon the "mixed-scenario" cost estimates of new and existing operators seeking cross-connection control credentials, it is reasonable to expect a minimum of 385 new applicants will seek cross-connection control licensure. This suggest an increase of nearly 47% within the cross-connection control category, as compared against the current number of 820 licenses. Additionally, the aggregated increase in administrative-related business processes (e.g., exam administration, continuing education tracking, certificate renewals, correspondence, customer service, etc.) is expected to increase by approximately 8% to 10%, with this estimate dependent upon the initial passing rate for the cross-connection control exams. The increased workload will likely remain stable over the long term since most of the labor to maintain licensure is repetitive and recurs on an annually basis. Currently, these duties are performed by a staff of three FTEs. Therefore, we anticipate the need for an additional 0.3 FTE. The average base salary of the program's support staff is $38,772 (or roughly $19 per hour). Benefits increase this figure by an additional $13 per hour, implying a total

cost for one FTE of $34 per hour. Therefore, our estimated labor requirement of 0.3 FTE translates into an annualized program cost of approximately $21,216. The program will rely on retaining a temporary employee when necessary to assist with the expanded work load. The cost described above will largely be offset in the first year by exam fees, which are required from the applicant per 15A NCAC 18D .0304. In subsequent years thereafter, the labor cost will be offset by license renewal fees. We expect deficits of $1,966 and $9,666 in the first and each subsequent year, respectively.

2.2 Benefits

a) Public Water Systems and the Consuming Public

Potential cross connections that require backflow prevention assemblies are common features in most NTNC and community water systems. Without adequate and reliable backflow prevention, backpressure or back-siphoning can occur which allows pollutants and/or non-potable water to enter the distribution system. If backflow prevention systems are not properly installed, tested and maintained, the resulting potential influx of contaminants into the potable water supply can result in negative impacts to public health. The revisions to 15A NCAC 18D .0206 described herein mandate a licensed professional to oversee state compliance with the installation and maintenance of backflow prevention assemblies for water systems that contain the established threshold of five devices. The activities performed by the cross-connection control operator will help manage the risk of contamination, resulting in benefits to public health as well as increased consumer confidence.

It is difficult to quantify with certainty a monetized public health benefit. However, historic examples suggest that avoiding even one contamination event can result in significant public health and economic benefit, and increasing oversight of cross-connections may be key to incidence avoidance. For example, a 2008 *salmonella* outbreak in Alamosa, CO was likely caused by animal fecal matter entering the potable water supply via an improper cross connection. The incident resulted in an outbreak which included more than 400 cases of salmonella, 20 hospitalizations and one confirmed death (Ailes et. al. 2008). A separate study concluded that the average cost associated with contamination from cross connection control failure was $16,143 per incident (Lee et. al. 2003).

b) Training Providers

The state has a network of external training providers that is utilized by the regulated community to complete the school requirement. These training providers will likely experience economic benefits. In the aggregate, we expect training providers to collect approximately $119,350 for school registration, and this will likely occur over a short period of time (1 to 2 years). Since the vast majority of new cross-connection control operators will likely have an active license that already requires continuing education credits, we do not believe there will be significant increased demand for enrollment in continuing education courses.

c) General Environment Benefits

The proposed revisions are designed to protect potable water within the distribution system of a public water supply system. No generalized environmental benefits are anticipated.

2.3 Summary of Total Economic Impacts

Based upon published data, the revisions to 15A NCAC 18D .0206 will likely impact 134 NTNC water systems and 578 community water systems. To comply with the revised rule and provide an improved public health benefit via better risk management, the impacted water systems will need to retain a licensed cross-connection control operator. Compliance costs will be incurred for local government, private entities, state and federal government because these entities own public water systems that will be subject to the revised rule.

