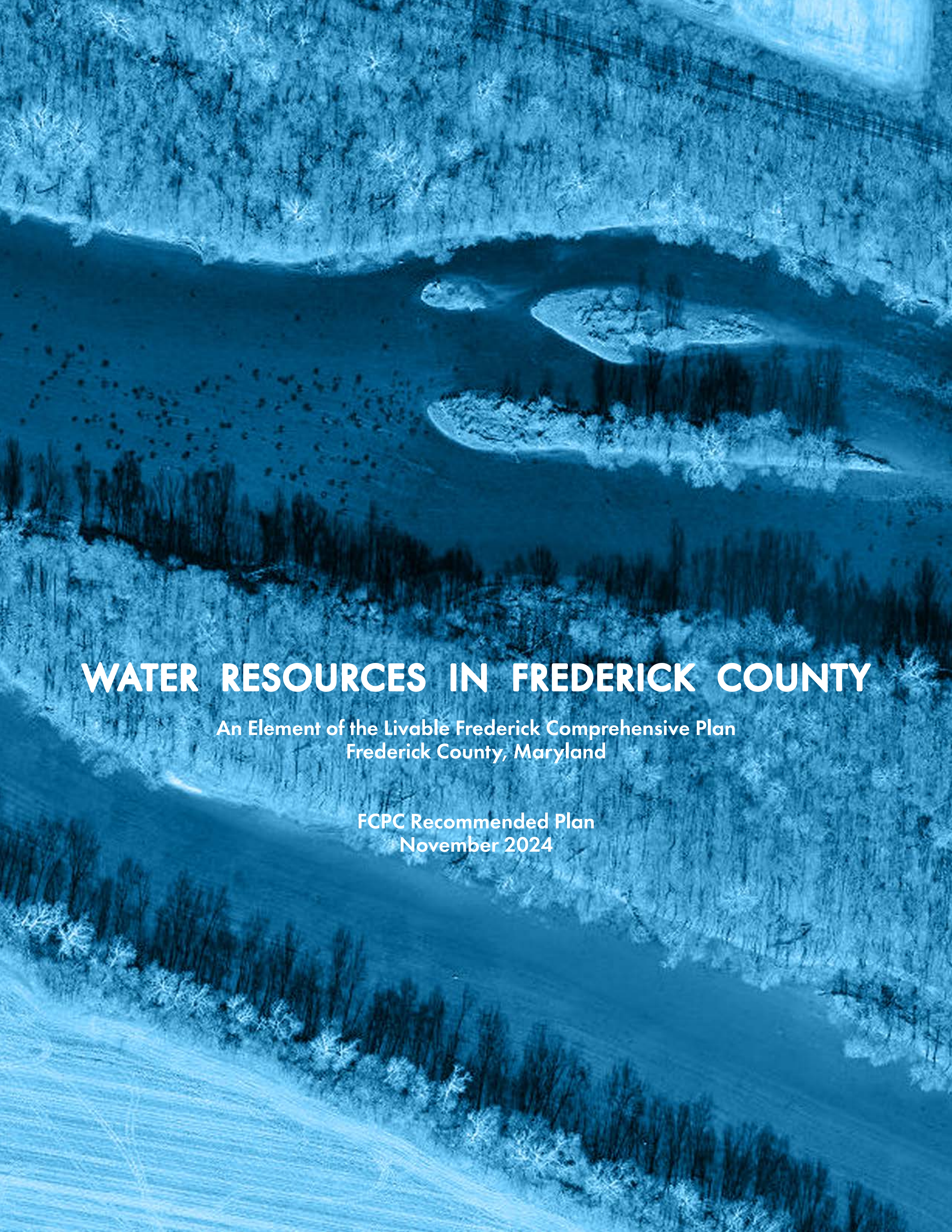

WATER RESOURCES IN FREDERICK COUNTY

An Element of the Livable Frederick Comprehensive Plan
Frederick County, Maryland

FCPC Recommended Plan
November 2024

Water Resources in Frederick County

A WATER RESOURCES ELEMENT OF THE LIVABLE FREDERICK COMPREHENSIVE PLAN

Frederick County, Maryland

FCPC Recommended Plan

November 2024

Acknowledgements

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This publication was prepared by the Livable Frederick Planning and Design Office of the Frederick County Division of Planning & Permitting in partnership with the Division of Water and Sewer Utilities (DWSU) and the Division of Energy & Environment. Technical assistance was also provided by the following County divisions/departments/offices:

Department of Health
Division of Public Works (DPW)
Department of Development Review & Planning (DRP)
Office of Economic Development (OED)

Municipal officials and staff from Brunswick, Burkittsville, Emmitsburg, Frederick, Middletown, Mount Airy, Myersville, New Market, Rosemont, Thurmont, Walkersville, Woodsboro, and the U.S. Army Garrison at Fort Detrick contributed to this publication.

Frequently Used Terms

Community Sewerage System - Any system serving two or more lots, for the collection and disposal of sewerage or industrial wastes of a liquid nature, including various devices for the treatment of such sewage and industrial wastes.

Community Water System - A public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

County Comprehensive Plan or Comprehensive Plan - A composite of maps and written text, the purpose of which is to guide the physical development of the County, adopted by the County Governing Body under the provisions of the Land Use Article of the Annotated Code of Maryland. The Comprehensive Plan includes a Countywide Plan land use map and text, and individual community and corridor plans. The municipal plan land use designation will be used for properties within a municipal boundary.

County Water and Sewerage Plan or Water and Sewerage Plan - A comprehensive plan for the provision of adequate water supply systems and sewerage systems throughout the County and includes all amendments and revisions thereto.

Designated Use - A goal for water quality. Every surface water has a designated use which is indicates how the water is meant to be used by humans and animals. The uses may or may not be met currently, but must be attainable.

DWSU - Frederick County's Division of Water and Sewer Utilities.

EDU - An Equivalent Dwelling Unit (or Equivalent Density Unit) is a quantity of water or wastewater equaling 250 gallons-per-day (gpd). EDUs are utilized by Frederick County and the Maryland Department of the Environment for the purposes of water and sewer capacity planning and are intended to represent the average amount of potable water used or wastewater generated by a single dwelling in a single day.

Fluvial - Relating to streams or rivers. Fluvial flooding is the result of an increase in stream flow beyond the capacity of stream channel to contain it. Fluvial flooding is typically mapped as the 100-year floodplain associated with a stream or river.

Existing Service Area - The area that is currently served by either a publicly-owned community sewerage system or publicly-owned community water system.

GPD or gpd - Gallons per day.

Lot - A contiguous area of land separated from other areas of land by separate description including a recorded deed, a subdivision plat of record or survey map, or by metes and bounds, for purpose of sale, lease, transfer or ownership or separate use, including separation of legal ownership by a condominium regime.

MDE - Maryland Department of the Environment.

MGD or mgd - Gallons per day (in millions).

Multi-Use Sewerage System - A system serving a single lot or institution with a treatment discharge capacity in excess of 5,000 GPD. A Multi-Use Sewerage System involves the collection, treatment and discharge of sewage or industrial wastes of a liquid nature and various devices for the pumping, storage and treatment of such wastes.

Multi-Use Water System - A system serving a single lot or institution with the capacity to provide in excess of 5,000 GPD utilizing a source of ground or surface water. The Multi-Use Water System includes piping, pumps, tanks, or other facilities utilizing a source of ground or surface water.

Nonpoint Source - Pollution originating from land run off where no specific outfall can be identified.

Parcel - A contiguous area of land separated from other areas of land by separate description including a recorded deed, a subdivision plat of record or survey map, or by metes and bounds, for purpose of sale, lease, transfer or ownership or separate use, including separation of legal ownership by a condominium regime. Multiple lots may be derived from a parcel.

Pluvial - Related to or resulting from rainfall. Pluvial flooding is the result of heavy rains and severe storms and may occur outside of mapped 100-year floodplains.

Point Source - Pollution originating from a specific outfall that can be identified.

Publicly Owned - Owned and operated by a State or local government.

Sewerage Service Area - That area served by, or planned to be served by, a sewage collection system.

Stormwater - Precipitation that does not penetrate the ground. Instead, it runs off and enters the storm drain system, flowing into local waterways.

Water and Sewerage Plan - The "County Water and Sewerage Plan" as defined above.

Water Quality Criteria - Numeric criteria which set the minimum water quality required to meet designated uses. If criteria are not met, a "pollution diet" or Total Maximum Daily Load (TMDL) may be established to improve water quality.

Water Service Area - That area served by, or planned to be served by, a water distribution system.

Water Treatment Plant (WTP) - An existing or planned water treatment facility, which has been located on the County Water and Sewerage Plan Map and designated to serve an entire regional service area or Community Growth Area defined in the County Comprehensive Plan.

Wastewater Treatment Plan (WWTP) - An existing or planned sewage treatment facility, which has been located on the County Water and Sewerage Plan Map and designated to serve an entire regional service area or Community Growth Area defined in the County Comprehensive Plan.

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drinking water

Water is all around us.

Residents and visitors of Frederick County are familiar with natural resources like the Potomac and Monocacy Rivers and Catoctin Creek. In addition to their recreational and ecological benefits, they are also a source of drinking water. And in cases like the Potomac River, it's a drinking water source for more than just Frederick County. These resources cannot be taken for granted.

Drinking water is available...

ABOUT **65,000 RESIDENTS** – ALMOST **25%** OF THE COUNTY'S POPULATION – RECEIVE DRINKING WATER FROM **NEW DESIGN**, THE COUNTY'S PRIMARY WAYER TREATMENT PLANT. IT SERVES COUNTY RESIDENTS AND BUSINESSES AND ALSO MUNICIPAL CUSTOMERS IN NEW MARKET.

ABOUT **122,000 RESIDENTS** - AROUND **45%** OF THE COUNTY'S POPULATION - RECEIVE THEIR WATER FROM **MUNICIPAL OR MAJOR INSTITUTIONAL SYSTEMS**.

JUST OVER **TWO-THIRDS** OF THE COUNTY'S POPULATION IS CONNECTED TO A **PUBLIC WATER SYSTEM**.

THE NEW DESIGN WATER TREATMENT PLANT WAS MOST RECENTLY **EXPANDED** AND UPGRADED IN **2011**. THE PLANT IS PERMITTED TO WITHDRAW A YEARLY AVERAGE OF **16 MILLION GALLONS PER DAY** FROM THE POTOMAC RIVER.

THE THREE-YEAR AVERAGE DEMAND (2021-2023) FOR NEW DESIGN WAS **6.537 MILLION GALLONS PER DAY**. IN 2021, THE TOTAL ANNUAL WATER PRODUCTION WAS **2.542 BILLION GALLONS**.

...but smaller County systems and some municipalities may be limited.

IN ADDITION TO THE PRIMARY NEW DESIGN PLANT, THE COUNTY OPERATES **5 REGIONAL PLANTS** AND **4 SUB-REGIONAL PLANTS**.

THERE ARE **9 MUNICIPALITIES** THAT OPERATE WATER PLANTS.

WATER PLANTS THAT PRIMARILY **RELY ON GROUNDWATER** ARE MORE LIKELY TO BE LIMITED IN THEIR POTENTIAL TO ACCOMMODATE GROWTH.

NEW REGULATIONS RELATED TO **PFAS** (PER- AND POLYFLUOROALKYL SUBSTANCES) WILL REQUIRE WATER UTILITIES TO TEST AND MONITOR FOR PFAS AND IMPLEMENT TREATMENT SOLUTIONS IF LEVELS EXCEED THE EPA STANDARDS. THIS MAY BRING **INCREASED COSTS** TO UTILITIES, PARTICULARLY TO SMALLER SYSTEMS.

SOME MUNICIPALITIES HAVE TAKEN **WELLS OFF-LINE** DUE TO HIGH LEVELS OF PFAS, WHICH IMPACTS THE TOTAL WATER AVAILABLE WITHIN THEIR SYSTEM.

Once constructed, infrastructure must be maintained and eventually replaced, which can be costly.

THE 2023 7TH DRINKING WATER INFRASTRUCTURE NEEDS SURVEY AND ASSESSMENT FROM THE ENVIRONMENTAL PROTECTION AGENCY DOCUMENTED A NEED OF **$12.7 BILLION** IN MARYLAND FOR PROJECTS RELATED TO DISTRIBUTION AND TRANSMISSION LINES OVER THE NEXT 20 YEARS.

FREDERICK COUNTY HAS OVER **381 MILES** OF WATER MAINS AND OVER **3,532** FIRE HYDRANTS.

The Fiscal Impacts of Development Patterns smartgrowthamerica.org/wp-content/uploads/2016/08/fiscal-implications-of-development-patterns.pdf
Smart Growth and Economic Success www.epa.gov/sites/default/files/2014-06/documents/sg-and-economic-success-for-governments.pdf
2020 Infrastructure Report Card https://infrastructurereportcard.org/state-item/maryland/

IN FREDERICK COUNTY'S FY 2024-2029 CAPITAL IMPROVEMENT PROGRAM, THE DIVISION OF WATER AND SEWER UTILITIES BUDGETED AROUND **$7 MILLION** FOR REHABILITATION PROJECTS OVER THE SIX-YEAR CIP. THESE PROJECTS ARE NEARING COMPLETION OR ARE PROGRAMMED FOR WATER STORAGE TANKS AND PARTS OF THE NEW DESIGN SYSTEM.

DEVELOPMENT PATTERNS ALSO AFFECT THE COST TO EXTEND UTILITIES AND MAINTAIN THEM. A 2015 REPORT BY SMART GROWTH AMERICA (THE FISCAL IMPACTS OF DEVELOPMENT PATTERNS) NOTED "ALL ELSE BEING EQUAL, **LOW-DENSITY** DEVELOPMENTS WILL HAVE **MORE WATER AND SEWER PIPES TO MAINTAIN** PER CAPITA, AND THEREFORE HIGHER MAINTENANCE EXPENSES."

A REPORT BY THE ENVIRONMENTAL PROTECTION AGENCY IN 2014 (SMART GROWTH AND ECONOMIC SUCCESS: STRATEGIES FOR LOCAL GOVERNMENT) "COMMUNITIES OFTEN STRUGGLE TO PAY FOR THE **CAPITAL COSTS OF INFRASTRUCTURE** THEY HAVE ALREADY BUILT, AND DEBT PAYMENTS CAN LEAD TO DIFFICULT BUDGET CUTS IN OTHER AREAS AND/OR LOCAL TAX INCREASES. THIS **FISCAL CHALLENGE** IS AN INCREASINGLY IMPORTANT ISSUE AS MORE AND MORE INFRASTRUCTURE SYSTEMS ARE REACHING THE END OF THEIR USEFUL LIFE."

MARYLAND'S DRINKING WATER INFRASTRUCTURE RECEIVED A GRADE OF C BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS IN THEIR 2020 INFRASTRUCTURE REPORT CARD.

wastewater

Wastewater treatment plants influence watershed health.

Once the wastewater treatment process is complete, the treated water (effluent) is discharged into streams and rivers. Environmental regulations limit the amount of pollutants that can be released into a water body from wastewater treatment plants and other sources. These regulations are in place to improve and protect water quality. These limits are unlikely to become less stringent in the future due to the uncertainties of climate change and efforts to restore the Chesapeake Bay.

Wastewater treatment capacity remains...

APPROXIMATELY **90,000 RESIDENTS** – ALMOST **ONE-THIRD** OF THE COUNTY'S POPULATION - RECEIVE WASTEWATER TREATMENT BY THE COUNTY'S PRIMARY PLANT, **BALLENGER-MCKINNEY**. THE PLANT SERVES COUNTY RESIDENTS AND BUSINESSES AND ALSO MUNICIPAL CUSTOMERS IN PARTS OF FREDERICK AND MOST OF WALKERSVILLE AND NEW MARKET.

ANOTHER **115,000** RECEIVE WASTEWATER TREATMENT FROM **MUNICIPAL OR MAJOR INSTITUTIONAL SYSTEMS**.

COMBINED, AROUND **TWO-THIRDS** OF THE COUNTY'S POPULATION IS CONNECTED TO THE **PUBLIC SYSTEM**.

THE BALLENGER-MCKINNEY PLANT WAS MOST RECENTLY EXPANDED AND UPGRADED IN 2013 TO A **TREATMENT CAPACITY OF 15 MILLION GALLONS PER DAY** – MORE THAN DOUBLE ITS PREVIOUS CAPACITY OF 7 MILLION GALLONS PER DAY.

THE THREE-YEAR AVERAGE (2021-2023) FLOW FOR BALLENGER-MCKINNEY WAS **7.340 MILLION GALLONS PER DAY**.

...but smaller County systems and some municipalities may be limited.

THE COUNTY OPERATES **3** SMALLER REGIONAL PLANTS AND **5** SUB-REGIONAL WASTEWATER TREATMENT PLANTS AND **8** MUNICIPALITIES OPERATE A WASTEWATER TREATMENT SYSTEM.

MANY OF THESE PLANTS DISCHARGE INTO WATER BODIES THAT HAVE **LIMITED OR NO CAPACITY** FOR MORE OF THE BY-PRODUCTS FROM WASTEWATER TREATMENT.

CONSTRUCTING NEW PLANTS OR EXPANDING EXISTING PLANTS BEYOND CURRENT DISCHARGE PERMITS IS LIKELY TO BE CHALLENGING.

IT WILL BECOME INCREASINGLY IMPORTANT FOR THE COUNTY – AND ITS MUNICIPAL PARTNERS – TO TARGET RESIDENTIAL AND EMPLOYMENT GROWTH WHERE PUBLIC FACILITIES LIKE WASTEWATER TREATMENT CAN SUPPORT IT.

NINE SMALLER AND OLDER COUNTY WASTEWATER TREATMENT PLANTS HAVE BEEN **DECOMMISSIONED** OVER THE PAST DECADE. THE WASTEWATER FROM THOSE PLANTS HAS BEEN **DIVERTED** AND NOW UNDERGOES MORE ADVANCED TREATMENT AT BALLENGER-MCKINNEY.

Once constructed, infrastructure must be maintained and eventually replaced, which can be costly.

A 2016 REPORT BY THE ENVIRONMENTAL PROTECTION AGENCY ABOUT NATIONAL WASTEWATER TREATMENT NEEDS ("CLEAN WATERSHEDS NEEDS SURVEY") STATED THE TOTAL DOCUMENTED NEED IN MARYLAND TO REHABILITATE OR REPLACE SEWERS AND TO ADDRESS INFILTRATION & INFLOW AT ALMOST **$2.5 BILLION**.

FREDERICK COUNTY MAINTAINS APPROXIMATELY **451 MILES OF SANITARY SEWER LINES** AND ADDS APPROXIMATELY A DOZEN MILES EACH YEAR.

Clean Watersheds Needs Survey https://www.epa.gov/sites/default/files/2015-12/documents/cwns_2012_report_to_congress-508-opt.pdf
The Fiscal Impacts of Development Patterns smartgrowthamerica.org/wp-content/uploads/2016/08/fiscal-implications-of-development-patterns.pdf
Smart Growth and Economic Success www.epa.gov/sites/default/files/2014-06/documents/sg-and-economic-success-for-governments.pdf
C+: the grade given to Maryland's wastewater infrastructure by the American Society of Civil Engineers in their 2020 Infrastructure Report Card.
2020 Infrastructure Report Card https://infrastructurereportcard.org/state-item/maryland/

IN FREDERICK COUNTY'S FY 2024-2029 **CAPITAL IMPROVEMENT PROGRAM**, THE DIVISION OF WATER AND SEWER UTILITIES BUDGETED AROUND **$14 MILLION** FOR REPLACEMENT OR RENOVATION PROJECTS OVER THE SIX-YEAR CIP. THESE PROJECTS ARE **NEARING COMPLETION** OR ARE PROGRAMMED IN THE BALLENGER-MCKINNEY, CRESTVIEW, FOUNTAINDALE, JEFFERSON, POINT OF ROCKS, AND WHITE ROCK SYSTEMS.

DEVELOPMENT PATTERNS ALSO **AFFECT THE COST** TO EXTEND UTILITIES AND MAINTAIN THEM. A 2015 REPORT BY SMART GROWTH AMERICA ("THE FISCAL IMPACTS OF DEVELOPMENT PATTERNS") NOTED "ALL ELSE BEING EQUAL, **LOW-DENSITY DEVELOPMENTS** WILL HAVE **MORE WATER AND SEWER PIPES** TO MAINTAIN PER CAPITA, AND THEREFORE HIGHER MAINTENANCE EXPENSES."

A REPORT BY THE ENVIRONMENTAL PROTECTION AGENCY IN 2014 (SMART GROWTH AND ECONOMIC SUCCESS: STRATEGIES FOR LOCAL GOVERNMENT) "COMMUNITIES OFTEN **STRUGGLE TO PAY** FOR THE CAPITAL COSTS OF **INFRASTRUCTURE** THEY HAVE ALREADY BUILT, AND DEBT PAYMENTS CAN LEAD TO DIFFICULT BUDGET CUTS IN OTHER AREAS AND/OR LOCAL TAX INCREASES. THIS **FISCAL CHALLENGE** IS AN INCREASINGLY IMPORTANT ISSUE AS MORE AND MORE INFRASTRUCTURE SYSTEMS ARE REACHING THE END OF THEIR USEFUL LIFE."

s t o r m w a t e r

Exceptional water resources remain in the County...

Watersheds are areas of land that collect precipitation. Water is either absorbed into the ground or runs off into nearby tributaries, like creeks and streams. Eventually, water drains to the lowest point in the watershed, collecting in lakes, bays, or oceans. Frederick County primarily drains to five major watersheds including the Upper Monocacy River, Lower Monocacy River, Catoctin Creek, Double Pipe Creek, and the Potomac River. Ultimately, all of the Frederick County drains into the Chesapeake Bay.

TO PROTECT WATERSHED HEALTH AND WATER QUALITY, THE **FEDERAL CLEAN WATER ACT** PLACES DESIGNATED PROTECTIONS ON STREAMS AND WATERSHEDS WHICH GUIDE MANAGEMENT DECISIONS AT THE STATE AND LOCAL GOVERNMENT LEVEL. SEVERAL COUNTY STREAMS AND WATERSHEDS ARE **SPECIALLY DESIGNATED**, AS THEY ARE VITAL RESOURCES FOR OUR AQUATIC COMMUNITIES THAT RELY ON HIGHER WATER QUALITY AND/OR LOWER WATER TEMPERATURES TO SURVIVE.

THESE STREAMS, RIVERS, AND WATERSHEDS SHOULD BE **PROTECTED** FROM THE **NEGATIVE IMPACTS** ASSOCIATED WITH DEVELOPMENT AND IMPROPERLY MANAGED AGRICULTURAL OR LIVESTOCK ACTIVITIES. BASED ON STATE- AND COUNTY-LED MONITORING EFFORTS, VARIOUS STREAMS AND WATERSHEDS HAVE BEEN IDENTIFIED AS **HIGHER VALUE RESOURCES** THAT NEED PROTECTION. THESE INCLUDE TIER II WATERS (EXCEED WATER QUALITY CRITERIA), STRONGHOLD WATERSHEDS (GOOD BIODIVERSITY AND/OR PRESENCE OF MANY THREATENED SPECIES), AND TROUT WATERSHEDS. SEE MAPS 1 AND 2 IN CHAPTER 1.

...but these resources face stressors...

MANY SPECIES OF AQUATIC PLANTS AND ANIMALS ARE **SENSITIVE TO CHANGES** IN THEIR ENVIRONMENT. POLLUTION SUCH AS SEDIMENT, SOME CHEMICALS, EXCESS NUTRIENTS, HIGH WATER VOLUMES, AND HIGH TEMPERATURES NEGATIVELY IMPACTS STREAM HEALTH. AS **STREAM HEALTH DECLINES**, SO DOES THE NUMBER AND VARIETY OF BUGS, FISH, AND PLANTS LIVING WITHIN AND ADJACENT TO THE STREAM. POLLUTED WATER CAN BE **DANGEROUS TO HUMANS** AND CAN MAKE DRINKING WATER MORE DIFFICULT AND EXPENSIVE TO TREAT.

POLLUTANTS CAN COME FROM MANY SOURCES, INCLUDING IMPERVIOUS SURFACE RUNOFF FROM ROADS, PARKING LOTS, AND BUILDINGS. THE RELATIONSHIP BETWEEN THE LEVEL OF **IMPERVIOUS COVER** AND STREAM HEALTH IS COMPLEX. HOWEVER, ONCE A WATERSHED REACHES 10% OF IMPERVIOUS COVER, THERE IS A **MEASURABLE DECLINE** IN WATER QUALITY AND THE NUMBER AND VARIETY OF AQUATIC LIFE PRESENT. BROOK TROUT ARE ALMOST NEVER SEEN IN WATERSHEDS WITH OVER 4% IMPERVIOUS COVER. IMPERVIOUS SURFACES ALSO INCREASE **RUNOFF VELOCITY** AND CAN INTENSIFY **FLOODING AND EROSION**. THEREFORE, ADDRESSING UNTREATED URBAN IMPERVIOUS AREAS IS A DRIVING FACTOR BEHIND STORMWATER QUANTITY AND QUALITY MANAGEMENT.

SURFACE WATERS MUST MEET ESTABLISHED WATER QUALITY CRITERIA, OR IT IS CONSIDERED IMPAIRED. A **"POLLUTION DIET"** MAY BE PUT IN PLACE TO IMPROVE WATER QUALITY. THIS POLLUTION DIET IS CALLED A **TOTAL MAXIMUM DAILY LOAD** (TMDL). TMDLS REPRESENT THE MAXIMUM AMOUNT OF AN IMPAIRING SUBSTANCE THAT A WATER BODY CAN ABSORB WITHOUT DAMAGING ITS DESIGNATED USES, WITHIN A MARGIN OF SAFETY. ALMOST EVERY WATERSHED IN FREDERICK COUNTY HAS A TMDL AND THE COUNTY IS PART OF THE LARGER **CHESAPEAKE BAY TMDL**. LOCAL TMDLS INCLUDE PHOSPHORUS, SEDIMENT, AND E. COLI. SEE MAP 3 IN CHAPTER 1. IN ADDITION, THREE WATERSHEDS HAVE BEEN IDENTIFIED FOR FUTURE DEVELOPMENT OF TEMPERATURE TMDLS: CATOCTIN CREEK, UPPER MONOCACY RIVER, AND LOWER MONOCACY RIVER.

...but the County is rising to the challenge.

THE COUNTY IS REGULATED THROUGH STORMWATER, WASTEWATER, AND INDUSTRIAL **DISCHARGE PERMITS** ISSUED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE). THE GOAL OF THE STORMWATER PERMIT IS TO CONTROL STORMWATER POLLUTION, IMPROVE WATER QUALITY, AND WORK TOWARD MEETING WATER QUALITY STANDARDS. FREDERICK COUNTY IMPLEMENTS **BEST MANAGEMENT PRACTICES (BMPS)** TO REDUCE POLLUTION WITHIN OUR LOCAL STREAMS AND WATERWAYS.

STORMWATER IMPACTS ARE IDENTIFIED BY **TIER II ANTIDEGRADATION REVIEWS**, WHICH FLAG NEGATIVE IMPACTS TO HIGH QUALITY WATERS FROM PERMITTED ACTIVITIES. ANY IMPACTS THAT CANNOT BE REASONABLY BE AVOIDED MAY BE MITIGATED THROUGH ADDITIONAL PRACTICES SUCH AS RESTORATION AND PLANNING ACTIVITIES.

THE COUNTY ALSO CONTINUES TO ASSESS VULNERABILITIES TO NATURAL HAZARDS AND PREPARE LONG TERM STRATEGIES THAT ADEQUATELY ADDRESS HAZARDS ASSOCIATED WITH **CLIMATE CHANGE**. THE COUNTY WILL IMPLEMENT **ADAPTIVE MANAGEMENT STRATEGIES** TO CONTINUE TO MEET THESE CHALLENGES.

THE COUNTY CONDUCTS FEASIBILITY STUDIES AND WATERSHED ASSESSMENTS TO IDENTIFY STREAMS AND PONDS THAT HAVE SHOWN **SIGNS OF DEGRADATION**, AND TARGETS AREAS WITHIN IMPAIRED SEGMENTS IN THE ASSESSMENTS. THESE STUDIES AND ASSESSMENTS ENSURE **MAXIMUM EFFICACY OF BMPS**, WHILE EFFICIENTLY UTILIZING COUNTY FUNDS TO PROTECT AND IMPROVE COUNTY WATERWAYS. THE COUNTY SUBMITS YEARLY PLANS TO MDE REPORTING ON THE STATUS OF MEETING TMDL TARGET REDUCTIONS FOR WATER QUALITY IMPAIRMENTS IN LOCAL WATERWAYS AND THE CHESAPEAKE BAY, INCLUDING THE RESTORATION BMPS AND THEIR ASSOCIATED IMPERVIOUS ACRES AND NUTRIENT REDUCTIONS WITHIN EACH WATERSHED.

Key Insights from the Water Resources Element

INTRODUCTION

The purpose of Frederick County's Water Resources Element (WRE) is to coordinate growth management and water resources planning efforts. It summarizes current capacity and projects estimated demand for the county-owned and operated water, wastewater, and stormwater systems with references to municipal systems and municipal growth areas. The inclusion of municipalities in the County WRE does not supersede municipal planning efforts since municipalities with planning and zoning authority must adopt their own WRE.

Estimates for future conditions are informed by three sources: the residential pipeline, Round 10.0 cooperative forecasts from the Washington Metropolitan Council of Governments, and County and municipal staff knowledge of local plans, trends, and constraints. The WRE considers two time periods (2035 and 2050).

Frederick County is a desirable place to live and work and is projected to continue attracting new employers and residents over the next 25 years. Under the Round 10.0 forecast, by 2050 Frederick County is estimated to be home to 162,537 jobs, 155,652 households, and 428,794 residents. This represents approximately 5% of projected growth in the greater Washington, DC region. The majority of this growth is expected to occur in Community Growth Areas (CGAs) due to the growth management and water and sewer policies of the County and its municipalities. Therefore, the WRE focuses on CGAs.

The following sections summarize the major findings for current and projected conditions for drinking water, wastewater, and stormwater systems.

DRINKING WATER

Where are we today?

Around two-thirds of Frederick County residents are connected to a public water supply operated by the County or a municipality. Public water supplies can come from surface water or groundwater (or a mix of both). Public water service areas are typically limited to unincorporated Community Growth Areas or properties within municipal limits. The remaining one-third of County residents are served by a private groundwater well.

The most abundant surface water supply available to Frederick County is the Potomac River. Other surface water sources used for drinking water by municipalities include the Monocacy River, Catoctin Creek, Linganore Creek, Turkey Creek, and Fishing Creek. However, these have availability limitations in order to protect the biological health of the waterway. For public systems and individuals that use groundwater, availability is difficult to predict since it depends on geologic factors such as soil type and aquifer type. **Overall, the County and its municipalities are meeting current drinking water demand.**

Equally important to having enough water is making sure it is safe. Groundwater and surface water are susceptible to contamination from naturally occurring and human-caused activity. Public water systems must test and treat their water supplies to meet or exceed federal drinking water standards, but this level of monitoring and treatment is not cost-effective or even affordable for those using individual wells. **Our public water supply is safe and complies with regulatory standards but emerging contaminants such as PFAS (per- and poly-fluoroalkyl substances) are a concern.**

What might the future look like?

The County's primary water treatment plant, New Design, is estimated to have a 3.3 million gallon per day increase in demand by 2035. By 2050, total average day demand may increase to just over 13 million gallons per day. **This amount is still within permit limits but indicates the County should anticipate planning for expanding the water supply by mid-century.** Smaller County systems that are not located within growth areas are not expected to experience much change in demand. **Water systems in growth areas supplied by groundwater are more constrained as the 2050 horizon year is reached** (Libertytown, Jefferson). These systems may need earlier efforts to plan for increasing the water supply. Many municipal systems are also projected to be constrained by 2050.

WASTEWATER

Where are we today?

Around two-thirds of Frederick County residents are served by a public wastewater treatment plant. Public sewer service areas are typically limited to unincorporated Community Growth Areas or properties within municipal limits. The remaining one-third have a private on-site disposal system (often referred to as a septic system). All sanitary sewer systems in Frederick County are separate from the stormwater system.

The largest limiting factor for wastewater capacity is pollutant loading limits for the effluent (wastewater after treatment). Wastewater contains nutrients like nitrogen and phosphorous. In large quantities, these nutrients degrade water quality. Enhanced treatment technology can reduce the amount of nitrogen and phosphorous being discharged into receiving waters such as rivers and streams. State and federal funding has been used by County and many municipal treatment plants to upgrade to these advanced technologies over the past 15 years. Issues like infiltration (when stormwater or groundwater enters the sanitary sewer system through cracks in pipes or deteriorating manholes) and inflow (improper or illegal connections to the sanitary sewer system by sump pumps or other drainage systems) can also place a strain on wastewater treatment capacity.

The County's primary wastewater treatment plant Ballenger-McKinney discharges into the Monocacy River. The Ballenger-McKinney service area has adequate capacity to meet current wastewater treatment demand. The smaller County systems discharge to creeks and typically have lower permit capacity levels. Most of these smaller systems do not serve growth areas. **Overall, the County and its municipalities are meeting current demand for wastewater treatment within permit limits.**

What might the future look like?

The County's primary wastewater treatment plant, Ballenger-McKinney, is estimated to have a 3.6 million gallon per day increase in flows by 2035. By 2050, the total average flows are anticipated to reach 15 million gallons per day, which would be slightly over the current permit limit. Some municipalities face similar situations approaching 2050 such as Emmitsburg, Frederick, and Middletown. However unlike water appropriation permits, wastewater permit limits are based on the level of treatment that can be achieved and the corresponding capacity of the water body that the wastewater plant discharges to. **Similar to water capacity, the County should anticipate planning for expanding wastewater treatment capacity around 2050.**

STORMWATER

Where are we today?

When it rains (or snow melts) on a natural surface, water mostly soaks into the ground. When rain falls on improved surfaces such as roads, roofs, or parking lots, it is unable to soak into the ground because these surfaces are usually made of impervious materials. This stormwater runoff must be collected, stored, and eventually discharged into a creek, stream, or river.

As runoff moves over impervious surfaces it collects pollutants. Pollutants also come from surface runoff over pervious surfaces like lawns, parks, and agricultural uses. There are federal, state, and local regulations and policy tools to reduce pollution to water bodies from stormwater runoff collected and discharged by storm drains. The purpose of these regulations is to protect water quality both for human purposes like drinking water and recreation but also for plants, animals, and aquatic resources. Protecting water quality is also important because watersheds are interconnected. While water in Frederick County drains locally to the Monocacy River, Catoctin Creek, the Potomac River, etc., eventually all the land in the County drains to the Potomac River and eventually the Chesapeake Bay.

In Frederick County, watershed health tends to be strongest where there are lower rates of impervious cover, such as Middletown Valley. There are seven Community Growth Areas with poor stream health indicators and higher rates of untreated impervious surface (Ballenger Creek, Buckeystown, Frederick Southeast, Mount Airy, Point of Rocks, Spring Ridge/Bartonsville, Woodsboro). As part of stormwater management activities, Frederick County regularly measures stream health, conducts watershed assessments, and undertakes stream and watershed restoration projects.

