Total Maximum Daily Load (TMDL) Action Plan

For Bacteria Reduction (*E. coli*) in the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run

MS4 General Permit No. VAR040022

Prepared by
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5204 Bernard Drive
Roanoke, VA 24018

March 2025
(Updated)

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I. EXECUTIVE SUMMARY

Roanoke County's "Total Maximum Daily Load (TMDL) Action Plan for *E. coli* Reduction in the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run" (Bacteria TMDL Action Plan) has been prepared and revised, as required by the Virginia Department of Environmental Quality's (DEQ) "General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems" (Permit # VAR040022). Roanoke County is subject to the requirements of this permit, effective November 1, 2023 through October 31, 2028.

Roanoke County's strategy to address the permit requirements is to progressively implement Best Management Practices (BMPs) to decrease the discharge of *E. coli* from the County's Municipal Separate Storm Sewer System (MS4) towards meeting the DEQ-assigned waste load allocation. Roanoke County will implement BMPs over multiple state permit cycles, using an adaptive iterative approach, to reduce *E. coli* discharges.

The following table shows the BMPs that Roanoke County plans to implement in this permit cycle to decrease discharges of *E. coli,* along with implementation dates for each. Note that some of these BMPs are also effective in addressing the County's sediment waste load allocations.

BMP #	BMP Name/Task	Implementation Date
B-1	Dog Waste Stations and Signage • Develop a written plan of where to install • Install at least 5 dog waste stations per year until plan is achieved	July 2020 Ongoing
B-2*	Protect Stream Buffers: Ordinance • Finalize ordinance language • Present to Board of Supervisors for consideration • Implement ordinance (if approved)	July 2020 Fall 2020 Fall 2021
B-3*	Protect Stream Buffers: No-Mow Policy for County-owned Lands	Spring 2021
B-4	Public Education: Reducing Food Sources Accessible to Wildlife	July 2020
B-5	Public Education: Septic System Repair & Maintenance	Ongoing
B-6	Business Outreach: Eliminating Illicit Discharges	Ongoing
B-7*	Enhanced Public Outreach	Ongoing
B-8*	Enhanced Employee Training	Ongoing

***** *Also effective in reducing sediment discharge to the Roanoke River.*

This Bacteria TMDL Action Plan was prepared by Roanoke County staff. Note that public input was sought through public advertisement and a comment period. The completed Plan was approved by the County Administrator. Nothing in this Action Plan shall be construed as binding Roanoke County to any action until such time that the Roanoke County Board of Supervisors provides final approvals and/or appropriates necessary funding for implementation.

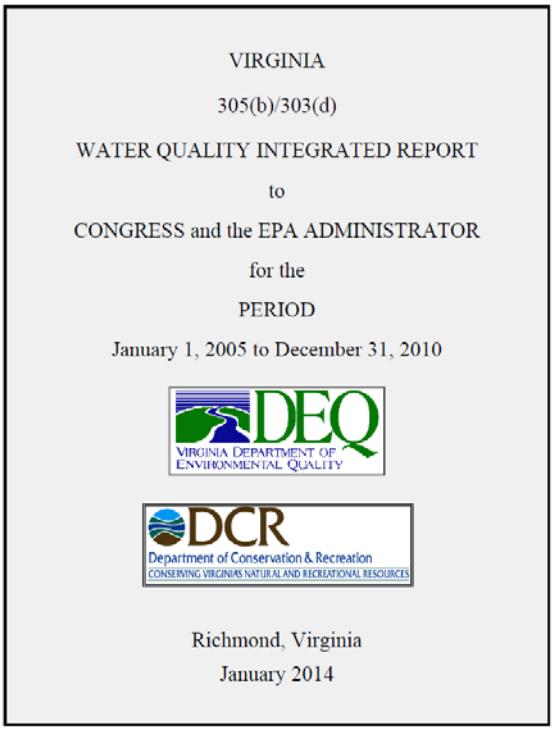
It is expected that this Bacteria TMDL Action Plan will be periodically revised to add, modify, or delete BMPs, to adjust estimated implementation dates, and to reflect new information as it becomes available. Progress regarding implementation of this plan will be included in the MS4 Annual Report that is submitted to DEQ by October 1st of each year in the permit term.

II. BACKGROUND

A. General

The Virginia Department of Environmental Quality (DEQ) routinely monitors and tests the Commonwealth's waters (i.e., streams, rivers, lakes, and estuaries) to confirm that they meet Virginia's water quality standards (9 VAC 25-260-10). According to the Virginia Water Quality Standards: *"all state waters are designated for the following uses: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might be reasonably expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish)."*

Where DEQ determines that a water does not meet Virginia's water quality standards, the water is termed "impaired." Impaired waters are listed on the "*Virginia Water Quality Assessment 305(b)/303(d) Integrated Report"* that is issued on even-numbered years to meet the requirements of the U.S. Clean Water Act, sections 305(b) and 303(d), and the Virginia Water Quality Monitoring, Information and Restoration Act. **Roanoke County has 16 different streams, including the Roanoke River, with 28 identified impairments.**


VIRGINIA

305(b)/303(d)

WATER QUALITY INTEGRATED REPORT

to

CONGRESS and the EPA ADMINISTRATOR

for the

PERIOD

January 1, 2005 to December 31, 2010

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

Richmond, Virginia

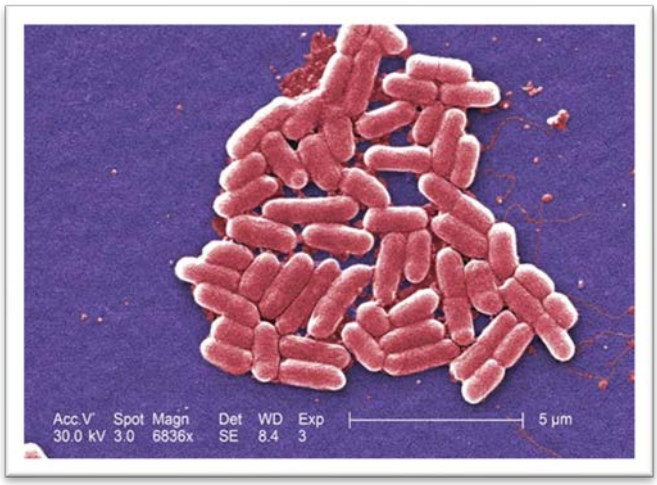
January 2014

DEQ performs studies on impaired waters to determine the "Total Maximum Daily Load" that the water can assimilate and still meet water quality standards. These studies are called TMDL studies. TMDL studies assign "waste load allocations" (WLAs) to permitted point sources of pollution. WLAs are numerical limits of a pollutant of concern that a permitted point source must meet by implementing appropriate strategies, or Best Management Practices (BMPs) using an adaptive iterative approach. BMPs may be implemented over multiple state permit cycles, as long as adequate progress to reduce the pollutant of concern is documented.

As previously noted, Roanoke County has coverage under the "Virginia General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems" (MS4 Permit); This MS4 Permit (General Permit No. VAR040022) is effective November 1, 2023 through October 31, 2028. Pursuant to this permit, all stormwater that passes through a County-owned or County-operated storm drain or improved channel that is located within the urban parts of the County, as designated in the latest decennial U.S. Census, is considered to be a point source discharge and, therefore, subject to WLAs, where appropriate.

Roanoke County has 10 streams, including the Roanoke River, located in its MS4 regulated area, and these have 13 TMDL WLAs. Of these WLAs, six are for *E. coli*. The six streams with *E. coli* WLAs are the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run.

E. coli is a bacterium that is commonly found in the lower intestine of humans and warm-blooded animals. It can survive for a limited time outside of the body, and it is used as an indicator organism for fecal contamination.



E. coli bacterium is used as an indicator organism for fecal contamination.

Section II.B of the MS4 Permit requires Roanoke County to have an updated MS4 Program Plan that includes a specific TMDL Action Plan for pollutants allocated to the MS4 in approved TMDLs.

This specific TMDL Action Plan addresses reduction of *E. coli* discharged into the six streams with *E. coli* WLAs.

Although only 6 streams have *E. coli* WLAs, pollutant discharges into all of the streams that are tributary to them must be decreased. Therefore, all of the Roanoke River's tributary streams in Roanoke County are impacted.