There could be recurring cost as well as initial cost to provide the oversight necessary to achieve public health benefits. The impact of recurring and initial cost is a direct function of whether the system elects to employ a contract operator versus repurposing a licensed operator already on staff. These two approaches have been discussed previously in detail. In general, water systems that retain a contract operator experience a recurring annual dollar-cost that reflects the labor required to perform the oversight duties. The recurring labor component can be estimated from Figures 3 and 4, for NTNC and community water systems, respectively. For water system that choose to repurpose an existing staff operator, much of the impact is not a true dollar cost but one of missed opportunity. In the repurposing approach, there is an initial dollar-cost associated with enrolling in school and applying for the exam. However, time to attend the school and recurring annual labor is cost of missed opportunity instead of a direct dollar-cost.

Table 6. Insight into initial versus recurring annual cost

Approach:	Initial Startup Cost:	Recurring Cost (Annual Labor):
Contract Operator	----------	Labor (direct dollar)
Repurposed Operator	School enrollment (direct-dollar) School attendance (missed opportunity)	Labor (missed opportunity)

Two cost scenarios were analyzed, with underlying assumptions varying among the NTNC versus the community water systems. The scenarios also varied with respect to direct dollar costs versus a monetized estimate of missed opportunity. These scenarios should be considered as likely upper and lower fiscal impact limits. Because the actual fiscal impact to the regulated community will likely exist within this range, we are reporting the average expected fiscal impact to be at the midpoint of the range, or $1,459,940.

Table 7. Total estimated costs

System Type	No. Systems	Average Cost	Total Cost (Scenario 1)
NTNC	134	$956	$128,115
Community	634	$1,735	$1,244,125

Total Cost (lower limit) = $1,372,240

System Type	No. Systems	Average Cost	Total Cost (Scenario 2)
NTNC	134	$948	$226,197
Community	634	$1,193	$1,321,443

Total Cost (upper limit) = $1,547,640

Table 8. Summary of average impacts listed by major entity

Entity Impacted	Averaged Cost	Benefits
Local Gov.	$586,544	Tangible, unquantifiable[1]
State Gov.	$3,707	Tangible, unquantifiable[1]
Federal Gov.	$5,436	Tangible, unquantifiable[1]
Private	$864,255	Tangible, unquantifiable[1]
Training Providers	(unknown)	Potential revenue increase $119,350
Certification Program	Revenue deficit (year 1) $1,966 Revenue deficit (year 2+) $9,666	Support public health goals Assist in meeting market demand

[1]Benefits are tangible but unquantifiable. As discussed, research shows that improperly managed cross connections can be a major driver of contamination events that cause disease outbreaks, illness and death. Therefore, there are major public health benefits that can be realized if only a few contamination events are either avoided or otherwise mitigated. Additional benefits include cost

avoidance of clean up and/or intensive public notification efforts; protection of water system infrastructure; and greater consumer confidence that the state takes is responsibly taking initiative to safeguard drinking water.

2.4 Alternatives

There are two alternatives to consider in comparison with the proposed revisions to 15A NCAC .0206:

a) Take no action to safe guard public health

Taking no action results in vulnerabilities and no mitigation to risk of drinking water contamination from fault cross connection control assemblies. To understand the potential scope of these vulnerabilities, one must quantify the possibility of device failure. In a recent survey by the agency, public water systems in NC were asked to provide information regarding devices that required repair or replacement. We received data from 12 systems that identified a total number of 110,481 backflow prevention assemblies. During the 2017 calendar year, 4,027 (or 3.6%) required repair or replacement. Even though this data set is limited, it suggests that there are thousands of potential situations during the year for a contamination event to occur from faulty cross-connection control assemblies.

Assuming that device failure is expected on a regular and recurring basis, it is valuable to examine events where public health has been compromised. One such example of a salmonella outbreak in Alamosa CO was discussed previously. Wide spread sickness, one confirmed death, and nearly $850,00 associated expenses were identified (Ailes et. al. 2008). Further, it has been reported that 10 of the 12 largest disease outbreaks in water systems during 1975 – 1994 were attributed to faulty or improper cross connection control (Craun and Calderon, 2001). Clearly, increased oversight and better management of cross connection control devices has the potential to reduce the incidence of biological or chemical contamination. Therefore, the alternative of taking no action was rejected.

