



# 15A NCAC 02L .0202 Groundwater Quality Standards PFAS Rulemaking

## July 2024 GWWMC

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# Follow-Up Responses to Questions from May 2024 GWWMC Meeting

- *What are other states doing to regulate PFAS in groundwater?*
  - Response: The Interstate Technology Regulatory Council (ITRC) maintains a PFAS Water and Soil Values Table (Microsoft Excel format) which can be accessed on their website at this link:  
<https://pfas-1.itrcweb.org/fact-sheets/>
  - Several states have guidance values, action levels, cleanup levels, standards, and promulgated rules in place to regulate various PFAS in groundwater, including Alaska, Colorado, Connecticut, Florida, Hawaii, Illinois, Iowa, Maine, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, Pennsylvania, Rhode Island, Texas, Vermont, and Washington. For example, Michigan has established Cleanup Criteria in groundwater for PFOA, PFOS, PFNA, PFBS, PFHxS, PFHxA, and HFPO-DA. Minnesota has established Health Risk Limits for groundwater for PFOA, PFOS, PFBA, PFBS, PFHxS, and PFHxA.
  - North Carolina is the only state in the Southeast Atlantic US with a PFAS manufacturer.
- *What are the “traditional testing methods” for the PQL for legacy PFAS?*
  - Response: The testing method for groundwater is Method 1633, issued by the EPA in January 2024, which includes 43 PFAS including PFOA and PFOS:  
<https://www.epa.gov/system/files/documents/2024-01/method-1633-final-for-web-posting.pdf>

# Follow-Up Responses to Questions from May 2024 GWWMC Meeting

- *Where are the manufacturers of PFAS?*
  - Response: North Carolina has one PFAS manufacturer. PFAS can also be released from manufacturing operations that formulate raw material containing PFAS chemicals. Examples of other industry categories that are potential PFAS sources include organic chemicals, plastics & synthetic fibers; metal finishing; electroplating; electric and electronic components; landfills; pulp, paper & paperboard; leather tanning & finishing; plastics molding & forming; textile mills; paint formulating, and airports.
- *What are the alternatives to PFAS in manufacturing, if PFAS are no longer able to be used?*
  - Response: This proposed amendment does not prohibit the use of PFAS in manufacturing. The existing rule states that substances without a groundwater standard which are not naturally occurring shall not be permitted in concentrations at or above the PQL. The existing rule requires a manufacturer, formulator, or other permitted activity to prevent releases of PFAS into groundwater that cause exceedances of the groundwater standards (either the PQL under the existing rule or the proposed standards, if adopted). The proposed rule amendment does not contain any requirements for the use of PFAS in manufacturing processes.

# Follow-Up Responses to Questions from May 2024 GWWMC Meeting

- *What is the Department's compliance and enforcement strategy and the burden on the State to implement PFAS groundwater and surface water quality standards?*
  - Response: Groundwater standards are used as clean-up standards and to protect groundwater as a resource. This rulemaking does not change the requirements and procedures for addressing groundwater contamination, only the clean-up standard is proposed to be changed from the current. For providing clarity to these compliance assistance processes, see Appendix B of the attached Fiscal and Regulatory Impact Analysis (RIA).
  - The strategy and the burden on the State would be the same under the existing groundwater standards or the proposed groundwater standards. The RIA outlines which DEQ programs implement groundwater quality standards and the impacts, which includes the potential for staff time saved in the future, which could be redirected to other project/sites.