This Bacteria TMDL Action Plan has been prepared by Roanoke County staff. Public input was sought through public advertisement and a public meeting. The completed Plan was approved by the County Administrator. Nothing in this Action Plan shall be construed as binding Roanoke County to any action until such time that the Roanoke County Board of Supervisors provides final approvals and/or appropriates necessary funding for implementation.

It is expected that this Bacteria TMDL Action Plan will be periodically revised to add, modify, or delete BMPs, to adjust estimated implementation dates, and to reflect new information as it becomes available. Progress regarding implementation of this plan will be included in the MS4 Annual Report that is submitted to DEQ by October 1st of each year in the permit term.

B. Watershed Descriptions

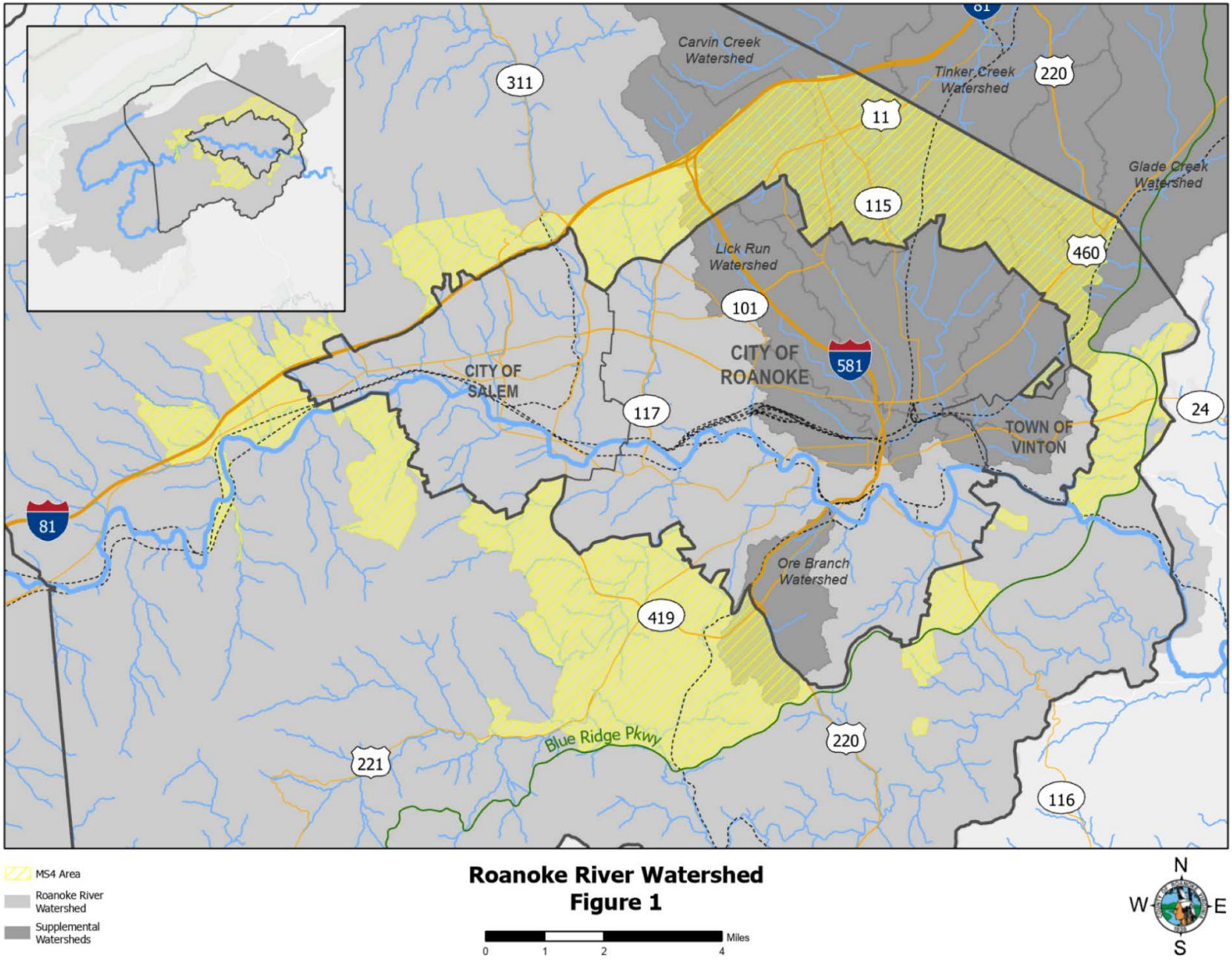
1. Roanoke River

The Roanoke River originates in Montgomery County and flows through Roanoke County, Salem City, Roanoke City, and the Town of Vinton. It flows through Roanoke County again and then into Bedford and Franklin Counties and Smith Mountain Lake.

All of Roanoke County, except for the northern part of the Catawba Valley, flows into the Roanoke River. Five streams flow into the Roanoke River that have their own WLAs for *E. coli:* Tinker Creek, Carvin Creek, Lick Run, Glade Creek, and Ore Branch. For the purposes of this description, the watersheds of these five streams are nested within the Roanoke River watershed but will be separately addressed in this plan.

Within Roanoke County, the Roanoke River watershed contains 50.5 square miles within the MS4 regulated area and 174.4 square miles outside of the MS4 regulated area. There are approximately 13.2 miles of river within the regulated MS4 area and approximately 2.7 miles of river outside of the regulated MS4 area.

Within Roanoke County's regulated MS4 area, the Roanoke River is fed by approximately 122.2 miles of drainage ways having drainage areas of 100 acres or greater. There are approximately 315.5 miles of drainage ways having drainage areas of 100 acres or greater outside of the regulated MS4 area. See **Figure 1: Roanoke River Watershed Map**.