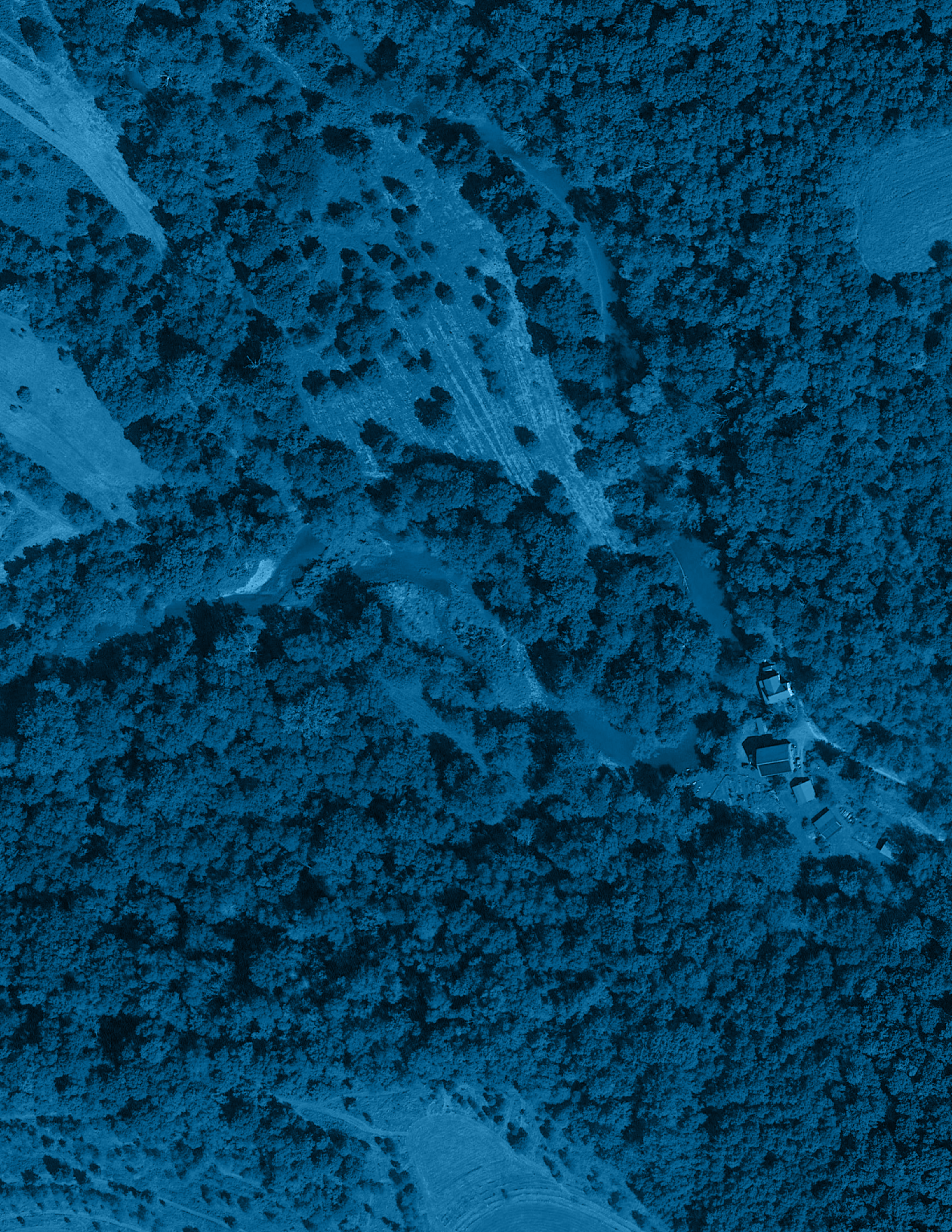
What might the future look like?

How will the estimated changes in population and jobs over the next ten years be expressed through changes in land use? And what impacts could this have on watersheds? Will this make our efforts to maintain and improve stream health harder, or even threaten its achievement? The WRE takes the estimated job and population changes and uses the four physical development scenarios in the Livable Frederick Master Plan to assess how different development patterns may affect stormwater runoff within Community Growth Areas. **The overall achievement of pollution reduction goals is not anticipated to be threatened by the expected growth. Development patterns that focus growth in existing places and that consume less land had less pollution potential under the models.** Some watersheds (such as the Lower Monocacy River) may need more resources to assess and reduce pollution.

WHAT SHOULD WE DO TO PREPARE?

Drinking water, wastewater, and stormwater are all connected. The following are a selection of policies and recommendations in this WRE that bridge the focus areas. More policies and recommendations can be found at the end of each chapter.

- Future County plans should assess existing water and wastewater demand, the potential demand under the proposed land use plan, and recommend additional facilities or improvements needed for plan implementation.
- Integrate watershed planning and management in the comprehensive planning process.
- Protect water resources for future generations by implementing climate resiliency and climate adaptation strategies.
- Promote the use of reused or recycled water for non-potable uses as a means to conserve treated drinking water while following any current greywater use regulations.
- Continue to leverage opportunities for redevelopment and neighborhood revitalization like those proposed under the South Frederick Corridors Plan.



Introduction

WHY PREPARE A WATER RESOURCES ELEMENT?

The purpose of Frederick County's Water Resources Element (WRE) is to coordinate growth management and water resources planning efforts. It addresses capacity of the county-owned and operated water and wastewater systems with references to municipal systems and municipal growth areas. It also considers the influences that the County can exert over stormwater runoff (non-point source pollution). The Water Resources Element is divided into three components:

- Drinking Water Assessment
- Wastewater Assessment
- Stormwater Assessment

Included within these components are discussions of the water resources of the County, the quality and quantity of drinking water supplies with respect to planned growth, the treatment capacity of wastewater treatment facilities and disposal of treated effluent, and a review of the county's stormwater management and non-point source pollution programs. Recommendations for sound land and water resource management practices that contribute towards the health and sustainability of our major watershed systems and human communities are included in the form of goals, policies, and action items.

The WRE requirement was established in 2006 by the Maryland State Legislature. All counties and municipalities with planning and zoning authority must adopt a Water Resources Element as part of their comprehensive plan. A WRE is intended to assess a jurisdiction's water resource limitations and challenges. WREs are typically updated concurrently with cyclical updates of a county or municipal Comprehensive Plan to reflect current demographic, economic, and development conditions. With the adoption of the Livable Frederick Master Plan (LFMP) in 2019, the Water Resources Element was identified as a component "Functional Plan" that addresses the goals and visions of Frederick County in a far more focused and detailed manner.

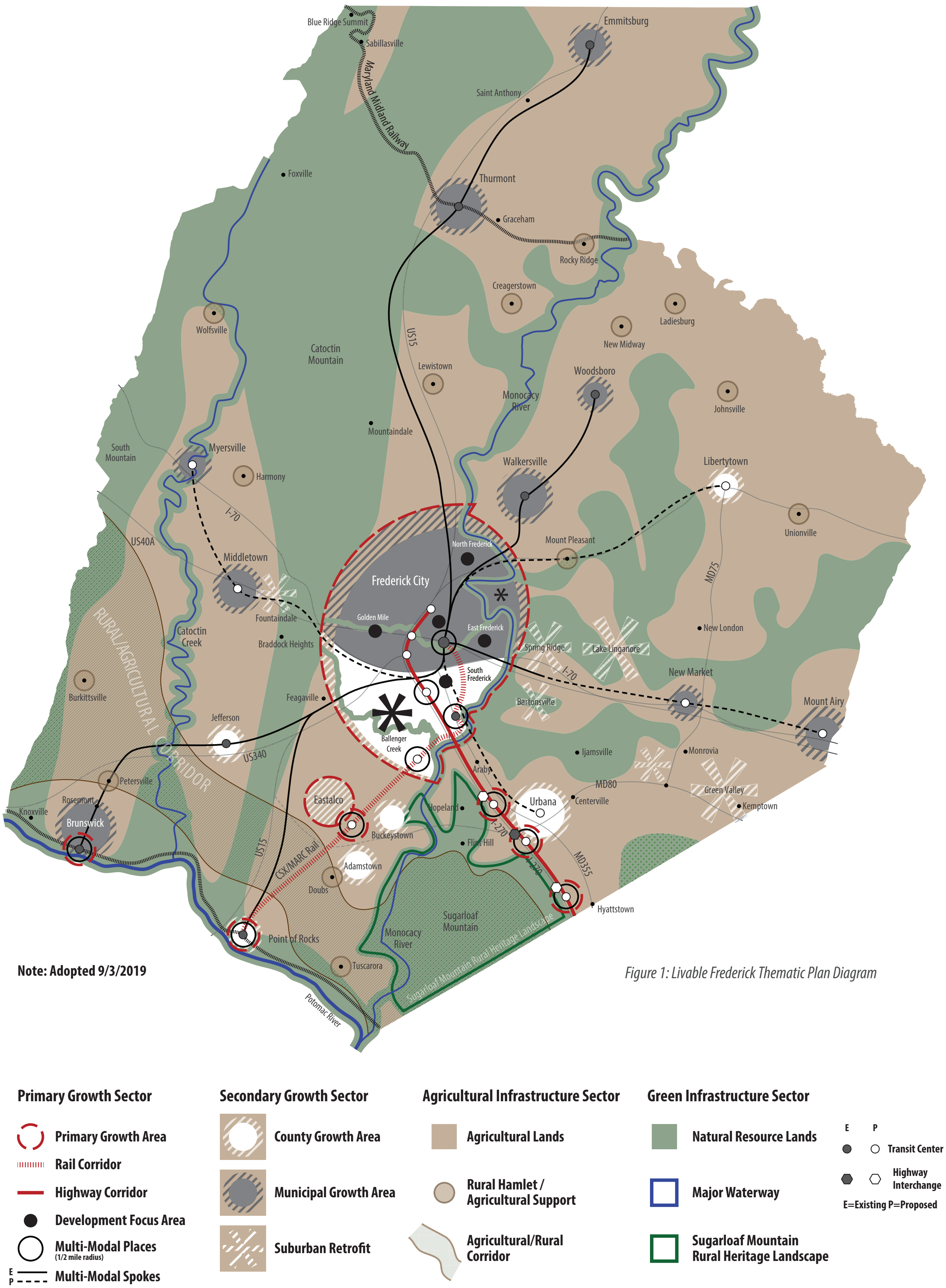
The WRE addresses the following State Planning Visions: Quality of Life, Growth Areas, Infrastructure, Environmental Protection, Resource Conservation, and Stewardship.

RELATED COUNTY PLANS

Livable Frederick Master Plan

The Livable Frederick Master Plan (LFMP), adopted in 2019, is the central policy document guiding the development of the County's Comprehensive Plan. Livable Frederick sets a vision for 2040. The plan identifies a Development Framework to achieve the vision by focusing on the forms and patterns that will determine the shape of the built environment in Frederick County.

Many findings of the scenario planning exercises informed the Development Framework. For example, a significant amount of the county's share of future household growth is likely to occur in currently planned developments known as the "pipeline growth." However, the traditional suburban patterns assumed with this growth may not align with future market demands for greater housing choices and more walkable communities. There are corridors and subareas of the county where new growth, infill development, and redevelopment can be targeted to achieve more compact, mixed-use patterns. The scenarios also intentionally directed development away from sensitive natural resources, green infrastructure, and working lands.



Note: Adopted 9/3/2019

Figure 1: Livable Frederick Thematic Plan Diagram

These and other findings informed the Development Framework's Thematic Plan. LFMP continued the practice of identifying Community Growth Areas (CGAs) where residential, commercial, and employment uses will be concentrated and public facilities such as community water and sewer will be provided.

The Thematic Plan Diagram (Figure 1) references selected community growth areas identified on the Comprehensive Plan Map as a means of prioritizing growth strategies, as well as defining preferred growth patterns connected to specific growth areas. The Thematic Plan identifies four sectors: the Primary Growth Sector, the Secondary Growth Sector, the Agricultural Infrastructure Sector, and the Green Infrastructure Sector. Each have differing priorities, but all play an equally vital role in the support of livability in Frederick County.

The Livable Frederick Master Plan also includes the Action Framework, which focuses on policies, goals, initiatives, and supporting initiatives across four themes: Our Community, Our Health, Our Economy, and Our Environment.

Frederick County Water and Sewerage Plan

The purpose of the Water and Sewerage Plan is to provide an overview of the goals, policies, and procedures for implementing water and sewerage plans. The Plan includes descriptions of both County and municipal water and sewerage systems including assessments of current demand/use and available capacities. The mapping component includes the various water/sewerage plan classifications, which identifies existing service areas and planned service areas. This Plan is required by the State and is updated every three (3) years.

The Water and Sewerage Plan and its rules, procedures, and classification mapping is the official document guiding water and sewer planning in Frederick County. The Water and Sewerage Plan takes precedence over the information contained within this Water Resources Element.

COORDINATING WITH MUNICIPALITIES

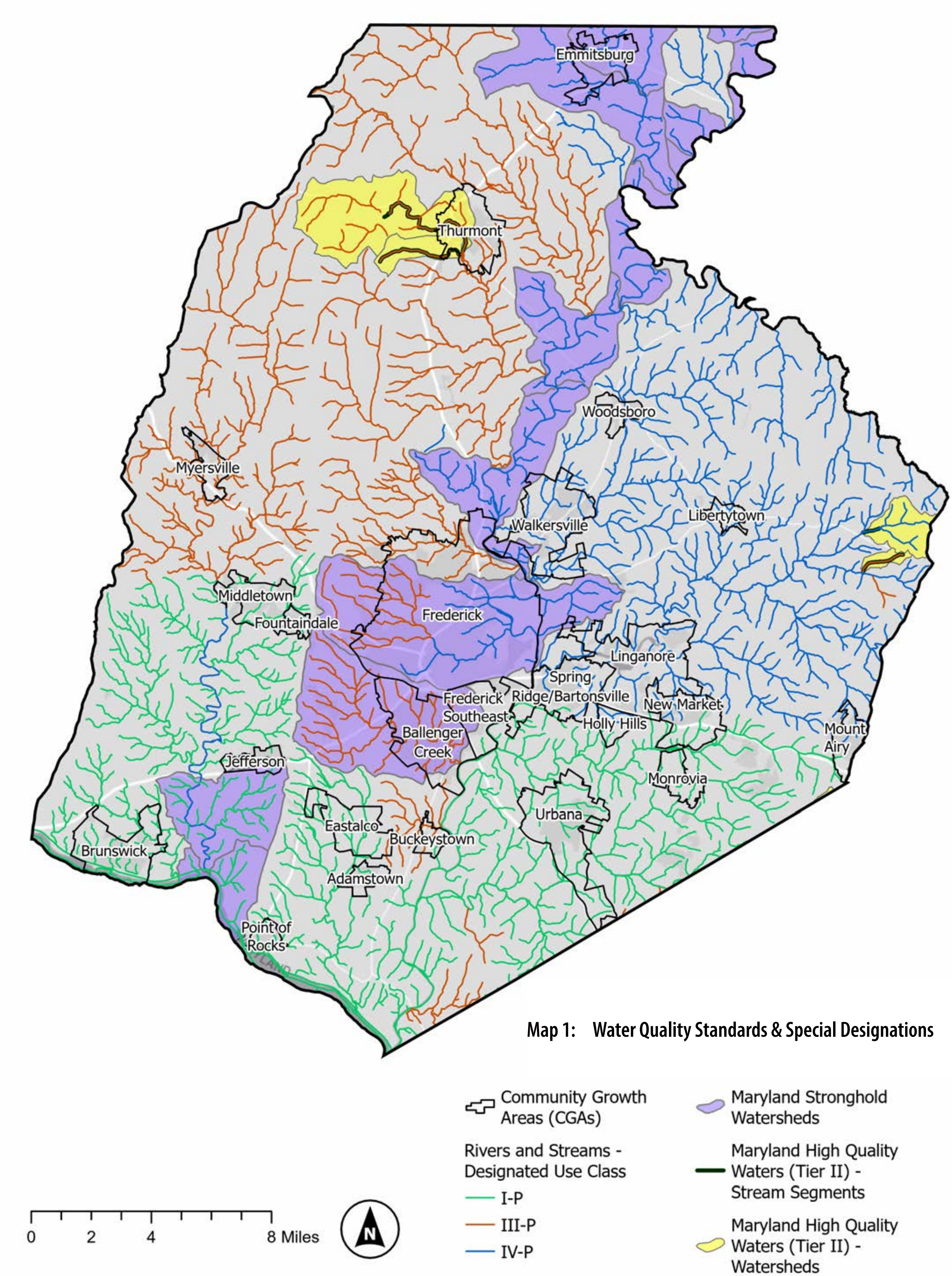
Twelve municipalities lie within the borders of Frederick County. Nine provide community water and eight provide community sewer service to the households and businesses within their municipal boundaries. Each is required to identify its own water resources vulnerabilities, limitations, and opportunities and include a water resources element in their respective comprehensive plans. This WRE will meet the requirement for the Town of Burkittsville and the Village of Rosemont.

To the extent possible, this plan includes qualitative and quantitative data from the municipalities on their drinking water, wastewater, and stormwater systems. A draft of all information in this plan was distributed to verify facts and figures provided for the municipalities. Policy statements and implementation strategies specific to a municipality will be independent of Frederick County's Water Resources Element and will be addressed within the respective municipal water resources elements and comprehensive plans.

Additionally, brief summaries of municipal water and wastewater systems in the County are provided in Appendices A and B of this Water Resources Element.

PROTECTING WATER QUALITY: FEDERAL, STATE, & LOCAL FRAMEWORKS

Safe and clean water is needed to drink, cook, bathe, irrigate crops, water livestock, and more. But human activity on the land can have negative impacts on the water quality of lakes, rivers, streams, and their associated watersheds. There are many local, state, and federal laws in place to protect water quality. The federal Clean Water Act, enacted in 1972, is perhaps the most well-known. The Maryland Department of the Environment (MDE) administers the Water Quality Standards (WQS) required by the Clean Water Act. These standards are intended to protect, maintain, and improve surface water quality.



Map 1: Water Quality Standards & Special Designations

Water Quality Standards have three components:

- Designated Uses are a goal for water quality. Every surface water has a designated use which is how the water is meant to be used by humans and animals. The uses may or may not be met currently but must be attainable.
- Water Quality Criteria are numeric criteria which set the minimum water quality required to meet designated uses. If criteria are not met, a "pollution diet" or Total Maximum Daily Load (TMDL) may be established to improve water quality.
- Antidegradation is a policy that assures water quality continues to support designated uses. Tier I applies to all surface waters and is often described as "fishable/swimmable." Tier II applies to surface waters where water quality criteria are higher than the minimum standards for the designated use. Tier III is currently under development by MDE and is described as an "Outstanding Natural Resource Water."

The US EPA's "My Environment" search application is an online tool intended to provide a cross section of environmental information based on a given search location. Visitors to the website can enter a postal address and view data about air quality and potential air pollution, sources of available energy, greenhouse gas emissions, and TMDL data about nearby surface waters (streams and rivers) through access to the Assessment Total Maximum Daily Load Tracking and Implementation System (ATTAINS). The tool is available on the EPA's website at: https://enviro.epa.gov/myenvironment/.

Designated Uses and Special Designations

Rivers and streams throughout Frederick County have designated use classes of I-P, III-P, and IV-P (Map 1). MDE defines the designated uses as follows:

- Use Class I-P: Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply
- Use Class III-P: Nontidal Cold Water and Public Water Supply
- Use Class IV-P: Recreational Trout Waters and Public Water Supply

MDE Designated Use Classes	I-P	III-P	IV-P
Growth and Propagation of fish (not trout), other aquatic life and wildlife	X	X	X
Water Contact Sports	X	X	X
Leisure activities involving direct contact with surface water	X	X	X
Fishing	X	X	X
Agricultural Water Supply	X	X	X
Industrial Water Supply	X	X	X
Growth and Propagation of Trout		X	
Capable of Supporting Adult Trout for a Put and Take Fishery			X
Public Water Supply	X	X	X

Use Class III and IV are cold water streams. Cold water streams in Maryland are a vital resource for aquatic communities that rely on lower temperatures to thrive because temperatures in these waters do not exceed 68 degrees Fahrenheit (20 degrees Celsius) for more than 10 percent of the summer index time period that extends from June 1 to August 31 in a given year. Identifying and protecting the thermal regime of these stream environments is crucial for supporting vulnerable cold water species that rely on specific temperatures and consistent water quality to maintain their populations. These species include Maryland's native brook trout, recreationally important populations of rainbow trout and brown trout, and two cold water obligate benthic macroinvertebrates (stonefly taxa *Tallaperla* and *Sweltsa*). Benthic macroinvertebrates are aquatic bugs and animals that do not have a backbone.

Growing concerns around climate change and warming temperatures highlight the importance of protecting these valuable cold water resources in Maryland. Elevated water temperatures due to climate change will limit the available cold water habitat for dependent species, threatening their populations. Additionally, higher water temperatures select for toxin-producing algae, a concern for fish, their food, stream processes, and human health. Increased development in the watersheds of cold water streams or best management practices (BMPs) lacking cold water protections can compound the problem, contributing to higher influxes of warm temperature stormwater runoff into vulnerable cold water streams. Water quality standards in conjunction with strategies to best manage and mitigate high temperatures are therefore critical to the survival and health of cold water communities.

Frederick County also has watersheds designated as Maryland Stronghold Watersheds (Map 1). According to the Maryland Department of Natural Resources (MDNR), "these are the places where Greatest Conservation Need species of stream-dwelling fish, amphibians, reptiles, or mussels have the highest abundance or diversity. These species are the most sensitive to environmental degradation. A small change in watershed or stream health can permanently eliminate one or more of these sensitive species."

Map 2 shows the location of trout watersheds in Frederick County, the type of trout present, and the location of temperature-impaired stream segments along with Community Growth Areas. Most trout watersheds are present in less intensely developed areas of the county or areas with nearby forested areas (such as the area near Sugarloaf Mountain). There are some trout watersheds that exist in close proximity to more developed areas of the county. The proximity of these waters does not necessarily imply that the area should be a target for disinvestment or should be restored to a predevelopment condition.

Water Quality Criteria

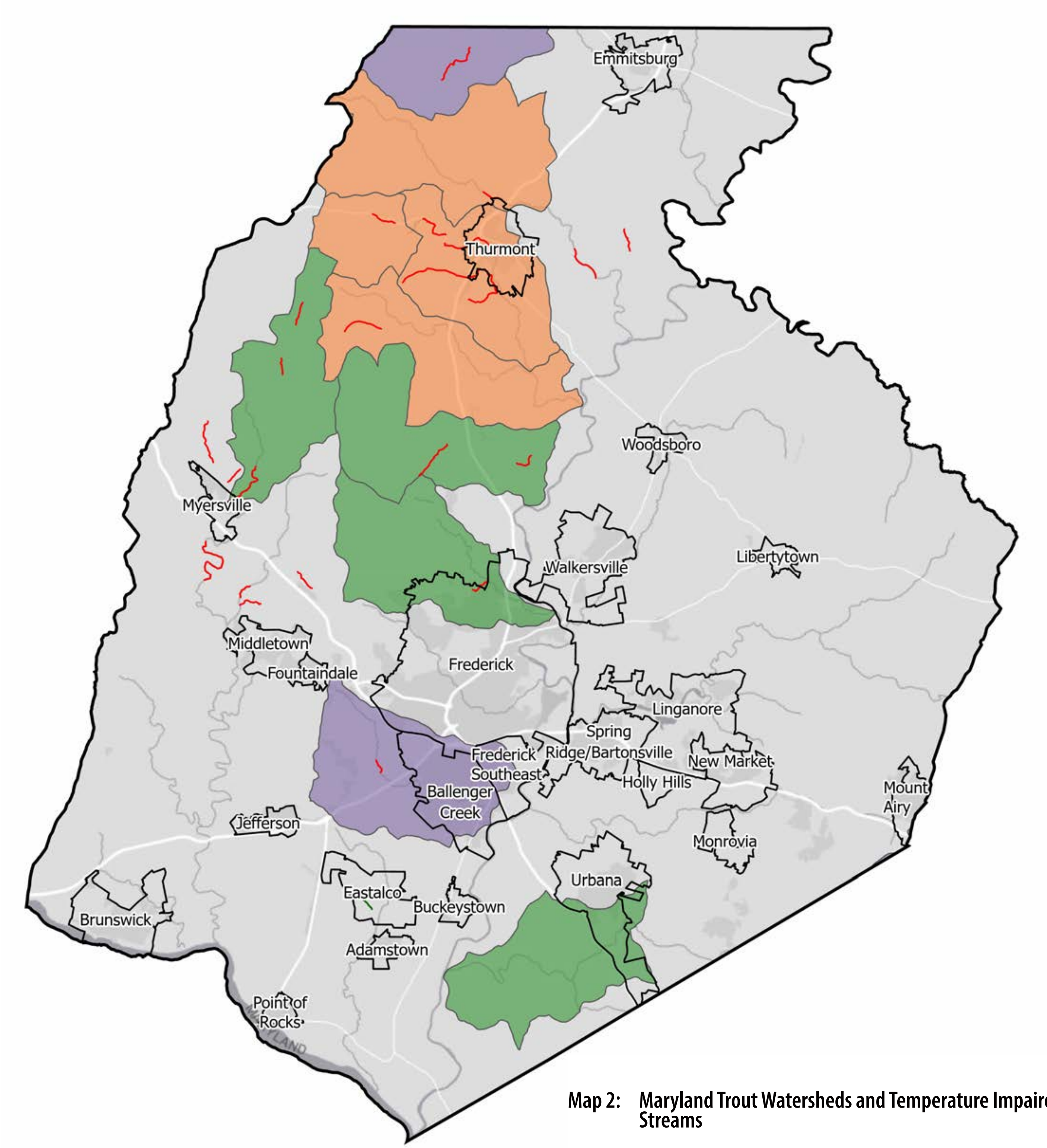
When a waterbody does not meet the water quality criteria for its designated use, it is considered impaired. MDE prepares an Integrated Report of Surface Water Quality in Maryland and submits this report to the federal Environmental Protection Agency (EPA) every two years. This report is a scientific analysis of water quality in rivers and streams and identifies impairments and threats to waterbodies.

A Total Maximum Daily Load (TMDL) may be established if a waterbody is impaired. A TMDL is a pollution diet to reduce the pollutants entering a waterbody with the goal of attaining the water quality criteria for a designated use. Because waterbodies draw their water from multiple streams, creeks, and rivers, TMDLs are often managed at the watershed level. They address specific impairments. Impairments within Frederick County with established TMDLs include sediment, nutrients (typically phosphorus or nitrogen), and pathogens/bacteria like E. coli.

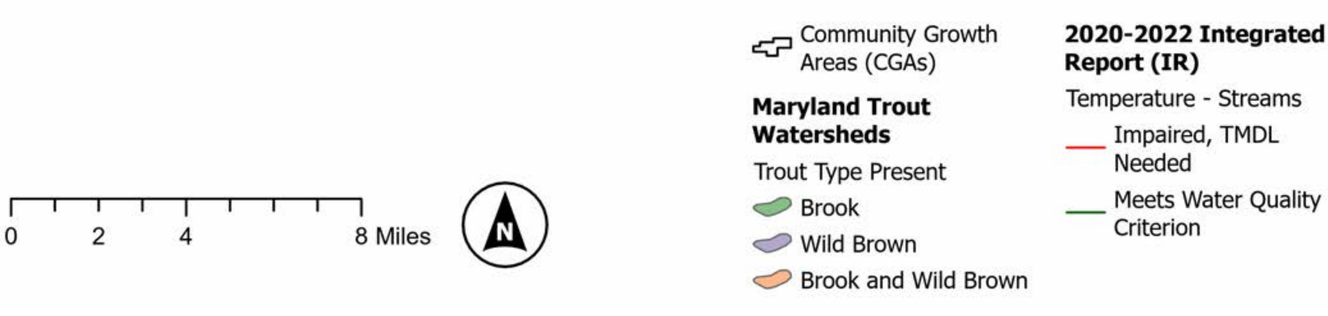
These impairments are described in the table below along with some ways water quality is affected.

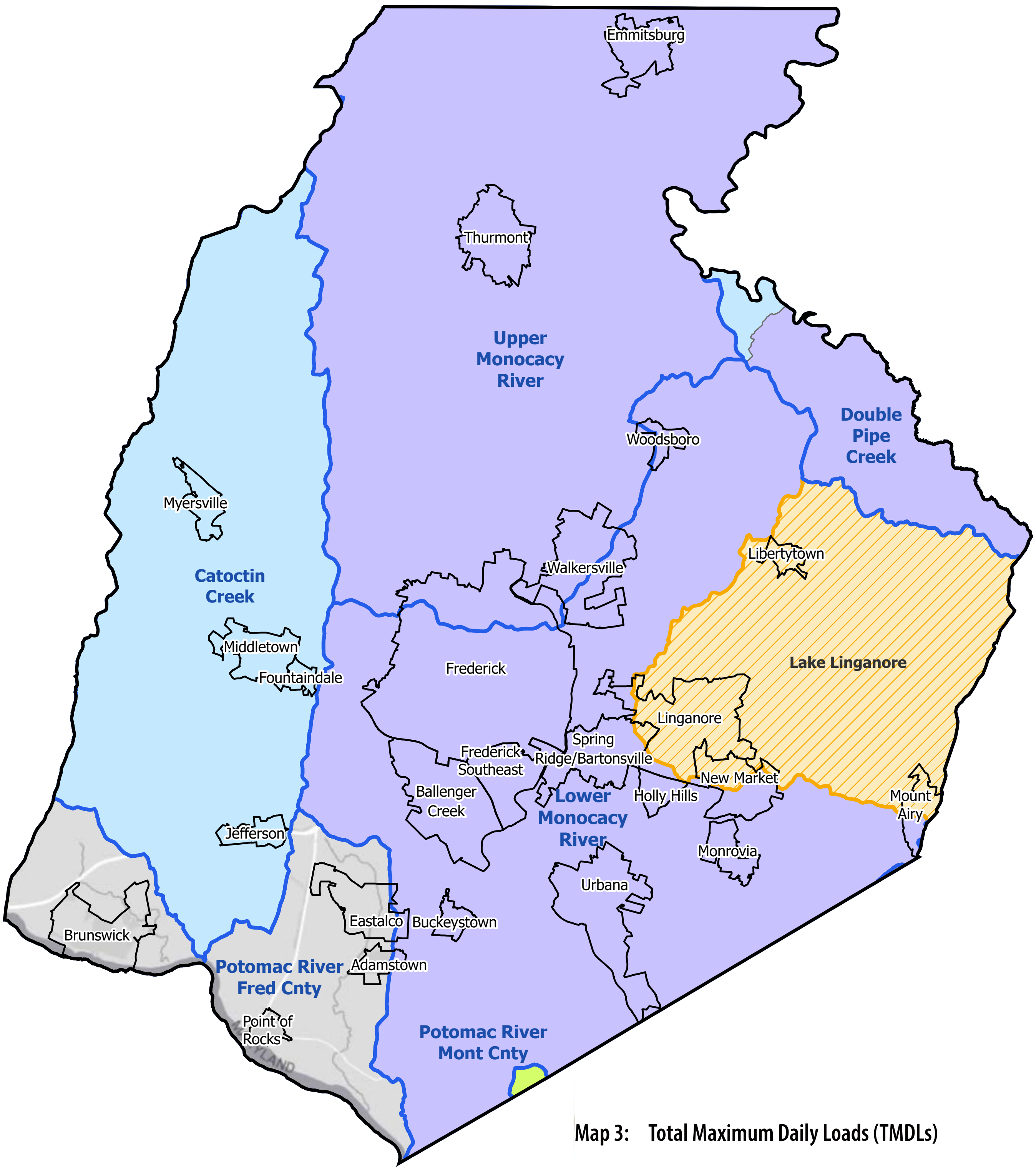
Table 1.01 Description of TMDL Impairments in Frederick County

Impairment	Cause	Effect
Sediment	Topsoil runoff from construction, stream erosion, agriculture, stormwater, etc.	- Murky water means less sunlight reaches plants and animals - Cause direct biological harm to underwater life, such as clogged gills - Increases the cost of water treatment - Primary source of phosphorous as a sediment bound nutrient
Nutrients	Wastewater (treatment plants and septic systems), crop and lawn fertilizer.	Spur plant and bacteria growth resulting in an out-of-balance ecosystem ("algae blooms")
Pathogens	Wastewater treatment plants, septic systems, runoff from livestock and pet waste.	Pathogens can cause disease in humans and animals.



Map 2: Maryland Trout Watersheds and Temperature Impaired Streams





Map 3: Total Maximum Daily Loads (TMDLs)

Community Growth Areas (CGAs)

Watersheds (MD 8-Digit)

Impoundment TMDLs

Phosphorus and Sediment

Stream TMDLs

Phosphorus, Sediment, and E. coli

Phosphorus and Sediment

Phosphorus and E. coli

Sediment

A watershed can be thought of as many different nested scales. In Maryland, watersheds are typically managed at the 8-digit watershed level. There are six 8-digit watersheds in Frederick County: Lower and Upper Monocacy, Double Pipe Creek, Catoctin Creek, and the Potomac River (Frederick and Montgomery Counties). Five of these watersheds plus Lake Linganore have approved TMDLs. The following table lists the watersheds or waterbody and the associated impairment(s). Map 3 shows the 8-digit watersheds in Frederick County and whether the watershed has an established TMDL.

Table 1.02 Established TMDLs in Frederick County

Watershed/Waterbody	Phosphorus	Sediment	Bacteria (E. coli)
Lower Monocacy	X	X	X
Upper Monocacy	X	X	X
Double Pipe Creek	X	X	X
Catoctin Creek	X	X	
Potomac River (Montgomery County)		X	
Lake Linganore	X	X	

Frederick County is also part of the Chesapeake Bay TMDL. Decades of measured water quality declines in the Chesapeake Bay led to the creation of a Chesapeake Bay TMDL in 2010, designed to achieve a substantial reduction in the four main pollution source sectors by 2025: land development, septic systems, agriculture, and wastewater treatment plants. These reductions are for nutrients (nitrogen and phosphorus) as well as sediment.

Because watersheds are connected and due to the complexity of the Bay TMDL, Watershed Implementation Plans (WIPs) were developed by the State of Maryland to guide the required nutrient and pollution reductions needed throughout the State to improve water quality in the Chesapeake Bay. Bay TMDL jurisdictions are currently implementing Phase III WIPs.

Antidegradation

There are four Tier II catchment areas associated with four Tier II stream segments in Frederick County (Map 1). Tier II waters are high quality waters that exceed the water quality criteria for the stream’s designated use or scored highly on the Index of Biotic Integrity (IBI). The IBI is a measure of the aquatic bugs and fish present in a stream. Tier II waters may be subject to additional review by the State of Maryland when seeking permits or approvals to ensure the activity or project will not degrade this higher water quality. Only one catchment area, High Run, has remaining assimilative capacity. Assimilative capacity is a way to measure how much Tier II stream water quality can lower with regard to baseline criteria before it’s considered degraded. Therefore, it is important to effectively manage land use to minimize any further degradation in these catchments.