# Outline

- Groundwater Quality Standards Background
  - Development of Groundwater Quality Standards
- Per- and Polyfluorinated Substances (PFAS)
- Proposed Groundwater Quality Standards for PFAS
- Regulatory Impact Analysis Summary
- Proposed Rulemaking Schedule and Action Item Request



# Types of North Carolina Water Quality Standards



Groundwater Standards  
(protect resource)

**State Regulations**



Surface Water Standards  
(protect resource)

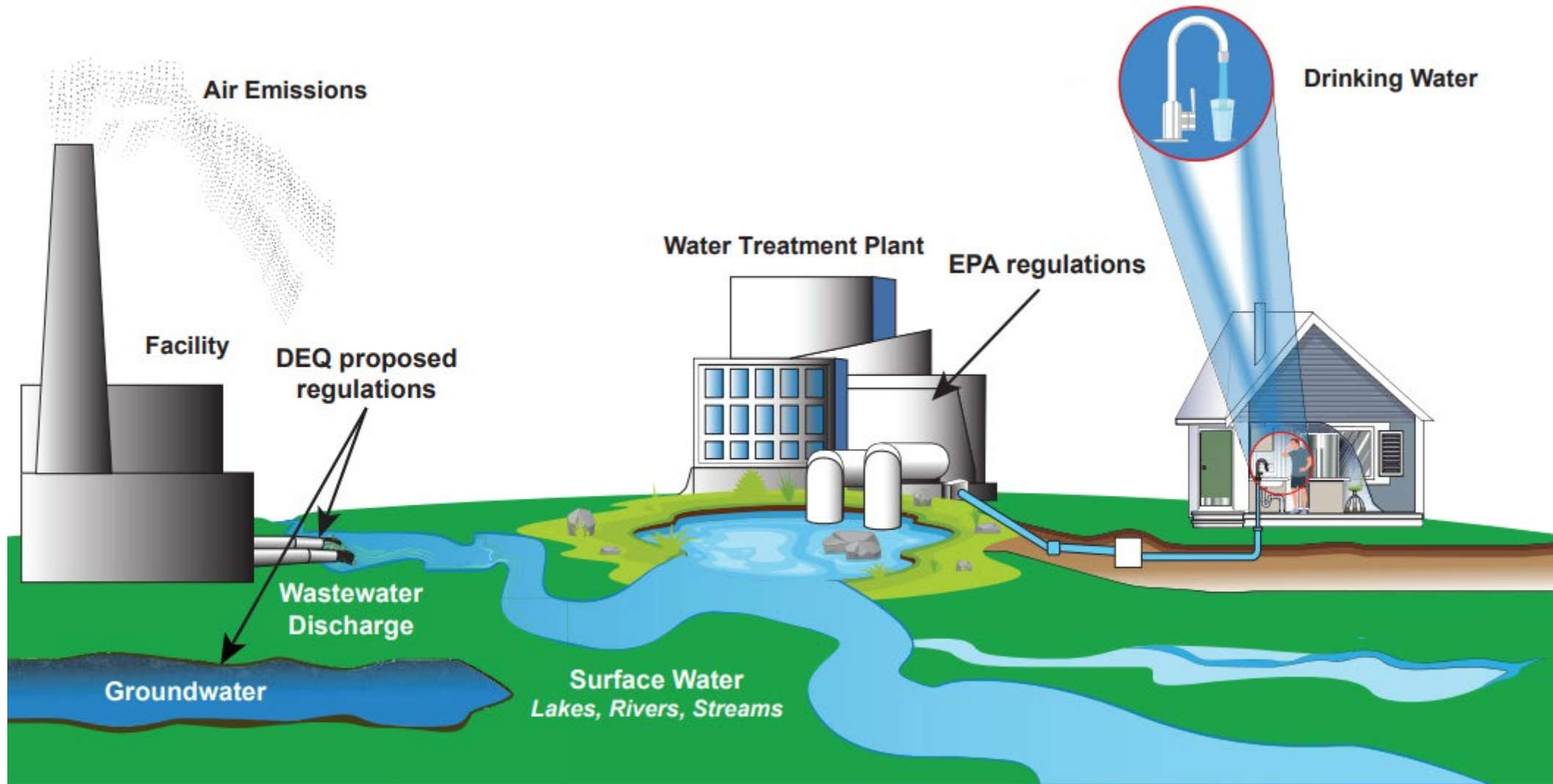
**Safe Drinking Water Act**



Drinking Water Standards  
(treatment)