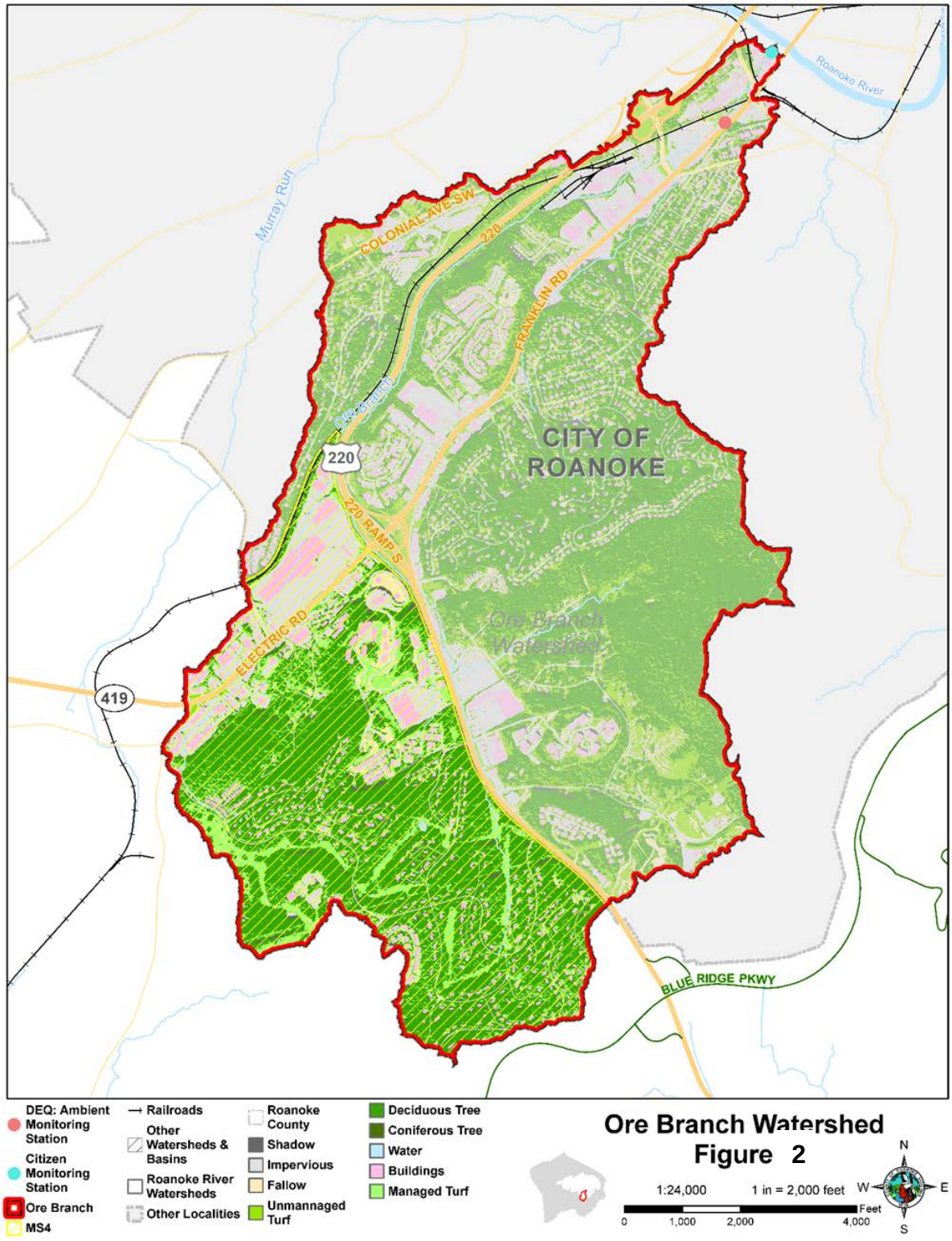


Roanoke River Watershed
Figure 1

2. Ore Branch

Ore Branch originates in Roanoke County in the vicinity of Tanglewood Mall and the Hunting Hills Subdivision. It then enters Roanoke City and flows beside the Roy L. Webber Expressway to its discharge into the Roanoke River, just upstream of the Franklin Road Bridge. The stream has been largely channelized and piped, and very little of the natural channel remains.

Within Roanoke County, Ore Branch's 1.38 square mile watershed is totally contained within the County's MS4 regulated area. There are approximately 3.72 miles of drainage ways having drainage areas of 100 acres or greater. See **Figure 2: Ore Branch Watershed Map**.


Roanoke River
Murray Run
COLONIAL AVE SW
220
FRANKLIN RD
Ore Branch
CITY OF ROANOKE
220
220 RAMPS
ELECTRIC RD
Ore Branch Watershed
419
BLUE RIDGE PKWY
DEQ: Ambient Monitoring Station
Citizen Monitoring Station
Ore Branch
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Ore Branch Watershed
Figure 2
1:24,000
1 in = 2,000 feet
0
1,000
2,000
4,000
Feet
N
W
E
S

3. Tinker Creek

Tinker Creek originates in Botetourt County on Tinker Mountain, flows through the Hollins area of Roanoke County, then enters Roanoke City and discharges into the Roanoke River just downstream from the discharge from the Western Virginia Water Authority's Roanoke Regional Water Pollution Control Plant. Tinker Creek forms the western boundary between the Town of Vinton and the City of Roanoke. Three streams flow into Tinker Creek that have their own WLA for *E. coli:* Carvin Creek, Lick Run, and Glade Creek. For the purposes of this description, these three streams will be addressed separately from Tinker Creek.

Within Roanoke County, Tinker Creek's 4.2 square mile watershed (excluding the three aforementioned streams) is totally contained within the County's MS4 regulated area. There are approximately 8.2 miles of drainage ways having drainage areas of 100 acres or greater. See **Figure 3: Tinker Creek Watershed Map**.

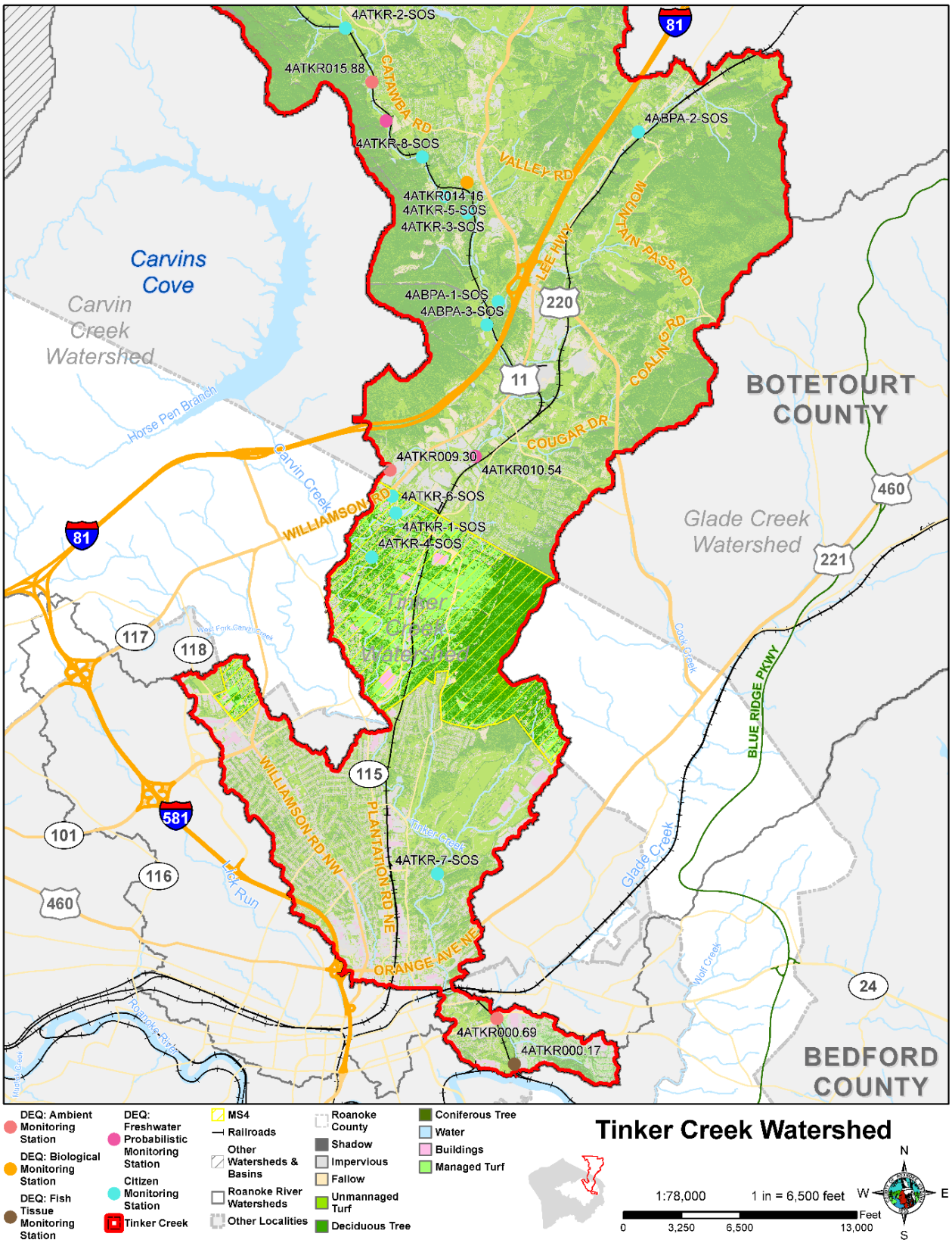

4ATKR-2-SOS
4ATKR015.88
CATAWBA RD
4ATKR-8-SOS
4ABPA-2-SOS
VALLEY RD
4ATKR014.16
4ATKR-5-SOS
4ATKR-3-SOS
MOUNTAIN PASS RD
LEE HWY
Carvins Cove
Carvin Creek Watershed
4ABPA-1-SOS
4ABPA-3-SOS
220
COALING RD
11
BOTETOURT COUNTY
Horse Pen Branch
COUGAR DR
4ATKR009.30
4ATKR010.54
Carvin Creek
WILLIAMSON RD
4ATKR-6-SOS
4ATKR-1-SOS
4ATKR-4-SOS
460
Glade Creek Watershed
221
81
Tinker Creek Watershed
117
118
West Fork Carvin Creek
Cook Creek
BLUE RIDGE PKWY
WILLIAMSON RD NW
PLANTATION RD NE
115
581
101
Tinker Creek
4ATKR-7-SOS
Glade Creek
116
Lick Run
460
ORANGE AVE NE
Wolf Creek
24
Roanoke River
4ATKR000.69
4ATKR000.17
BEDFORD COUNTY
DEQ: Ambient Monitoring Station
DEQ: Biological Monitoring Station
DEQ: Fish Tissue Monitoring Station
DEQ: Freshwater Probabilistic Monitoring Station
Citizen Monitoring Station
Tinker Creek
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Tinker Creek Watershed
1:78,000
1 in = 6,500 feet
Feet
0
3,250
6,500
13,000
N
W
E
S

Figure 3

4. Glade Creek

Glade Creek originates in Botetourt County near Curry Gap, flows through northeastern Roanoke County (including Vinyard Park), a small portion of the City of Roanoke, northwestern Town of Vinton, and then it discharges into Tinker Creek across from Roanoke City's Fallon Park.