Two of these streams and catchments are located in the western part of the Town of Thurmont and the adjacent Catoctin Mountain Park. The other two streams and associated catchment areas are in the eastern part of the County, in the general area north and south of MD-26 at the Carroll County border.

Tier II Stream Segments

1. Big Hunting Creek (Thurmont area), 4.76 miles
2. High Run (Thurmont area), 3.22 miles
3. Weldon Creek (north of MD-26), 0.6 miles
4. Talbot Branch (south of MD-26), 1.61 miles

Importance of the Regulatory Framework

The following chapters of this Water Resource Element each address a component of water utilization in Frederick County that can have profound impacts on the availability of potable water supplies. If the drinking water is over-allocated and groundwater and surface water supplies become too depleted, this can have negative impacts for not only communities but the natural environment as well. If the generation of wastewater and the associated discharges to Frederick County's streams and waterways exceed the capacity of the waters to integrate nutrients and other pollutants, communities and the natural environment can suffer. If point-source and non-point-source discharges of nutrient and pollutant laden stormwater runoff (or stormwater related or "pluvial" flooding) exceed the capacity of streams and waterways to receive those flows, communities and the environment can suffer additional negative consequences. The Water Resources Element is intended to address each of these topics, in-turn, to ensure that the mindful management of water, wastewater, and stormwater promotes the long-term safety and availability of Frederick County's water resources.

PROJECTING POPULATION GROWTH AND DEVELOPMENT

A methodology was developed to analyze the impacts of future growth on water capacity and wastewater capacity that utilizes development pipeline data, forecasting data from the Metropolitan Washington Council of Governments' (MWCOG) Cooperative Forecast, and local planning knowledge at the county and municipal levels. For the purposes of analyzing the impacts of future growth on stormwater runoff, this methodology was supplemented with modeling of land use and land cover change utilizing data from the Chesapeake Conservancy, the Chesapeake Bay Program, and the Chesapeake Assessment Scenario Tool (CAST, Phase 6).

These data sources were the most recent available and comprehensive. However, all data sources and methodologies have limitations. For example, current conditions are informed from one snapshot in time. Projected conditions represent only one possible future and by necessity involve a certain level of assumptions. This is not meant to undermine the sources and projections in the WRE. Instead, it's important to understand these are intended as a framework or guide for some of the following questions:

- What are the estimated changes in population and jobs over the plan horizon?
- How could these changes affect the capacity of water and wastewater systems?
- How could these changes affect land use change? What impacts could these have on watershed health?
- If there are potential negative impacts on water or wastewater capacity or watershed health, what are some policy or planning solutions?

Projecting Population Growth

MWCOG's Cooperative Forecasting Program was established in 1975 to allow local, regional, and federal agencies to coordinate planning activities using common assumptions about future growth and development. The first Cooperative Forecast (Round 1.0) was released in 1976, and new iterations of the forecast (in the form of "rounds") have been released when deemed necessary by the Cooperative Forecasting and Data Subcommittee at MWCOG.

Each forecast is prepared by a team of planners, economists, and demographers, and is underpinned by "econometric " data that predicts impacts to employment, population, and households based on national economic trends and local demographic factors. Each round focuses on a base year of analysis, and for the most recent round (Round 10.0), that base year was 2020. Forecasts are also set to a 20-to-30-year target horizon, and the target year for Round 10.0 is 2050. The 2050 horizon is reflected in the tables included in this report. Due to the arrival of the COVID-19 pandemic in 2020, MWCOG retained the consulting firm ICF, Inc., to identify the potential short-term and long-term impacts of the pandemic on assumptions related to growth in various sectors as well as impacts on typical household size.

The utilization of cooperative forecast data represents an effort with this Water Resources Element to incorporate residential development activity data, economic trends, transportation behaviors, cultural and social behaviors, and potential technological innovations into an analysis of how Frederick County might grow in the future because of policy decisions as well as other local, regional, and national influences. The breadth of cooperative forecast data can be attributed to the utilization of Transportation Analysis Zones (TAZ) as a basis for analysis. TAZs were first utilized as part of the 1980 US Census (then recognized as "traffic zones") to capture both "journey to work" and "place of work" statistics. The focus on these two types of locations allows transportation planners to assess the capacity of regional road networks, but it also allows economists, demographers, and planners to infer levels of economic activity implied by the utilization of those networks.

Projecting Non-Point Source Pollution

The Conservation Innovation Center (CIC) of the Chesapeake Conservancy was established in 2013 to "use cutting-edge technology to empower data-driven conservation and restoration." With the aid of funding provided by the Chesapeake Bay Program, the Chesapeake Conservancy partnered with the U.S. Geological Survey (USGS) and University of Vermont Spatial Analysis Lab (UVM SAL) to compile land use and land cover (LULC) data for all 206 counties within the Chesapeake Bay Watershed regional area utilizing National Agriculture Imagery Program (NAIP) imagery and light detection and ranging (LIDAR) survey data. The Conservancy's initial analysis of LULC data occurred in 2015 and 2016 and focused on NAIP imagery collected in 2013 and 2014. The 2022 release of this data (based on 2017/2018 collection) is utilized to establish a baseline from which the potential impacts of land use change may be analyzed.

The Chesapeake Assessment Scenario Tool (a.k.a. CAST model) was first developed in 2011 to assist jurisdictions in assessing their progress toward Watershed Implementation Plan (WIP) goals that had been set for jurisdictions within the 64,000 square mile Chesapeake Bay Watershed by the US EPA as part of the first Chesapeake Bay TMDL. CAST has been adopted as the Chesapeake Bay Program's (CBP) official modeling tool, and it can be utilized at a variety of scales, including the county level. CAST Phase 6 loading rates are used together with baseline data from the Chesapeake Conservancy and future estimated land use to estimate annual loads for each CGA under each scenario. Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS) loading rates (lbs/acre/year) from the Phase 6 CAST 2010 "No Action" scenario for Frederick County are used to estimate pollutant loads for each scenario.

Local Land Use Planning

It should be noted that utilization of the MWCOG, LULC data, and CAST data is not to be construed as a replacement for local planning efforts and expertise. Rather, they are intended as additional evidence to complement these efforts. While the Cooperative Forecast has successfully demonstrated an ability to mirror aggregated, regional trends over time, it does require more thorough review and consideration when analyzed on a more granular scale like a single municipality or specific regions within that municipality's growth area. For this reason, Livable Frederick staff also relied on existing pipeline data, local expertise, and consultations with planning staff representatives for each of the local municipalities as well as the US Army Garrison at Fort Detrick. Additionally, the CAST model is being utilized to "double check" assumptions related to the impacts of new development and the expansion of impervious area, as well as the potential water quality improvements that may be realized in conjunction with other planning efforts under way at the county level, like the South Frederick Corridors Plan. The CAST model can provide insight into the potential for large-scale redevelopment to improve water quality through the incorporation of modern stormwater management "best management practices" (BMPs) that treat water quality in addition to water quantity.

Scenario Planning

This Water Resources Element is a functional component of the Livable Frederick Master Plan, and it incorporates the LFMPs use of scenario planning to imagine possible futures and analyze the potential impacts of those futures. While the drinking water and wastewater assessments focus more on the Cooperative forecast and local planning knowledge as well as pipeline data, the following scenarios were carried forward from the LFMP to analyze the potential impacts of alternative patterns of growth for the stormwater assessment.

Scenario 1 - Business as Usual: This scenario assumes that we maintain the trajectory of our current planning policies, establishing a future direction that reflects past trends.

Scenario 2 - City Centers Rise: This scenario acknowledges the City of Frederick, and developed county land surrounding the city, as a major regional center for business, institutions, residential living, and culture. This scenario assumes that the growth potential of areas within and surrounding the city is maximized to create an even stronger urban center boasting walkable neighborhoods, historic character, and thriving commercial districts.

Scenario 3 - Suburban Place Making: In this scenario, our suburban communities are recognized as vital places, loved by generations of Frederick County residents. This scenario assumes a pattern of reinvestment in suburban areas of the county in order to create additional opportunities to shop, work, and play closer to home.

Scenario 4 - Multi-Modal Places and Corridors: This scenario focuses on our physical connections to places beyond and within our borders. Existing rail and highway corridors connect Frederick County to the larger Baltimore-Washington Region and this model assumes a development pattern that makes efficient use of these transportation systems to move people, build new mixed-use places, and catalyze the redevelopment of aging retail and office developments. The two primary corridors in this model – the CSX/MARC Frederick Branch and the I-270 Corridor – provide a framework for future development and redevelopment in the southern half of the county.

For a more detailed description of the methodologies used and the results yielded for each of these assessments, please refer to the corresponding chapter in this document.

NEW COMPONENTS OF THE 2024 WATER RESOURCES ELEMENT

The content, goals, and objectives of this Water Resources Element maintain some of aspects of the 2010 Frederick County Water Resources Element. However, it is important to note that it has also changed in several important ways. One of those ways, as noted previously in this chapter, is the pivot toward the Livable Frederick Master Plan framework.

In 2022, the Maryland Department of Planning updated the guidance for the preparation of county and municipal Water Resources Elements. As part of that update, all Water Resource Elements are required to address both potential impacts of planned growth on traditionally marginalized communities as well as the impacts a changing climate might have on not only the community at large, but particularly for traditionally marginalized communities.

Each subsection of this Water Resources Element will, in-turn, address potential issues or impacts associated with water supply management, wastewater management, and stormwater management that deal with hardships that can be brought about by a changing climate as well as impacts those changes might have for Frederick County's most vulnerable populations. A consideration of these topics is very much in keeping with the Goals and Visions set forth in the Livable Frederick Master Plan as described in the following summaries.

The Livable Frederick Master Plan, Equity & Environmental Justice

Equality is defined as the even allocation of resources and opportunities across various groups. Equity recognizes that each group's circumstances are unique and allocates appropriate resources and opportunities with the intent of achieving equal outcomes.

Environmental Justice is the fair treatment and meaningful involvement of all people, regardless of race, ethnicity, income, or other social factors, in the development, implementation, and enforcement of environmental laws, regulations, and policies. It ensures Frederick County residents have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices. Of the 65 census tracts within Frederick County, at least 11 are identified as underserved.

The LFMP's Vision Statement provides a description of the characteristics of life in Frederick County in 2040, and, inherent to that Statement, is a guiding focus on equitable and environmentally just outcomes. The Vision Statement can be found on Pages 22 – 29 of the Master Plan. Those aspects of the Vision Statement related to the Water Resources Element include the following:

Lf The Liavble Frederck Master Plan ➔ Vi Our Vision

Our community enables young and old to lead fulfilling lives. We ensure that all people can be successful, enjoy a high quality of life and are free from poverty.

Good health is fundamental to our quality of life. We value a healthy environment, clear air, water, and green energy, and we are good stewards of environmental and natural resources.

Additionally, and more specifically, with regard to water and sewer infrastructure planning, the Livable Frederick Master Plan's Supporting Initiative 1.2.1.3.18, Our Community Infrastructure Design Settlement Patterns Interconnectivity, states the following:

Lf The Liavble Frederck Master Plan ➔ Vi Our Vision ➔ Co 1. Our Community ➔ 2. Infrastructure Capacity

"Ensure that the provision of water and sewer infrastructure fulfills county planning goals and policies and that expansion of water and sewer system capacity maximizes efficiency, addresses public health issues, enhances opportunities for sustainable economic development, and respects the stewardship of natural resources."

With the adoption of the updated Water Resources Element, Frederick County recognizes its role as a steward of the natural resources within the County and its responsibility to those communities that live downstream and rely on the very same waters that sustain life in Frederick County. This role is critical to the continued ordered development of Frederick County, as well as the quality of life in other communities that rely on the waters of the Potomac River basin, including the District of Columbia and Fairfax County, Virginia.

The Livable Frederick Master Plan and Climate

With the adoption of the Livable Frederick Master Plan (LFMP) in 2019, Frederick County had already taken steps toward addressing the impacts of a changing climate on the County's residents and infrastructure. The following Goals, Initiatives, and Supporting Initiatives from the LFMP each address climate change adaptation in one form or another:

Lf The Liavble Frederck Master Plan ➔ Vi Our Vision ➔ Ev 4. Our Environment ➔ 4. Climate and Energy

Goal 4.4.1 Climate Resiliency – Plan and prepare for the impacts to public infrastructure, human health, private property, and the environment from increasing flooding, fires, droughts, crop and tree damage, temperature extremes, and intense storm events.

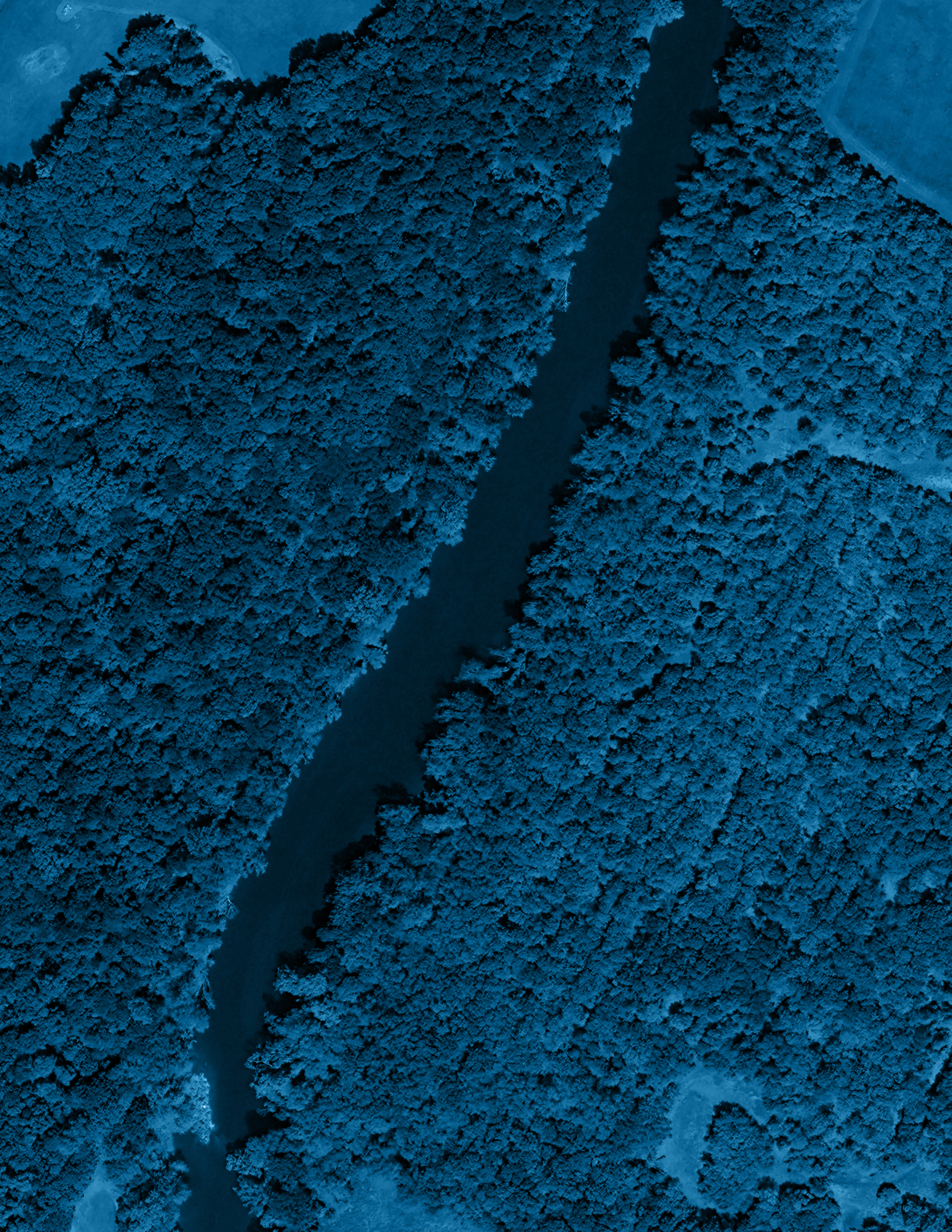
Initiative 4.4.1.1 Hazard Planning – Thoroughly examine, evaluate, and implement the resiliency, adaptation, and mitigation actions needed to prepare the county for future climate related impacts.

Initiative 4.4.1.3 Stormwater Impacts – Plan for and anticipate the impact of increased stormwater flows.

Supporting Initiative 4.4.1.3.2 – Infrastructure is designed to accommodate new storm flows and is resilient to increased severity of weather events.

Supporting Initiative 4.4.2.3.8 – Incentivize development of communities where residents can walk to shops, dental and doctor's offices, and general services.

With the adoption of the updated Water Resources Element, Frederick County recognizes its role in making sure that the potential impacts of a changing climate are minimized through active forethought and careful planning regarding potential hazards such as excessive heat, drought, severe precipitation events and subsequent flooding.



Drinking Water Assessment

INTRODUCTION

As noted in the 2010 Frederick County Water Resources Element, healthy watersheds provide a safe and sustainable drinking water supply. With more than 1,400 miles of rivers and streams in Frederick County, water appears abundant. The perception of abundance highlights the importance of water resources planning, as the availability of sources of clean water can vary significantly from season to season and can also be affected over a period of years with prolonged drought conditions. Additionally, the effects of a changing climate, such as increased evaporation, increased intensity of precipitation, and an increasing frequency of severe flood events have the potential to drastically impact the natural ecosystem as well as those sources of fresh water critical to the population of Frederick County.

In accordance with the goals of the Livable Frederick Master Plan outlined below, the drinking water assessment investigates drinking water supply, drinking water demand, and major issues related to drinking water availability. The assessment also revisits current drinking water policies and projects. The current drinking water supplies for the County and municipal water systems are compared with the projected build out of the respective Community Growth Areas (CGAs) identified in the Livable Frederick Master Plan.

The following goals and initiatives of the Livable Frederick Master Plan address aspects of water supply:

Lf The Liavble Frederck Master Plan → Vi Our Vision → Ev 4. Our Environment → 2. Water

Goal 4.2.1 Quality - Improve and protect water quality for human and environmental health by eliminating impairing levels of pollution to local waterways and by adequately funding and implementing water quality restoration and protection efforts.

Goal 4.2.2 Supply and Treatment Infrastructure - Ensure groundwater and surface water remain safe, reliable, and sustainable sources for public consumption.

Initiative 4.2.2.1 Water and Sewer Adequacy - Ensure that wastewater and water supply infrastructure is adequate, sound, and efficient to provide for current and future populations.

Supporting Initiative 4.2.2.1.2 Thoroughly evaluate the location and size of areas dedicated for growth and development based on the adequacy of impacts to drinking water supplies and wastewater treatment and conveyance capacities.

DRINKING WATER SOURCES, QUALITY, AND SUPPLY

In Frederick County, drinking water is obtained from surface water and groundwater sources, and the two supplies are intimately related. Groundwater is stored in aquifers beneath the ground that are recharged by precipitation. In an unconfined aquifer, the most common in Frederick County, groundwater moves horizontally before it is discharged into a stream or other surface water body, such as a seep, spring, or wetland. Stream flow directly correlates with the rise and fall of the water table, and both are impacted by climatic conditions and droughts.

If not prudently managed through sound planning and development practices, disruptions to the natural hydrologic cycle by land use can affect the availability of both groundwater and surface water. The steady increase in the County's population expected over the next ten years and beyond poses limitations to these resources. Increased development reduces water recharge through increased impervious surface and associated increases in surface water runoff. It also has the potential for introducing new pollutants and contaminants to both groundwater and surface water. As noted previously in this document, changes in the frequency and intensity of precipitation events as a result of climate change can have profound effects on both sources as well.

Groundwater

The available supply of groundwater in Frederick County is dependent upon the underlying geologic conditions. In most areas of Frederick County, the water bearing characteristics of the geology offer low storage capacity and low transmissibility due to an extensive stream network and typically fine-particle soils. The United States Geologic Survey (USGS), Maryland Geological Survey (MGS), and the Maryland Department of the Environment (MDE) have generalized the water yielding character of the County's aquifers and organized them by hydrogeomorphic region. The provinces/regions located in Frederick County are the Blue Ridge (or BR), the Middletown Valley (Piedmont Crystalline or PCR), the Frederick Valley (Piedmont Carbonate or PCA), and the Mesozoic Lowlands (or ML).

Groundwater availability is difficult to predict, as aquifers are not confined to topographic, political or watershed boundaries. Availability is often based on the amount of recharge (in the form of precipitation and septic system discharge) to the aquifer less the amount of water required to provide base flow to streams. This method provides an estimate, usually on a watershed scale, and is not used to guarantee availability at a particular well. The nature of underlying geology in the fractured rock aquifers that underly much of the County can also impact the anticipated yield of planned private or municipal wells.

As a result of a severe droughts in 1998 - 1999 and 2001 - 2002 and the effects experienced by municipalities and associated water utilities in the region (including building restrictions and moratoriums), the Maryland Department of the Environment and the Maryland Geological Survey undertook multiple studies in an attempt to ascertain influences on well yields and the impacts associated with withdrawals for public water supply wells. In 2012, the Maryland Geological Survey (Burgy and Duigon, 2012) studied 2,315 wells in Frederick, Montgomery, and Carroll Counties to evaluate factors affecting well yield, and the study found that well use is a significant factor that affects yield.[1] The study also found that public supply and industrial wells, which often benefit from better siting and increased depth and (bore hole) diameter, tend to exhibit better yields than domestic wells. Additionally, yields of wells in the Piedmont physiographic region tend to have greater median yields and variability than those in the Blue Ridge, though the difference was not statistically significant. The study also found that siting and depth to bedrock may be statistically significant factors affecting yield, though this is not consistently demonstrated across well-use groups.

A study by the Water and Science Administration (then the Water Management Administration) of the Maryland Department of the Environment, completed in 2022, noted that there have been about 100 known private wells of the nearly 200,000 in the State of Maryland (0.05%) that have been impacted by proximate withdrawal for public water supplies or other sizeable withdrawals of groundwater (>10,000 gpd).[2] The associated report also noted that, in approximately 90% of these cases, the impacts associated with these withdrawals occurred in Montgomery County (Poolesville, MD), Carroll County (Taneytown, MD), or in the southwestern limits Garrett County (Oakland, MD). Notably, two of the cases studied were in Middletown and Myersville in Frederick County. The report also indicated that, while testing and monitoring data have been collected since the droughts of the early 2000's, conditions unique to each particular location's geology inhibit the development of a specific methodology for calculating the influence of withdrawal for a community water supply on private wells in the vicinity. As a result, when a new public water supply well or other similar withdrawal of more than 5,000 gpd and requiring a Water Appropriation and Use Permit is proposed for permitting purposes, MDE now requires an inventory of surrounding water supply wells for the purpose of aquifer testing and has established certain radial distances for the establishment of test locations from the proposed well sites based on underlying geology. In the case of those individual wells near Middletown and Myersville that were impacted by the new community water supply withdrawals, those properties were connected to the municipal systems.

1 Burgy, K., & Duigon, M. T. (2012). Preliminary Assessment of Factors Affecting Well Yields in The Fractured-Rock Terrane of Frederick County and Portions of Carroll and Montgomery Counties, Maryland. In Report of Investigations No. 79 (DNR Publication No. 12-5102012-567). Maryland Geological Survey.
2 Hammond, P. A. (2022). Interference Impacts Caused by Groundwater Withdrawals from Public Supply Wells in The Crystalline Rock Aquifers of Central Maryland. Maryland Department of the Environment, Water Management Administration. Retrieved February 8, 2024.

The water balance method Is used by the Maryland Department of the Environment (MDE) for distribution of Water Appropriation or Use Permits (WAUPs) for groundwater withdrawals for community water systems (CWSs). To apply for a permit, a community must own or otherwise control (such as through easements) sufficient undeveloped land resources to allow for recharge of the aquifer they intend to utilize for withdrawal. The amount of land acquired or placed under easement for recharge is then calculated in conjunction with the 7-day, 10-year low flow (7Q10) for the watershed/stream in which a planned withdrawal is located to determine how much water might safely be withdrawn without reducing the flow in the associated stream to unpermitted levels during drought conditions. This policy primarily affects municipalities that are constrained by a municipal boundary with respect to where their wells are located. These communities must develop under Maryland State "Smart Growth" policies, which prescribe higher densities for growth areas, while also identifying land resources to keep in permanent open space for their groundwater appropriations.

In summary, groundwater supplies in Frederick County have diverse limitations affecting a broad range of users. As identified in the 2010 Frederick County Water Resources Element, the most limiting factor in identifying and maintaining future groundwater supplies will be the difficulty in locating sufficiently high yielding well sites necessary for public water supplies and in ensuring that those supplies remain viable in the face of drought or other potential environmental and man-made disasters. The County continues to move toward providing community drinking water from more reliable surface water supplies. There are several areas in which well sites are currently off-line and only used as a back-up supply. As population increases in communities relying on groundwater, like Libertytown, Middletown, Thurmont, Walkersville, and Woodsboro, they will need to continue to steward a valuable resource as well as identify alternatives that will serve to diversify their current supplies.

Surface Water

The most abundant surface water supply available to Frederick County is the Potomac River. The river drains a watershed of 14,679 square miles encompassing parts of West Virginia, Virginia, Maryland, Pennsylvania, and the District of Columbia. Frederick County, at 664 square miles in size, represents approximately 4.5% of the total contributing area to the river basin. The river originates at Fairfax Stone, West Virginia and runs 383 miles to its confluence with the Chesapeake Bay at Point Lookout, Maryland. Frederick County's use of the Potomac River is considered non-consumptive because the return flow discharged from the County's wastewater treatment plants (WWTPs) is typically at or near the County's withdrawal rates from the Potomac River.

The highest flow on record for the Potomac River was measured in 1936 at Point of Rocks, Maryland at 310,080 mgd (480,000 cubic feet per second (cfs), or more than 50 times the average flow), which reached a gage height of 41.03 feet. The average flow at Point of Rocks for the period of record is 6,147 mgd. The record low flow was 342 mgd in September 1966, which is about 6% of the average (Frederick County Water and Sewerage Plan, 2021).

The Potomac River supply is augmented by two reservoirs: Jennings Randolph located on the North Branch of the Potomac in Garrett County, MD and Little Seneca Lake located on Little Seneca Creek near Boyds in Montgomery County, MD. Releases are made from the reservoirs when low flow conditions of 600-700 mgd are present. The Potomac River has a minimum flow-by requirement of 100 mgd (the minimum flow needed to maintain suitable conditions for fish and aquatic communities); summertime demand ranges between 400 and 700 mgd. The Interstate Commission on the Potomac River Basin's Cooperative Water Supply Operations Office (CO-OP) was established in 1979 to engage in long term planning, to monitor drought conditions, and to conduct drought exercises with the goal of ensuring that the Potomac River's water resources can continue to meet future demand.[1] As part of ongoing monitoring operations, CO-OP noted that low flow conditions resulting from low groundwater levels and low precipitation levels over the summer months in 2023 (10% below average) led to an elevated chance of releases from the reservoirs for the fall and winter of 2023 (ICPRB Water Supply Outlook, August 2023). Precipitation received in November of 2023 resulted in a suspension of monitoring activities due to sufficient water levels as indicated by USGS gaging stations on the Potomac River that has carried forward into 2024.

The volume and consistency of the Potomac River's flow has leveraged it to become the County's principal source of community drinking water. Other sources of surface water used for drinking water, including the Monocacy River, Catoctin Creek, Linganore Creek, Turkey Creek, and Fishing Creek, have availability limitations that restrict their use as a primary source due to "flow-by requirements" mandated by the State of Maryland. As is the case with groundwater withdrawals for water supplies, these requirements, which protect the biological integrity of the stream, are based on the 7-day, 10-year low flow (7Q10). Without an in-stream or adjacent reservoir or other means of adequate storage, some streams

1 https://www.potomacriver.org/focus-areas/water-resources-and-drinking-water/cooperative-water-supply-operations-on-the-potomac/

cannot always meet the minimum required flow to function as a community water source while still supporting necessary ecological functions, such as sustaining fish and wildlife populations. Linganore Creek, Turkey Creek, and Fishing Creek are augmented by reservoir storage; however, the relatively small reservoirs provide limited, sustained, safe yields.

The Code of Maryland (COMAR, Title 26, Part 3, Subtitle 17) states that water systems in Maryland that withdraw water from the Potomac River must comply with the Potomac River Low-Flow Allocation Agreement (LFAA) of 1978. The LFAA limits the total amount of consumptive use by a permittee (for surface water withdrawal) to 1 million gallons-per-day (mgd). The State of Maryland entered the LFAA to ensure that Washington D. C., Arlington County, and Falls Church, VA, would maintain adequate water supplies during times of drought. For more information on the LFAA, see the Major Water Issues section later in this chapter.

Surface Water Appropriations

Surface water is appropriated by the Maryland Department of the Environment (MDE) for a maximum period of twelve years. The County holds a WAUP for the Potomac River and Linganore Creek. The combined permitted withdrawals total 16.3 mgd (daily average) and 28.0 mgd (maximum daily). A portion of this appropriation is used by the City of Frederick as part of the Potomac River Water Service Agreement (PRWSA) that was entered into by the City of Frederick and Frederick County in 2006.

The following Frederick County jurisdictions hold individual WAUPs for surface water withdrawals: City of Frederick (Monocacy River, Fishing Creek, Potomac River, and Linganore Creek), City of Brunswick (Potomac River), Town of Emmitsburg (Turkey Creek), and the Town of Myersville (Little Catoctin Creek). Fort Detrick in the City of Frederick also maintains its own water system and has a withdrawal permit for the Monocacy River.

WATER QUALITY PROTECTION

The quality of drinking water varies by source, and different types of sources face different types of threats and present different types of challenges. Surface water is vulnerable to contamination from nonpoint sources such as runoff from parking lots, roads, and agricultural lands as well as within waterway algal blooms. Therefore, water quality concerns like sedimentation, potential spills, and fecal contamination are more prevalent.

Groundwater quality can be negatively impacted by naturally occurring radon or iron and can also be contaminated by fecal coliform, particularly from septic systems. Groundwater may also be impacted by active quarry operations that exist in the County. The State of Maryland has delineated zones of dewatering influence where quarry operations may impact wells of individual residences or wells for community water systems. Several such zones are associated with the quarrying operations around the Town of Woodsboro.

In certain areas within the County that are subject to subsurface erosion (also known as karst topography or karst aquifers), groundwater may also be influenced by the infiltration of surface water through eroded channels in the bedrock.

Wellhead Protection

The State of Maryland currently has regulations that provide minimum wellhead protection to all public water supply wells. Well construction regulations require wells using an unconfined aquifer as a water supply source to be located 100 feet from identifiable sources of contamination and designated subsurface disposal areas. In addition, there are minimum distances set for location of wells away from sewer lines, roads, building foundations, and property lines.

The Wellhead Protection Program is administered by the Maryland Department of the Environment and relies upon coordination among several other state agencies, federal agencies, and local governments. Oversight authority is combined to manage all potential sources of contamination in a Wellhead Protection Area (WHPA). A WHPA is defined as the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field. Delineation of the Wellhead Protection Area is not usually a simple matter of measuring a horizontal distance on the land surface. Maryland extends across eight physiographic regions, which results in extremely varied hydrological settings. The selection of methods and criteria for delineating WHPA's can be complex and varied. See Map 4 for the designated WHPAs in Frederick County.

In response to the Clean Water Act requirement, the state has prepared Source Water Assessments (SWAs), which inventory and map potential sources of contamination such as underground storage tanks and other potential sources of contamination in the WHPA of a public drinking water well or well field. In 2007, Frederick County enacted legislation that regulates the location of hazardous substance storage tanks in relation to a community water supply system well and requires that a hazardous substance storage tank must be more than 500 feet from a community water supply system well. When a hazardous substance storage tank is located within a WHPA and is greater than 500 feet from a community water supply well, the tank must be above ground, surrounded by a 100% catchment basin or double-walled containment, and monitored by a spill protection overfill alarm. Outside a WHPA, the tank may be located underground if accompanied by a report from a hydrogeologist describing the nature of the underlying soil, the geologic structure, the aquifer, the likelihood of contamination of the neighboring water sources in the event the contents of the tank are discharged, and the estimated groundwater travel time.

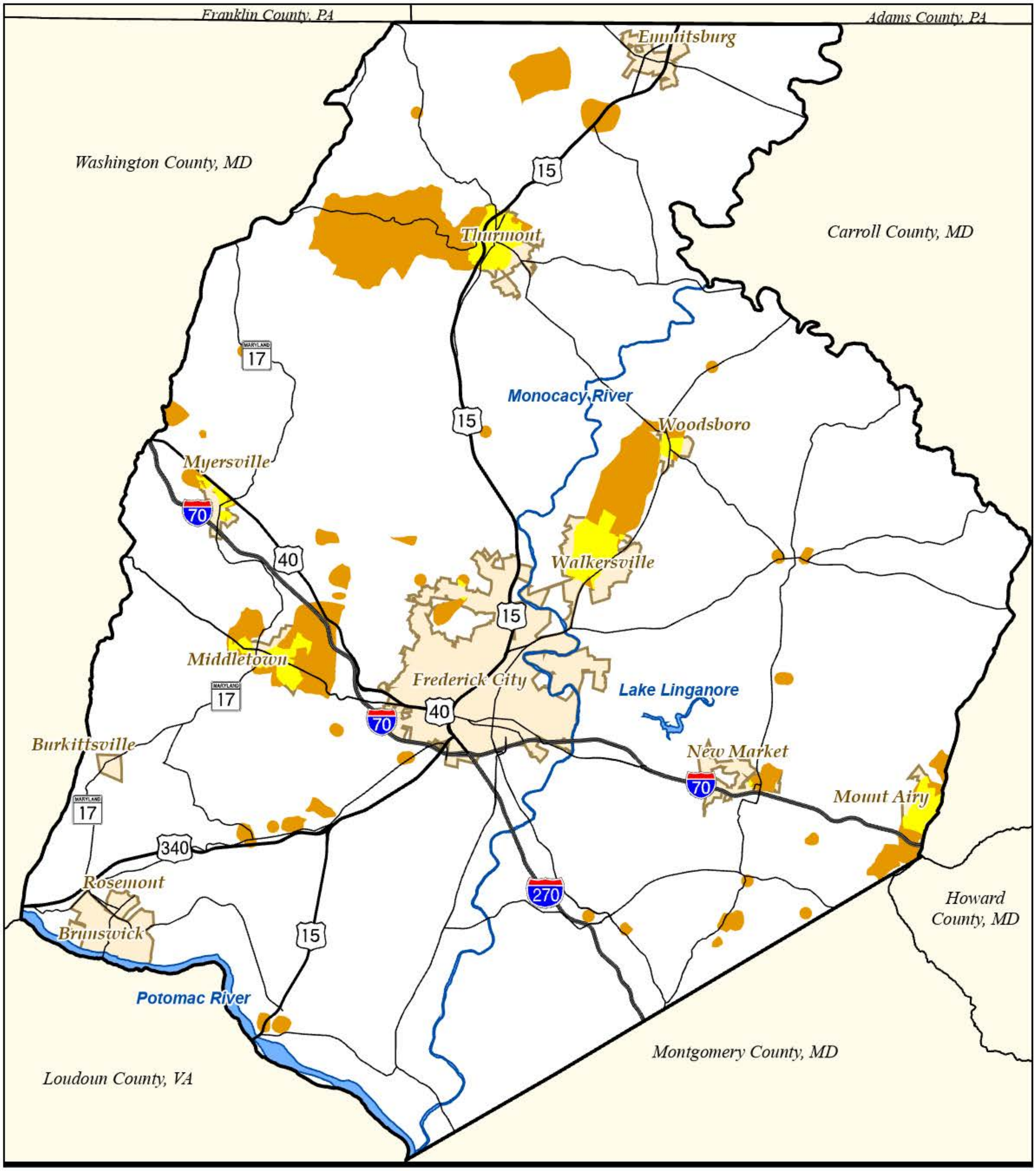
The County may refuse to grant a permit for a hazardous materials storage tank if there is undue danger to the public health, safety, or general welfare. The location of all community water supply system wells has been mapped and the tank location regulations are implemented by a permit system, which refers to those maps. Frederick County also amended the Permitted Use Chart in the Zoning Ordinance to indicate that several land uses are now prohibited in Wellhead Protection Areas, and they, and other uses, are marked and cross-referenced to the storage tank section of the Code. The Special Exception requirements for uses, which might address the storage or leakage of hazardous substances, were also amended to cross-reference the storage tank section of the Code as part of the 2007 updates.