**Clean Water Act**

# Impacts of Groundwater and Surface Water on Drinking Water Treatment Burden



# Groundwater in NC

- Groundwater is the water that fills cracks and other openings in beds of rocks and sand and is stored in underground reservoirs known as aquifers
- Groundwater supports approximately 50% of drinking water use in the state
- Public Water Supply Sites
  - 80% of approximately 2300 Public Water Systems rely on groundwater as drinking water source
  - Majority are smaller systems providing drinking water to rural communities with fewer residents
- Private Drinking Water Wells
  - 25% of residents rely on groundwater sourced wells





# Groundwater Quality Standards Rule

## Title 15A NCAC Subchapter 02L – Groundwater Classifications and Standards

Section .0100: General Considerations

Section .0200: Classifications and Groundwater Quality Standards

.0201 Groundwater Classifications

.0202 Groundwater Quality Standards



# North Carolina Groundwater Quality Standards

## NC Groundwater Quality Standards

<b>Federal Requirement</b>	No*
<b>North Carolina Rule</b>	15A NCAC 02L .0202
<b>Population</b>	Human Adults
<b>Target use</b>	Ingestion Household use
<b>Standard endpoints</b>	Noncancer Cancer Aqueous taste and odor

\*Groundwater standards are used in Federal programs in NC (such as Superfund, RCRA, etc.)

- Maximum allowable concentrations which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage
- Best Usage: existing or potential source of drinking water supply for humans
- Protect groundwaters of the state as a resource for human consumption
  - Groundwater supports approximately 50% of drinking water use in the state
- Implemented in various programs including site clean-ups, risk assessments, health evaluations, etc.



# Groundwater Quality Standards Rule Language

15A NCAC 02L .0202 (b) and (c)

- Substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit (PQL).
- Where the standard for a substance is less than the PQL, the detection of that substance at or above the PQL constitutes a violation of the standard.

Practical quantitation limit or "PQL" means the lowest concentration of a given material that can be reliably achieved by analytical technique during routine laboratory analysis.



# Developing Groundwater Quality Standards

Established as the least of the following\*:

1. Systemic/non-cancer threshold concentration
2. Concentration which corresponds to an incremental lifetime cancer risk of  $1 \times 10^{-6}$  (one in a million)
3. Taste threshold limit value
4. Odor threshold limit value
5. Maximum contaminant level
6. National secondary drinking water standard

\*15A NCAC 02L .0202 (d)



# Groundwater Standards Calculation

## 1. Noncancer/systemic

$$GWQS = \frac{RfD \times BW \times RSC}{WCR}$$

## 2. Cancer

$$GWQS = \frac{RL \times BW}{CPF \times WCR}$$

RL = Risk Level =  $1 \times 10^{-6}$

## Toxicity benchmarks

RfD = Chronic Oral Reference Dose

CPF = Carcinogen Potency Factor  
or Cancer Slope Factor (CSF)

## Exposure estimates

RSC = Relative Source Contribution  
(0.1 for inorganics; 0.2 for organics)

BW = Body Weight = 70 kg (adult)

WCR = Water Consumption Rate =  
2 L/day (adults)



# Developing Groundwater Quality Standards cont.

The following references are used, in order of preference\*:

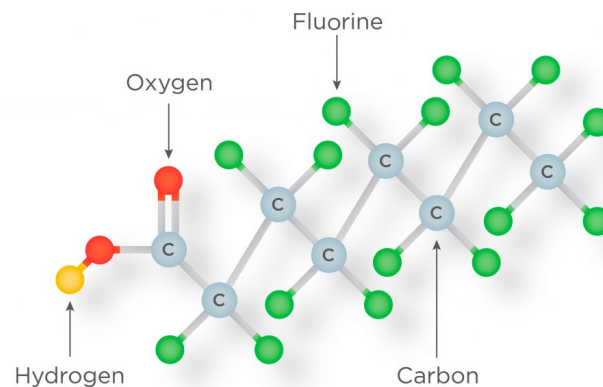
1. EPA Integrated Risk Information System (IRIS)
2. EPA Drinking Water Health Advisories
3. Other EPA health risk assessment data
4. Other relevant, published health risk assessment data and scientifically valid peer-reviewed published toxicological data