Within Roanoke County, the watershed contains 3.7 square miles within the MS4 regulated area and 1.74 square miles outside of the MS4 regulated area. There are approximately 10.0 miles of drainage ways having drainage areas of 100 acres or greater within the regulated MS4 area. There are approximately 1.72 miles of drainage ways having drainage areas of 100 acres or greater outside of the regulated MS4 area. See **Figure 4: Glade Creek Watershed Map**.

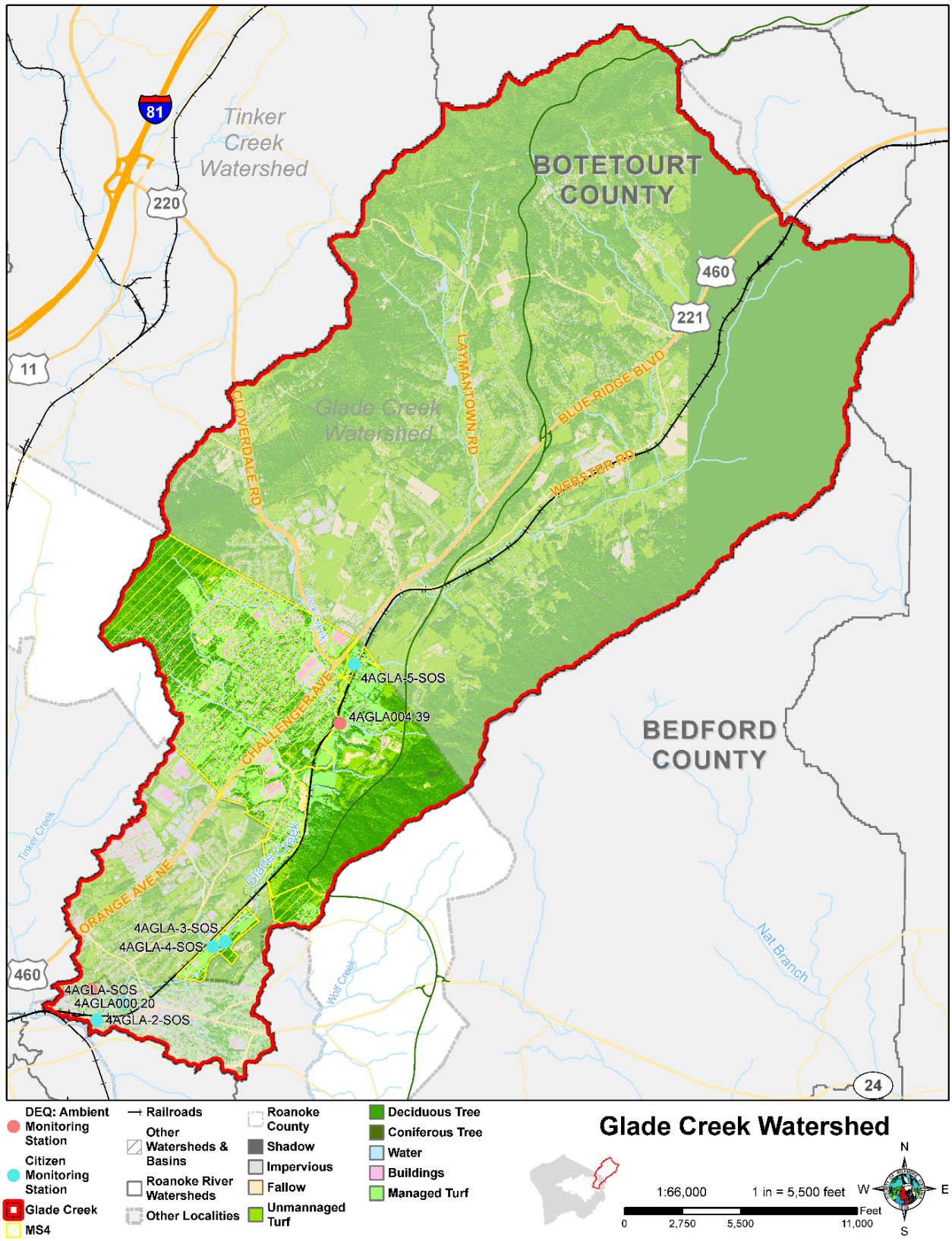

Tinker Creek Watershed
BOTETOURT COUNTY
BEDFORD COUNTY
Glade Creek Watershed
81
220
11
460
221
24
LAYMANTOWN RD
BLUE RIDGE BLVD
WEBSTER RD
CLOVERDALE RD
CHALLENGER AVE
ORANGE AVE NE
Glade Creek
Tinker Creek
Wolf Creek
Nat Branch
4AGLA-5-SOS
4AGLA004.39
4AGLA-3-SOS
4AGLA-4-SOS
4AGLA-SOS
4AGLA000.20
4AGLA-2-SOS
DEQ: Ambient Monitoring Station
Citizen Monitoring Station
Glade Creek
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Glade Creek Watershed
1:66,000
1 in = 5,500 feet
Feet
0
2,750
5,500
11,000
N
S
W
E

Figure 4

5. Carvin Creek

Carvin Creek originates in Botetourt County on Tinker Mountain, flows through the Carvin Cove Reservoir, enters Roanoke County and flows through the Hollins area, and then it discharges into Tinker Creek near the intersection of Plantation Road and Hollins Road.

Within Roanoke County, the watershed contains 2.61 square miles within the MS4 regulated area and 4.15 square miles outside of the MS4 regulated area. There are approximately 7.5 miles of drainage ways having drainage areas of 100 acres or greater within the regulated MS4 area. There are approximately 8.1 miles of drainage ways having drainage areas of 100 acres or greater outside of the regulated MS4 area. See **Figure 5; Carvin Creek Watershed Map**.