Source Water Assessment and Protection

Water quality standards are in place for community systems using ground and surface water. Regular testing of drinking water is a requirement. The federal Safe Drinking Water Act amendments of 1996 require public systems to conduct Source Water Assessments to better understand the vulnerabilities of their water sources. In the early 2000s, the State of Maryland completed or contracted Source Water Assessments for all public, municipal water systems in the state, and plans were compiled for all municipal systems in Frederick County. These plans designate Source Water Assessment Areas (SWAAs) for each system, identify potential sources of contamination, list in detail the susceptibilities of the supply, and offer recommendations for continued protection.

Typical contributing sources of concern associated with impaired water quality that are identified and addressed as part of these assessments are sedimentation, nitrates, phosphorous, human pathogens, natural organic matter, fecal contamination (coliforms, Cryptosporidium and Giardia), algae (with several toxin-producing species benefiting from a warming climate), taste and odor compounds, gasoline related compounds, and other contaminants that may be introduced through potential spills.

In response to potential hazards identified during the preparation of SWAs, the vulnerabilities of several municipal water supplies were addressed with the preparation of Source Water Protection Plans (SWPPs) in the following years that provided updates on topics addressed in SWAs and identified potential measures that could be undertaken to help preserve the integrity of the systems. In 2013, SWPPs were adopted for the Fountaindale system (Frederick County maintained), the Town of Myersville system, the Town of Thurmont system, and the Town of Woodsboro system. These plans propose a set of recommendations for agriculture, development, infrastructure and maintenance, homeowners, and outreach. The recommendations, once implemented, serve to improve the water quality and quantity issues within the SWAAs.



Map 4: Wellhead Protection Areas

Frederick County, Maryland
Division of Planning and Permitting
Frederick County GIS

Delineated Municipal and Community Wellhead Protection Areas

Delineated Municipal and Community Wellhead Protection Areas within Incorporated Limits

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0 1 2 3 4 Miles

Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet
While efforts have been made to ensure the accuracy of this map, Frederick County accepts no liability or responsibility for errors, omissions, or positional inaccuracies in the content of this map. Reliance on this map is at the risk of the user. This map is for illustration purposes only and should not be used for surveying, engineering, or site-specific analysis. Printed 10/25/2023, 00092\Master_Plan\2024

FREDERICK COUNTY WATER SYSTEMS

In Frederick County, community drinking water is either currently provided or planned for land within the unincorporated community growth areas and most municipalities. The designated community water service areas generally mirror the community growth boundaries with which they are associated. According to the 2021 Frederick County Water & Sewerage Plan, approximately 66% of the County's residents, or 169,452 people, obtained their drinking water from community water systems. Work associated with the 2024 update to the County's Water & Sewerage Plan indicates that this percentage has increased to approximately 68% of the County's residents, or approximately 194,558 people. This represents a change from the allocation identified in the 2010 Frederick County Water Resources Element, which indicated that 60% of the population was served by community systems with the remaining 40% of the population relying on individual wells. This decrease in the percentage of the population being served by individual wells is most likely the result of a concerted effort to direct development to growth areas that are served by public water systems. It should be noted that the total number of individual wells is not necessarily decreasing within the County. In fact, it could be increasing as a function of continued population growth, just not at the same rate as new service connections to community drinking water systems.

Frederick County currently operates and supplies six regional Community Water Systems (CWS), including: Cambridge Farms, Copperfield, Fountaindale, Libertytown Apartments (aka Libertytown West), Libertytown (East), and New Design. The County also operates four sub-regional Community Water Systems that include the White Rock, Samhill, Windsor Knolls, and Bradford Estates facilities.[2]

The County's Water and Sewerage Plan, the Livable Frederick Master Plan, and the WRE, seek to generally limit connection to a CWS ("public water") to properties within regional service areas <u>or</u> Community Growth Areas. These service and growth areas are delineated on the County's Water and Sewerage Plan maps. It is important to note that a service area and a CGA are not, necessarily, interchangeable. Some existing service areas are located outside CGAs, such as the White Rock, Samhill, Windsor Knolls, and Bradford Estates service areas.

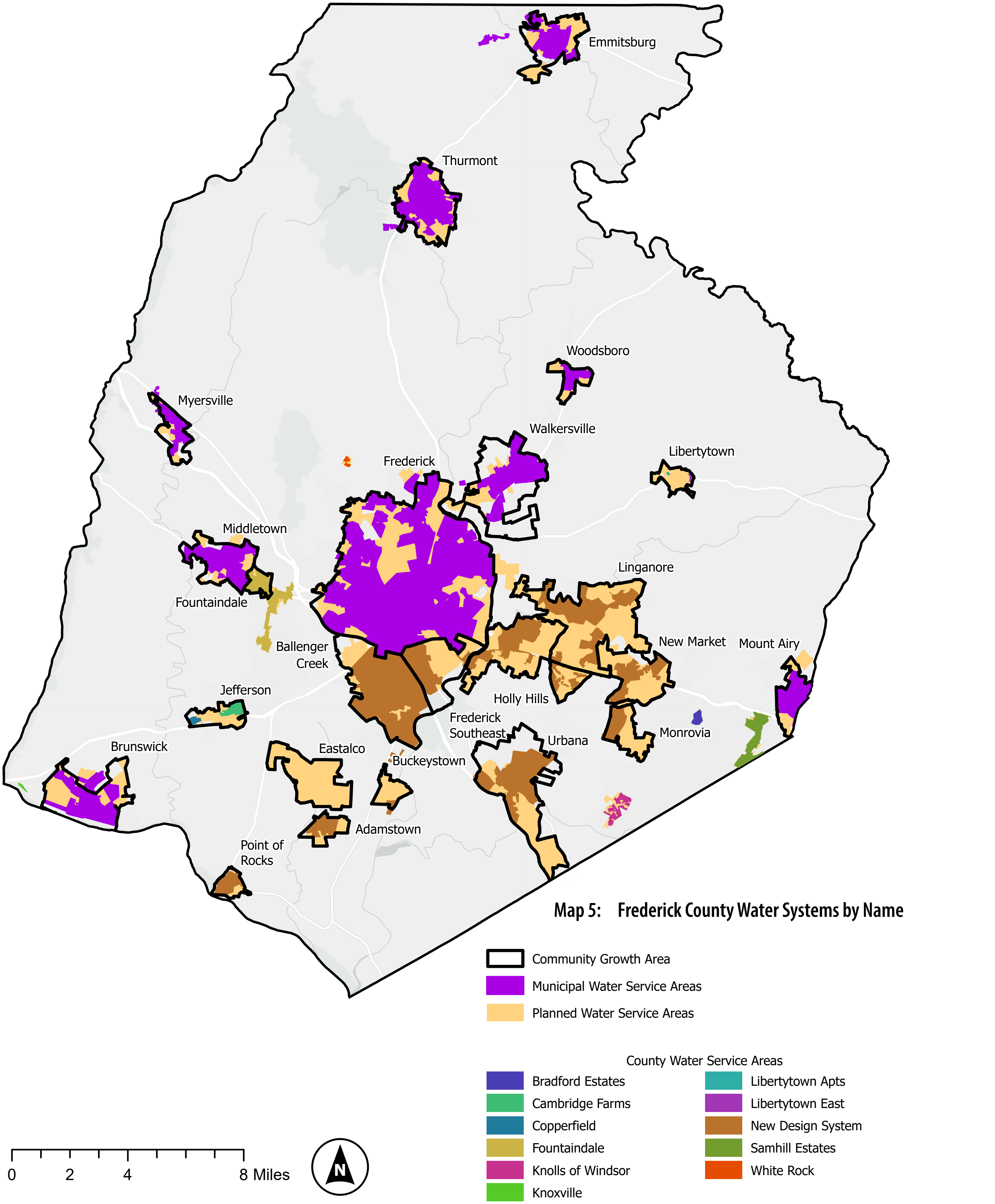
While it is the policy of the County to extend new public water service to areas designated for growth (CGAs), there are situations when a public water connection, or a new service area outside of a CGA, are warranted. The Water and Sewerage Plan has specific policies and procedures to address these exceptions.[3] As noted in this WRE's Introduction, as well as the 2010 WRE (Page 2), the Water and Sewerage Plan, and its rules, procedures, and classification mapping, is the official document guiding water and sewer planning in Frederick County and takes precedence over the information or general policies and recommendations contained within this Water Resources Element.

The service areas depicted on Map 5 reflect properties with a water classification of "1" (existing service) under the Frederick County Water and Sewerage Plan. In some locations, properties with a classification of "3" (service expected within 3 years) that have received approval of development plans and are substantially under construction have also been included in the existing service area. The Planned Service Area would generally be expected to have water service within a 20-year time frame. However, areas within a Community Growth Area may also have a No Planned Service (NPS) water category, indicating a longer-term time frame for public sewer service than the Planned Service (PS) category, consistent with growth policies in the County Comprehensive Plan and the Water and Sewerage Plan.

It is important to note that there is not a direct correlation between the water service areas and wastewater service areas that are supplied or serviced by the Frederick County Division of Water and Sewer Utilities (DWSU). The service areas for these utilities have evolved over time in response to opportunities and challenges that have been overcome through partnerships between the County and various municipalities. The following maps are reflective of the fact that certain municipalities, like New Market, rely on the County for both water and sewer service. Walkersville maintains their own water system but wastewater is directed to the County's Ballenger-McKinney WWTP. Yet other municipalities,

2 Frederick County also maintains distribution networks for the communities of Rosemont, Cloverhill, and Waterside. Water for these networks is supplied by the City of Brunswick in the case of Rosement and the City of Frederick in the case of Cloverhill and Waterside.

3 The construction of new sub-regional systems outside of Community Growth Areas is not permitted, although there are exceptions for water problem areas. For more information, refer to Water and Sewerage Plan Chapter 1, Section E. General Policies, Policies #4, Sub-Regional Water and Wastewater Plants; #5, Plant Size-Service Area; and Policy #11, Response to Sanitary and Water Supply Problems.



Map 5: Frederick County Water Systems by Name

like the City of Frederick, maintain their own, independent water and sewer systems, but also coordinate with Frederick County to enter cost-sharing agreements to provide service to certain areas within the City of Frederick and its surrounding growth area.

There are several additional locations in the County in which DWSU cooperates with municipalities and/or other jurisdictions to provide drinking water. The Village of Rosemont's water distribution infrastructure is owned and maintained by DWSU, but water supplied through that infrastructure is provided by the City of Brunswick. Additionally, in the northwestern limits of the county, the Highfields/Cascade system provides drinking water to the unincorporated community of Sabillasville, with the infrastructure being owned and operated by neighboring Washington County.

Current and Future Capacity (Frederick County Systems)

The following table depicts the water treatment plant (WTP) capacities and the current and future demand for treatment facilities owned and operated by Frederick County's Division of Water & Sewer Utilities (DWSU). It is important to note that the water treatment capacities described in Table 2.01 reflect current, permitted capacities and current demand of the individual county systems as derived from an analysis of monthly distribution totals for the years 2021 through 2023. Permitted capacity could possibly be increased in the future, dependent upon federal, state, and local approvals.

Potential future needs (in terms of capacity) are identified for the 10-year planning horizon for this Drinking Water Assessment (2035) and the 25-year horizon (2050) identified in Maryland Department of Planning guidance. Estimates of future capacity reflect projections developed by staff utilizing local planning knowledge, residential pipeline data, and Round 10.0 of the MWCOG Cooperative Forecast. Growth projections are intentionally aggressive so that weaknesses or inadequacies in the infrastructural and environmental systems serving our communities may be identified, studied, and remedied before significant problems arise.

The methodology used to predict future utilization of drinking water systems is identical to that which is employed in the Wastewater Assessment to predict impacts to wastewater systems. In both chapters, water use by existing residential development is assumed to be captured by the current average and current maximum demand. The impact of future residential development is tallied using the total number of new dwellings within a community growth area, multiplied by the equivalent of 250 gallons-per-day-per-dwelling, also known as an "Equivalent Dwelling Unit" (EDU). This unit of measure is also utilized by the Maryland Department of the Environment for the permitting and tracking of water and wastewater systems. As previously indicated, the total number of new dwelling units in each growth area for target years 2035 and 2050 has been set by Livable Frederick staff based on local planning knowledge, existing pipeline data maintained by the Frederick County Division of Planning and Permitting, and population projections in the Round 10.0 Cooperative Forecast to the year 2050.

For the purposes of estimating non-residential water utilization in the drinking water and wastewater assessment, existing non-residential use is also assumed to be captured by the existing average and maximum demand. Future non-residential use is based on local planning knowledge coupled with employment projections identified in the Round 10.0 Cooperative Forecast. To correlate employment trends to corresponding growth areas in Frederick County, Transportation Analysis Zones (TAZs) have been utilized. TAZs allow for a variety of data – inherent to TAZs because of widespread regional and national adoption – to be brought to bear upon this exercise. It should be noted that TAZ boundaries do not necessarily follow municipal boundaries or Community Growth Area boundaries. For that reason, the approximate percentage of each TAZ that falls within a County or Municipal growth area boundary was approximated and results were apportioned accordingly. In some cases, the analysis internalized specific knowledge about the developability of certain land areas to reflect the amount of development in the TAZ that would be attributable to the specific municipality or county growth area. For County systems, non-residential water use was also projected to the 2050 planning horizon.

For a more in-depth evaluation of the growth projections see the supplemental data published concurrently with the release of the Water Resources Element.

Table 2.01 Water Supply and Demand by County Service Area

Service Area	Permitted Withdrawal (avg. MGD) (1)	Permitted Withdrawal (max. MGD) (1)	Existing Treatment Capacity (MGD) (1)	Existing Demand, Yearly Average (MGD) (2)	Maximum Demand, Monthly Average (MGD) (3)	Projected Demand, Yearly Average 2035 (MGD)	Projected Demand, Yearly Average 2050 (MGD)
Rosemont (4)	0.038	0.060	-	0.010	0.019	0.012	0.013
Copperfield (5)	0.075	0.124	0.075	0.046	0.060	0.057	0.092
Cambridge Farms (6)	0.062	0.100	0.062	0.042	0.054	0.042	0.042
Fountaindale/ Braddock	0.280	0.420	0.280	0.167	0.204	0.192	0.237
White Rock	0.030	0.045	0.030	0.022	0.036	0.022	0.022
Samhill Estates	0.156	0.260	0.156	0.088	0.117	0.088	0.088
Bradford Estates	0.017	0.028	0.017	0.012	0.016	0.012	0.012
Knolls of Windsor	0.107	0.177	0.107	0.066	0.089	0.066	0.066
Libertytown West (7)	0.093	0.147	0.093	0.003	0.004	0.091	0.123
Libertytown East	0.016	0.024	0.016	0.007	0.010	0.007	0.007
New Design (8)	16.000	26.000	25.000	6.537	11.433	9.892	13.232
TOTALS	**16.874**	**27.385**	**25.836**	**7.000**	**12.042**	**10.481**	**13.934**

(1) Information obtained from Frederick County Water & Sewerage Plan – Approved – February 2, 2021 (as amended August 25, 2023) – Table 3.04.
(2) Average of 2021 – 2023. WTP flow data provided by Frederick County DWSU, unless otherwise noted.
(3) The maximum demand monthly average is the maximum average daily flow for a single calendar month from the 2021 – 2023. WTP flow data provided by Frederick County DWSU.
(4) Rosemont water is supplied by the City of Brunswick. Permitted withdrawal listed per the Rosemont Water and Sewer Service Area Agreement, dated April 2013. The unincorporated community of Knoxville is also supplied by the City of Brunswick. These systems have been noted in the chart due to the potential for limited (but potential) growth in utilization.
(5) Includes approved allocations for the Woodbourne Manor Wells. Permit numbers are FR2004G103(02) & FR2004G003(02).
(6) Does not include permit FR2024G001(01) for 5,000 gallons per day (average) and 8,000 gallons per day (maximum) approved October 2024.
(7) Includes the former Libertytown Apartments system infrastructure and wells. Also Includes approved allocations for the Mill Creek and Mayne Wells. Permit numbers are FR2013G004(01) and FR2006G004(06).
(8) The Quantum Frederick Data Center campus is located within New Design WTP service area. The current allocation of drinking water for this project has been included in the Projected Demand, Yearly Average for 2035 and 2050.

Capacity Management

The Environment Article of the Annotated Code of Maryland Title 9, Subtitles 2 and 5, sets forth requirements for ensuring the adequacy of public water supplies to serve new development as well as the authority of the Secretary of MDE to require Capacity Management Plans (CMPs) for community water systems. CMPs are submitted by owners of drinking water systems utilizing more than 20,000 gpd of water if they are operating at more than 80% of average permitted withdrawal or purchasing water at more than 80% of their contractual limit with their supplier. [4]

4 If "Existing Average Demand," exceeds 80% of the "Average Permitted Withdrawal" in Table 2.01 per https://mde.maryland.gov/programs/water/water_supply/Documents/WaterSupplyCapacityPlansGuidance2013.pdf.

Typically, CMPs address current utilization, sources of potential excess capacity, and controls that are established by systems to ensure that drinking water allocations do not exceed permitted capacity. Capacity Management is being addressed in this Drinking Water Assessment, but the Frederick County Water & Sewerage Plan, which is updated by the County on a revolving 3-year basis and approved by MDE, is the official document of record for tracking Capacity Management. The Water & Sewerage Plan is available on the County website at the following location: *https://www.frederickcountymd.gov/8653/Water-Sewerage-Planning*.

The following table summarizes current and future utilization estimates based on the values in Table 2.01. As of the drafting of this Water Resources Element, no County systems require the development of a Capacity Management Plan for drinking water service.

Table 2.02 Utilization by County Service Area[5]

System Name	Current % Utilization	2035 % Utilization	2050 % Utilization
Rosemont	27%	32%	35%
Copperfield	61%	75%	122%
Cambridge Farms	67%	67%	67%
Fountaindale/Braddock	60%	68%	85%
White Rock	73%	73%	73%
Samhill Estates	56%	56%	56%
Bradford	71%	71%	71%
Knolls of Windsor	62%	62%	62%
Libertytown West	3%	97%	131%
Libertytown East	44%	44%	44%
New Design	41%	62%	83%

Table 2.02 indicates that the Libertytown West system would likely require a CMP prior to 2035 and that the Copperfield system could require a CMP near the 10-year plan horizon. Additional capacity would be needed for both systems by 2050. The Fountaindale/Braddock system and the New Design system could require CMPs by 2050, but they would not exceed average permitted capacity.

As noted above, the thresholds indicated in this chart have been provided for planning purposes only, and the Frederick County Water and Sewerage Plan is the governing document regarding the management of drinking water system capacity. That being stated, Table 2.02 does identify potential actions that could be taken to address future need, including linking the separate systems in Jefferson and Libertytown and the exploration of additional capacity for those systems.

The topic of Capacity Management is focused solely on County owned and operated drinking water systems for the purposes of this Water Resources Element. Frederick County's Division of Water and Sewer Utilities coordinates with the incorporated municipalities with regard to the preparation and implementation of the Frederick County Water and Sewerage Plan, but individual municipalities are each responsible for their own Capacity Management unless water or wastewater service is provided by Frederick County, as is the case with the Towns of Walkersville (wastewater) or New Marking (drinking water and wastewater).

Potential Futures for County Water Service Areas

The introductory chapter of this Water Resources Element briefly described four potential Development Frameworks that were considered as part of the Livable Frederick Master Plan Process, including: Business as Usual, City Centers Rise, Suburban Placemaking, and Multi-Modal Places and Corridors. While no single framework was ultimately adopted as part of the LFMP, each contributed to the development of the LFMP Thematic

5 Rosemont/Knoxville have been included in this analysis due to limited, yet potential, growth in the system.

Plan. The intent of the Thematic Plan was to ". . . achieve a pattern of development that employs a jobs-based approach to growth and that is centered on multi-modal accessibility in Frederick County, taking advantage of the existing transportation systems in place, the future systems and technologies for moving people and products, and the innovative land use patterns that support transportation choices." This focus on transportation choice recognizes the importance of existing incorporated municipalities and those unincorporated communities that have been designated as Community Growth Areas. These places have the inherent ability to serve as hubs of future growth that reduce dependence on automobile travel and facilitate the implementation of alternative modes of transportation. The following service areas, and the growth areas they serve, are anticipated to experience noticeable growth by the 2035 or 2050 plan horizons. An overview of each of these systems, including additional information regarding current and future improvements, is included in Appendix A.

New Design Service Area

The New Design Service Area is the largest of the existing service areas, covering the Adamstown, Ballenger Creek, Buckeystown, Eastalco, Linganore, Holly Hills, Spring Ridge, Bartonsville and Urbana Community Growth Areas. It also covers the Feagaville/Mt. Zion area associated with the Jefferson Technology Park (Ballenger Creek CGA) and the urban revitalization associated with the South Frederick Corridors Plan (Frederick Southeast CGA and a portion of the Ballenger Creek CGA).

Non-residential water use for the 10-year planning horizon for the Water Resources Element is anticipated to see the continued build-out of the Quantum Frederick Data Center campus on the former Alcoa "Eastalco" facility site, as well continued expansion of businesses in the I-270 corridor of the Urbana Community Growth Area.

Residential growth is expected throughout the service area, with a particular emphasis on the area around Lake Linganore, as well as the Urbana/I-270 corridor. Initial infill and redevelopment, with a residential focus in the South Frederick Corridors planning area, is also expected to begin during this time.

The analysis conducted as part of this Water Resources Element also indicates that, while average demand and the demand for the month of maximum use may more than double for the service area by 2050, calculations indicate that the New Design WTP appears to have adequate capacity to address the anticipated 26,780 equivalent dwelling units that could be constructed within this service area.

Copperfield and Cambridge Farms (Jefferson) Service Areas

The unincorporated community of Jefferson is situated on two established, well-traveled highways between the City of Frederick and the communities of Brunswick in Frederick County and Harpers Ferry, Charles Town, and Martinsburg in West Virginia via MD-340. Additionally, the cities of Leesburg and Ashburn, Virginia, on the western banks of the Potomac are readily accessible via US-15 from Frederick County.

The 10-year planning horizon for this area includes the build-out for the Jefferson Village age-restricted development and a modest expansion of non-residential uses associated with businesses seeking to take advantage of Jefferson's location along two important regional highways.

Planning staff also believe that Jefferson's location could make it an attractive location for potential future residential growth toward the latter half of this document's planning horizon in the years 2040 to 2050. To accommodate increased residential capacity, it may be necessary to establish an interconnection between the Copperfield and Cambridge Farms systems and to explore additional sources of groundwater through developer-initiated improvements to the drinking water system.

Libertytown Apartments and Libertytown East (Libertytown) Service Area

The unincorporated community of Libertytown is centrally located in the eastern half of Frederick County. It rests at the intersection of several state-owned roads that connect the towns of Eldersburg, New Windsor, Union Bridge, and Westminster in Carroll County with the City of Frederick to the west. Libertytown is also connected to the community of Lake Linganore and the Town of New Market in Frederick County to the south, as well as to the Town of Woodsboro to the northwest.

The residential development of the Mill Creek and Mayne properties will provide for a modest increase in the households in the next ten years, as these developments begin construction. An expansion of the Libertytown Apartments (or Libertytown West) water system has been permitted to accommodate residential growth that is anticipated to be complete by the 2035 planning horizon. Additionally, modest residential growth is anticipated as Libertytown approaches the 2050 planning horizon. A limited amount of non-residential water use is also anticipated as businesses and services will seek to locate in proximity to the growing residential community.

Like the Jefferson Service Area, the Libertytown Service Area is also comprised of two separate systems. A future interconnection of those systems may be beneficial to ensure adequate service throughout the Libertytown Community Growth Area. Current estimates indicate that some additional capacity could be required to meet the growth estimates for the 25-year planning horizon.

Fountaindale/Braddock Service Area

The unincorporated communities of Fountaindale and Braddock Heights are situated near the City of Frederick and the Town of Middletown and along the major highways of I-70 and US-40. These communities also have connections to the community of Jefferson to the south via Holter Road and Jefferson Boulevard.

Due to their location immediately between the City of Frederick and the Town of Middletown and access to major highways, these communities are expected to see some residential growth in the 10-year planning horizon (105 EDUs) and a modest increase in non-residential water use. As the City of Frederick and the Town of Middletown grow toward the 25-year planning horizon, a further increase in residential growth is expected.

Currently, the Fountaindale system utilizes between one-half and two-thirds of its capacity, and estimates indicate that an expansion of capacity could be needed as the system approaches the year 2050 to meet anticipated residential demand.

MUNICIPAL WATER SYSTEMS

There are currently nine municipalities in Frederick County that maintain and operate their own Community Water Systems (CWS), including the Cities of Brunswick and Frederick and the Towns of Emmittsburg, Mount Airy, Middletown, Myersville, Thurmont, Walkersville, and Woodsboro. There is one federal CWS, operated by Fort Detrick, and one private, institutional system that serves Mount Saint Mary's University.

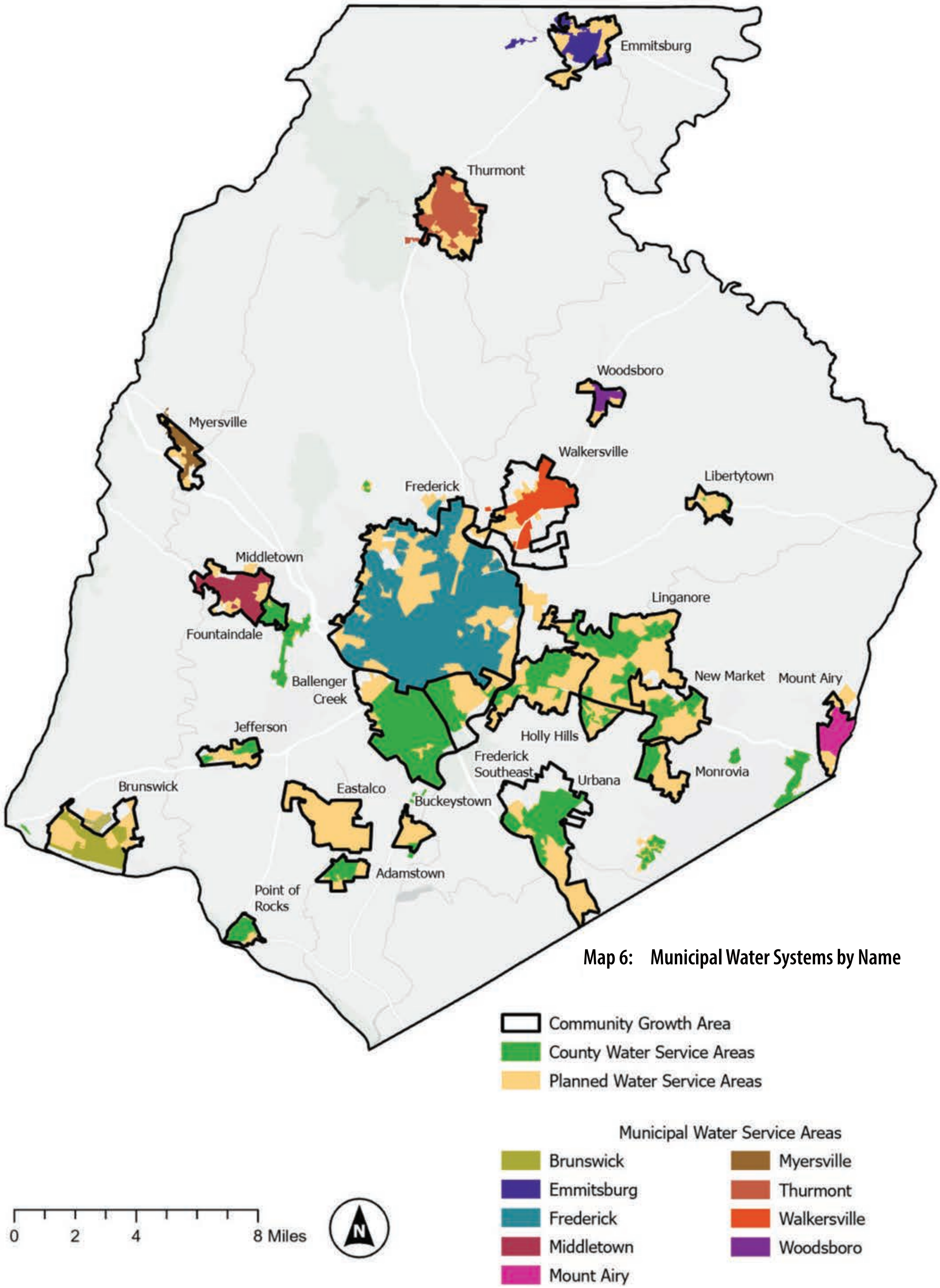
Current Service Areas (Municipal Systems)

Map 6 indicates the location of those incorporated cities and towns that are currently served by their own municipal water system and identifies those systems by name.

Current and Future Capacity (Municipal Systems)

The following table depicts the WTP capacities and the current and future demand for the drinking water systems/facilities owned and operated by municipalities in Frederick County. It is important to note that the water treatment capacities described in Table 2.03 reflect estimates provided by municipalities for the current update to the County's Water & Sewerage Plan. As is the case with the County systems, permitted capacity could possibly be increased in the future, dependent upon federal, state, and local approvals.

The methodology employed for the projected demand for municipal systems closely mirrors the methodology established for future demand for county-owned systems. It is important to note that non-residential water demand for municipal systems only addresses the 10-year planning horizon of 2035. Residential growth is carried out to the 25-year planning horizon of 2050. For a more in-depth evaluation of the growth projections see the supplemental data published concurrently with the release of the Water Resources Element.



Map 6: Municipal Water Systems by Name

Table 2.03 Water Supply and Demand by Municipal Service Area

Service Area	Permitted Withdrawal (avg. MGD)	Permitted Withdrawal (max. MGD)	Existing Treatment Capacity (MGD)	Existing Demand, Yearly Average (MGD)	Maximum Demand, Monthly Average (MGD)	Projected Demand 2035 (MGD)	Projected Demand 2050 (MGD)
Brunswick	1.350	2.000	2.000	0.596	0.680	0.727	0.850
Emmitsburg (2)	0.612	0.994	0.600	0.243	0.277	0.376	0.506
Frederick	14.923	19.344	12.400	6.270	10.032	8.197	9.735
Middletown	0.387	0.504	0.533	0.308	0.329	0.380	0.420
Myersville	0.256	0.481	0.300	0.115	0.129	0.164	0.236
Mount Airy (1)	0.927	1.387	1.500	0.704	0.770	0.721	0.733
Thurmont	0.806	1.209	1.200	0.426	0.436	0.588	0.713
Walkersville	1.000	1.500	1.200	0.635	0.715	0.694	0.825
Woodsboro (3)	0.128	0.178	0.128	0.085	0.157	0.098	0.123
Fort Detrick	2.000	2.600	4.250	1.400	1.726	1.450	1.600
TOTALS	**22.389**	**30.197**	**24.111**	**10.782**	**15.251**	**13.395**	**15.741**

(1) Mount Airy WTP existing flows are indicated per the Carroll County Water and Sewer Master Plan – Approved – September 22, 2023. Projected demand reflects growth in Frederick County only. The Carroll County Water and Sewer Master Plan indicates a total demand of 1.079 mgd for 2035.
(2) Existing demand reflects 2023 1-Year Average. A leak was repaired in 2022 and demand has increased.
(3) Woodsboro WTP flows were not provided, average flow is obtained from Frederick County Water & Sewerage Plan – Approved – February 2, 2021 (as amended August 25, 2023) - Table 3.04.

Potential Futures for Municipal Water Service Areas

As mentioned in the discussion of future conditions for County water systems, municipalities are intended to play a central role in the accommodation of future residential and non-residential growth as the County approaches the years 2035, 2050, and beyond. The following municipal service areas are anticipated to experience notable growth by the 2035 or 2050 plan horizons. An overview of each of these systems, with additional information regarding current and future improvements, is included in Appendix A. Additional information may also be found in the Comprehensive Plans and Water Resources Elements prepared and adopted by respective municipalities.

City of Frederick

Projections developed as part of this Water Resources Element predict that approximately 7,709 EDUs could be needed to serve combined residential and non-residential growth within and around the City of Frederick by 2035. That total number could nearly double by the 2050 planning horizon. It should be noted that, while this growth results in increased water demand, it also facilitates a multitude of potential benefits to the citizens of Frederick in terms of employment opportunities and multi-modal transportation options envisioned by both the City in their 2030 CommUNITY Vision Statement and by Frederick County with the Livable Frederick Master Plan. Additionally, the existing Potomac River Water Service Agreement between the City of Frederick and Frederick County DWSU ensures that additional capacity to meet some future demand has been reserved at the New Design Water Treatment Plant.

The Town of Middletown

Middletown's recently adopted Middletown Comprehensive Plan 2023 states the Town's intent to maintain its small-town character as a central tenet of the Vision Statement. Projections under this plan indicate modest residential growth for both planning horizons, and that the Town's existing capacity would be exceeded for maximum withdrawal in 2035 and average and maximum withdrawal in 2050. It is important to note that the Town requires all new developments to provide an offsetting expansion of water system capacity as part of the entitlement process. Under this assumed condition, potential future growth would be required to offset any created capacity needs.

The Towns of Emmitsburg and Thurmont

The Towns of Emmitsburg and Thurmont are well established municipalities in the northern part of Frederick County, along the US-15 corridor. Emmitsburg also lies at the crossroads with MD-140, which extends northwest from Taneytown and Westminster in Carroll County toward PA Route 16 and Carroll Valley, Blue Ridge Summit, and Waynesboro, PA to the northwest. School capacity, which can be an inhibiting factor for growth in other parts of Frederick County, is also not a limiting factor for Thurmont or Emmitsburg as of the drafting of this Water Resources Element. Both communities have been identified as potential centers for growth in this assessment. While estimates indicate that Emmitsburg's current system capacity may be adequate to accommodate the 10- and 25-year horizons, some additional expansion of Thurmont's system may be required to accommodate the 2050 estimate.