b) Require water systems to transfer oversight responsibility to the customer

Transferring oversight responsibility to the customer is a viable alternative that has been embraced by a number of states. In this model the water system has authority to require the customer to regularly test, repair, document and report tracking information back to the water system. While this approach may alleviate oversight responsibility for the water system, it creates a different burden associated with enforcement. Clearly, inadequate enforcement may leave a water system vulnerable to legal liability in instances where a device fails and contamination enters the water system. It is doubtful that this approach would work in NC. There is currently no statutory authority available to the agency to require water systems to create and enforce legal provisions against their customers. The model most widely used includes the passing of local ordinances, which requires legal expertise and political will. Therefore, since one burden (back flow prevention device oversight) is simply traded for another (legal enforcement), and since the agency also lacks adequate statutory authority to require accountability via local ordinances, this alternative was rejected.

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15A NCAC .0206 CERTIFIED OPERATOR REQUIRED

(a) All public water systems ~~systems, except transient non-community systems with either or both ultraviolet light disinfection, or softening (not required by 15A NCAC 18C the North Carolina Department of Environmental Health - Public Water Supply Section), as the only treatment applied to water, must~~ shall have a certified operator in responsible charge for each water treatment facility that alters the physical, chemical, or microbiological characteristics of the water; has approved plans for such alterations; or has equipment installed for such alterations. ~~Upon vacancy of a position resulting in noncompliance with this requirement each facility~~ The owner shall ~~must~~ notify the Board ~~Office and Division of Environmental Health Public Water Supply Section Regional Office, in writing,~~ in writing within 10 days of a vacancy that results in noncompliance with this rule.

(b) There shall ~~must~~ be an operator holding at least a Grade C-Surface certification ~~or above~~ assigned to be on duty on the premises when a surface water treatment facility is treating water. Implementation of this requirement is subject to the following provisions:

(1) ~~Upon~~upon vacancy of a position resulting in noncompliance with this requirement, the owner shall ~~each facility must~~ notify the Board ~~Office~~ within 24 hours or at the start of the next regular business day of such vacancy; and

(2) ~~Upon~~upon such vacancy the owner ~~the facility must~~ shall fill the position with a certified ~~grade~~Grade C-Surface operator or an operator with a temporary Grade C-Surface certification within 90 days.

(c) There shall ~~must~~ be an operator in responsible charge for the distribution portion of ~~the~~ community and non-transient non-community public water systems. This operator shall ~~must~~ possess a valid distribution certificate issued by the Board with the grade equivalent to or exceeding the water system's distribution classification ~~facility for which he or she is designated~~. A system serving 100 or fewer service connections ~~is~~ shall be exempt from this requirement if it has an operator in responsible charge as required in Paragraph (a) of this Rule. A system ~~which~~that is classified as D-distribution only may use a Board-certified ~~state certified~~ distribution, ~~well~~well, or surface operator to meet the operator in responsible charge requirements of this Rule.

(d) There ~~Effective July 1, 2003 there~~ shall be an operator in responsible charge for the cross-connection-control facilities ~~of the distribution system for all~~of any public water ~~systems~~system required by 15A NCAC 18C .0406(b) to have five or more testable backflow prevention assemblies. ~~This~~The operator shall possess a valid ~~Grade~~ Cross-Connection Control certificate issued by the Board.

(e) All operators of community and non-transient non-community public water systems shall follow the standard operating procedures established by the operator in responsible charge. ~~Any decisions~~Decisions about water quality or quantity that affect public health ~~which~~that have not been ~~defined~~addressed in the standard operating procedures shall ~~must~~ be referred to the operator in responsible charge or to the certified operator on duty.

(f) No operator in responsible charge is required for transient non-community public water systems with either or both ultraviolet light (uv) disinfection or softening (if not required by 15A NCAC 18C ~~the North Carolina Department of Environmental Health - Public Water Supply Section~~) as the only treatment applied to water.

History Note: *Authority G.S. 90A-20; 90A-28; 90A-29; 90A-32;*
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