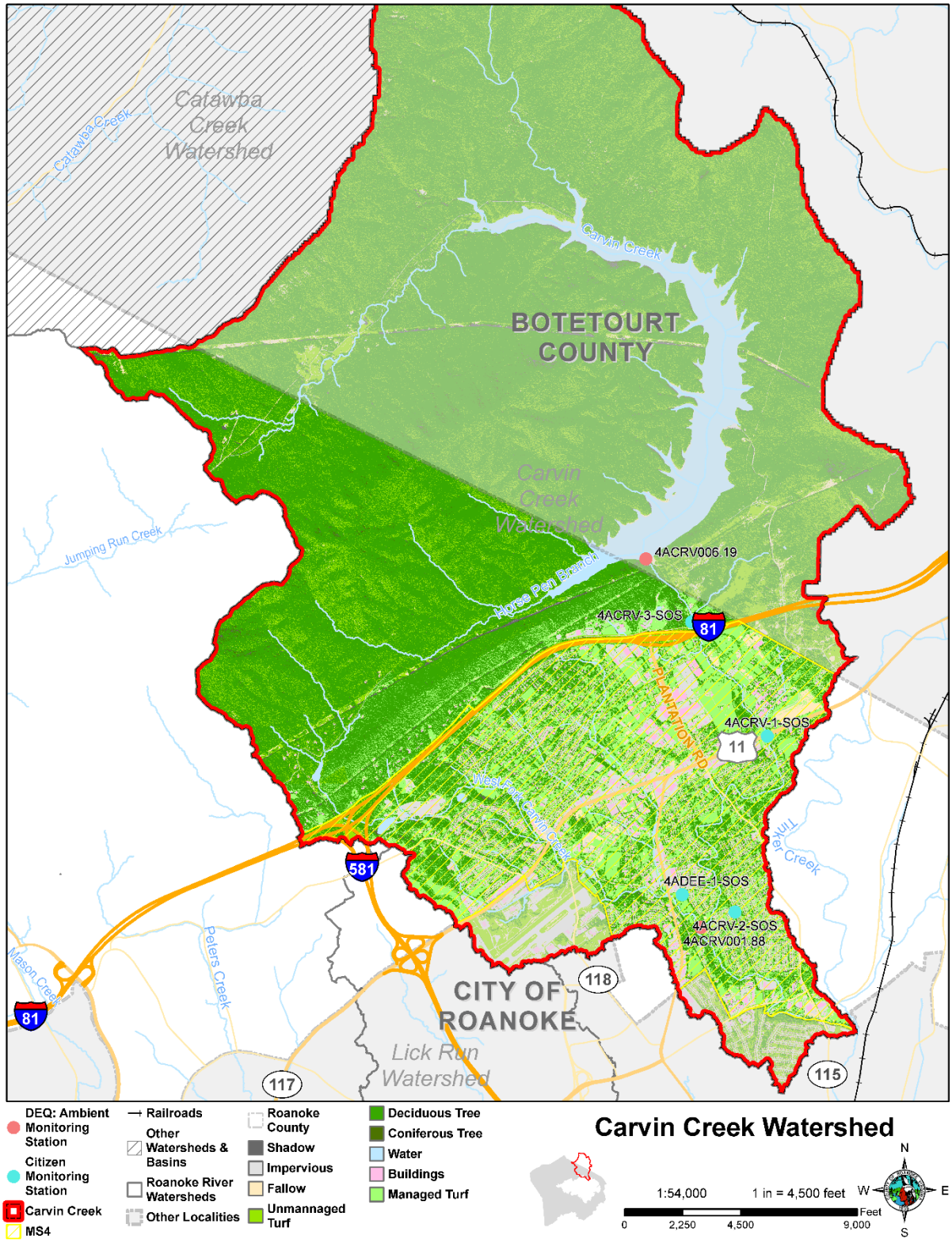

Catawba Creek Watershed
Catawba Creek
Carvin Creek
BOTETOURT COUNTY
Carvin Creek Watershed
Jumping Run Creek
Horse Pen Branch
4ACRV006.19
4ACRV-3-SOS
81
PLANTATION RD
4ACRV-1-SOS
11
West Fork Carvin Creek
581
Tinker Creek
4ADEE-1-SOS
4ACRV-2-SOS
4ACRV001.88
Mason Creek
Peters Creek
118
CITY OF ROANOKE
Lick Run Watershed
117
115
DEQ: Ambient Monitoring Station
Citizen Monitoring Station
Carvin Creek
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Carvin Creek Watershed
1:54,000
1 in = 4,500 feet
0
2,250
4,500
9,000
Feet
N
W
E
S

Figure 5

6. Lick Run

Lick Run originates near the crossing with Peters Creek Road, then enters Roanoke City and flows to its discharge into Tinker Creek, approximately a third of a mile upstream from its crossing under Walnut Avenue.

Within Roanoke County, Lick Run's 0.51 square mile watershed is totally contained within the County's MS4 regulated area. There are approximately 0.34 miles of drainage ways having a drainage area of 100 acres or greater. See **Figure 6: Lick Run Watershed Map**.

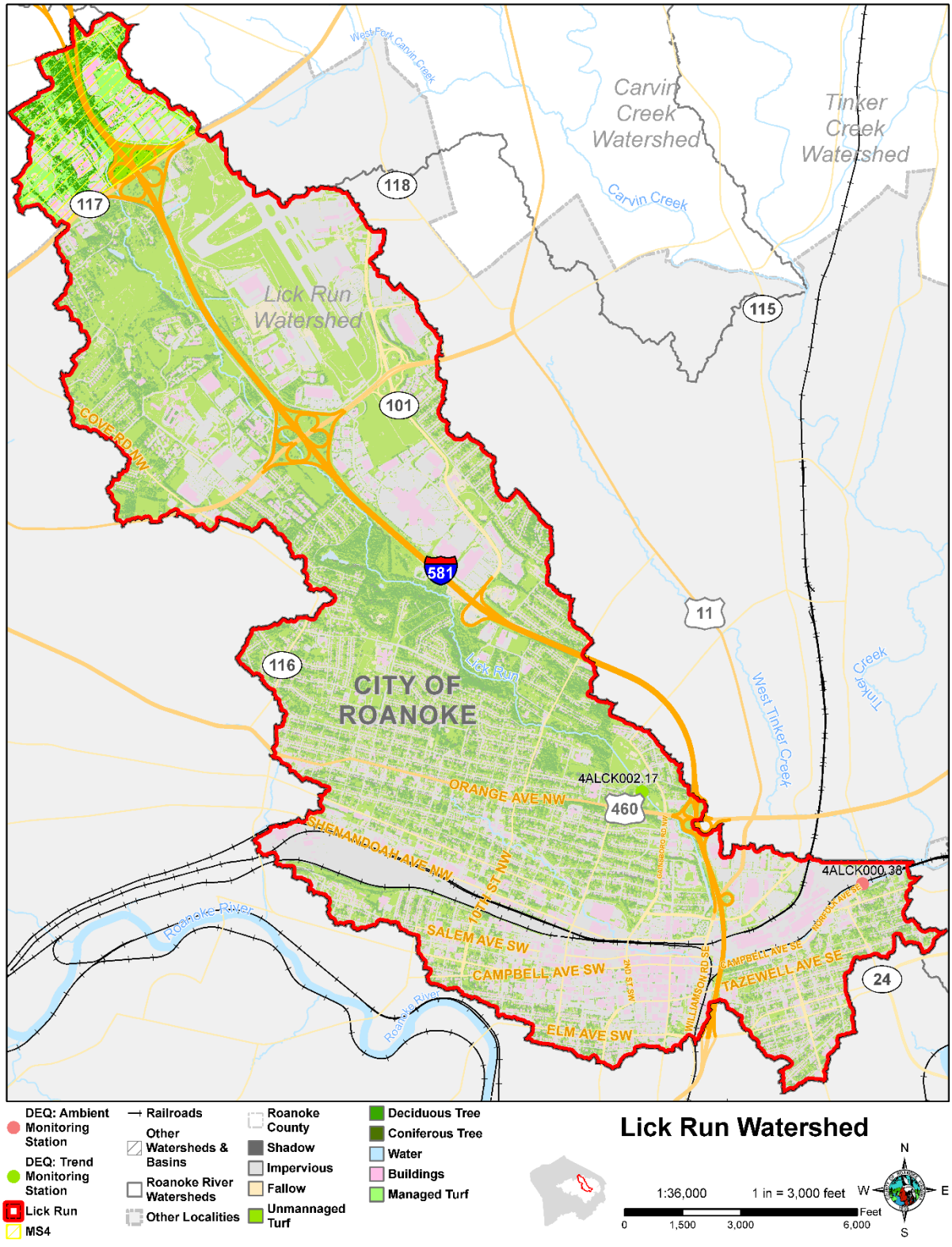
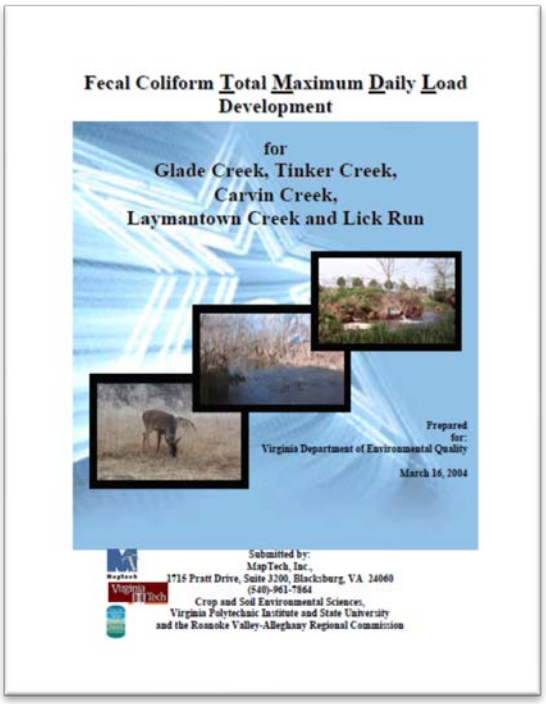