The Town of Mount Airy

The Town of Mount Airy is unique in Frederick County due to its location at the intersection of Carroll and Frederick Counties. The Town is also well situated at the intersection of MD-27 and I-70. For the purposes of this assessment, only growth in the Frederick County portion of the Town's growth area has been analyzed. More information on the Town's future capacity is available through the Town's comprehensive plan or the Carroll County Water and Sewer Master Plan.

The Towns of Brunswick, Walkersville, Myersville, and Woodsboro

Growth was allocated to each of these municipalities in accordance with current pipeline data for the 10-year planning horizon and roughly proportionate to their size and anticipated capacity to expand based on their corresponding growth area with some additional influence from Cooperative Forecast data. Local growth areas and projections were informed from *Brunswick Forward (2024)*, *The Town of Myersville Comprehensive Plan (2023)*, and *Woodsboro Comprehensive Plan (2008)*. Information was incorporated from the draft planning efforts for the Town of Walkersville 2024 comprehensive plan.

PRIVATE SUPPLY AND COMMUNITY SYSTEMS

There are several small community systems, some owned and maintained by the County and others that are privately owned and maintained. All of these are located outside of community growth areas and are groundwater-based systems. These systems serve educational facilities, mobile home parks, and small residential developments (like apartment complexes).

INDIVIDUAL WELL USE

Outside of the community growth areas and the small community systems residents and businesses rely on individual wells in a variety of water-bearing formations. As of 2023, it was estimated that there are approximately 30,000 private wells in the County. Properties that utilize wells are estimated to return 80% of the water back to the aquifer through associated septic systems, allowing for natural recharge of the aquifer. However, it is important to note that the water returned to the aquifer can be rich in nitrogen or other dissolved substances that are not present in the rainfall or snowfall that typically recharges an aquifer. An excess of nitrogen or other substances can, in time, migrate to groundwater withdrawal points (wells) or surface waters.

Title 26, Subtitle 4, Chapter 4 of the Maryland Code of Regulations (COMAR) establishes requirements for well construction within the State of Maryland and requires that groundwater wells utilized for domestic purposes yield a minimum of one gallon of water per minute for a period of six hours. In certain areas of the County, outside of the Frederick Valley, additional pump test requirements (including an initial pump-down period prior to testing) are outlined in COMAR to ensure that adequate well yield can be maintained. In situations where an individual well location cannot meet the minimum yield requirement, and in which the Health Department approves a request by the property owner, a single well may be supplemented by the provision of a second well, the installation of a storage tank, or the utilization of storage in the well bore hole.

Map 7 provides an overview of average specific capacities for wells in Frederick County. The differing shades on the map reflect the potential variation in the amount of yield (in terms of gallons per minute) that might be expected based on the depth of the well. The amount of well yield for a given property will vary based on the intended use and the number and type of plumbing fixtures that will be utilized. More information related to wells can be found on the web page for the Well and Septic Branch of the Frederick County Health Department at *https://health.fredrickcountymd.gov/375/Well-Septic*.

COMMERCIAL, INDUSTRIAL, AND AGRICULTURAL WITHDRAWAL

Commercial, industrial, and agricultural water use on those properties not served by County or municipal water and sewer systems can be tracked by ground and surface water permit data from the State of Maryland. The largest permit holders, in no particular order, are quarries; aquaculture/goldfish farm facilities; nurseries/farms/orchards; golf courses; and low intensity commercial/industrial developments. The County also has numerous institutional uses like churches and private schools in agricultural areas that rely on groundwater-based systems.

Lilypons Water Gardens, a water garden nursery in the Adamstown area, has the largest maximum water appropriation. They are permitted to withdraw 7.5 mgd (max 90.0 mgd) of surface water from Bennett Creek.

Quarries are also one of the largest commercial consumers of water in the County. Martin Marietta's Frederick quarry holds an appropriation/dewatering permit for 8.0 mgd (allocated average), and Lehigh Cement Company holds combined appropriation/dewatering permits for 8.0 mgd (allocated average).

Irrigation is also used for golf courses, greenhouse/plant nursery operations, and agriculture, although most agricultural operations rely on rainwater that is captured in cisterns or other on-site facilities. As part of the 2010 Water Resources Element, an estimate of total water use in the Catoctin Creek watershed showed that agricultural operations utilizing irrigation accounted for about 11% of total water use, while livestock operations were shown to account for less than 1% of total water use in the watershed.

Data provided by the Water and Science Administration at the Maryland Department of the Environment yields the following breakdown with regard to the allocation of the various Water Appropriation or Use permits (for withdrawals greater than 5,000 gpd) in the County since 1901. The categories identified in Table 2.04 represent the use descriptions set by the Maryland Department of the Environment when reviewing permits.

Commercial uses historically account for approximately 25% of the total number of permits held, farming and plant nurseries account for approximately 15%, and industrial and mining uses account for approximately 7% of permits. It should be noted that a variety of uses can be covered under the category of "Government Run Water Supply" as both county and municipal community water systems and their associated permits would be captured within this category.

MAJOR WATER ISSUES

Water Conservation

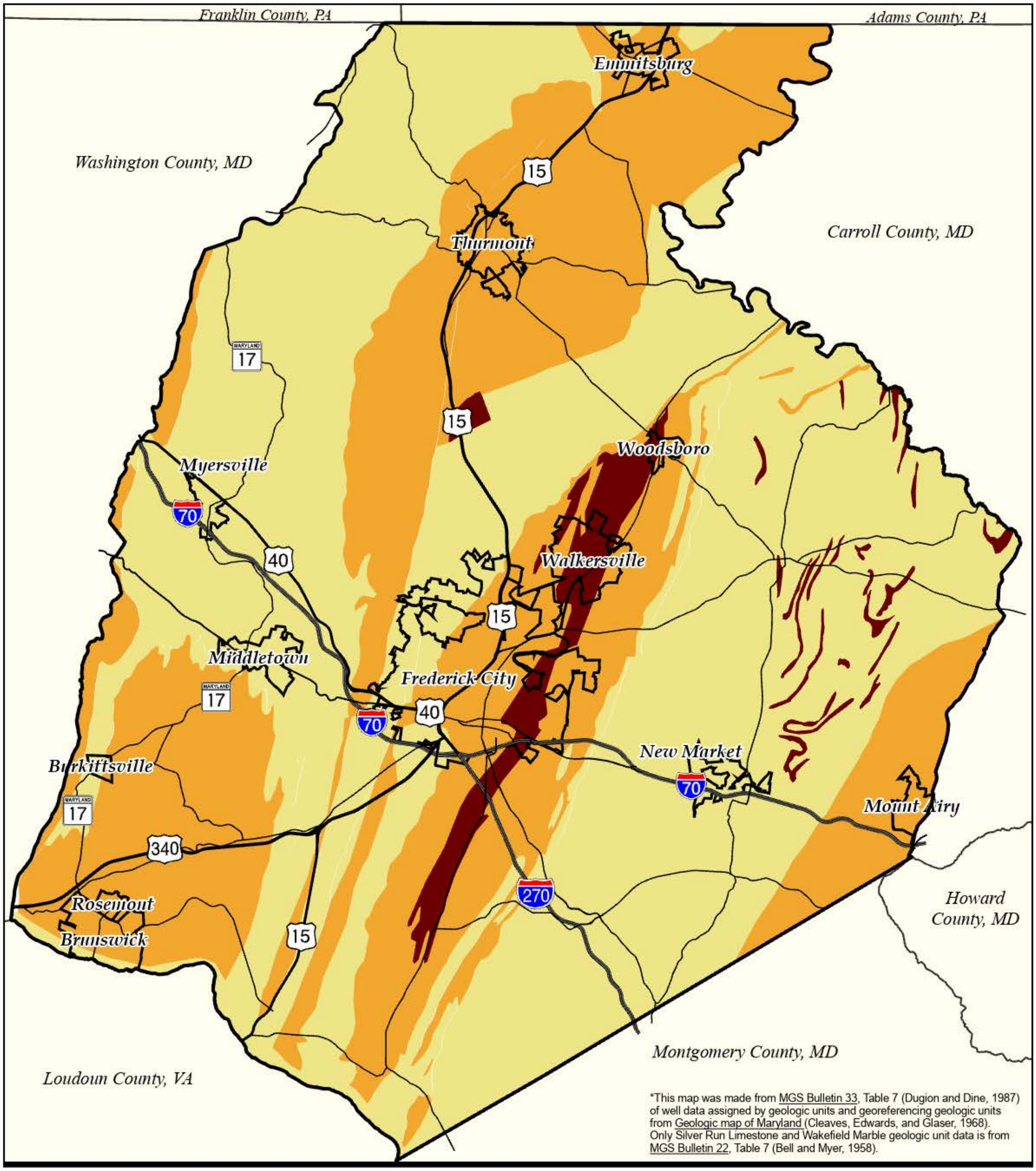
While water consumption by individual households in Frederick County is below the national average, opportunities exist for further reductions in daily water use. Households, businesses, and institutions can reduce consumption by installing water efficient landscaping, rain barrels, low-flow bathroom fixtures, gray water systems, and retrofits to older homes. Widespread education and outreach efforts on the benefits of water conservation are proven to reduce water use in a community.

Conservation is especially important during the summer months when demand is high, and supplies are low. Peak season water demand management is in place in many local jurisdictions. Middletown, for example, has implemented the use of tiered billing where rates increase with consumption, lawn watering restrictions, and water conservation public alert systems for use during drought. Other communities have investigated or implemented leak detection programs and public education and outreach efforts like providing free dye tablets to detect leaky toilets, low-flow shower heads, toilet dams, and faucet aerators.

Table 2.04 - Distribution of Water Appropriation and Use Permits by Use (1901-2023)

Type of Use	# of Permits
Aquaculture & Aquarium	9
Commercial (Non-Specific)	9
Commercial Drinking/Sanitary	59
Commercial Heating & Cooling Water	1
Commercial Washing Processes	1
Crop Irrigation	17
Dairy Animal Watering	5
Environmental Enhancement	3
Farm Potable Supplies	2
Food Processing (On-Site)	1
Golf Course Irrigation	19
Government Drinking/Sanitary	1
Government Run Water Supply	56
Hydrostatic Testing & Fire Protection	1
Industrial (Non-Specific)	2
Industrial Drinking/Sanitary	9
Industrial Heating & Cooling Water	1
Institutional Drinking/Sanitary	28
Irrigation (Non-Specific)	16
Lawn & Park Irrigation	4
Mine Construction & Dewatering (Excavation)	6
Mining Operations (Potable & Process Uses)	2
Nursery Irrigation	16
Other Livestock Watering	5
Poultry (Foggers)	1
Private Water Supplier	3
Product Manufacturing	3
Recreational Drinking/Sanitary	10
Religious Drinking/Sanitary	1
Residential Heat Pumps	17
Subdivisions with Individual Wells	8
Trailer Park, Apartment Buildings, & Condominiums	5
Water Well Drilling Operations	2
Wildlife Ponds and Recreational	3
Grand Total	326

Water conservation measures lower consumer rates and utility bills while placing less pressure on precious resources. Communities realize major benefits from conservation measures when its citizens participate. Rather than seeking additional sources of water, conservation provides an alternate source of drinking water supply to the community.



Map 7: Average Well Specific Capacity

Frederick County, Maryland
Division of Planning and Permitting
Frederick County GIS

Specific Capacity (gpm/ft.)

- 0.000 - 0.700
- 0.701 - 2.011
- 2.012 - 8.2

1:250,000

0 1 2 3 4 Miles

N

Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet
While efforts have been made to ensure the accuracy of this map, Frederick County accepts no liability or responsibility for errors, omissions, or positional inaccuracies in the content of this map. Reliance on this map is at the risk of the user. This map is for illustration purposes only and should not be used for surveying, engineering, or site-specific analysis. Printed 10/25/2023, 00092\Master_Plan\2024

Drinking Water Monitoring and Testing

Drinking water monitoring and testing is one way for community water systems and the owners of individual water systems to ensure the safety of their drinking water sources. Common targets for monitoring and testing include barium, nitrates, chlorination biproducts (in the case of public systems), bacteria, lead, copper, and PFAS (see the discussion of PFAS later in this section). In the case of public water supplies, the Division of Water and Sewer Utilities (DWSU) regularly tests water systems in concert with the Maryland Department of the Environment to ensure public water systems comply with EPA and state drinking water health standards. DWSU publishes an annual Consumer Confidence Report for all systems in April of each year that contains data for the previous calendar year. This data can be retrieved online from the Frederick County Documents Center at *https://www.frederickcountymd.gov/DocumentCenter* under the heading of "Water & Sewer Utilities."

Applicable standards include those set under the EPA's 1993 Lead and Copper Monitoring Rule. The Lead and Copper Monitoring rule requires community water systems to test for the presence of lead and copper in drinking water on a basis of one year or three years.[6] DWSU notes that there are no publicly owned lead service lines within any of the designated County service areas. However, DWSU also notes that dwellings constructed before the federal ban on lead in solder in 1986 or the prohibition of lead in brass fixtures in 2014, may still have the potential to introduce lead into drinking water. As a preventative measure, DWSU closely monitors water chemistry, calculates corrosivity indexes, and installs corrosivity control infrastructure when warranted.

DWSU adds that there are several simple things that concerned consumers can do to minimize their lead exposure:

- Always flush water lines for 30 seconds to 2 minutes before using water for drinking or cooking.
- Drink or cook with only water from the cold-water faucet. Warm or hot water may contain more lead. Boiling water will not reduce the amount of lead in water.
- Periodically inspect or clean the aerator on the end of the faucet to remove debris or metal particles that may have accumulated.

Individuals on private wells who wish to secure water quality testing data can contact the Frederick County Health Department's Community Services Office to apply to have samples of their well water tested. The Frederick County Health Department also maintains a list of privately run water testing laboratories within and outside Frederick County that can provide well water testing services. Interested property owners can find more information on the web at *https://health.frederickcountymd.gov/340/Well-Water-Testing* or by calling the Frederick County Health Department at 301-600-1029.

Per- and Poly-Fluoroalkyl Substances (PFAS)

"PFAS" is short for per- and poly-fluoroalkyl substances. More than 12,000 chemicals in this family are found in products like food packaging, cookware, personal care products, and fabrics designed to retard flames or repel water, grease, and stains. PFAS don't easily break down once ingested or released into the environment, and they can persist for decades. The Centers for Disease Control and Prevention (CDC) estimates that more than 97% of the U.S. population has PFAS in their bodies.

Drinking water is one of the most significant pathways of PFAS exposure. The United States Geological Survey released a report in June of 2023 detailing the analysis of water samples taken from 716 locations throughout the United States between 2016 and 2021. The study tested for thirty-two of the known varieties of PFAS and concluded that there is a 75% chance of PFAS not being observed in rural areas and a 25% chance of PFAS not being observed in urban areas (Smalling et al., 2023).[7]

6 Frederick County Division of Water and Sewer Utilities. (n.d.). DWSU Lead and Copper Monitoring Summary. Frederick County Government. Retrieved March 25, 2024, from https://frederickcountymd.gov/DocumentCenter/View/286711/Lead-and-Copper-Monitoring-Summary?bidId=

7 Kelly L. Smalling, Kristin M. Romanok, Paul M. Bradley, Mathew C. Morriss, James L. Gray, Leslie K. Kanagy, Stephanie E. Gordon, Brianna M. Williams, Sara E. Breitmeyer, Daniel K. Jones, Laura A. DeCicco, Collin A. Eagles-Smith, Tyler Wagner, Per- and polyfluoroalkyl substances (PFAS) in United States tapwater: Comparison of underserved private-well and public-supply exposures and associated health implications, Environment International, Volume 178, 2023, 108033, ISSN 0160-4120, https://doi.org/10.1016/j.envint.2023.108033.

Municipalities in Frederick County that predominantly rely on groundwater supplies are currently dealing with this issue. In October of 2022, testing conducted by the Maryland Department of the Environment detected PFOA and PFOS (two specific PFAS compounds) in two of the Town of Thurmont's municipal water supply wells. The town took both wells off-line and is currently exploring engineering solutions to implement PFAS filtering technology. The Town of Myersville took wells offline in August of 2022, as did the Town of Mount Airy after tests indicated elevated levels of PFAS in December of 2022. The City of Brunswick is currently investigating the potential for the well at Yourtee Springs to be impacted by PFAS due to the influences of karst topography. In addition, in August of 2023, elevated levels of PFAS in wells serving Mount Saint Mary's University were confirmed, and the Town of Emmitsburg temporarily halted a program through which it purchases water from the University until such time as the issue can be remedied.

The Frederick County Division of Water and Sewer Utilities is actively monitoring developments involving these substances as well as their presence in the County's drinking water system. Drinking water utilities are often referred to as "passive receivers" of PFAS because they do not produce PFAS but receive the chemicals into their systems as part of the source waters they accept. The Division of Water and Sewer Utilities' website incorporates information on this subject and notes that an interim Health Advisory (HA) was issued in 2022 that identified a threshold of 0.02 parts per trillion (ppt) for PFOS and 0.004 ppt for PFOA in combined in drinking water supplies.[8] This is the lowest possible level of detection possible with current technology.

DWSU also notes that, on April 10, 2024, the U.S. EPA announced an intent to establish Maximum Contaminant Levels (MCLs) for PFOS of 4.0 nanograms per liter (ng/L) and PFOA of 4.0 ng/L or parts per trillion (ppt). MCLs for PFHxS, PFNA, and HFPO-DA would be established at a threshold of 10 ng/L. Additionally, an enforceable MCL to address mixtures of PFHxS, PFNA, HFPO-DA, and PFBS would be established where they occur in drinking water. Following enactment of the rule, drinking water systems will have a period of three years to complete an initial monitoring period for these chemicals and will be required to inform the public of measured levels in their drinking water. Drinking water systems would then have an additional two years to implement solutions to meet the required thresholds.[9]

At the local level, DWSU has been working with MDE since 2021 as part of statewide efforts to have all source water tested and treated for PFAS. As part of that testing, DWSU provides data regarding sampling results for all eleven of the regional and subregional community water systems under their management along with additional information about measures residents can implement to reduce PFAS in the water system at: *https://frederickcountymd.gov/1284/Water-Purification-Distribution*. The County is unable to estimate or project how much of the private groundwater supply may be at risk from PFAS. Individual property owners concerned about PFAS exposure should explore water quality testing. The Frederick County Health Department does not conduct water testing for the general public but publishes a list of local State-certified labs at the following location: *https://health.frederickcountymd.gov/340/Well-Water-Testing.*

The implications of PFAS infiltration into public water supply systems are likely to be a matter of concern for the foreseeable future. To assist communities and water systems, the US EPA announced the establishment of the Emerging Contaminants in Small or Disadvantaged Communities Grant Program in February 2023 to provide up to $2 billion in assistance to communities in addressing PFAS contamination. Homes served by privately owned wells may also qualify. More information on the program is available on the EPA's website at the following location: *https://www.epa.gov/dwcapacity/emerging-contaminants-ec-small-or-disadvantaged-communities-grant-sdc*.

Low-Flow Augmentation

The State of Maryland is a party to the Potomac River Low Flow Allocation Agreement (LFAA), which was signed by several states in the Potomac River Basin on January 11, 1978. The crafting of this agreement was a result of an application submitted by the Washington Suburban Sanitary Commission (WSSC) to the United States Army Corps of Engineers (USACE) in 1967 for a permit to construct a water diversion in the Potomac River to improve withdrawal capacity during times of drought. As a condition of permit approval, the USACE required that an agreement be established to equably apportion water during low-flow periods and to prevent non-federal interests from taking so much water from the river that it would threaten drinking water supplies for the District of Columbia and Arlington County and the City of Falls Church in Virginia.

8 https://frederickcountymd.gov/1284/Water-Purification-Distribution
9 https://www.epa.gov/system/files/documents/2024-04/pfas-npdwr_prepubfederalregisternotice_4.8.24.pdf

Subsequently, the Unites States Congress enacted Section 181 of the Water Resources Development Act of 1976, which authorized the construction of the diversion structure provided that Maryland, Virginia, WSSC, and other "desirable signatories" enter into a written agreement for withdrawal of waters from the Potomac between Little Falls Dam on the downstream end and the farthest upstream limit of the pool of water behind the Chesapeake and Ohio Canal rubble dam at Seneca, MD, during periods of low flow. This update to the Water Resources Development Act of 1976 led to the creation of the LFAA in 1978.[10]

As a signatory party, the State of Maryland's Code of Regulations (COMAR) states in Title 26, Subtitle 17, Section 07, Chapter 03, Section 02 that permits for withdrawals that are issued or amended by the Maryland Department of the Environment for surface water appropriation in the Potomac River Basin and upstream of Little Falls after January 1, 1985, shall condition the withdrawal of water by any permittee upon the provision of low-flow augmentation for consumptive water use if the maximum consumptive water use can exceed 1-million gallons per day (1 mgd) at any time. Additionally, low-flow augmentation may be required if the 1mgd level is reached under one permit or incrementally as part of successive reviews for the same permit. Low-flow augmentation requirements are typically satisfied by the creation of an impoundment system that allows water to be captured, held, and released during periods of low flow.

Much of Frederick County's current utilization of water from the Potomac River is considered "non-consumptive" because the water is returned to the Potomac River watershed after treatment by wastewater treatment plants. Certain uses like bottling or evaporative cooling are considered consumptive because they result in the transfer of water outside the watershed through transportation or evaporation. Future planning efforts that focus on the establishment or development of industrially zoned land that can support packaging plants or technological applications like data centers should be undertaken with consideration of the implications of consumptive use. Additionally, the establishment of an augmentation system represents a significant investment in terms of time, effort, and expense which should borne by permittees and not the citizens of Frederick County.

Cyanobacteria

Cyanobacteria are a member of a bacterial phylum that evolved over 2 billion years ago and are found in terrestrial and aquatic habitats throughout the globe. They are often referred to as "algae," which is a generic term that includes organisms from a variety of taxonomic groups. Cyanobacteria are also often described as "blue-green algae," though they can exhibit other colors in nature. Unlike other organisms often referred to as algae, cyanobacteria are prokaryotic (exclusively unicellular and lacking a true nucleus and membrane bound organelles) and not eukaryotic (potentially multicellular and possessing a true nucleus and membrane bound organelles) like green algae, diatoms, and dinoflagellates.[11]

This group of 'algae' now dominate many Frederick County waterways. They are often observed during the summer months, but they can be present throughout the year in many lakes and ponds, remaining in cooler, deeper waters. When water temperatures warm and streams and rivers calm or slow during the late summer, floating or attached populations can be observed.

Rapid growth and accumulation of these cells, with the highest densities noted as "blooms" or "harmful algal blooms" (a.k.a. HABs), can also be triggered by nitrogen and phosphorous pollution washed into water ways or released from bottom sediments during heavy rains and by slow moving or still waters that result from drought conditions. These growths can be accelerated in locations where surface waters are exposed to sunlight. Bloom frequency will likely increase with more frequent, heavy rainstorms and near optimal growth conditions resulting from the increased temperatures that the region is experiencing as a result of climate change.

10 The Cruden Team. (2018). A Review of the Potomac River Low Flow Allocation Agreement. Retrieved January 31, 2024, from https://www.potomacriver.org/wp-content/uploads/2018/04/LFAA_Review_Final_2.22.185.pdf
11 ITRC (Interstate Technology & Regulatory Council). 2022. Strategies for Preventing and Managing Harmful Benthic Cyanobacterial Blooms (HCB-2). Washington, D.C.: Interstate Technology & Regulatory Council, HCB Team.

Within the last decade, several bacterial blooms have been noted in Frederick County. In 2016, Lake Anita Louise (near Lake Linganore) was partially drained and treated with peroxide to prevent the recurrence of a cyanobacterium that releases a potent toxin called microcystin. Microcystin can induce liver cancers in humans and wildlife mortalities if swallowed.[8] In another case, staff of the Center for Coastal and Watershed Studies at Hood College dispersed peroxide to treat the same cyanobacterium and its toxin microcystin in Sparh's Pond (quarry) near Thurmont, MD.[12] The same cyanobacterium also reached bloom densities in Lake Merle, near Lake Linganore, from April to June of 2023. In September of 2023, the Frederick County Health Department issued a Public Health Alert for the potential presence of other blue-green algae in Cunningham Falls State Park near Thurmont.

Three species of attached cyanobacteria (*Planktothrix isothrix*, *Microseira wollei*, and *Microcoleus autumnalis*) have been documented in recent years in the Potomac River, and each is capable of producing toxins that can pose a human health threat. Due to the potential health effects and the fact that they can occur in locations that are designated sources of surface drinking water, the continued monitoring of cyanobacteria is necessary.

The implementation of measures for treating cyanobacteria in drinking water is costly, with conventional treatment methods inadequate for removing the cyanobacterial toxins. Limiting the amount of nutrients running off and deposited in streams, ensuring adequate groundwater recharge to support stream base-flow, and providing shading for surface waters in the form of streamside vegetation are all critical to ensuring the continued health and safety of Frederick County's surface waters. The Interstate Technology and Regulatory Council (ITRC) has developed a visual guide for the identification of cyanobacteria on the internet at the following address: *https://hcb-2.itrcweb.org/appendix-a/*.

Karst Topography

As noted in the 2021 Water and Sewerage Plan, approximately 35 square miles within the County possess underlying geology that is susceptible to subsurface erosion. "*Karst*" is a Slavic word meaning "barren, stony ground," and it describes terrain that is characterized by caves, underground streams, and other features that are formed by the slow dissolution of calcium and magnesium oxides in limestone, dolomite, or marble bedrock.

In populated areas, sudden subsidence features known as "sinkholes" can form under buildings, roads, and farmed land. Not only do sinkholes present a threat of injury to people and damage to property, but surface water runoff that enters a sinkhole can bypass the natural filtration processes otherwise provided by intact soils, subsoils, and geological features.

The occurrence of sinkholes can be exacerbated by human activity. Intensive groundwater withdrawals associated with mineral mining can accelerate the conductance of groundwater through susceptible formations and result in accelerated rates of dissolution in geological formations. The concentrated infiltration of water associated with some stormwater management facilities can also result in accelerated circulation of subsurface water that can also accelerate the dissolution of susceptible formations.

It is important to note that the effects of karst topography can be mitigated with the cessation of dewatering activities associated with mineral mining or other activities such as construction site preparation, the lining of stormwater management facilities in areas subject to karst influence, and through extensive subsurface investigations prior to construction and/or alternative foundation design techniques for infrastructure and buildings. It is more difficult to mitigate the effects of surface water intrusion in areas subject to karst topography, and, for this reason, karst topography should be considered when planning for the location of future drinking water supplies or the expansion of existing supply systems. Groundwater supplies in areas of karst topography are often referred to as "groundwater under the direct influence of surface water" or "GWUDI."

12 *https://www.hood.edu/sites/default/files/Coastal%20Studies/CCWS/CCWS%20Rpt%202018-2022.pdf*

EQUITY AND THE DRINKING WATER ASSESSMENT

As noted in the opening chapter of this Water Resources Element, the Livable Frederick Master Plan aims to ensure that all people can be successful, enjoy a high quality of life, and be free from poverty. A reliable source of clean, potable drinking water that is available and affordable is foundational to ensuring that all Frederick County's citizens can lead safe, productive, and enjoyable lives.

In their September 2023 briefing paper entitled "An Equitable Water Future," the US Water Alliance defines the concept of water equity as occurring when "all communities have access to safe, clean, affordable drinking water and wastewater services; are resilient in the face of floods, drought, and other climate risks; have a role in decision-making processes related to water management in their communities; and share in the economic, social, and environmental benefits of water systems."[13] The paper also recognizes the many challenges that drinking water systems face that can result in increased costs of operation and subsequent limits on affordability. Additionally, it recognizes that limits on affordability disproportionately affect those people least equipped to accommodate them.

Ageing infrastructure, the identification and replacement of lead service lines, algal blooms, the presence of PFAS, pluvial (rainstorm induced) flooding, groundwater contamination, and population change (both increases and declines) can pose difficulties for the operation of drinking water systems. Many of these problems can also be exacerbated by climate change, as discussed later in this chapter and in subsequent chapters. Proactive planning by local governments and utility service providers that addresses these potential pitfalls is one avenue for lessening the impacts associated with maintaining water and sewer infrastructure, but it may not be able to anticipate all sources of increased costs.

The US EPA's 7th Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) was released in September 2023 and indicates that, in Maryland alone, water infrastructure needs over the next 20 years could total $14.64 billion, with $12.788 billion of that total being allocated to distribution and transmission infrastructure. Federal funding assistance is available to utility providers through measures like the Bipartisan Infrastructure Law approved in the fall of 2021, but the American Society of Civil Engineers (ASCE) noted in their 2021 Report Card for America's Infrastructure that, "the federal government's share of capital spending in the water sector fell from 63% in 1977 to 9% of total capital spending in 2017. On average, about two-thirds of public spending for capital investment in water infrastructure since the 1980s has been made by state and local governments."[14] Constrained federal assistance can result in the need for water utilities to pursue grants or raise rates for service to maintain their operating budgets, and this results in a transfer of costs to those who can least afford the increases.

With the implementation of a web-based Environmental Justice (EJ) Screening Tool, the Maryland Department of the Environment has identified the location of traditionally underserved and overburdened communities that could be hardest impacted by funding shortfalls in drinking water funding. An "underserved community" is defined as a census tract that meets one of the following criteria: at least 25% are low-income; or at least 50% are nonwhite; or at least 15% have limited English proficiency. In Frederick County, approximately 11 census tracts in the City of Frederick or immediately adjacent to the City of Frederick meet the thresholds identified in definition. It should be noted that these census tracts significantly overlap established water and sewer service areas for both the City of Frederick's Water Treatment Plant and Frederick County's New Design Water Treatment Plant.

In the face of increasing costs and the need to play more of a role with regard to water availability, Frederick County's Division of Water and Sewer Utilities (DWSU) has adopted some measures to help customers continue to afford service. DWSU has instituted "inclining block rate" billing that places a premium on the per-gallon price paid by the largest potable water users on the system. Additionally, the Capacity Fee Payment Plan Fund allows smaller, non-residential customers utilizing less than 50 EDUs to adopt a payment schedule (enforced through a lien on the property) for fees associated with the establishment of water and sewer service.

13 'An Equitable Water Future: A National Briefing Paper' (September 2023). https://uswateralliance.org/wp-content/uploads/2023/09/uswa_waterequity_FINAL.pdf> accessed 20 November 2023.
14 2021 Report Card for America's Infrastructure (Drinking Water). (2021). American Society of Civil Engineers. Retrieved November 21, 2023, from https://infrastructurereportcard.org/wp-content/uploads/2017/01/Drinking-Water-2021.pdf

It should also be noted that, as of the drafting of this document, Frederick County is experiencing relatively strong economic conditions. In September 2023, the US Census Bureau estimated the percentage of the national population living below the poverty line as of 2022 at, approximately, 11.5% [15] and the Bureau of Labor and Statistics places the national unemployment rate for October 2023 at 3.9%.[16] Concurrently, the Census Bureau reports the percentage of persons living in poverty in Frederick County at 6.6%[17] and the Federal Reserve Economic Database reports the unemployment rate as low as 1.7%.[18] It is important, however, to ensure that future decisions regarding maintenance and allocation of resources consider the needs of those residents that may not be experiencing the effects of otherwise apparent prosperity.

The US Water Alliance identifies a number of potential solutions to protect water and wastewater utilities and vulnerable populations in the face of current and potential future increases in cost resulting from operational needs or unanticipated disasters related to economic or climactic events. A selection of these solutions that may be of particular use to Frederick County include the following options:

Expand Water Affordability Programs: Currently, public water service customers at or below 60% of the Maryland State Median Income are eligible for the Low-Income Housing Water Assistance Program[19] (LIHWAP) offered through the Maryland Department of Housing Services (DHS). The program covers up to $2,000 annually, and applications are processed on a first come, first served basis, so there is no guarantee of the receipt of benefits. Additionally, DWSU currently offers assistance to those residents connecting to public water and sewer as a result of the failure of their well or septic systems in the form contributions from the Capacity Fee Fund (cost of 100 feet of utility extension or 50% of project cost, whichever is less) and through the establishment of a 10-year payment plan option for capacity fees at an interest rate set by the County Executive. It should be noted, however, that the payment plan program is intended for existing structures only.

An example of another program that could be considered and is designed to operate at the local level is the City of Philadelphia's Tiered Assistance Program (or TAP, formerly identified as the Water Revenue Assistance Program or WRAP) that was launched in 2015. Under the program, households with incomes at or below 150% of the federal poverty limit receive reduced rates and fees for service intended to fix monthly water bills at between 2% and 3% of household income with a minimum payment amount of $12 per month. In addition to fixing monthly payments, the program does not require the immediate repayment of past-due bills to enroll. Balances are carried if the recipient continues to make on-time monthly payments, and some past-due balances may be forgiven after two years of regular payment. The intent of the program is to reduce expenses related to the operation of collections and shutoffs of service by ensuring that more customers are able to regularly make their required payments for service.

Improve Affordability Data: As noted earlier in this section, Frederick County is performing well from an economic standpoint. Depending on the level at which economic data is aggregated, it can appear as though water affordability is not a widespread problem. Incorporation of data available from the US Census Bureau (including the American Community Survey), the Maryland Department of the Environment's Environmental Justice Screening Tool,[20] and a geographic analysis of late payments, non-payments, and service shut-offs may help in identifying locations for enhanced promotion or implementation of water affordability programs.

Engage in Workforce Development & Build a Career Pipeline: In October of 2023, Marketplace.org reported that approximately one-third of the nation's water infrastructure workers are approaching retirement age and many are expected to leave the profession in the near future.[21]

15 Shrider, E. A., & Creamer, J. (2023). Poverty in the United States: 2022: Current Population Reports (No. P60-280). United States Census Bureau. Retrieved November 23, 2023, from https://www.census.gov/content/dam/Census/library/publications/2023/demo/p60-280.pdf

16 U.S. Department of Labor. (2023, November 3). Employment Situation News Release [Press release]. https://www.bls.gov/news.release/archives/empsit_11032023.htm

17 United States Census Bureau. (2023). QuickFacts: Frederick County, Maryland [Dataset]. https://www.census.gov/quickfacts/fact/table/frederickcountymaryland/BZA115221

18 St. Louis Federal Resource. (n.d.). Unemployment Rate in Frederick County, MD (MDFRED5URN). FRED (Federal Reserve Economic Data). Retrieved November 22, 2023, from https://fred.stlouisfed.org/series/MDFRED5URN

19 Applying for Water Assistance. (n.d.). Maryland Department of Human Services. Retrieved November 22, 2023, from https://dhs.maryland.gov/office-of-home-energy-programs/low-income-household-water-assistance-program/applying-water-assistance/

20 EJ Screening Tool. (n.d.). Department of the Environment. https://mde.maryland.gov/Environmental_Justice/Pages/EJ-Screening-Tool.aspx

21 Trovall, E. (2023, October 18). With many water workers nearing retirement, utilities seek a younger workforce. Marketplace. https://www.marketplace.org/2023/10/18/with-many-water-workers-nearing-retirement-utilities-seek-a-younger-workforce/

A great number of these individuals entered the profession following the adoption of the Clean Water Act and Safe Drinking Water Act in the 1970's and 1980's. Frederick County should continue to actively promote programs like American Jobs Center Network and the Frederick County Workforce Services network to ensure a career pipeline is in place to ensure that adequate staffing needs can be met. When possible, efforts should be made to emphasize the inclusion of people from underserved or traditionally disadvantaged communities to leverage the unique knowledge and skills these individuals can provide for solving the challenges of today and those that arise in the future.