\*15A NCAC 02L .0202 (e)



# Per- and Polyfluorinated Substances (PFAS)

- PFAS are a group of manufactured chemicals that are used to make fluoropolymer coatings and products
- Perfluorinated compounds are chemicals of specific concern to North Carolina
  - Widely produced and used; significant presence in NC
  - Persist in the environment
  - Bioaccumulate in humans, animals, and the environment
- Evaluated the available scientific data to develop groundwater standards for a subset of PFAS compounds



# Background – NPDWR for Drinking Water

- March 2023 – EPA announced the proposed National Primary Drinking Water Regulation (NPDWR) for six PFAS:
  - PFOA, PFOS, PFNA, HFPO-DA, PFHxS, and PFBS
- April 2024 – Finalized NPDWR, establishing legally enforceable levels for drinking water, called Maximum Contaminant Levels (MCLs), for six PFAS:

Compound	Final MCLG	Final MCL (enforceable levels)
PFOA	Zero	4.0 parts per trillion (ppt) (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

<https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas>





# Background- Previous GWWMC and EMC Presentations



## 2022-2023

- May 2022 EMC Meeting
  - Information Item – Prevalence of PFAS in NC, EPA actions, and regulations in other states
- July 2022 EMC Meeting
  - Information Item – PFAS Update
- July 2023 GWWMC Meeting
  - Information Item – Groundwater Quality Standards and PFAS Rulemaking Update
- November 2023 EMC Meeting
  - Information Item – Proposed PFAS Toxicological Summaries

## 2024

- January 2024 GWWMC Meeting
  - Information Item – Affected Sources and Anticipated Implementation Requirements; Cost and Benefits Analysis Approach
- March 2024 GWWMC Meeting
  - Information Item – Plan Implementation Timeline; DWM Stakeholder Meetings Overview and Feedback
- May 2024 GWWMC Meeting
  - Information Item – Proposed Groundwater Standards; Regulatory Impact Analysis Overview



# Proposed PFAS Compounds for Groundwater Standards Development

	PFAS Compound	Acronym
1	Perfluorooctane sulfonic acid	PFOS*
2	Perfluorooctanoic acid	PFOA*
3	Hexafluoropropylene oxide dimer acid	HFPO-DA (GenX)*
4	Perfluorobutane sulfonic acid	PFBS*
5	Perfluorononanoic acid	PFNA*
6	Perfluorohexane sulfonic acid	PFHxS*
7	Perfluorobutanoic acid	PFBA
8	Perfluorohexanoic acid	PFHxA

\*Regulated under the Safe Drinking Water Act in the form of MCLs and Hazard Index.

# Why these PFAS Compounds?

1. All eight compounds have an available literature base and available health effects data to support the development of groundwater standards.
2. The literature bases for all compounds have been reviewed and evaluated by a federal agency.
3. All eight PFAS compounds have been detected in North Carolina's environmental media.
4. There is a final EPA test method (Method 1633) available to measure these compounds in groundwater.

*For full toxicological summary, see Appendix A documenting principal studies and health effects data used, description of assigned toxicological values, and calculation of the numeric water quality criteria.*



# Proposed Groundwater Standards for PFAS Compounds

*See Appendix A for Details on Toxicological Summary and Derivation of the Standard*