Carvin Creek Watershed
Tinker Creek Watershed
Lick Run Watershed
CITY OF ROANOKE
West Fork Carvin Creek
Carvin Creek
Lick Run
West Tinker Creek
Tinker Creek
Roanoke River
117
118
115
101
581
11
116
460
24
4ALCK002.17
4ALCK000.38
COVE RD NW
ORANGE AVE NW
SHENANDOAH AVE NW
10TH ST NW
SALEM AVE SW
CAMPBELL AVE SW
ELM AVE SW
TAZEWELL AVE SE
WILLIAMSON RD SE
DEQ: Ambient Monitoring Station
DEQ: Trend Monitoring Station
Lick Run
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Lick Run Watershed
1:36,000
1 in = 3,000 feet
0
1,500
3,000
6,000
Feet
N
S
E
W

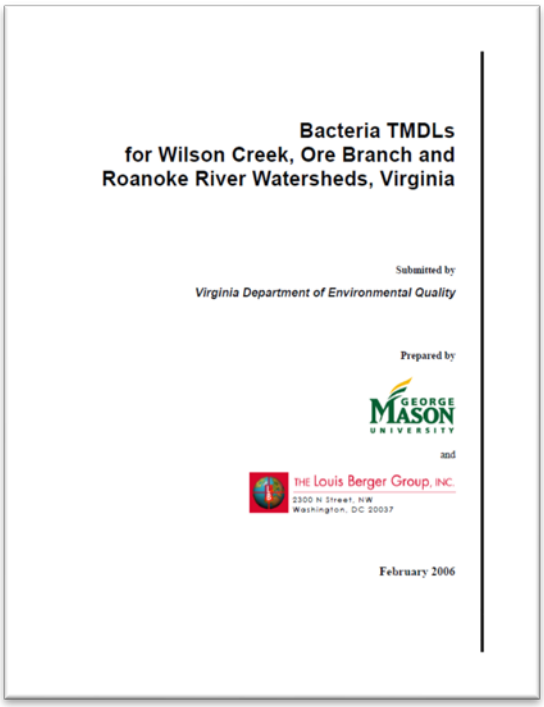
Figure 6

C. Impairments and TMDL Waste Load Allocations

The Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carven Creek, and Lick Run were originally listed as "impaired" because they did not meet the Virginia water quality standard for fecal coliform bacteria. After the initial listing, the state water quality standard was changed from fecal coliform bacteria to *E. coli* bacteria.

The current Virginia water quality standard for *E. coli*, to protect primary contact recreation (swimming), is a monthly geometric mean of 126 colony forming units per 100 milliliters (CFU/100 ml), based on a minimum of 4 monthly samples in a month. If insufficient samples are available to determine a valid geometric mean, then no more than 10% of the samples may exceed 235 CFU/100ml.





1. Roanoke River

The Roanoke River was initially listed as impaired in 1996 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock, runoff from urbanized high-density areas, septic and other onsite treatment systems, sanitary sewer overflows, wet weather discharges (non-point source), and wildlife other than waterfowl. The Roanoke River is listed as impaired from the Spring Hollow Reservoir water intake, in west Roanoke County, to Smith Mountain Lake.

Bacteria TMDLs for Wilson Creek, Ore Branch and Roanoke River Watersheds, Virginia were approved by U.S. EPA on 8/2/06 and the Virginia State Water Control Board on 6/27/07. During the TMDL study, the pollutant of concern was changed from fecal coliform to *E. coli* due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County was contributing 23,700,000,000,000 (2.37E+13) colony forming units per year and that an approximate **98.8% reduction** was required to remove the impairment. *Roanoke County's WLA was set at 284,000,000,000 (2.84E+11) colony forming units per year. The WLAs for Ore Branch and Tinker Creek are nested within the Roanoke River WLA.*

2. Ore Branch

Ore Branch was initially listed as impaired in 1996 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, runoff from urbanized high-density areas, sanitary sewer overflows, wet weather discharges (non-point source), and wildlife other than waterfowl. Ore Branch is impaired for its entire length.

Bacteria TMDLs for Wilson Creek, Ore Branch and Roanoke River Watersheds, Virginia was approved by U.S. EPA on 8/2/06 and the Virginia State Water Control Board on 6/27/07. During the TMDL study, the pollutant of concern was changed from fecal coliform to *E. coli* due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County was contributing 213,000,000,000 2.13E+11) colony forming units per year and that an approximate **99.5% reduction** was required to remove the impairment. *Roanoke County's WLA was set at 1,070,000,000 (1.07E+09) colony forming units per year.*

3. Tinker Creek

Tinker Creek was initially listed as impaired in 1998 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high-density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Tinker Creek is impaired for its entire length.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to *E. coli* due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **98% reduction** from developed lands. *Roanoke County's WLA was set at 536,000,000,000 (5.36E+11) colony forming units per year. The WLAs for Glade Creek, Carvin Creek, and Lick Run are nested within the Tinker Creek WLA.*

4. Glade Creek

Glade Creek was initially listed as impaired in 1998 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high-density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Glade Creek is impaired for its entire length.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was approved by U.S. EPA on 8/5/04 and the Virginia

State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to *E. coli* due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **96% reduction** from developed lands. *Roanoke County's WLA was set at 80,200,000,000 (8.02E+10) colony forming units per year.*

5. Carvin Creek

Carvin Creek was initially listed as impaired in 2002 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high-density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Carvin Creek is impaired from just upstream of I-81 to the mouth of Carvin Creek on Tinker Creek.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to *E. coli* due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **90% reduction** from developed lands. *Roanoke County's WLA was set at 4,070,000,000,000 (4.07E+12) colony forming units per year.*

6. Lick Run

Lick Run was initially listed as impaired in 2002 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high-density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Lick Run is impaired for its entire length.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to *E. coli* due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **99% reduction** from developed lands. *Roanoke County's WLA was set at 3,290,000,000 (3.29E+09) colony forming units per year.*

D. Significant Sources of *E. coli* Discharging into MS4

No specific localized significant sources of *E. coli* have been determined. The two TMDL studies identified the following as the most likely sources: discharges from municipal separate storm sewer systems, livestock, runoff from urbanized high-density areas, septic and other onsite treatment systems, sanitary sewer overflows, wet weather discharges (non-point source), wastes from pets, unspecified domestic waste, and wildlife other than waterfowl.

Roanoke County has chosen to focus its efforts on the following strategies (BMPs) to lower the discharge of *E. coli* from its MS4 system:

BMP B-1 **Dog Waste Stations and Signage**
- Develop a written plan describing where dog waste stations will be installed
- Install at least 5 stations or signs per year, until plan is achieved

BMP B-2 **Protect Stream Buffers: Ordinance**
- Finalize ordinance
- Present to Board of Supervisors for consideration
- Implement ordinance (if approved)

BMP B-3 **Protect Stream Buffers: No-Mow Policy for County-Owned Lands**

BMP B-4 **Public Education: Reducing Food Sources Accessible to Wildlife**

BMP B-5 **Public Education: Septic System Repair & Maintenance**

BMP B-6 **Business Outreach: Eliminating Illicit Discharges**

BMP B-7 **Enhanced Public Outreach**

BMP B-8 **Enhanced Employee Training**

Do not feed wild animals

Repair failing septic systems

Dog Waste Station with bags and trash can

Active citizen engagement: inspecting a drop inlet

III. BMPs DESIGNED TO REDUCE BACTERIA *(E. coli)*

The following Best Management Practices (BMPs) have been specifically identified to reduce discharges of *E. coli* from the County's MS4. Many of the BMPs listed below are also effective in reducing sediment discharges. Note that the highlighted categories shown below align with "*Table 5 Strategies for Bacteria Reduction Stormwater Control/Management Strategy"* in the MS4 Permit Section II.B.5.

A. Domestic Pets

BMP B-1: Dog Waste Stations and Signage

It is believed that dog waste is one of the most significant sources of controllable bacteria. Nationally, there are 0.58 dogs per household (according to the American Veterinary Medical Association), and the United States Environmental Protection Agency estimates that the typical dog excretes three quarters of a pound (0.75 lb.) of waste per day - or 274 pounds per year. Applying these national averages to Roanoke County gives a total of approximately 22,000 dogs that generate over 6 million pounds (or ~3,000 tons) of fecal material per year.