Neighborhood Revitalization: Community revitalization efforts, like the South Frederick Corridors Plan, provide an opportunity for Frederick County to maximize the benefits associated with development within the limits of existing water infrastructure. Provided adequate capacity exists, the revitalization of neighborhoods incorporates an expanded customer base to cover operational costs without a corresponding expansion of the footprint of the infrastructure network and a subsequent increase in costs of maintaining perpetually expanding service lines.

Planning & Assessment: Matters related to equity should also be addressed as part of the development of planning documents. In 2022, the Maryland Department of Planning adopted new requirements that incorporate a consideration of equitable outcomes as part of the comprehensive planning process and as part of the Water Resources Element. Community vulnerability assessments can play a central role in these planning processes as well as the identification of underserved communities. An underserved community is defined as a census tract that meets one of the following criteria: at least 25% are low-income; or at least 50% are nonwhite; or at least 15% have limited English proficiency. The new requirements instated by the Maryland Department of Planning and the development of this Water Resources Element represent steps toward the incorporation of a focus on equity into planning and assessment within the County.

CLIMATE CHANGE AND THE DRINKING WATER ASSESSMENT

The Fifth National Climate Assessment, prepared by the US Global Change Research Program (USGCRP) and released in 2023, reports that the United States experiences a billion-dollar weather or climate disaster every three weeks. Between 2018 and 2022, 89 events for which damages/costs exceeding $1 billion (as adjusted for inflation) were reported, with 52 severe storms and 4 droughts comprising nearly two-thirds of the 89 events.[22] A trend toward more frequent severe weather events has also been observed at the local level. The most recent update to the Frederick County Hazard Mitigation and Climate Adaptation Plan identifies 22 presidentially declared disasters that affected the County between 1962 and 2021, and this list does not include the droughts of 1998-1999 and 2001-2002, an outbreak of tornadoes in 2004, deadly flooding in 2006, the blizzards of 2010 that dropped over 50" of snow in some locations, severe thunderstorms in 2012 that left over 1-million people in the region without power, and severe thunderstorms in 2015 that flooded 42 residences and 13 businesses.[23]

More frequent and intense precipitation events are already evident in the State of Maryland and Frederick County. Runoff from these events can transport debris and contaminants into surface waters that can result in harmful algal blooms (HABs) or pollute surface or subsurface drinking water supplies, particularly in locations where groundwater supplies have been determined to be under the influence of surface waters. Droughts are also projected to increase in intensity, duration, and frequency. They can strain both surface and groundwater supplies, reduce agricultural productivity, and lower water levels in major reservoirs, which can also stimulate the growth of potentially harmful algal blooms. When coupled with higher temperatures and corresponding increases in agricultural irrigation demand, droughts can have significant impact on aquifers and streamflow.

It is important to note that Frederick County has undertaken steps to plan for and mitigate potential impacts associated with climate change and the potential severe weather events that can result from it. The Frederick County Hazard Mitigation and Climate Adaptation Plan, which is updated every five years (and most recently in 2022), incorporates data from the Fourth National Climate Assessment in 2018 that identifies trends toward increasing average annual temperature as well as precipitation. The plan identifies infrastructure within the County that may be

22 Jay, A.K., A.R. Crimmins, C.W. Avery, T.A. Dahl, R.S. Dodder, B.D. Hamlington, A. Lustig, K. Marvel, P.A. Méndez-Lazaro, M.S. Osler, A. Terando, E.S. Weeks, and A. Zycherman, 2023: Ch. 1. Overview: Understanding risks, impacts, and responses. In: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023.CH1
23 Frederick County. (2022). Hazard Mitigation and Climate Adaptation Plan. Retrieved March 18, 2024, from https://frederickcountymd.gov/DocumentCenter/View/337780/2022-Frederick-County-Hazard-Mitigation-and-Climate-Adaptation-Plan---for-Adoption?bidId=

impacted by worsening severe weather resulting from climate change and establishes guidelines for identifying hazards to public infrastructure and allocating future growth to mitigate potential future hazards. Plan Actions, like FC-31, recommend expansion of dry hydrants in rural areas and minimizing the expansion of the Rural Residential (RR) land-use designation into areas currently designated for Agricultural (A) or Natural Resources (NR) land uses.

In March of 2023, Frederick County's Division of Energy and Environment, in partnership with the Metropolitan Washington Council of Governments and ICF, released the Frederick County Climate and Energy Action Plan for Internal Government Operations. This plan is a tool intended to assist the County in achieving the goals outlined in the County's Climate Emergency Resolution, but it also identifies strategies and recommendations to address equity in the implementation of resilience efforts as well as potential actions that can be taken to improve the resilience of water and wastewater infrastructure in the face of rising temperatures and increasing precipitation.

Additionally, the United States Environmental Protection Agency has also developed a web-based tool, identified as the Climate Resilience Evaluation and Awareness Tool (CREAT), for assisting in the evaluation of potential climate change impacts. A subset of tools has been specifically developed for Creating Resilient Water Utilities (CRWU) [24] that includes step-by-step instructions and tools for establishing resiliency in a public water utility, as well as historical climate data and scenario modeling capability to project potential impacts associated with climate change on local water utilities.

Important resources like the Hazard Mitigation and Climate Adaptation Plan, the Climate and Energy Action Plan, and the CREAT tool should continue to inform both planning and operations of Frederick County's public water infrastructure.

Advanced treatment technologies to remove toxins resulting from harmful algal blooms (HABs) are very expensive. While the topic of HABs may be somewhat new to the Frederick County Water Resources Element, water systems in other parts of the country have been dealing with this issue for years. In 2020, the Ohio Division of Drinking and Ground Water's (DDAGW) conducted a survey of 108 systems in the state for HAB related costs. Eight systems in the Western Lake Erie Basin (WLEB) responded to the survey to indicate that they had made capital investments to address the issue at an average cost of $14.1 million dollars per system. The City of Toledo, Ohio, (population 270,870) indicates that costs associated with toxin monitoring, treatment through infrastructure improvements, and disposal of treatment residuals result in a cost of $18.76 per capita per year.[3] As indicated in the discussion of cyanobacteria earlier in this chapter, the occurrence of algal blooms is becoming more frequent in Frederick County and their recurrence in waters that serve as drinking water sources should be monitored closely.

3 Zimnicki, T. (2022). Western Lake Erie Basin drinking water Systems: Harmful algal bloom cost of intervention. In Alliance for the Great Lakes. https://greatlakes.org/wp-content/uploads/2022/05/FINAL-COI-Report-051622.pdf

24 Climate Resilience Evaluation and Awareness Tool | US EPA. (2024, January 31). US EPA. https://www.epa.gov/crwu/climate-resilience-evaluation-and-awareness-tool

DRINKING WATER GOALS, STRATEGIES, POLICIES & IMPLEMENTATION

To achieve water resources goals related to the Drinking Water Assessment, the following policies and action items have been identified. Completion of the action items and adherence to the policies will be monitored by the County through future review of and updates to the Water Resources Element and the Livable Frederick Master Plan.

Policies

- Continue to protect community groundwater-based systems and individual wells in karst (limestone) areas (2010 Water Resources Element, Policy P-07).
- Support compatible land uses within designated wellhead protection areas (2010 Water Resources Element, Policy P-08).
- Promote the use of reused or recycled water for non-potable uses as a means to conserve treated drinking water while following any current greywater use regulations.
- When considering expansion of small systems in proximity to the City of Frederick, evaluate the feasibility of connecting sub-regional water systems to the County's New Design system, which can provide enhanced water treatment and capacity.
- Future County area and corridor plans and certain functional plans should assess existing water demand and potential demand under the proposed land use plan and recommend additional facilities or improvements needed for plan implementation.

Recommendations

- Investigate possible implementation of additional affordability programs for drinking water supply like the City of Philadelphia's TAP Program.
- Begin work on an affordability database to assist in directing outreach and funding for affordability programs.
- Partner with Frederick County Workforce Services to develop a career pipeline for public water and wastewater utilities.
- Continue to leverage opportunities for redevelopment and neighborhood revitalization like those proposed under the South Frederick Corridors Plan.
- Leverage resources available through the U.S. EPA's Creating Resilient Water Utilities (CRWU) program when addressing challenges for drinking water systems resulting from climate change within Frederick County.
- Leverage resources available through the U.S. EPA's Cyanotoxins Preparedness and Response Toolkit (CPRT) to develop cyanotoxin monitoring and communication plans for public water systems utilizing surface water sources that may be susceptible to Harmful Algal Blooms (HABs).
- Explore the application of water recharge easements as a complement to existing agricultural and land preservation easement programs in areas served by non-surface water systems (2010 Water Resources Element, Recommendation A-01).
- In karst areas, explore options such as providing public water and limiting permitted land uses that require significant groundwater withdrawals (Adaptation of Frederick County 2010 Water Resources Element, Recommendation A-09).

Policies and Recommendations from Related Plans

The topics covered in this Water Resources Element are highly interconnected with other existing planning efforts. The following are policies and action items from these plans with page numbers or recommendation references noted and are hereby adopted as part of the Frederick County Water Resources Element.

Climate *Response and Resilience Report, August 2021 (Volume 2, Technical Recommendations) - Frederick County and City Climate Change Working Group of Frederick County*

- Plan for addressing hazardous toxins in surface and subsurface drinking water sources by developing monitoring programs, identifying potential alternate sources, and identifying potential toxin removal infrastructure for local facilities (adapted from p. 206).
- Identify and track water use in historically drought-sensitive areas of the City of Frederick and the County to enable more effective targeting of water conservation or reuse practices (p. 185).

Frederick County Hazard Mitigation and Climate Adaptation Plan, March 2022 – Frederick County Government

- **Recommendation FC-31** - Improve the rural water supply in areas with significant wildfire/urban interface fire hazards by installing and repairing dry hydrants. Minimize new residential developments that rely on wells and dry hydrants by prohibiting the expansion of the Rural Residential Land Use Designation into Agricultural and Natural Resource areas.

Frederick County Climate and Energy Action Plan for Internal Government Operations, March 2023 – Frederick County Government

- **Action 11B:** Harden physical resilience for assets and facilities.
- **Action 12B:** Implement flood risk reduction measures.

Wastewater Assessment

INTRODUCTION

As noted in the first Frederick County Water Resources Element in 2010, safe and effective wastewater disposal is a key component of healthy communities and a healthy environment. Community wastewater systems will continue to experience pressure from population growth and the expansion of employment. The continuing use of individual septic systems, especially those that are failing, must actively be monitored. Frederick County must continue to balance the ability to provide wastewater treatment capacity based on current and future limitations of pollutant loads that can be safely discharged into the County's streams and rivers. As with the availability and quality of water supplies, the effects of a changing climate, such as increased evaporation, increased precipitation, and an increasing frequency of severe flood events have the potential to negatively impact the wastewater infrastructure critical to the population of Frederick County.

In accordance with the goals of the Livable Frederick Master Plan outlined below, the wastewater assessment investigates treatment capacity, major issues related to wastewater, and wastewater policies and projects. In this chapter, the current wastewater treatment capacities for county and municipal wastewater systems are compared to the projected build-out of the respective community growth areas identified in the Livable Frederick Master Plan.

The following goals and initiatives of the Livable Frederick Master Plan address aspects of wastewater treatment capacity:

Lf The Liavble Frederck Master Plan → Vi Our Vision → Ev 4. Our Environment → 2. Water

Goal 4.2.2 Supply and Treatment Infrastructure - Ensure groundwater and surface water remain safe, reliable, and sustainable sources for public consumption.

Initiative 4.2.2.1 Water and Sewer Adequacy - Ensure that wastewater and water supply infrastructure is adequate, sound, and efficient to provide for current and future populations.

Supporting Initiative 4.2.2.1.2 Thoroughly evaluate the location and size of areas dedicated for growth and development based on the adequacy of impacts to drinking water supplies and wastewater treatment and conveyance capacities.

IMPACT TO RECEIVING WATERS

Wastewater treatment plants (WWTPs) treat raw wastewater to meet effluent requirements established by the Maryland Department of the Environment (MDE). WWTPs are considered point sources of pollution discharge because they discharge treated effluent directly into waterways at single location, or "point." MDE issues a National Pollution Discharge Elimination System (NPDES) permit for each WWTP, which specifies the allowable ranges for chemical, physical, and biological parameters of the effluent. Permits are issued on a five-year planning horizon, and these permits set discharge limits for WWTPs for the period in which they are effective.

The contribution of nutrients (nitrogen and phosphorus) from WWTPs is a major water quality problem facing Frederick County streams, with impacts to the Potomac River and the Chesapeake Bay watershed as well. Frederick County WWTPs discharge to main stem sections of the Monocacy River, Catoctin Creek, the Potomac River, and their tributaries. The type of treatment required at each WWTP is determined by the ability of the receiving stream to assimilate effluent discharge and the overall impacts to the watershed. The County's major streams have limited ability to assimilate pollution due to low flow, seasonal variation in flow, and slow-moving stream conditions.

For example, Catoctin Creek has reached its maximum capacity of permitted pollutant loads from the existing WWTPs that discharge to it. Expansion of the existing WWTPs serving Middletown, Myersville, Fountaindale, and Jefferson would require a corresponding reduction in nutrient effluent concentrations.

In order to proactively address the permitted discharge capacity within the Monocacy River, the Division of Water and Sewer Utilities (DWSU) commissioned and completed upgrades that incorporate enhanced nutrient removal (ENR) and membrane bioreactor technology into the Ballenger-McKinney WWTP. These improvements, completed in 2013, enabled the plant to reach its current permitted treatment capacity of 15 million gallons-per-day (mgd). Additional future expansions to the plant were included as part of the facility planning process and could provide up to 25 mgd treatment capacity when completed.

As part of the treatment expansion at Ballenger-McKinney, Frederick County and several incorporated municipalities worked cooperatively to decommission smaller, older treatment facilities to achieve an overall improvement in the treatment of discharged effluent. These facilities included the Lake Linganore WWTP, Spring Ridge WWTP, Pinecliff WWTP, Buckingham Hills WWTP, Urbana High School WWTP, Libertytown WWTP, Reich's Ford Road Landfill WWTP, New Market WWTP, and Monrovia WWTP. Currently, the Ballenger-McKinney WWTP provides wastewater treatment capacity for Frederick County, portions of the City of Frederick, the Town of New Market, and the Town of Walkersville. The Town of Emmitsburg, Fort Detrick, the City of Frederick, the Town of Thurmont, the Town of Woodsboro, and Frederick County (Ballenger-McKinney WWTP, Crestview WWTP, Mill Bottom WWTP, Pleasant Branch WWTP, and White Rock WWTP) currently operate treatment facilities that discharge either directly to the Monocacy River or its tributaries.

As is the case with drinking water supply, the Potomac River has emerged as the panacea for meeting future wastewater disposal needs in Frederick County. Two wastewater treatment plants currently discharge directly into the Potomac River (Brunswick and Point of Rocks) and both the Monocacy River and Catoctin Creek flow directly to the Potomac. In the future, the City of Frederick and Frederick County may utilize an outfall line to the Potomac River from the Ballenger-McKinney WWTP to handle excess treated effluent that cannot be assimilated by the Monocacy River. Some of the infrastructure necessary to establish this outfall currently exists, but additional planning and improvements are necessary to ensure proper function of this system. The development of the Quantum Frederick data center campus in the Eastalco growth area may aid in accelerating the timeline for operation of new discharge infrastructure to the Potomac River, as the potential exists for treated wastewater from the Ballenger-McKinney WWTP to be withdrawn from this conveyance system for use in cooling operations at data centers within the campus.

Discharge permits for the Potomac River require the use of denitrification plants with filters to reduce the nitrogen loadings into receiving waters. This requirement protects downstream water users and serves to protect the Chesapeake Bay. In the future, new or expanded wastewater treatment plants will need to employ filtration and nitrification/denitrification to meet strict discharge permit requirements.

FREDERICK COUNTY WASTEWATER SYSTEMS

The service areas depicted on Map 8 reflect properties with sewer classifications of "1" (existing service) under the Frederick County Water and Sewerage Plan. In some locations, properties with a classification of "3" (service expected within 3 years) that have received approval of development plans and are substantially under construction have also been included in the existing service area. The Planned Service Area would generally be expected to have sewer service within a 20-year time frame. However, areas within a Community Growth Area may also have a No Planned Service (NPS) sewer category, indicating a longer-term time frame for public sewer service than the Planned Service (PS) category, consistent with growth policies in the County Comprehensive Plan and the Water and Sewerage Plan.

The County's Water and Sewerage Plan, the Livable Frederick Master Plan, and the WRE seek to generally limit connection to a publicly owned treatment works ("public sewer") to properties within regional service areas or Community Growth Areas. These service and growth areas are delineated on the County's Water and Sewerage Plan maps. It is important to note that a service area and a CGA are not, necessarily, interchangeable. Some existing service areas are outside CGAs such as the Crestview, White Rock, Mill Bottom, Lewistown, and Pleasant Branch service areas.

While it is the policy of the County to extend new public sewer service to areas designated for growth (CGAs), there are situations when a public sewer connection, or a new service area outside of a CGA, are warranted. The Water and Sewerage Plan has specific policies and procedures to address these exceptions.[1] As noted in this WRE's Introduction, as well as the 2010 WRE (Page 2), the Water and Sewerage Plan and its rules, procedures, and classification mapping is the official document guiding water and sewer planning in Frederick County and takes precedence over the information or general policies and recommendations contained within this Water Resources Element.

It is important to note that there is not a direct correlation between the water service areas and wastewater service areas that are supplied or serviced by the Frederick County Division of Water and Sewer Utilities (DWSU). The service areas for these utilities have evolved over time and in response to opportunities and challenges that have been overcome through a partnership between the County and various municipalities. The following maps are reflective of the fact that while certain municipalities like New Market may rely on the County for both water and sewer service, other municipalities like Walkersville maintain their own water system but sewer service is provided by the County's Ballenger-McKinney WWTP. Other municipalities, like the City of Frederick, maintain their own, independent water and sewer systems, but also coordinate with Frederick County to enter cost-sharing agreements to provide service to certain areas within the City of Frederick and its surrounding growth area.

Current and Future Capacity (Frederick County Systems)

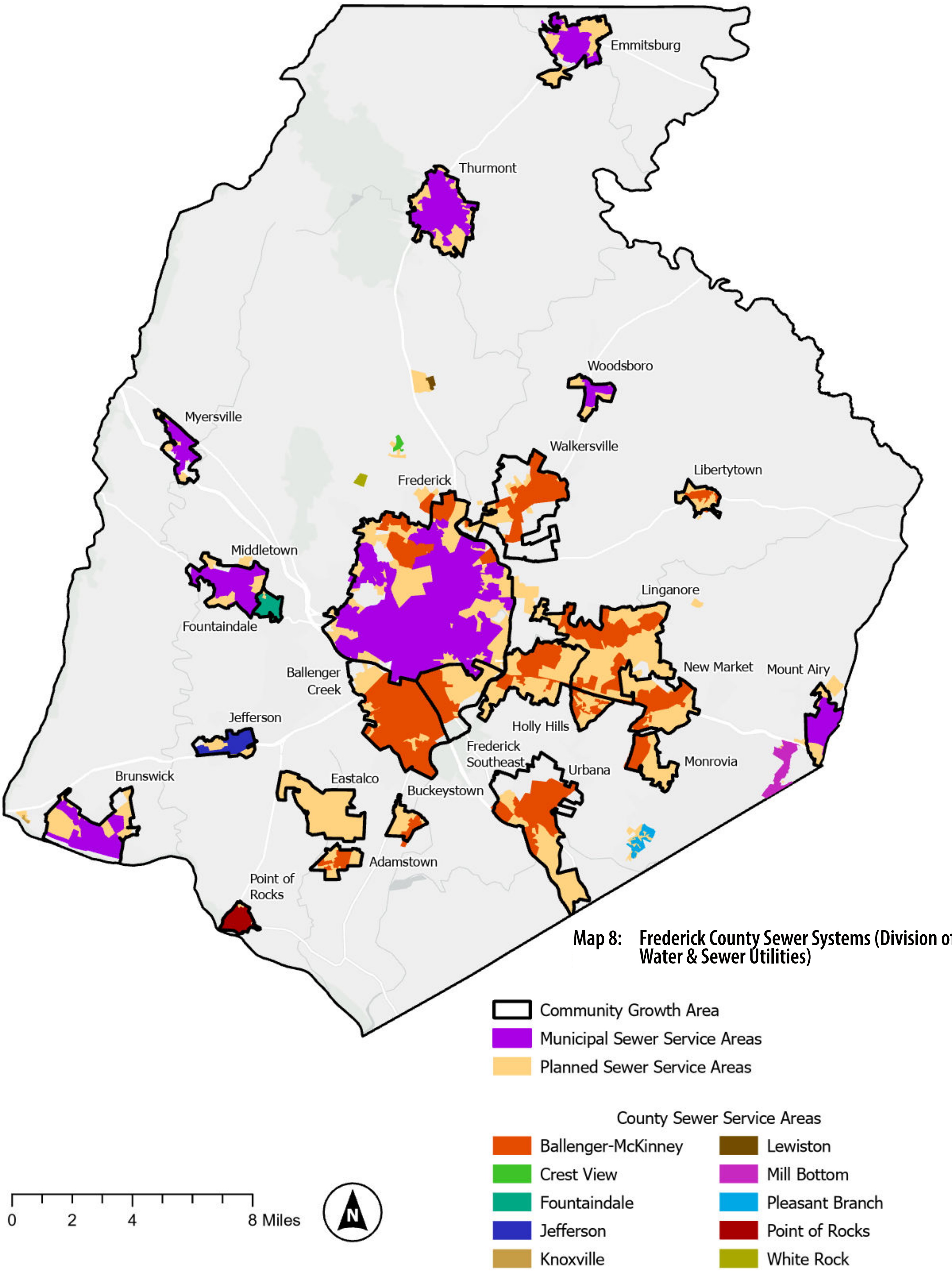
The following table depicts the WWTP capacities and the current and future demand for the respective treatment facilities owned and operated by Frederick County's Division of Water & Sewer Utilities (DWSU). It is important to note that the wastewater treatment capacities described in Table 3.01 reflect current, permitted capacities and current demand of the individual county systems as derived from an analysis of monthly flow totals for the years 2021 through 2023. Permitted capacity could possibly be increased in the future, dependent upon federal, state, and local approvals.

Potential future needs are identified for the 10-year planning horizon for this Wastewater Assessment (2035) and the 25-year horizon (2050) identified in Maryland Department of Planning guidance. Estimates of future capacity reflect projections developed by staff utilizing local planning knowledge, residential pipeline data, and Round 10.0 of the MWCOG Cooperative Forecast. Growth projections are intentionally aggressive so that weaknesses or inadequacies in the infrastructural and environmental systems serving our communities may be identified, studied, and remedied before significant problems arise.

The methodology used to predict future utilization of wastewater systems is identical to the methodology employed in the Drinking Water Assessment. Wastewater generation by existing residential development is assumed to be captured by the existing average flow experienced by each system. The impact of future residential development is tallied using the total number of new dwellings within a community growth area, multiplied by the equivalent of 250 gallons-per-day-per-dwelling, also known as an "Equivalent Dwelling Unit" (EDU). This unit of measure is also utilized by the Maryland Department of the Environment for the permitting and tracking of water and wastewater systems. The total number of new dwelling units in each growth area for target years 2035 and 2050 has been set by Livable Frederick staff based on local planning knowledge, existing pipeline data maintained by the Frederick County Division of Planning and Permitting, and population projections in the Round 10.0 Cooperative Forecast to the year 2050.

For the purposes of estimating non-residential wastewater generation in the wastewater assessment, existing non-residential use is also assumed to be captured in the existing flow. Future non-residential wastewater generation is based on employment projections identified in the Round 10.0 Cooperative Forecast. To correlate employment trends to corresponding growth areas in Frederick County, Transportation Analysis Zones (TAZs) have been utilized. TAZs allow for a variety of data – inherent to TAZs because of widespread regional and national adoption – to be brought to bear upon this exercise. It should be noted that TAZ boundaries do not necessarily follow municipal boundaries or Community Growth Area boundaries. For that reason, the approximate percentage of each TAZ that falls within a County or Municipal growth area boundary was

1 The construction of new sub-regional systems outside of Community Growth Areas is not permitted, although there are exceptions for septic problem areas. For more information, refer to Water and Sewerage Plan Chapter 1, Section E. General Policies, Policies #4, Sub-Regional Water and Wastewater Plants; #5, Plant Size-Service Area; and Policy #11, Response to Sanitary and Water Supply Problems.



Map 8: Frederick County Sewer Systems (Division of Water & Sewer Utilities)

approximated and results were apportioned accordingly. In some cases, the analysis internalized specific knowledge about the developability of certain land areas to reflect the amount of development in the TAZ that would be attributable to the specific county growth area. Non-residential water use was also projected to the 2050 horizon year.

For a more in-depth evaluation of the growth projections see the supplemental data published concurrently with the release of the Water Resources Element.

Table 3.01 Wastewater Supply and Demand by County Service Area

Service Area	Permit No. (1)	Receiving Stream (1)	Permit Capacity (MGD) (1)	Design Capacity (MGD) (1)	Average Flow (MGD) (2)	Remaining Capacity (MGD) (3)	Projected Flow 2035 (MGD)	Projected Flow 2050 (MGD)	Current Population: Total (1)
Lewistown	15-DP-0730 MD0022900	Fishing Creek	0.027	0.027	0.002	0.025	0.012	0.015	227
Crestview	18-DP-0672 MD0022683	Muddy Run	0.036	0.036	0.018	0.018	0.018	0.018	458
White Rock	18-DP-0278A MD0025089	Tributary of Tuscarora Creek	0.050	0.025	0.010	0.015	0.010	0.010	264
Fountaindale	20-DP-0668 MD0022721	Hollow Creek	0.200	0.250	0.107	0.093	0.132	0.177	1,712
Pleasant Branch	15-DP-2814 MD0065269	Tributary of Bennett Creek	0.100	0.100	0.055	0.045	0.055	0.055	839
Mill Bottom	15-DP-2841 MD0065439	Bush Creek	0.100	0.100	0.066	0.034	0.066	0.066	1,215
Jefferson	16-DP-0097 MD0020737	Catoctin Creek	0.300	0.300	0.137	0.163	0.148	0.183	2,270
Point of Rocks	15-DP-0482 MD0020800	Potomac River	0.230	0.230	0.095	0.135	0.117	0.157	1,754
Ballenger-McKinney (4)	16-DP-0809 MD0021822	Monocacy River	15.000	15.000	7.340	7.660	11.245	15.071	148,178
Knoxville / New Addition (5)	-	-	0.100	-	0.030	0.070	0.032	0.035	563
TOTALS	-	-	**16.143**	**16.068**	**7.860**	**8.258**	**11.835**	**15.787**	**157,480**

(1) Information obtained from Frederick County Water & Sewerage Plan - Approved - February 2, 2021 (as amended August 25, 2023) - Table 4.03. Permit numbers reflect currently issued permits.
(2) Average of 2021 - 2023 WWTP flow data provided by Frederick County.
(3) The remaining capacity is the difference between the average flow and the permit capacity or design capacity, whichever is less.
(4) The Quantum Frederick Data Center campus is located within Ballenger-McKinney WWTP service area. The projected wastewater yield for this project has been included in the Projected Flow for 2035 and 2050.
(5) Knoxville / New Addition is serviced by the City of Brunswick. Permit capacity reflects the capacity allotted by the City of Brunswick to the Knoxville-New Addition system and the Village of Rosemont per the Joint Operational Agreement between Frederick County and the City of Brunswick signed in 1993 and as amended in 2020. Agreement capacity is not included in permitted totals. Current population total reflects 2020 census data for blocks 2001, 2008, 3010-3012, 5001, 5002, 5009,

5010, and 5031.

Capacity Management

As is the case with public drinking water systems, the Environment Article of the Annotated Code of Maryland Title 9, Subtitle 5, enables MDE to require Wastewater Capacity Management Plans (WWCMPs) for wastewater systems. WWCMPs are submitted by operators of WWTPs that have reached 80% of the associated WWTP design capacity,[2] based on an average of the previous 3-years' flow data, or when WWTPs are under a pre-existing order to submit a WWCMP to MDE or DOJ/MDE.

Typically, WWCMPs address current utilization, sources of potential excess capacity, and controls that are established by systems to ensure that wastewater service connections do not exceed permitted capacity or design capacity (whichever is less) of the system. Capacity Management is being addressed in this Wastewater Assessment, but the Frederick County Water & Sewerage Plan, which is updated by the County on a revolving 3-year basis and approved by MDE, is the official document of record for tracking Capacity Management. The Water & Sewerage Plan is available on the County website at the following location: *https://www.frederickcountymd.gov/8653/Water-Sewerage-Planning*.

The following table summarizes current and future utilization estimates based on the values in Table 3.01. As of the drafting of this Water Resources Element, no County systems require the development of a Wastewater Capacity Management Plan for wastewater treatment.

Table 3.02 Current Utilization by County Service Area[3]

System Name	Current % Utilization	2035 % Utilization	2050 % Utilization
Lewistown	8%	44%	56%
Crestview	50%	50%	50%
White Rock	20%	20%	20%
Fountaindale	54%	66%	89%
Pleasant Branch	55%	55%	55%
Mill Bottom	66%	66%	66%
Jefferson	46%	49%	61%
Point of Rocks	41%	62%	68%
Ballenger-McKinney	49%	75%	100%

Table 3.02 indicates that the Ballenger-McKinney WWTP could meet this threshold sometime after the 2035 planning horizon. However, it should be noted, that the full allocation of potable water assigned to the Quantum Frederick Data Center campus is assumed to be returned to the Ballenger-McKinney WWTP in this assessment and that no evaporative cooling of potable water will occur. If potable water is utilized for cooling in some capacity, the WWCMP requirement threshold may not be triggered until a later date. The Fountaindale WWTP and the Ballenger-McKinney WWTP could require WWCMPs by 2050 if capacity is not expanded, though Fountaindale would not exceed its treatment capacity. The use of potable water for evaporative cooling at the Quantum Frederick Data Center campus could result in the Ballenger-McKinney WWTP not reaching or exceeding 100% design capacity by 2050.

As noted above, the thresholds indicated in this chart have been provided for planning purposes only, and the Frederick County Water and Sewerage Plan is the governing document regarding the management of wastewater system capacity. That being stated, Table 3.02 does identify potential actions that could be taken to address future need, including the consideration of how data center evaporative cooling affects both water and wastewater supplies.

The topic of capacity management is focused solely on County-owned and operated wastewater systems for the purposes of this Water

2 If "Average Flow" exceeds 80% of "Design Capacity" in Table 3.1 per https://mde.maryland.gov/programs/researchcenter/reportsandpublications/documents/www.mde.state.md.us/assets/document/water/wastewatercapacitymgmtguidance.pdf.
3 Knoxville/New Addition has been included in this analysis due to limited, yet potential, growth in the system. Utilization is based on the existing agreement with the City of Brunswick to supply wastewater treatment.

Resources Element. Frederick County coordinates with the incorporated municipalities with regard to the preparation and implementation of the County's Water and Sewerage Plan, but individual municipalities are each responsible for their own capacity management unless water or wastewater service is provided by Frederick County, as is the case with the Towns of Walkersville (wastewater) or New Market (drinking water and wastewater).

Potential Futures for County Service Areas

The introductory chapter of this Water Resources Element briefly described four potential Development Frameworks that were considered as part of the Livable Frederick Master Plan (LFMP) process, including: Business as Usual, City Centers Rise, Suburban Placemaking, and Multi-Modal Places and Corridors. While no single framework was ultimately adopted as part of the LFMP, each contributed in some manner to the development of the LFMP Thematic Plan. The intent of the Thematic Plan was to "... achieve a pattern of development that employs a jobs-based approach to growth and that is centered on multi-modal accessibility in Frederick County, taking advantage of the existing transportation systems in place, the future systems and technologies for moving people and products, and the innovative land use patterns that support transportation choices." This focus on transportation choice recognizes the importance of existing incorporated municipalities and those unincorporated communities that have been designated as Community Growth Areas to function as hubs of future growth and development that reduce dependence on automobile travel and facilitate the development of alternative modes of transportation. The following service areas, and the Community Growth Areas they serve, are anticipated to experience noticeable growth by the 2035 or 2050 plan horizons. An overview of each of these systems, with additional information regarding current and future improvements, is included in Appendix B.

Central Frederick Sewerage Service Area (Ballenger-McKinney WWTP)

The Central Frederick Sewerage Service Area is the largest of the existing County-owned service areas, covering the Adamstown, Ballenger Creek, Buckeystown, Eastalco, Linganore, Holly Hills, Spring Ridge, Bartonsville and Urbana Community Growth Areas. It also covers the Feagaville/Mt. Zion area associated with the Jefferson Technology Park (Ballenger Creek CGA) and the urban revitalization associated with the South Frederick Corridors Plan (Frederick Southeast CGA and a portion of the Ballenger Creek CGA). Ballenger-McKinney WWTP also serves the Towns of Walkersville and New Market and portions of the City of Frederick (south and north).

Non-residential water use for the 10-year planning horizon for the Water Resources Element is anticipated to see the initial build-out of the Quantum Frederick data center campus on the former Alcoa "Eastalco" facility site, as well as continued expansion of businesses along the I-270 corridor in the Urbana Community Growth Area.

Residential growth is expected throughout the service area, with a particular emphasis on the area around Lake Linganore, as well as the Urbana area. Initial infill and redevelopment with a residential focus in the South Frederick Corridors planning area is also expected to begin during this time.

The analysis conducted as part of this Water Resources Assessment indicates that average flow will more than double for the service area by 2050, and calculations indicate that the Ballenger-McKinney WWTP may require a capacity analysis to meet the anticipated 30,925 equivalent dwelling units (EDUs) that could be generated within this service area. It should be noted that discharge permits associated with WWTPs are set for nutrient and pollutant levels within discharged wastewater rather than the volume of wastewater. The relatively high level of treatment that can be achieved by the Ballenger-McKinney WWTP may accommodate discharge volumes above those indicated in Table 3.01 in the future, provided that current levels of treatment are maintained or potentially improved.

Jefferson Service Area

As noted in the Drinking Water Assessment, the unincorporated community of Jefferson is situated along two established, well-traveled arteries between the City of Frederick and the communities of Brunswick in Frederick County and Harpers Ferry, Charles Town, and Martinsburg in West Virginia via MD-340. Additionally, the cities of Leesburg and Ashburn, Virginia, on the western banks of the Potomac are readily accessible vs US-15 from Frederick County.