PFAS Compound	Reference	Critical Health Effects	Toxicity Benchmarks and Values Available <sup>^</sup>
1 PFOS	2023 EPA Toxicity Assessment <sup>+</sup>	Developmental and Cardiovascular effects	<b>RfD</b> , CSF, MCL
2 PFOA	2023 EPA Toxicity Assessment <sup>+</sup>	Renal cell carcinomas	RfD, <b>CSF</b> , MCL
3 HFPO-DA (GenX)	2021 EPA Human Health Toxicity Assessment <sup>+</sup>	Liver effects	RfD, <b>MCL</b>
4 PFBS	2021 EPA Human Health Toxicity Assessment <sup>+</sup>	Thyroid effects	<b>RfD</b>
5 PFNA	2021 ATSDR* Minimal Risk Level <sup>+</sup>	Developmental effects	RfD, <b>MCL</b>
6 PFHxS	2021 ATSDR* Minimal Risk Level <sup>+</sup>	Thyroid effects	<b>RfD</b> , <b>MCL</b>
7 PFBA	2022 EPA IRIS Assessment	Liver and Thyroid effects	<b>RfD</b>
8 PFHxA	2023 EPA IRIS Assessment	Developmental effects	<b>RfD</b>

<sup>+</sup>Used as basis for EPA's PFAS National Primary Drinking Water Regulation

\*ATSDR= Agency for Toxic Substances and Disease Registry

<sup>^</sup>RfD: reference dose; CSF: cancer slope factor; MCL: Maximum Contaminant Level in drinking water

# Proposed Groundwater Standards for PFAS Compounds

PFAS Compound		Proposed 02L .0202(h) Standard (ng/L)	Existing 02L Standard - PQL (ng/L)	Compliance Level Under Proposed Rule (ng/L)
1	PFOS	0.7	4.0	PQL (4.0)
2	PFOA	0.001	4.0	PQL (4.0)
3	HFPO-DA (GenX)	10	5.0	10
4	PFBS	2,000	3.0	2,000
5	PFNA	10	4.0	10
6	PFHxS	10	3.0	10
7	PFBA	7,000	5.0	7,000
8	PFHxA	4,000	3.0	4,000

15A NCAC 02L .0202 (b)(1):

Where the standard for a substance is less than the PQL, the detection of that substance at or above the PQL constitutes a violation of the standard.

\*PQLs were calculated using the method detection limits (MDLs) reported in EPA Method 1633, which were based on the national Multi-Laboratory Validation Study of PFAS by Isotope Dilution LC-MS/MS Wastewater, Surface Water, and Groundwater.



# *Regulatory Impact Analysis*

- The attached Fiscal and Regulatory Impact Analysis (RIA) was approved by OSBM per G.S. 150B-21.4.
  - Includes reason for rule amendment, fiscal analysis approach, cost and benefits summary, and rule alternatives
  - Supporting Information
    - Appendix A – Toxicological Summary, Derivation of Groundwater Standards, and Calculation Sheets
    - Appendix B – Proposed Plan for Addressing PFAS Impacts to Groundwater at DWM-Regulated Sites Under Existing Regulations
    - Appendix C – Technical Memorandum Used to Determine PFAS Treatment Cost for Groundwater



# *Regulatory Impact Analysis Summary*

- Impact Summary of rule amendment as compared to baseline (existing rule/absence of 02L groundwater standard/PQL):
  - Benefit of regulatory certainty.
  - No additional impacts to human health risks.
  - No additional costs to regulated community, and potential for benefit in avoided costs in the future (potential substantial economic impact in benefits) for:
    - Local government-owned sites;
    - Private industry-owned sites;
    - Inactive Hazardous Sites Fund (allowing funds to be redirected to other site priorities); and
    - State government staff time (allowing staff time to be redirected to other priorities).