Roanoke County currently has ordinances that prohibit dogs from running at large, requires the areas where house dogs are kept to be free of flies and nuisance odors, and prohibits depositing waste in public parks and recreation areas.

Roanoke County has developed and implemented a Dog Waste Stations and Signage program to increase the number of maintained dog waste stations and associated signage in public parks and greenways to reduce the discharge of *E. coli* from dog waste into receiving waters.

By July 1, 2020, Roanoke County developed a written plan that described where dog waste stations should be installed on County property with the goal of installing at least three per year until the plan was met. The County updated the written plan in FY23 and has installed all the proposed stations.

For the locations of existing "Mutt Mitt" dog waste stations in Roanoke County, see the online map at https://www.roanokecountyva.gov/2594/GIS-Mapping-Support. Each dog waste station has signage reminding owners to pick up after their dogs.

BMP B-2: Protect Stream Buffers: Ordinance

Stream buffers can be effective in dissuading stream access and in filtering stormwater runoff that sheet flows through the buffer, which helps to remove sediment, bacteria, and other pollutants.

This activity began in permit year 2016 - 2017. The stream buffer requirements were incorporated into the County's now-retired Erosion & Sediment Control (ESC) Ordinance (effective date July 27, 2021) and carried over into its new Erosion and Stormwater Management (ESM) Ordinance, effective date August 1, 2024. Pursuant to the requirements, a 25-ft. wide stream buffer along perennial streams must be established in which no land grading may occur.

The ESM Ordinance with stream buffer requirements may be accessed here:
Erosion and Stormwater Management Program Ordinance

BMP B-3: Protect Stream Buffers: No-Mow Policy for County-owned Lands

The County owns significant property that is adjacent to streams. Historically, the County has mowed much of this property up to the top of stream bank. More recently, the County has recognized that this practice contributes to accelerated stream bank erosion and provides dogs with ready access to the streams.

A no-mow policy for County-owned lands is being implemented by the County's Department of Parks, Recreation, and Tourism. This policy attempts to balance the competing goals of providing adequate access to streams for the public, providing adequate views of the streams, excluding dogs, protecting stream banks, and providing vegetative filters. The implementation of this policy began in spring 2021. The policy is provided on the next page.

No-Mow Policy
For Roanoke County Public Lands
Effective Date: May 2021

Background

Streams are a valuable asset to Roanoke County property. Leaving natural vegetated banks with a suitable no-mow buffer can serve to protect streams from excessive erosion and pollution.

Policy

It shall be the general policy to leave a buffer strip consisting of 10 feet in width from the top edge of the streambank. This may include existing natural vegetation and a no-mow area that would make up the 10 feet wide buffer along all streams located on Roanoke County property. A no-mow buffer is desirable and may be provided if such area is consistent with the property's use. The locations of no-mow stream buffers are generally indicated on the attached drawings.

Exceptions

Mowing may occur closer than 10 feet from a stream bank, as follows:

- To allow public access to a stream;
- Where existing facilities do not allow maintaining a 10 feet wide no-mow buffer at a stream; or
- Where a 10 feet wide no-mow buffer is inconsistent with the desired use of the park.

B. Urban Wildlife

BMP B-4: Public Education: Reducing Food Sources Accessible to Wildlife

Roanoke County is blessed with natural beauty and an abundance of wildlife. However, problems often arise when wildlife can access food sources derived, either purposefully or inadvertently, from people. These problems include wildlife becoming dependent on people for food, increased potential for disease for both people and animals, increased property damage, and increased bacteria discharged from animal waste that may find its way into the nearest storm drainage system.

By July 2020, Roanoke County expanded its public education program to encourage citizens to reduce food sources accessible to wildlife. Typical messages include:

- Keep trash cans covered and protected from animals
- Do not feed pets outdoors
- Secure bird feeders from squirrels, bears, and other animals
- Do NOT feed wild animals, including Canadian geese

C. Illicit Connections or Illicit Discharges to the MS4

BMP B-5: Public Education: Septic System Repair & Maintenance

Onsite sewage disposal systems predominately consist of septic tanks with drain fields. Roanoke County has over 14,169 septic tanks or other onsite sewage disposal systems, with approximately 45% of them installed prior to 1970.

Malfunctioning or poorly maintained onsite sewage disposal systems may result in discharges of bacteria from human waste.

By July 2020, Roanoke County expanded its public education program to encourage citizens to periodically pump out their septic systems and to keep them properly operating. Roanoke County will continue these messages.

BMP B-6: Business Outreach: Eliminating Illicit Discharges

Roanoke County conducts site inspections of targeted businesses that have an elevated potential to discharge bacteria, such as veterinary clinics, kennels, pet stores, restaurants, vehicle maintenance shops, and car washing facilities.

if the business owner is willing, County staff conduct an inspection of the selected facility and discuss ways to minimize illicit discharges in the day-to-day operations at the facility. If an actual or potential illicit discharge is identified, the County's inspection staff work with the business owner to eliminate or reduce the risk. A minimum of 15 businesses will be inspected each year.

BMP B-7: Enhanced Public Outreach

In accordance with the MS4 Permit requirements, Roanoke County's Public Education Program targets three high-priority water quality issues that contribute to the degradation of stormwater runoff and receiving waters: excess bacteria, excess sediment, and excess nutrients. The following BMPs, as outlined in the County's MS4 Program Plan, address these issues:

BMP 1-1: Stormwater Educational Resources - The County has created and will maintain a comprehensive listing of existing stormwater-related agencies and organizations along with pertinent educational programs and resources, which shall be made available to the public by way of the County's stormwater website.

BMP 1-2: Roanoke County Stormwater Newsletter - Roanoke County will create and distribute a Stormwater Newsletter, which shall be annually distributed to all Roanoke County single-family residences.

BMP 1-4: Stormwater Education Program for Schoolchildren (Revised) Roanoke County will develop and implement a stormwater education program for its schoolchildren. Different programs will target appropriate grade levels.

BMP 1-5: Stormwater Public Awareness Program - Roanoke County has developed and will implement a Stormwater Public Awareness Program that includes the distribution of stormwater merchandise, public service announcements, and other high visibility educational media.

BMP 1-7: Targeted Education Program - Roanoke County conducts targeted education to communicate its high-priority stormwater messages. This BMP coordinates with **BMP 1-5: Stormwater Public Awareness Program**.

BMP 2-3: MS4 Program and Stormwater Pollution Prevention Website - Roanoke County has updated and will continue to maintain the webpage dedicated to the MS4 program and stormwater pollution prevention.

The BMPs listed above have been revised, where appropriate, to include messages from the Bacteria TMDL Action Plan: (1) Use of Dog Waste Stations; (2) Protecting Stream Buffers; (3) Reducing Food Sources Accessible to Wildlife; (4) Septic System Repair & Maintenance; and (5) Eliminating Illicit Discharges. This effort also extended to training materials developed for County employees. See **BMP B-8: Enhanced Employee Training**.