The 10-year planning horizon for this area includes the build-out for the Jefferson Village age-restricted development and a modest expansion of non-residential use associated with businesses seeking to take advantage of Jefferson's location along two important regional highways.

The analysis in this WRE indicates that Jefferson's location could make it an attractive location for potential future residential growth toward the latter half of this document's planning horizon in the years 2040 to 2050. Future projections conducted as part of this assessment appear to indicate that the Jefferson Service Areas existing wastewater facilities may be adequate to accommodate projected growth.

Point of Rocks Service Area

The unincorporated community of Point of Rocks lies near the southeastern limits Frederick County, at the intersection of Tuscarora Road, which connects it to MD-85 and MD-28 to the east, and US-15, which connects it to Leesburg, VA, and other towns on the western banks of the Potomac River to the south.

No major projects are identified in the residential pipeline, and only light to moderate growth has been projected for completion by the 2035 planning horizon. However, modest residential growth may be anticipated as it approaches the 2050 planning horizon due to a favorable location and proximity to the suburbs of Washington, D.C., and northern Virginia. A limited amount of non-residential water use is also anticipated as businesses and services will seek to locate in proximity to a growing community with proximity to the Potomac River and destinations in Washington, D.C., and Virginia.

This assessment and the associated projections indicate that the Point of Rocks WWTP may be adequate to meet future demand for the 25-year planning horizon.

Fountaindale/Braddock Service Area

The unincorporated communities of Fountaindale and Braddock Heights are situated near the City of Frederick and the Town of Middletown and along major east-west highways (I-70 and US-40). These communities also have connections to the community of Jefferson to the south via Holter Road and Jefferson Boulevard.

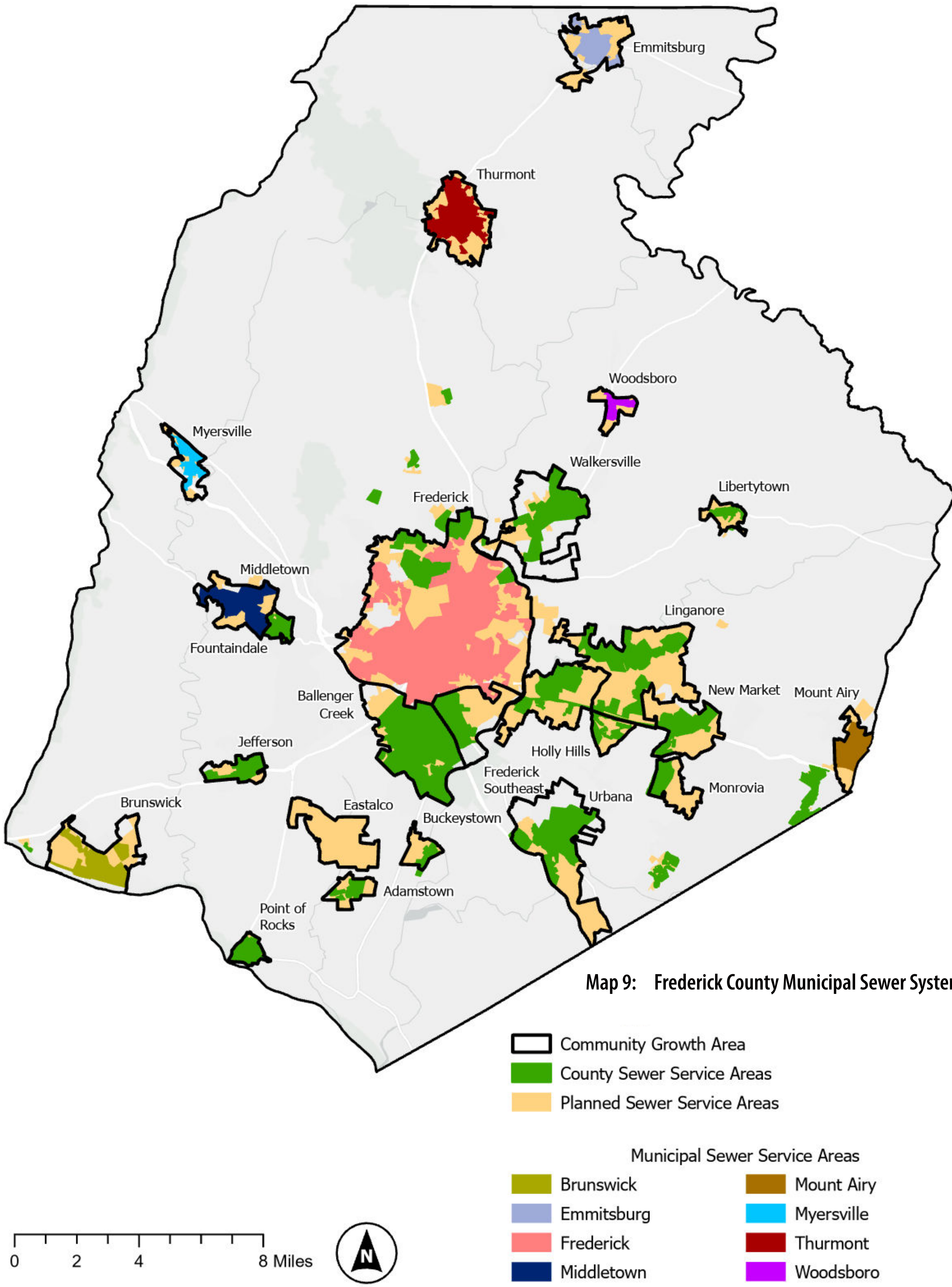
Due to their proximity to their location immediately between the City of Frederick and the Town of Middletown and access to major highways, these communities are expected to see some residential growth in the 10-year planning horizon and a modest increase in non-residential water use. As the City of Frederick and the Town of Middletown grow toward the 25-year planning horizon, a further increase in residential growth is expected.

Currently, the Fountaindale wastewater system utilizes slightly less than half of its potential capacity, and projections indicate that the system may be adequate to address wastewater flows from the full allocation of growth identified in this assessment.

MUNICIPAL WASTEWATER SYSTEMS

There are currently eight municipalities in Frederick County that maintain and operate their own municipal wastewater systems, including the Cities of Brunswick and Frederick and the Towns of Emmitsburg, Mount Airy, Middletown, Myersville, Thurmont, and Woodsboro. The Town of Middletown operates two, separate wastewater systems to serve its population, and that distinction has been noted in the table provided in this chapter, as well as in the Appendix B that provides additional detail regarding each municipal system.

As noted previously in this chapter, county and municipal WWTPs release their discharges (or most of their discharges in the case of some systems) to surface waters. The City of Brunswick is the lone municipal system to discharge directly to the Potomac River. The remaining municipal plants discharge to the Monocacy River, Catoctin Creek, or tributaries to those waters, and these discharges are accounted for in the evaluation of compliance with established Total Maximum Daily Loads (TMDLs) for nitrogen, phosphorous, and other tracked influencers of water quality.



Map 9: Frederick County Municipal Sewer Systems

Current Service Areas (Municipal Systems)

Map 9 indicates the location of those incorporated cities and towns that are currently served by their own municipal wastewater system and identifies those systems by name.

Current and Future Capacity (Municipal Systems)

The following table depicts the WWTP capacities and the current and future demand for the respective treatment facilities owned and operated by municipalities in Frederick County. It is important to note that the wastewater treatment capacities described in Table 3.03 reflect estimates provided by municipalities as part of work on updates to the County's Water & Sewerage Plan. As is the case with the County systems, permitted capacity could possibly be increased in the future, dependent upon federal, state, and local approvals.

Methodology employed for the projected demand for municipal systems closely mirrors the methodology established for future demand for County-owned systems. It is important to note that non-residential wastewater flows for municipal systems address only the 10-year planning horizon of 2035. Residential growth is carried out to the 25-year planning horizon of 2050.

For a more in-depth evaluation of the growth projections see the supplemental data published concurrently with the release of the Water Resources Element.

Table 3.03 Wastewater Supply and Demand by Municipal Service Area

Service Area	Permit No. (1)	Receiving Stream (1)	Permit Capacity (MGD) (1)	Design Capacity (MGD) (1)	Average Flow (MGD) (2)	Remaining Capacity (MGD) (3)	Projected Flow 2035 (MGD)	Projected Flow 2050 (MGD)	Current Population: Total
Brunswick	21-DP-0106 MD0020958	Potomac River	1.400	1.400	0.687	0.713	0.818	0.941	6,364
Emmitsburg	16-DP-0113 MD0020257	Toms Creek	0.750	0.750	0.501	0.249	0.634	0.764	3,137
Frederick City	18-DP-0801A MD0021610	Monocacy River	8.000	8.000	5.810	2.190	7.312	8.487 (4)	72,481
Middletown West	18-DP-0462 MD0024406	Catoctin Creek	0.250	0.250	0.192	0.058	0.192	0.192	4,688
Middletown East	13-DP-3182 MD0067628	Hollow Creek	0.250	0.350	0.247	0.003	0.319	0.359	
Myersville	13-DP-0124 MD0020699	Grindstone Run	0.300	0.300	0.132	0.168	0.181	0.253	1,799
Mount Airy	14-DP-0641 MD0022527	Patapsco River	1.200	1.200	0.732	0.468	0.749	0.761	3,854
Thurmont	16-DP-0639	Hunting Creek	1.000	1.000	0.555	0.445	0.717	0.842	6,752
Woodsboro	12-DP-1855 MD0058661	Israel Creek	0.250	0.250	0.077	0.173	0.090	0.115	1,240
Fort Detrick	18-DP-2527 MD0023230	Toms Creek Tributary	2.000	3.000	0.770	1.230	1.050	1.100	8,330
TOTALS	**-**	**-**	**15.400**	**16.500**	**9.703**	**5.697**	**12.062**	**13.814**	**108,645**

(1) Information obtained from Frederick County Water & Sewerage Plan - Approved - February 2, 2021 (as amended August 25, 2023) - Table 4.03. Permit numbers reflect currently issued permits.
(2) 3-Year average flow data as reported by the municipality or Fort Detrick. Emmitsburg data represents a 1-year average utilization for the calendar year 2023.
(3) The remaining capacity is the difference between the average flow and the permit capacity or the design capacity, whichever is less.
(4) Per the Central Frederick Sewer Service Area Agreement, when flow at the City of Frederick WWTP exceeds 8.000 mgd, an additional 1.360 mgd of treatment capacity has been allocated at the Ballenger-McKinney WWTP.

Potential Futures for Municipal Wastewater Service Areas

As mentioned in the discussion for potential futures related to County wastewater systems, municipalities are intended to play a central role in the accommodation of residential and non-residential growth as Frederick County moves toward the years 2035, 2050, and beyond. The following municipal service areas are anticipated to experience noticeable growth by the 2035 or 2050 plan horizon. An overview of each of these systems, with additional information regarding current and future improvements, is included in Appendix B. Additional information may be found in the Comprehensive Plans and Water Resources Elements for each of the incorporated municipalities.

City of Frederick

Projections developed as part of this Water Resources Element predict that as many as 7,709 EDUs could be generated through combined residential and non-residential growth within and around the City of Frederick by 2035. That total number could, roughly, double by the 2050 planning horizon. As discussed in the Drinking Water Assessment, growth in and around the City of Frederick results in increased wastewater demand, but it also facilitates a multitude of potential benefits enumerated in the City of Frederick's 2030 CommUNITY Vision Statement and Frederick County's Livable Frederick Master Plan. Additionally, the Central Frederick Sewer Service Area Agreement, as adopted in 2014, ensures that additional capacity to meet some of this demand has been reserved at the Ballenger-McKinney WWTP.

The Town of Middletown

Middletown's recently adopted Middletown Comprehensive Plan 2023 identifies the Town's intent to maintain its small-town character as a central tenet of the Vision Statement. Projections under this plan indicate modest residential growth for both planning horizons, and that the Town's existing wastewater capacity could be exceeded by the 25-year planning horizon. Middletown is currently and actively seeking support to decommission the Middletown West wastewater treatment facility and to make necessary upgrades to the Middletown East WWTP to accommodate wastewater flow for the entire municipal service area.

The Towns of Emmitsburg and Thurmont

The Towns of Emmitsburg and Thurmont are well situated in the northern part of Frederick County along the US-15 corridor. Both possess the capacity to accommodate additional growth from a utility and school capacity perspective, and both indicate an intent to grow responsibly in their most recently approved comprehensive plans. Correspondingly, both communities have been identified as potential centers for growth in this Water Resources Element. While estimates indicate that Emmitsburg's current wastewater capacity may be adequate to accommodate the 10-year horizon, some additional capacity may be needed by 2050. The projections in this WRE indicate that Thurmont may already possess sufficient wastewater treatment capacity to meet future estimates.

The Town of Mount Airy

The Town of Mount Airy is unique in Frederick County due to its location at the intersection of Carroll and Frederick Counties. The Town is also well situated at the intersection of MD-27 and I-70. For the purposes of this assessment, only growth in the Frederick County portion of the Town's growth area has been analyzed. More information on the Town's future system capacity is available through the Town's comprehensive plan or the Carroll County Water and Sewer Master Plan.

The Towns of Brunswick, Walkersville, Myersville, and Woodsboro

Growth was allocated to each of these municipalities in accordance with current pipeline data for the 10-year planning horizon and roughly proportionate to their size and anticipated capacity to expand based on their corresponding growth area with some additional influence from Cooperative Forecast data. Local growth areas and projections were informed from *Brunswick Forward (2024)*, *The Town of Myersville Comprehensive Plan (2023)*, and *Woodsboro Comprehensive Plan (2008)*. Information was incorporated from the draft planning efforts for the Town of Walkersville 2024 comprehensive plan.

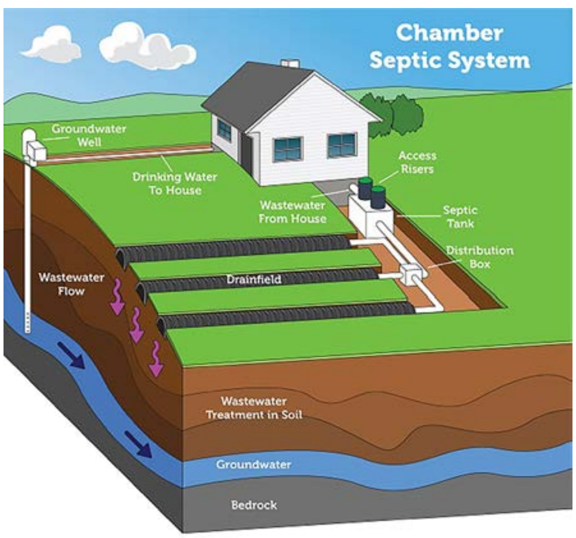
While Walkersville receives treatment through the Ballenger-McKinney WWTP, estimates indicate that the remaining municipalities may currently possess adequate capacity to meet estimated demand for the planning horizons identified in this Wastewater Assessment.

ON-SITE DISPOSAL SYSTEMS (SEPTIC)

Residences and businesses outside of the County's community sewerage service areas treat their wastewater with individual septic systems. It is estimated that there are approximately 27,000 residential on-site disposal systems (septic systems) in Frederick County.

Residential on-site disposal systems are typically designed to serve a single dwelling unit. Regulations at the state level (COMAR Section 26.04.02.05) establish sizing criteria for tanks and design standards for drainage fields based on an anticipated wastewater flow that is derived from the number of bedrooms in a dwelling and observed soil percolation test rates. For residences with on-site disposal systems, the minimum flow is based on established quantities of 150 gpd per bedroom and a minimum of 300 gpd for any single dwelling. Non-residential on-site disposal system components are sized based on a formula for estimated daily peak flow for the intended uses to be served by the system and observed soil percolation test rates.

For residential system owners in Frederick County, it may be possible to expand an existing structure (including additional bedrooms) if it can be demonstrated that the existing tank and drain field are adequately sized to accommodate additional flow. In some situations, physical modification of the system may be necessary to expand capacity. Necessary improvements are determined and approved by the Well and Septic Branch of the Frederick County Health Department.



Please note: The ends of the chamber system lines are open for illustrative purposes only. In reality, and when properly installed, these lines are closed at the end. Septic systems vary. Diagram is not to scale.

Figure 2: A Typical Chamber Septic System
Source: U.S. EPA (https://www.epa.gov/septic/types-septic-systems)

Depending on site conditions and the scope of proposed improvements, attached accessory dwelling units might also be incorporated into existing residential systems when allowed under applicable zoning regulations. Accessory dwelling units that will generate wastewater flows more than the capacity of an existing tank or drain field (with or without modification) may require the installation of a separate septic tank and drainage field to serve them. In the case of detached accessory dwelling units, the Frederick County Health Department currently requires the installation of a separate tank and delineation of a new drainage field to serve the new detached unit.

These requirements can have implications for the construction of additions or the inclusion of accessory dwelling units on a property served by an on-site disposal system. Under the Frederick County Code, an "accessory dwelling unit" is "an independent, self-contained dwelling unit located within a single-family dwelling, or within an accessory structure, or built as a separate accessory structure, and located on the same lot as a single- family dwelling." As Frederick County continues efforts to improve housing affordability, the potential to incorporate additional dwellings into existing residential communities throughout the County may be an option to increase available housing stock. However, it should be noted that many of the properties served by on-site disposal systems are located outside designated Community Growth Areas and water and sewer service areas. The State of Maryland convened an ADU Task Force in the fall of 2023 to study ADU implementation and issued a report and recommendations in 2024. As part of their work, the Task Force indicated early consensus that jurisdictions seeking to expand housing options, including ADUs, should prioritize strategies to expand public water and sewer capacity and limit ADU permitting in areas served by wells and on-site disposal systems or in areas with insufficient water and sewer capacity.

Frederick County currently allows ADUs, either by-right or by special exception, based on the size of the proposed accessory dwelling. As a result of unique aspects of the ADU permitting process, Frederick County began tracking ADUs separately in monthly permit reports. These reports indicate that construction activity related to ADUs has been limited. From 2019-2023, 27 building permits and 16 certificates of occupancy have been issued. Due to the limited number of permits and certificates that have been issued, ADUs are not anticipated to negatively impact the County's ability to meet wastewater (or water) demand through the planning horizon.

The County's projected household and population growth, as set forth in this WRE, is also agnostic about dwelling type. One household is estimated to require 250 gallons per day of water and/or sewer capacity, whether they live in an apartment building or an accessory dwelling unit. In other words, impacts to wastewater (or water) resources from ADUs are "baked in" to the analysis contained in these chapters. Additionally, if an ADU connects to public water or sewer, the County collects capacity fees on the ADU. If changes to the ADU ordinance are considered in the future, the conversation could also include a revisitation of ADU impact fees.

An aspect of housing in Frederick County that may be addressed by accessory dwelling units is the concept of multi-generational housing. Following the 2020 Census, the U.S. Census Bureau reported that as many as 4.7% of all households and 7.2% of family households in the U.S. are multi-generational as of 2020.[1] Census Bureau data also indicates that multigenerational households comprise between 5% and 7% of all households within the Frederick County.

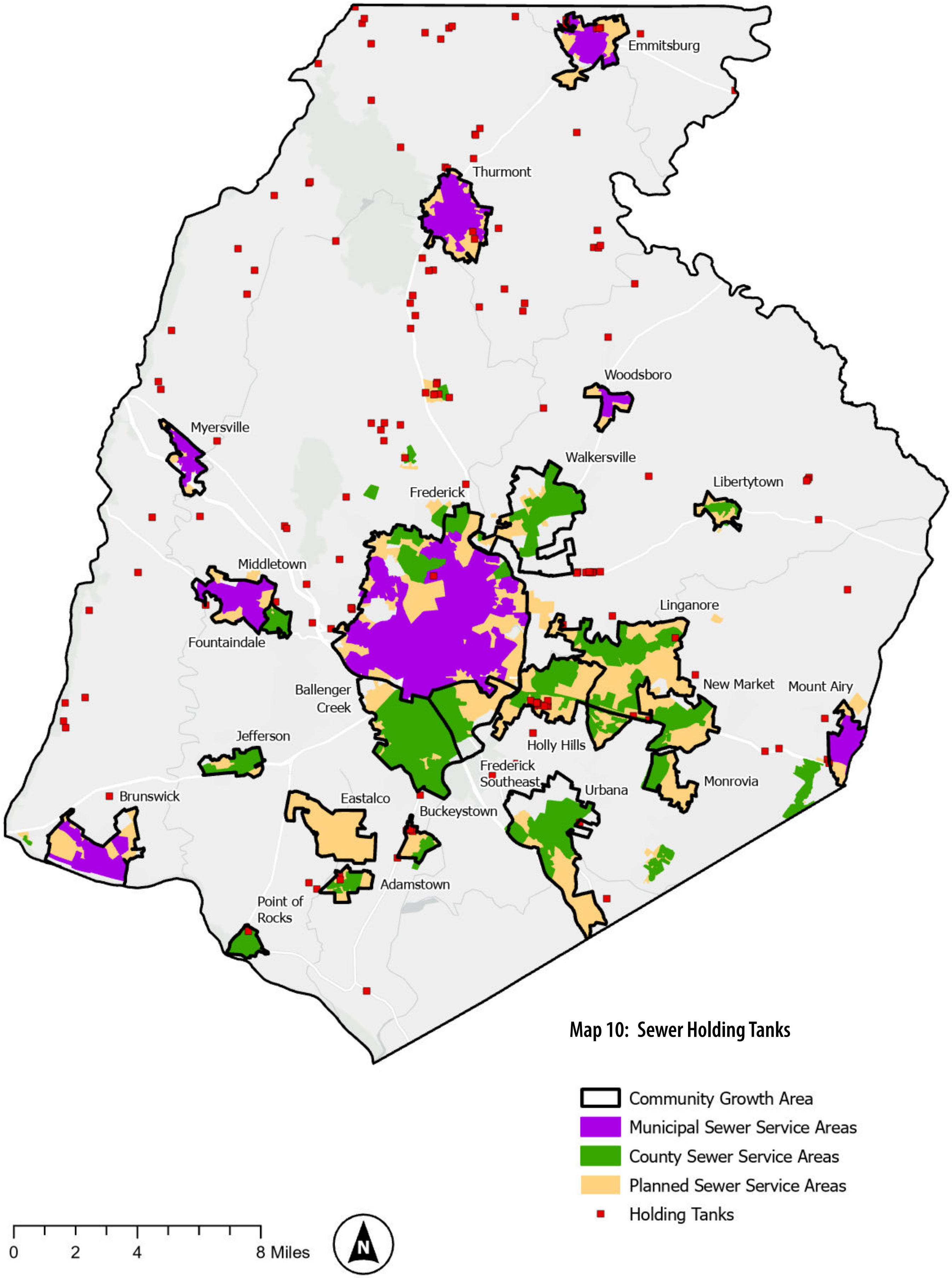
1 https://www.census.gov/library/stories/2023/06/several-generations-under-one-roof.html

When considering the impacts of on-site disposal systems on water quality, it is important to note that there are areas of the County where septic systems are failing. Poor soil conditions are the primary causes of septic failure, but lack of regular pumping and inspection by homeowners are also a cause. Sand mound (above-ground) systems can be employed in some of these areas. In some cases, soil conditions preclude the use of any on-site septic disposal system. According to the Frederick County Health Department, failing systems are prevalent in Adamstown, Bartonsville, Buckeystown, Burkittsville, Creagerstown, Lewistown, Myersville (south of town), Rocky Ridge, and Wolfsville. Failing systems are typically identified when the Frederick County Health Department receives notice of effluent on the soil surface of a property or when, in the case of property transfers, no inspection record of the on-site disposal system is submitted and staff inspection identifies a problem. The Health Department issues notices of required corrections and maintains records of repairs to non-functioning systems.

New technologies can limit the nitrogen loads from onsite septic systems in locations where soils are problematic or where on-site systems might have an outsized impact on water quality. The Bay Restoration Fund has made available grants through the local Health Department and Canaan Valley Institute to upgrade or replace existing septic systems to reduce nitrogen loading to the Bay. The Health Department has indicated that the assistance supports the implementation of Best Available Technology (BAT) treatment to failing septic systems that increase the nitrogen removal capacity. However, individual property owners are still responsible for any costs associated with improvements to leach fields associated with their systems. Additionally, the Health Department has noted that the number of applications for the grant program has exceeded the funding for several years.

Map 10 indicates the location of existing holding tanks that have been inventoried by the Frederick County Health Department. Holding tanks are installed when leach fields are not capable of functioning normally due to restrictive soil conditions. These tanks must be sized, engineered, certified, and regularly inspected to ensure they do not leak. Additionally, they must be regularly pumped out and the effluent must be transported by truck to wastewater treatment plants for processing. These requirements make holding tanks very costly to install and maintain, and they pose a persistent hazard as a potential source of effluent leaks and overflows. As part of future efforts to ensure capture and treatment of wastewater, the potential extension of service area designations and associated infrastructure may be considered in locations where a concentration of holding tanks exist in proximity to existing service areas. This WRE does not propose any specific, new, or extended service areas to address failing septic systems or holding tanks. As such, the WRE does not project for an increased demand over the planning horizon from failing septic systems. However, it is the policy of the Division of Water and Sewer Utilities to reserve 15% of water/wastewater capacity for public buildings and "health hazard" areas.[4] If extensions of service or new service areas are considered in the future, impacts to wastewater (or water) systems, treatment and discharge capacity, and other resources would be studied during the feasibility stage.

4 Division of Water and Sewer Utilities Rules and Regulations, as amended October 1, 2022: Section 10, Paragraph A. https://www.frederickcountymd.gov/DocumentCenter/View/279941/DWSU-Rules-and-Regs?bidId=.



Map 10: Sewer Holding Tanks

EQUITY AND WASTEWATER TREATMENT

As noted in the opening chapter of this Water Resources Element and in the Drinking Water Assessment, the Livable Frederick Master Plan aims to ensure that all people can be successful, enjoy a high quality of life, and be free from poverty. Safe and effective wastewater collection and treatment are critical to maintaining and healthy population and environment.

While much of the study dedicated to equity in the allocation of public water and wastewater service focuses on the provision and allocation of clean, potable water, it is important to consider the potential impacts of the non-equitable distribution of resources in the allocation of wastewater treatment infrastructure. Frederick County and the incorporated municipalities provide public wastewater treatment for nearly 80% of the county's population. As is the case with the drinking water infrastructure, the costs of maintaining wastewater treatment infrastructure can be significant as facilities constructed in the late 1960's and early 1970's are reaching the end of their operations cycle and, in many cases, utilize outdated methods and technology or are sited in locations that could be impacted by the results of climate change.[5] Expenses associated with upgrading these facilities can total tens of millions of dollars.[6] Such significant expenses can result in in the urgent need for grants or other forms of assistance or in the need for utilities to raise rates for customers.[7]

As noted in the Drinking Water Assessment, there is a significant overlap between those census tracts meeting the criteria for underserved and overburdened communities and the existing wastewater service areas for the City of Frederick Wastewater Treatment Plant and Frederick County's Ballenger-McKinney Wastewater Treatment Plant. Consequently, addressing the disparate impacts of rate increases on customers as a result of costs associated with upgrading outdated wastewater infrastructure or expanding wastewater infrastructure to accommodate growth can be addressed with some of the very same mechanisms identified in the discussion of equity and drinking water that were identified in the Drinking Water Assessment and the recommendations included in that chapter.

As is the case in Frederick County, approximately 20% of households nationwide are not connected to a public wastewater system and depend upon an on-site disposal system or septic system. In a 2022 paper entitled "Investing in America's Onsite Wastewater Treatment Systems for Equity and Sustainability," the authors note that affordability can also be a key concern when it comes to on-site systems, as much of the cost of operating and maintaining the system is borne by the property owner, and a lack of proper maintenance due to cost can result in system failures with consequences for public health.[8] The paper goes on to state that the EPA, in 2021, delivered a report to the United States Congress that indicated that households at or below the national median household income (derived from the Census Bureau's American Community Survey data from 2017) are ten percent more likely to not have adequate access to wastewater treatment and that fifty-two percent of households with on-site systems live at or below the median household income level. Additionally, identification of these households is difficult at the national level because the US Census last collected data on decentralized wastewater treatment systems in 1990.

On-site disposal systems can be costly for households at or below the state median household income level to maintain. Installing new systems can range between $8,000 and $30,000 (or more), depending on the required technology, and repairs to those systems can cost between $1,000 and $20,000. Regular pumping of the settling tank is also needed every three-to-five years to properly maintain the system, and this cost can range from hundreds to thousands of dollars depending on contractor costs, hauling costs, and disposal costs.

As mentioned in the earlier discussion of on-site disposal systems, it should be noted that there are financial resources for residents who may be struggling with the cost of maintaining an on-site disposal system. The State of Maryland, through the Maryland Bay Restoration Fund, includes a $60 fee as part of the property tax assessment for each property served by an on-site disposal system. Owners of an on-site disposal

5 Center for Sustainable Systems, University of Michigan. 2023. "U.S. Wastewater Treatment Factsheet." Pub. No. CSS04-14.
6 https://www.fredericknewspost.com/news/politics_and_government/budget_and_tax/middletown-looks-for-multiple-funding-sources-for-wastewater-project/article_b6ce3f21-b031-5096-98c1-7b5a171f492f.html
7 Jacoby, C. (2023, August 8). Town Council votes to raise water, sewer rates in Mount Airy. Frederick News Post. Retrieved February 5, 2024, from https://www.fredericknewspost.com/news/economy_and_business/services/town-council-votes-to-raise-water-sewer-rates-in-mount-airy/article_dd874963-7a62-52b3-9a62-6ad8c93c6d4f.html
8 Calabretta, S., M. Cunningham, and S. Vedachalam. (2022). "Investing in America's Onsite Wastewater Treatment Systems for Equity and Sustainability." Environmental Policy Innovation Center.

system in need of repair and facing financial hardship may apply for grants of up to $20,000 for needed repairs, but applications to this program in the County have regularly exceeded available funding. There is an additional option for owners of on-site disposal systems. The Maryland WholeHome[9] program from the Maryland Department of Housing and Community Development is available to help with needed repairs to on-site disposal systems.

In locations with problematic soils or frequent occurrences of septic failure, one potential option open to local governments is regionalization, or the construction of a central, public wastewater treatment facility that is operated privately or publicly. The Washington Suburban Sanitary Commission constructed the Hyattstown Wastewater Treatment Plant in Montgomery County in 1998 to address failing on-site systems in the vicinity of Hyattstown, and Frederick County elected to regionalize wastewater treatment in the Lewistown area in 2016. Similarly, the Highfield/Blue Ridge Summit Wastewater Treatment Plan, operated by the Washington County Sanitary District, serves residents in the vicinity of Sabillasville in northwestern Frederick County.

CLIMATE CHANGE AND WASTEWATER TREATMENT

Wastewater treatment infrastructure is susceptible to the impacts of climate change in several of the same ways that drinking water infrastructure can be impacted. Intense rainfall and flooding events are of particular concern because of the potential for infiltration of rainwater or floodwater into wastewater conveyance and treatment systems resulting in a sanitary system overflow (SSO). Overflow events can release significant quantities of stormwater and untreated waste that can result in significant health hazards to the public or in impacts to aquatic and terrestrial wildlife in the vicinity of the overflow. In locations where combined sewer systems exist that incorporate both building wastewater and storm sewer water, these combined sewer overflows (CSOs) can pollute waterways with industrial waste, oil and grease, metals, deicing chemicals, debris, and other pollutants. The Maryland Department of the Environment tracks the location of Combined Sewer Systems within the state, and MDE notes that there are no combined sewer systems in Frederick County. While drought is less likely to affect a sanitary (only) sewer system, drought can lead to potential accrual of sediments and solids in combined sewer systems that can result in an excessive delivery of accumulated materials as part of a "first flush" when a rainstorm does occur.[10]

In the State of Maryland, regulations addressing the reporting and public notification for wastewater system overflows and wastewater treatment plant bypasses became effective on March 28, 2005. Data related to these events is available online through the Maryland Department of the Environment in a searchable online database at the following address: *https://opendata.maryland.gov/Energy-and-Environment/Reported-Sewer-Overflows/3rgd-zjxx/data*.

In a 2017 paper published in the journal *Water Research*, a review of literature on the subject of resilience in urban wastewater treatment found the most commonly suggested improvements for increasing resilience in wastewater systems were "added capacity (buffering) equipment backup, maintenance and repair, and asset protection."[11] A 2019 paper, published in the Journal of the American Water Resources Association by Kirchhoff et al, that focused on wastewater systems in the state of Connecticut found that approximately 78% of wastewater system managers that had been impacted by past storms made adaptive changes to systems as a result of prior experiences. Nearly 30% of those changes were low-cost or temporary fixes intended to cope with future storm events. Sixty-two percent of managers also reported making operational or permanent physical changes to improve resiliency to future storm events. Those managers that did make changes identified local public support, organizational leadership, the incorporation of up-to-date technology, and being empowered to make changes as being helpful in improving resiliency of systems.[12] It is important to note that the primary driver for changes in these systems was reactivity to impacts from prior storm events, but the potential costs associated with such events (as identified in the Drinking Water Assessment) reflect the need for active planning to avoid such events or mitigate their costs.

9 Improving Your Home with Maryland WholeHome. (n.d.). Maryland Department of Housing and Community Development. https://dhcd.maryland.gov/Residents/Pages/WholeHome.aspx
10 Rhea, D. (n.d.-b). What are Combined Sewer Overflows? https://extension.psu.edu/what-are-combined-sewer-overflows
11 Juan-Garcia, P., D. Butler, J. Comas, G. Darch, C. Sweetapple, A. Thornton, and L. Corominas. 2017. "Resilience Theory Incorporated into Urban Wastewater Systems Management. State of the Art." Water Research115: 149–61. https://doi.org/10.1016/j. watres.2017.02.047 cited in Kirchhoff, C.J. and P.L. Watson. 2019. "Are Wastewater Systems Adapting to Climate Change?" Journal of the American Water Resources Association 869–880. https://doi.org/10.1111/1752-1688.12748.
12 Kirchhoff, C.J. and P.L. Watson. 2019. "Are Wastewater Systems Adapting to Climate Change?" Journal of the American Water Resources Association 869–880. https://doi.org/10.1111/1752-1688.12748.

As was noted in the Drinking Water Assessment, the United States Environmental Protection Agency has also developed a web-based tool, identified as the Climate Resilience Evaluation and Awareness Tool (CREAT), for assisting in the evaluation of potential climate change impacts. A subset of tools has been specifically developed for Creating Resilient Water Utilities (CRWU)[13] that includes step-by-step instructions and tools for establishing resiliency in a public water utility as well as historical climate data and scenario modeling capability to project potential impacts associated with climate change on local water utilities.