## *Potential Costs and Benefits from the Proposed Amendment For One Hypothetical DWM-Regulated Site*

Category	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>ADDED COSTS FROM PROPOSED AMENDMENT</b>										
Additional expenses to the regulated community to address PFAS as compared to baseline/existing rule	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>CHANGES TO HUMAN HEALTH IMPACTS FROM PROPOSED AMENDMENT</b>										
Changes to human health impacts as compared to baseline/existing rule	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>POTENTIAL BENEFITS TO REGULATED COMMUNITY FROM PROPOSED AMENDMENT *</b>										
<b>Potential Avoided Future Capital Expenditures at One Hypothetical DWM-Regulated Site</b>										
• Construction of additional 1 to 4 Groundwater Wells for either assessment monitoring or extraction, if needed	\$13,054 to \$78,322	--	--	--	--	--	--	--	--	--
• Treatment System Construction	\$156,858 to \$883,133	--	--	--	--	--	--	--	--	--
<b>Potential Avoided Future Annual O&amp;M and Monitoring Expenses at One Hypothetical DWM-Regulated Site</b>										
• Adding PFAS Analysis to Routine Monitoring for 3-25 Wells, 1 or 2 Events	\$2,303 to \$38,034	\$2,349 to \$38,795	\$2,396 to \$39,571	\$2,444 to \$40,362	\$2,493 to \$41,169	\$2,543 to \$41,993	\$2,594 to \$42,832	\$2,645 to \$43,689	\$2,698 to \$44,563	\$2,752 to \$45,454
• Groundwater Well O&M (1 to 4 wells)	\$2,494 to \$9,975	\$2,544 to \$10,175	\$2,595 to \$10,378	\$2,647 to \$10,586	\$2,700 to \$10,797	\$2,754 to \$11,013	\$2,809 to \$11,233	\$2,865 to \$11,458	\$2,922 to \$11,687	\$2,981 to \$11,921
• Treatment System O&M	\$59,428 to \$301,383	\$60,617 to \$307,411	\$61,829 to \$313,559	\$63,065 to \$319,830	\$64,327 to \$326,227	\$65,613 to \$332,751	\$66,926 to \$339,406	\$68,264 to \$346,194	\$69,629 to \$353,118	\$71,022 to \$360,181
<b>TOTAL QUANTIFIED BENEFITS TO REGULATED COMMUNITY IN POTENTIAL FUTURE AVOIDED COSTS AT ONE HYPOTHETICAL DWM-REGULATED SITE *</b>	\$208,670 to \$1,156,140	\$65,510 to \$356,380	\$66,820 to \$363,507	\$68,156 to \$370,778	\$69,519 to \$378,193	\$70,910 to \$385,757	\$72,328 to \$393,472	\$73,774 to \$401,342	\$75,250 to \$409,368	\$76,755 to \$417,556
<b>Ten-Year Net Present Value, 7% discount rate, 2024 dollars</b>								<b>\$604,975 to \$3,323,557</b>		

(\* ) Range of potential avoided assessment and remediation costs over time for one hypothetical DWM-regulated site, if a site fell under certain circumstances (see fiscal note in Attachment C).

Original Costs obtained were in November 2023 dollars, but have been escalated at 2.42% for CapEx and 2% for O&M. Table assumes Year 1 is 2026 per the DWM implementation schedule. Net Present Value (NPV) total is in 2024 dollars.

The year that remediation would have begun is site-specific. Remediation timeframe would also be site-specific, but annual avoided costs would continue until remediation would have been completed, if warranted under existing rules.



# Proposed Rulemaking Schedule

Action / Responsibility	Date
Stakeholder Meetings	January and February 2024
GWWMC/EMC – Information items	May 2022, July 2022, July 2023, November 2023, January 2024, March 2024, and May 2024
<b>GWWMC – Decision to Approve Rule Text and RIA to go to EMC</b>	<b>July 10, 2024</b>
EMC – Decision to Approve Rule and RIA for Public Comment	September 12, 2024
Public Comment Period	October 15 – December 16, 2024
Earliest Date for Public Hearing	October 30, 2024
EMC – Decision to Approve Hearing Officer’s Report and final RIA, Adopt Rule	March 2025
RRC - Approval of Rule	April 2025
Proposed effective date	May 1, 2025

## Action Item Request

Approval to proceed to the EMC with request for public notice and hearings for the proposed rule amendment to 15A NCAC 02L .0202 Groundwater Quality Standards and the associated Fiscal and Regulatory Impact Analysis.



# Thank you

## Groundwater Standards Calculations:

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