Figure 7. Targeted Education & Outreach Program for Bacteria Reduction

High-Priority Water Quality Issue	Target Audiences	Means to Determine Audience Size	Audience Size	Overall Messages	Means to Deliver Messages	Rationale
#2 BACTERIA	Restaurants	Business Licenses/ Yellow Pages	484	• Excessive bacteria hinder stream usage and contributes to algae overgrowth, which hurts aquatic life. • All wastewater to sanitary sewers. • Keep exterior trash receptacles and dumpsters covered and do not wash out into storm drain. • Clean kitchen hoods and floor mats; properly dispose of the wastewater.	• Mailer, annually • PSAs on local cable station	Uncovered dumpsters containing garbage and greasy floor mats that are rinsed out onto the pavement can contribute bacteria to the MS4, which discharges directly to local streams.
	Pet / Kennel Owners (dogs/cats)	Pet Licenses	Dog: 7463 Cat: 256	• Excessive bacteria hinder stream usage. • Dog waste ends up in streams. • Pick up after your pet and properly dispose of waste.	• County publication sent annually to homeowners & kennels • PSAs on local cable station	Dog waste is a major source of bacteria in local streams.
		Kennel licenses	186			
	Veterinarian Offices	Business Licenses/ Yellow Pages	28	• Excessive bacteria hinder stream usage. • Dog waste ends up in streams. • Pick up after pets and properly dispose of waste.	• Brochures sent to veterinarian offices, annually • PSAs on local cable station	Dog waste is a major source of bacteria in local streams.
	Pet Stores/Pet Boarding/ Grooming/ Stables	Business Licenses/ Yellow Pages	34	• Excessive bacteria hinder stream usage. • Dog waste ends up in streams. • Pick up after pets and properly dispose of waste.	• Brochures sent to pet stores, annually • PSAs on local cable station	Dog waste is a major source of bacteria in local streams.
	County Police and Firemen; Animal Control Officer	County Records	2	• Excessive bacteria hinder stream usage. • Dog waste ends up in streams. • Pick up after pets and properly dispose of waste.	• In-house training	Dog waste is a major source of bacteria in local streams; these County employees own or handle dogs as part of their work.
	Homeowners	Tax Records	34,883	• Do not feed wildlife • Do not feed pets outdoors	• Mailer, annually	By encouraging wildlife to come close to homes, their feces have a higher chance of entering the MS4.
	Septic System Owners	Tax Records; WVWA	~14,169 septic systems	• Keep septic system maintained; provide periodic pump out. • Repair failing septic systems.	• Mailer, annually	Malfunctioning or poorly maintained onsite sewage disposal systems may result in discharges of bacteria from human waste.

BMP B-8: Enhanced Employee Training

In accordance with the MS4 Permit requirements, Roanoke County's Public Education Program targets three high-priority water quality issues that contribute to the degradation of stormwater runoff and receiving waters: *excess bacteria, excess sediment, and excess nutrients*. Thus, Roanoke County has enhanced its employee training program to recognize bacteria (*E. coli*) as a "high-priority water quality issue." Training courses include the following, as outlined in the MS4 Program Plan:

- **Recognition and Reporting of Illicit Discharges** - all applicable field personnel receive training on a biennial basis in the recognition and reporting of illicit discharges. Among many potential illicit discharges, sediment and bacteria are identified as potential pollutants in this training.

- **Good Housekeeping and Pollution Prevention Practices** - all employees that perform road, street, and parking lot maintenance, or are employed in and around maintenance and public works facilities and at recreational facilities receive biennial training in good housekeeping and pollution prevention practices. Sediment and bacteria are identified as potential pollutants in this training.

  NOTE: All employees who are required to take the Good Housekeeping and Pollution Prevention Practices training are also required to read and follow the County's Standard Operating Procedures (SOPs). These procedures were designed to eliminate or minimize pollutant discharges in stormwater and are detailed in BMP 6-3 of the MS4 Program Plan.

- **Contractor Oversight for Environmental Compliance** - all supervisors who oversee Contractors that perform work for the County or employees involved in developing contracts for Contractors take this training on a biennial basis. The training explains that all Contractors must have their own written good housekeeping and pollution prevention program, or they must comply with the County's written policies and SOPs. This training discusses the significance of soil erosion from construction sites, the potential harm to receiving waters, and the need to use effective erosion and sediment controls. It also discusses the need to carefully place and maintain portable toilets onsite to ensure bacterial wastes do not enter stormwater runoff. County employees who oversee Contractors working for the County must ensure compliance by Contractors.

- **Hazardous Materials (HAZ-MAT) Training** - the County of Roanoke currently maintains basic hazardous materials training for its employees, including volunteers, in Fire and Rescue. All career (paid) staff are certified to HAZ-MAT Operations. HAZ-MAT certification does not expire from the Virginia Department of Fire Programs; however, all career personnel receive annual, internal training on this topic as part of their career development training.

The BMPs listed above and the County's Standard Operating Procedures (SOPs) for Pollution Prevention and Good Housekeeping have been revised, where appropriate, to include messages from the Bacteria TMDL Action Plan: (1) Use of Dog Waste Stations; (2) Protecting Stream Buffers; (3) Reducing Food Sources Accessible to Wildlife; (4) Septic System Repair & Maintenance; and (5) Eliminating Illicit Discharges.

IV. ANNUAL REPORTING REQUIREMENTS

The MS4 Annual Report will include a summary of actions conducted to implement this Bacteria TMDL Action Plan during the reporting period of July 1st - June 30th for each year of the permit term.

In accordance with the MS4 Permit, the report is submitted to DEQ by October 1st of each year.

V. EVALUATION OF TMDL ACTION PLAN

The *Total Maximum Daily Load (TMDL) Action Plan for Bacteria Reduction (E. coli) in the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run* was originally completed in April 2020.

To satisfy the requirements of Section II.B.2.a.(1) of the current MS4 Permit, the County hereby provides "an evaluation of the results achieved by the previous action plan" named above.

The Bacteria TMDL is somewhat subjective and the MS4 permit identifies mostly qualitative measures to reduce loads to the MS4. As such, the County has implemented strategies using the following three permit categories from Table 5 in II.B.5: (a) Domestic Pets; (b) Urban Wildlife, and (c) Illicit Connections or Illicit Discharges to the MS4.

For each of these categories, the County has developed one or more Best Management Practice (BMP) to help decrease the discharge of *E. coli* from the MS4 in an effort towards meeting the DEQ-assigned waste load allocation. The County finds them to be effective, as described below:

DOMESTIC PETS		EVALUATION / EFFECTIVENESS
B-1	Dog Waste Stations and Signage	It is believed that dog waste is one of the most significant sources of controllable bacteria. As such, it is beneficial for the County to maintain dog waste stations and associated signage in public parks and greenways to reduce the discharge of *E. coli* from dog waste into receiving waters.
B-2	Protect Stream Buffers: Implement Ordinance	Continued implementation of the stream buffer ordinance is an effective strategy to assist the County in its overall long-term reduction of bacteria, as stream buffers can be effective in dissuading stream access and in filtering stormwater runoff that sheet flows through the buffer, which helps to remove sediment, bacteria, and other pollutants.
B-3	Protect Stream Buffers: No-Mow Policy for County-owned Lands	A no-mow policy for County-owned lands is being implemented by the County's Department of Parks, Recreation, and Tourism. This policy attempts to balance the competing goals of providing adequate access to streams for the public, providing adequate views of the streams, excluding dogs, protecting stream banks, and providing vegetative filters. The implementation of this policy began in spring 2021 and helps to keep dogs (and their waste) away from streams.
URBAN WILDLIFE		EVALUATION / EFFECTIVENESS
B-4	Public Education: Reducing Food Sources Accessible to Wildlife	Roanoke County's public education program encourages citizens to reduce food sources accessible to wildlife with a host of messages, including (1) Keep trash cans covered and protected from animals, (2) Do not feed pets outdoors, (3) Secure bird feeders from squirrels, bears, and other animals, and (4) Do NOT feed wild animals, including Canadian geese. Such messages help keep wild animals and their feces away from homes and nearby storm drains.
ILLICIT CONNECTIONS OR ILLICIT DISCHARGES TO THE MS4		EVALUATION / EFFECTIVENESS
B-5	Public Education: Septic System Repair and Maintenance	Roanoke County's expanded public education program is effective in encouraging citizens to periodically pump out their septic systems and to keep them properly operating. With recent grant funding, the County has also been able to offer free septic tank pump-outs to over 70 homes.
B-6	Business Outreach: Eliminating Illicit Discharges	Visiting targeted businesses that have an elevated potential to discharge bacteria in the conduct of their day-to-day activities is an effective means for the County to identify illicit discharges and work with business owners to have them eliminated.
B-7	Enhanced Public Outreach for Bacteria *(E. coli)*	Use of tailored messages to address bacteria that are focused on the proper target audiences is an effective means to raise awareness, improve individual's actions, and increase support for water quality programs in general.
B-8	Enhanced Employee Training for Bacteria *(E. coli)*	The County believes that raising awareness of applicable County employees involved in certain municipal operations will lead to better implementation of pollution prevention strategies, which will help to minimize the discharge of bacteria from County facilities.

Conclusion

Although the County's bacteria-related BMPs do not have numeric efficiencies, the County has consistently met its BMP metrics as described in each MS4 Annual Report. The County finds its approach to be consistent with the Bacteria TMDL, and believes the selected strategies are effective in increasing public awareness of bacteria sources and ways to reduce their loads to the MS4.