Important resources like the Frederick County Hazard Mitigation and Climate Adaptation Plan, the Climate and Energy Action Plan, and the CREAT tool should continue to inform both planning and operations of Frederick County's public wastewater infrastructure. The impacts of climate change can also affect the owners of on-site disposal systems. Increases in the frequency and total of precipitation can lead to saturation of soils within and immediately adjacent to the drainage fields for these systems, and this can inhibit the ability of effluent to be slowly and safely infiltrated into soils and subsoils. The Water Quality Program with the University of Maryland Extension has prepared and released documents and videos to help owners of on-site disposal systems diagnose and mitigate the potential effects of increasingly heavy rainfall, including the installation of rain barrels, rain gardens, permeable paving, berms, swales, and French drains to divert the concentrated flow of rainwater on saturated soils away from septic systems.[14] It should be noted that measures like French drains and swales should be employed only at distances from the drain field that ensure that effluent is not captured and conducted by these systems.

MAJOR WASTEWATER ISSUES

Inflow and Infiltration (I & I)

"I & I" pose major challenges to community sewerage systems. Inflow of stormwater through sump pumps and downspouts into sewer pipes and infiltration of groundwater through leaky pipes introduce large amounts of clean water to the sanitary sewer system causing overflows and an increase in the amount of water to be treated. These conditions can cause overflow where raw sewage bypasses the treatment facility and is discharged directly into a stream. Overflow places public health at risk and violates state and federal water quality regulations.

Wastewater Monitoring

Wastewater monitoring received significant attention during the COVID-19 pandemic as a non-intrusive means of community health surveillance.[15] Beginning in May of 2020, the Frederick County Division of Water and Sewer Utilities partnered with private laboratories to test wastewater samples from the Ballenger-McKinney WWTP for the presence of the COVID-19 virus. [16] Later that year, data was incorporated into the 'Sewer Sentinel' program undertaken by the Maryland Department of the Environment.[17] MDE ended the 'Sewer Sentinel' program in 2022,[18] but the potential remains to reinstate this type of program in the future at one or more WWTPs if health emergencies should arise.

Water Quality

Frederick County's major waterways – Catoctin Creek and the Monocacy River – have limited assimilative capacity for pollution. Total Maximum Daily Loads (TMDLs) were established for Total Suspended Solids (TSS) and Phosphorous for Catoctin Creek in 2009 and 2013, respectively. The Monocacy River received TMDL's in both its upper and lower reaches for Bacteria (*E. coli*) in 2009, TSS in 2009, and Phosphorous in 2013. Frederick County is also part of the Chesapeake Bay TMDL which set limits on nitrogen, phosphorus, and sediment (TSS). The Bay TMDL limits are implemented through NPDES permits for WWTPs referenced earlier in the chapter.

13 Climate Resilience Evaluation and Awareness Tool | US EPA. (2024b, February 6). US EPA. https://www.epa.gov/crwu/climate-resilience-evaluation-and-awareness-tool-creat-risk-assessment-application-water

14 Water Quality - University of Maryland Extension. (2021, April 22). All this rain – does it harm my septic system? [Video]. YouTube. https://www.youtube.com/watch?v=tnDhC0nnssA

15 Flood MT, Sharp J, Bruggink J, Cormier M, Gomes B, Oldani I, Zimmy L, Rose JB. Understanding the efficacy of wastewater surveillance for SARS-CoV-2 in two diverse communities. PLoS One. 2023 Aug 3;18(8):e0289343. doi: 10.1371/journal.pone.0289343. PMID: 37535602; PMCID: PMC10399835.

16 Frederick County Government. (2020, July 13). County Undertakes Innovative Approach to Studying Coronavirus [Press release]. Retrieved March 27, 2024, from https://frederickcountymd.gov/DocumentCenter/View/327213/Wastewater-study-for-covid-071320

17 Maryland Department of the Environment & Maryland Department of Health. (2020). Sewer Sentinel Phase 2 Localized Actionable Sewer Testing for COVID -19 https://mde.maryland.gov/Documents/Sewer_Sentinal_Phase_2_Factsheet.pdf

18 Alonso, J., & Alonso, J. (2022, August 4). Maryland has ended its COVID-19 wastewater program. Not everyone wants to say goodbye. Maryland Daily Record. https://thedailyrecord.com/2022/07/22/md-ended-covid-19-wastewater-program-not-everyone-wants-to-say-goodbye/

Permitted point source effluent load limits (from WWTPs) have been reached on Catoctin Creek and are unlikely to be raised. Similar restrictions exist on the lower section of the Monocacy River near Frederick City. Septic systems are often located in soils that are poor, with infiltration problems resulting in nutrient pollution to local streams. Failing septic systems negatively impact groundwater quality and eventually surface water quality. One way to address the impacts of these systems is to facilitate the connection of properties served by private septic systems to public wastewater facilities that employ Enhanced Nutrient Removal (ENR) and Biological Nutrient Removal (BNR) technologies. If connection to a community system is not feasible, replacement with a Best Available Technologies (BAT) septic system may be an option. BATs provide increased nitrogen reductions compared to conventional septic systems.

Best Available Technologies (BAT) for On-Site Disposal

Best Available Technologies (BAT) for on-site disposal refers to the incorporation of an aerobic treatment unit (ATU) that is intended to increase the amount of nitrogen removed from septic system effluent before it is reintroduced to surface and ground waters. Typically, a BAT system is installed as a multi-chambered tank that allows for both aerobic (with oxygen) and anaerobic (without oxygen) conditions within a single structure. BAT units can support assorted populations of beneficial bacteria that reduce nitrogen levels by 55 to 80% when compared to the 5% reduction that may be achieved with a conventional septic tank.

In 2012, the State of Maryland approved regulations requiring the installation of BAT for all on-site disposal systems within the Chesapeake Bay and Atlantic Coastal Bay watersheds. In 2016, the regulations were revised to remove the requirement for BAT use in systems installed in the Chesapeake Bay Watershed, but outside of the Chesapeake Bay Critical Area, that do not exceed a design flow of 5,000 gpd.[19] The Frederick County Health Department indicates that there are still some instances in which a BAT system will be required. These include sites where the Health Department determines that a BAT is necessary to protect the water supply or water resources of the state, sites within designated Wellhead Protection Areas (WHPAs), or sites where lots possess poor soils for on-site sewage disposal (i.e., requires an alternative or innovative sewage design) and/or the wastewater strength is greater than typical domestic strength. When utilized in non-residential applications, the Health Department requires BAT treatment to reduce effluent strength to residential/domestic levels.

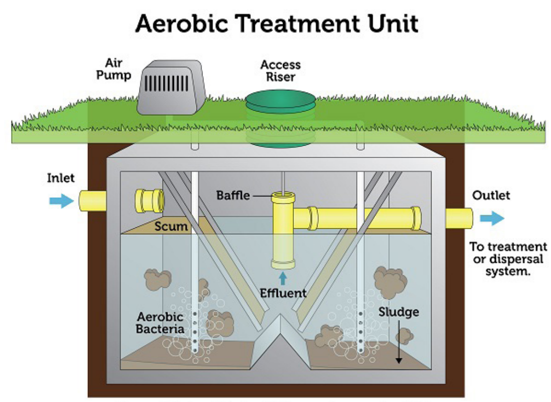


Figure 3: Aerobic Treatment Unit Diagram
Source: U.S. EPA (https://www.epa.gov/septic/types-septic-systems)

It should be noted that the installation of BAT for on-site disposal systems does increase the cost to the property owner for both installation and continued maintenance. This can represent a hardship for the property owner. As indicated elsewhere in this chapter, funding may be available to assist with the cost of implementation, but it is currently not sufficient to address the number of applications that are received by the program on a yearly basis.

19 The Chesapeake Bay Critical Area includes all land within 1,000 feet of Maryland's tidal waters and tidal wetlands. Mapping provided by the Maryland Department of Natural Resources indicates that no lands within Frederick County are included within the limits of the Chesapeake Bay Critical Area Program.

WASTEWATER GOALS, STRATEGIES, POLICIES & IMPLEMENTATION

To achieve water resources goals related to the wastewater assessment, the following policies and action items have been identified. Completion of the action items and adherence to the policy statements will be monitored regularly by the County through review and update of this Water Resources Element and the County's Comprehensive Plan.

Policies

- When considering expansion of smaller WWTPs in proximity to the City of Frederick, evaluate the feasibility of connecting sub-regional systems to the Central Frederick Sewerage Service Area and the Ballenger-McKinney WWTP, which can provide enhanced treatment and capacity. (Adapted and restated from WR-P-10, 2010 Water Resources Element).
- Continue to explore funding sources and programs to address inflow and infiltration problems in wastewater collection systems with a focus on those areas subject to sanitary sewer overflows during storm events (Adopted from A-01, 2010 Water Resources Element).

Recommendations

- Investigate possible implementation of additional affordability programs for wastewater service like the City of Philadelphia's TAP Program for drinking water supply.
- Begin work on an affordability database to assist in directing outreach and funding for affordability programs.
- Partner with Frederick County Workforce Services to develop a career pipeline for public water and wastewater utilities.
  Continue to leverage opportunities for redevelopment and neighborhood revitalization like those proposed under the South Frederick Corridors Plan.

Policies and Recommendations from Related Plans

The topics covered in this Water Resources Element are highly interconnected with other existing planning efforts. The following are policies and action items from these plans with page numbers or recommendation references noted and are hereby adopted as part of the Frederick County Water Resources Element.

Climate Response and Resilience Report, August 2021 (Volume 2, Technical Recommendations) - Frederick County and City Climate Change Working Group of Frederick County

- Develop long-term infrastructure plans for stormwater and sewage conveyance and storage systems for the City of Frederick and primary and secondary growth areas identified in the Livable Frederick Master Plan (p. 31).
- Strengthen the resilience of wastewater treatment plants to extreme precipitation through measures such as minimizing penetration, raising critical electrical equipment, expanding storage capacities, and waterproofing techniques as described in the Livable Frederick Master Plan's goal for wastewater and sewer adequacy, focusing on making this infrastructure sufficient for current and future populations (p. 180).

Frederick County Climate and Energy Action Plan for Internal Government Operations, March 2023 – Frederick County Government

- **Action 11B:** Harden physical resilience for assets and facilities.
- **Action 12B:** Implement flood risk reduction measures.

Suitable Receiving Waters & Water Hazards

INTRODUCTION

This chapter addresses the suitable receiving waters and water hazards requirements of the Water Resources Element. Suitable receiving waters is the concept that water bodies do not have infinite capacity to take on pollutants and still be safe for use. This chapter establishes the current water quality conditions in Frederick County and analyzes whether water quality will be maintained under the projected growth. The current conditions for water hazards – in fluvial and pluvial flooding and dam safety – are described and potential growth impacts considered.

Throughout this chapter, various methodologies are employed to estimate the amount of impervious surface, land use, pollutant loading and more. The analyses within this document were conducted only for the planning purposes of the Water Resources Element and are intended to be separate from the regulatory reporting of the County's Municipal Separate Storm Sewer System (MS4) permit.

The following goals and initiatives of the Livable Frederick Master Plan address aspects of stormwater, suitable receiving waters, and water hazards:

Lf The Liavble Frederck Master Plan → Vi Our Vision → Ev 4. Our Environment → 4. Climate and Energy

Goal 4.4.1 Climate Resiliency - Plan and prepare for the impacts to public infrastructure, human health, private property, and the environment from increasing flooding, fires, droughts, crop and tree damage, temperature extremes, and intense storm events.

Goal 4.4.1.3 Stormwater Impacts- Plan for and anticipate the impact of increased stormwater flows.

Supporting Initiative 4.4.1.3.1 - Explore and implement efforts to reduce compaction of lawns in new residential development, and to increase overall stormwater/Green infrastructure capacities to address the implications of increased precipitation (greater than 1" rainfall events).

Supporting Initiative 4.4.1.3.2 - Ensure infrastructure is designed to accommodate new storm flows and is resilient to increased severity of weather events.

As described in the Introduction & Framework Chapter, there are four Tier II streams and catchment areas in Frederick County. Tier II waters are recognized under Maryland's Clean Water Act framework as high quality waters that exceed the water quality criteria for the stream's designated use. These high-quality waters are subject to additional review by MDE when reviewing water and sewer plan amendments, nontidal wetlands and waterways permits, and new or modified NPDES permits. These Tier II areas are shown in Map 1 of the Introduction chapter. Only two of these streams and catchment areas are located within a growth area (the Town of Thurmont).

STORMWATER MANAGEMENT

The introductory chapter of this WRE described the regulatory drivers of water quality protection, as well as how water quality is evaluated within the goals, criteria, and policies of those regulations. See "Protecting Water Quality: Federal, State, & Local frameworks" on Page 1-3 of Chapter 1 for more information.

Frederick County is a Municipal Separate Storm Sewer System (MS4) jurisdiction. The MS4 permit is a federal requirement of the National Pollutant Discharge Elimination System (NPDES) program. NPDES is another component of the Clean Water Act that is administered by the Maryland Department of the Environment (MDE) and relies on data supplied by Frederick County government and non-governmental discharge permit holders to monitor compliance. The purpose of the MS4 permit is to reduce pollution to water bodies from stormwater runoff collected and discharged by storm drains and protect water quality.

It is important for stormwater management to address both the quality and quantity of runoff. Stormwater quality practices remove as many pollutants as possible before runoff is released back into the ground or a river or stream. Stormwater quantity practices collect and move runoff from impervious and pervious surfaces, detain it, and release it slowly to prevent downstream flooding and mitigate potential erosion of receiving streams and rivers. For many decades, stormwater management focused only on stormwater quantity. Today, many stormwater management ordinances require the inclusion of a mix of Best Management Practices (BMPs) that can perform both roles.

The following sections of this chapter discuss the levels of impervious surface throughout Frederick County, pollutant loads reaching waterways from impervious and other surfaces, watershed restoration efforts, and hazards related to stormwater runoff, including flooding and dam safety.

Stormwater Management Ordinances in Frederick County

Frederick County reviews development plans for compliance with Maryland's stormwater regulations for all municipalities except for the City of Frederick and Mount Airy. Stormwater management requirements and the design standards for best management practices in Frederick County are established by the "Maryland Stormwater Management Design Manual" that was released by MDE in October 2000 and amended by MDE in May 2009. As of the adoption date of this Water Resources Element, the 2009 manual is the set of regulations legally in effect. However, since 2021, MDE has been working to update the manual to increase resiliency of stormwater systems throughout Maryland and reduce flooding. More information begins on Page 4-36.

Frederick County implements these state requirements prior to construction through Chapter 1-15.2 of the County Code. Generally, stormwater management must be addressed for both new construction and redevelopment projects if the area of disturbance is more than 5,000 square feet (or, about 1/10th of an acre). The first step is a stormwater development concept plan. This provides information like how much impervious surface is being created, where land disturbance will take place, existing natural features and soil types, and the location and type of proposed stormwater practices.

After this concept plan is approved, the next step is a stormwater management development plan. This includes the same information as the approved concept plan but with more technical detail and calculations in order to demonstrate compliance with the Stormwater Design Manual.

The stormwater management development plan phase also includes an Erosion and Sediment Control plan. Similar to stormwater management, erosion and sediment control regulations come from the State and the Frederick County Soil Conservation Districts have been designated to implement the regulations. Erosion and Sediment Control plans are intended to minimize soil runoff from construction activities and to protect sensitive features like steep slopes and natural resources during construction. Small scale projects may use an approved standard plan, such as construction of single-family dwellings, small commercial sites, and other minor earthwork.

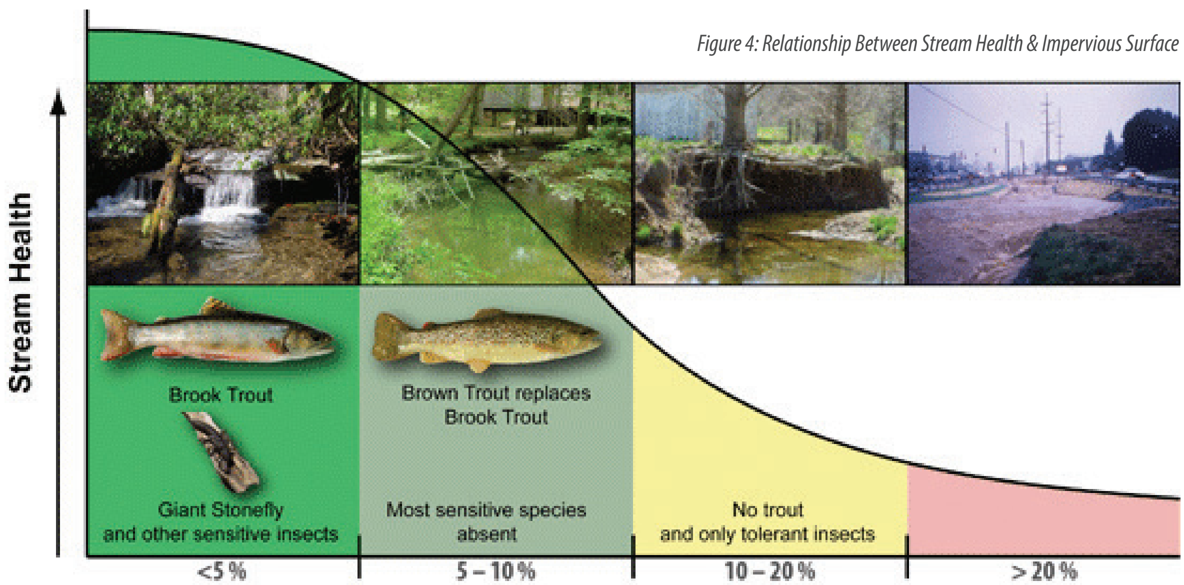
Once the proposed plans have been approved, an applicant is able to submit final construction drawings for approval (typically referred to as "improvement plans"). These plans must be in conformance with all previous agency comments and direction. A project developer must also enter into a stormwater performance agreement with the County which includes a financial security to guarantee construction of stormwater management. Only after these final improvement plans and performance agreement are approved can a grading permit and/or building permit be issued and construction begin.

After construction is completed, the County conducts regular inspections of stormwater facilities, as required by the MS4 permit, to ensure they are operating correctly. In Fiscal Year 2023, the County inspected 1,072 facilities, with 99% of facilities receiving a passing inspection.

Impervious Cover

As described previously, impervious surfaces like parking lots, buildings, and roads change the natural flow of water in the environment because water is not able to soak into the ground. Impervious surfaces have negative impacts on water quality because the runoff picks up pollutants and makes it more likely those pollutants reach a waterbody. Fast moving water is also a contributing cause to flooding. Research has shown when impervious coverage exceeds 10% in a watershed, there is a measurable decline in water quality and the number and variety of aquatic life present. Once certain bugs and fish are gone from a stream, it is challenging to reintroduce them successfully even if water quality improves.

Figure 4: Relationship Between Stream Health & Impervious Surface



Source: Maryland Department of Natural Resources

Percent Impervious Surface

<5 %	5 – 10 %	10 – 20 %	> 20 %
• Water cool and clean • Stream banks and bottom typically stable • Trout can be found • Endangered species can be found • Many fish species • Many salamander species • Many freshwater mussels • Many insect taxa	• Water may be warmer and slightly polluted • Erosion may be evident • No brook trout • Most rare and endangered species absent • Many pollution tolerant fish • Fewer salamander species • Only tolerant mussels • Fewer insect taxa	• Water warmer • Erosion usually obvious • Trout absent • Rare stream species absent • Fewer fish species • Only three tolerant salamander species • No native mussels • Mostly tolerant insects	• Water warm and pollution usually evident • Unstable habitat • Trout absent • Non-native species dominate some streams • Only tolerant fish species • One salamander species • No native mussels • Only tolerant insects

In Frederick County, three watersheds exceed the 10% threshold for impervious cover: Ballenger Creek, Carroll Creek, and Upper Bush Creek. Several others are above 5% and approaching the 10% threshold, mostly in the eastern portion of the County. See the corresponding Map 12 and Table 4.01.

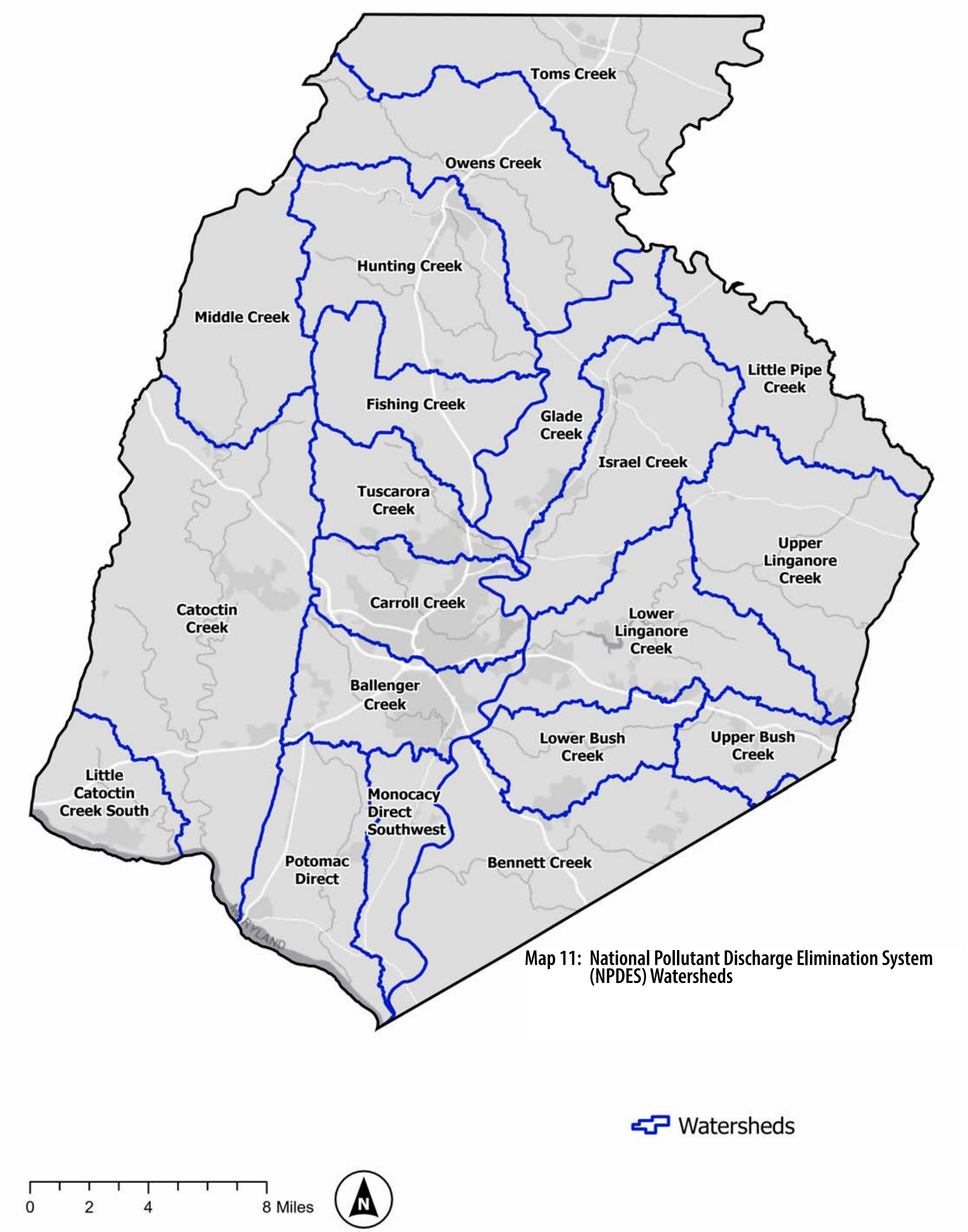
Table 4.01: Percent Impervious Cover by NPDES Watershed

NPDES Watershed	Impervious Cover, % of Total Area
Middle Creek	3%
Owens Creek	3%
Fishing Creek	3%
Hunting Creek	4%
Toms Creek	4%
Potomac Direct	4%
Catoctin Creek	4%
Upper Linganore Creek	5%
Little Pipe Creek	5%
Glade Creek	5%
Israel Creek	5%
Bennett Creek	5%
Monocacy Direct Southwest	6%
Frederick County, Total	8%
Little Catoctin Creek South	6%
Lower Linganore Creek	7%
Tuscarora Creek	9%
Lower Bush Creek	9%
Upper Bush Creek	11%
Ballenger Creek	19%
Carroll Creek	28%
Frederick County, Total	**6%**

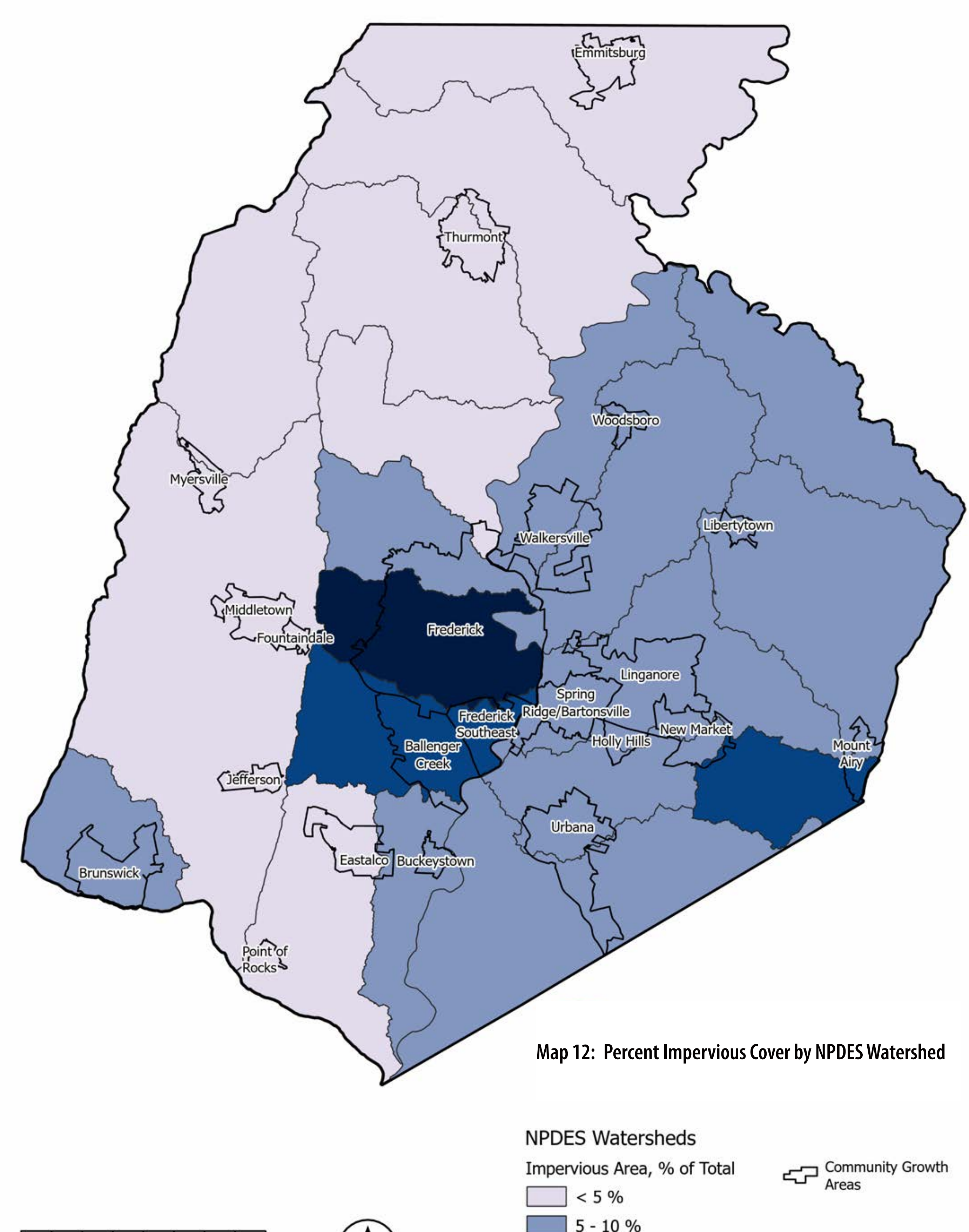
Source: Analysis of 2017-2018 Chesapeake Bay Program's Land Use/Land Cover dataset

Watersheds with 5-10% impervious surface coverage may require land use policies, special watershed studies, or additional efforts to mitigate adverse impacts on water quality conditions. Many of these watersheds are located in the eastern portion of the County which is the historical location of much of the County's growth. However, in the most recent round of the Frederick County Stream Survey (FCSS) (Round 3) as shown on Map 13, these watersheds mainly scored "Poor" or "Very Poor" on Benthic Index of Biotic Integrity (BIBI) scores. A BIBI score is an index to categorize stream health based on measurements of benthic macroinvertebrates (aquatic animals without a backbone) can be found in the water. The index encompasses different measurements such as how many, what kind, and how much species diversity there is. In addition, there are some trout watersheds that exist in close proximity to more developed areas of the County (refer to Map 2 on Page 1-7).

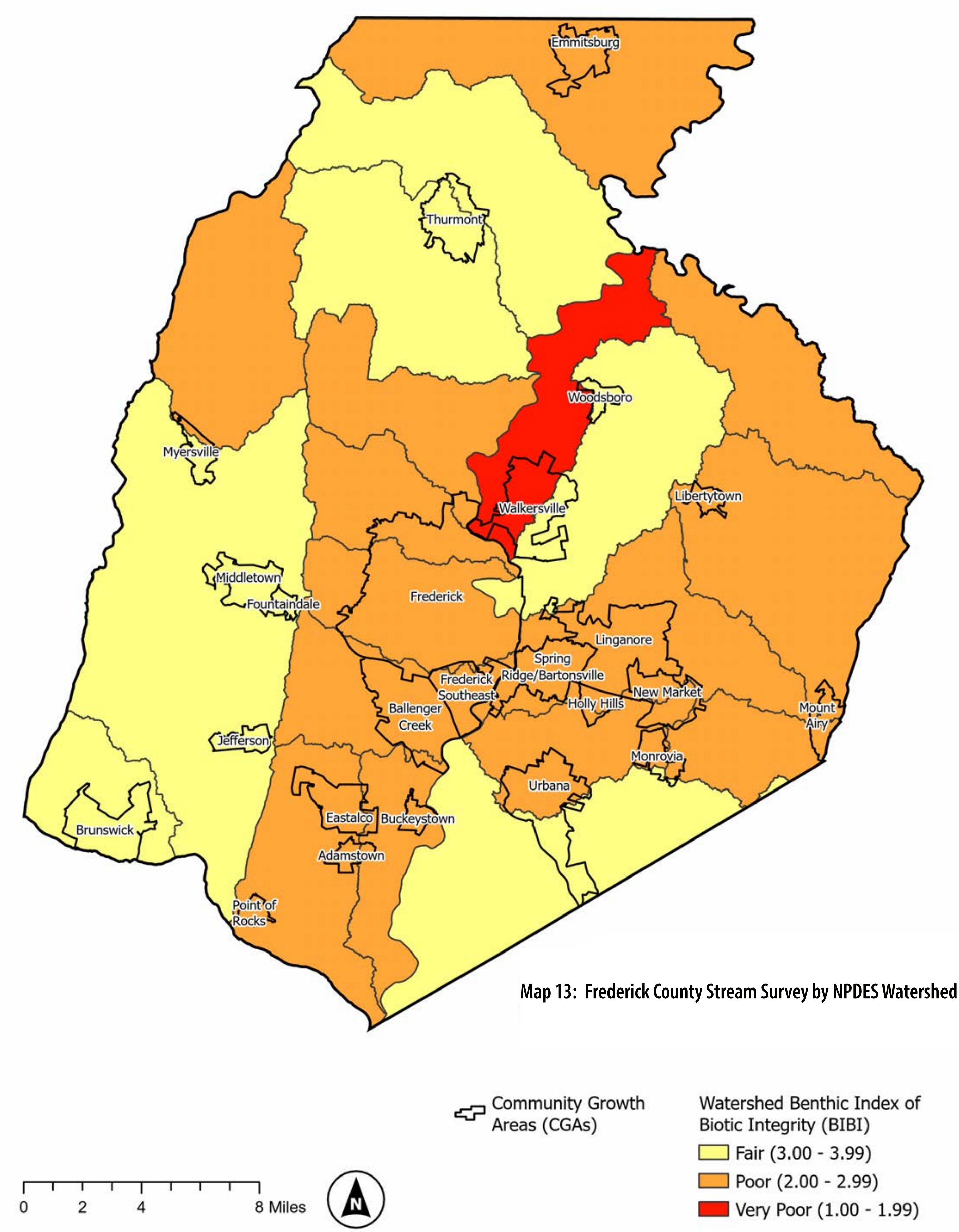
The proximity of existing growth areas to trout waters or watersheds approaching 10% impervious cover does not necessarily imply that the area should be a target for disinvestment or should be restored to a predevelopment condition. In many cases, this is not practical or feasible. Rather, it presents an opportunity, through prudent redevelopment, to incorporate additional capacity, like multi-modal transit and traditional urban land uses, to maximize the benefits of existing infrastructure and lessen development pressure on those lands within the county that are currently undeveloped.



Map 11: National Pollutant Discharge Elimination System (NPDES) Watersheds



Map 12: Percent Impervious Cover by NPDES Watershed



Map 13: Frederick County Stream Survey by NPDES Watershed

The Frederick County Stream Survey (FCSS) has been conducted on a nearly annual basis since 2008. The report is based on a random stream sampling from multiple sites (typically 2 to 3) in subwatersheds throughout the County. The purpose of the stream surveys is to get real-time information about stream health and track trends over time.

The Glade Creek subwatershed, which generally stretches from the City of Frederick through to Walkersville, Woodsboro, and the border with Carroll County, scored Very Poor for the BIBI score in the most recent Round 3 (2018-2021). Over the span of the FCSS effort, this indicator of stream health has been steadily declining in this watershed. Both the Round 1 analysis (2008 – 2011) and Round 2 analysis (2013-2016) examined whether there was a statistical relationship between upstream land uses and lower BIBI scores. In both reports, this relationship was present but not strong. Both reports found that the stronger predictor of low BIBI scores was the level of Total Nitrogen (TN) and to a lesser extent Total Phosphorus (TP). This suggests nutrient reduction efforts may be the most effective tools to increase biological diversity and promote improved watershed health. Such efforts could include increased outreach, education, and incentives to residential property owners and farmers about best practices around: fertilizer and chemical use, management of agricultural lands and livestock, cleaning up after pets, septic system maintenance.

Furthermore, it presents an opportunity through redevelopment to retrofit existing stormwater management infrastructure in places where it exists and may be in need of update and repair due to age. There are also opportunities to provide stormwater management infrastructure in areas that were developed prior to implementation of stormwater management ordinances. Frederick County's South Frederick Corridors Plan is an example of a planning initiative that intends to leverage infill development and redevelopment in a manner that meets the needs of the County's expanding population without requiring a coincident expansion of development within the County.

Additional measures like the daylighting of stream segments that have been culverted in urban or suburban contexts and the restoration or enhancement of urban and suburban tree canopy can be incorporated into redevelopment through incentives to further enhance and protect water resources where they exist in close proximity to existing communities. Daylighting of streams, tree canopy enhancement, and the incorporation of trails and other recreational facilities present another potential added benefit because they increase public awareness and can enhance public perception of these resources.

In summary, stream and watershed health is influenced by many complex factors. The County's future area plans should include an analysis of local watersheds, consider watershed impacts of any land use changes or development called for in the plan, and recommend and implement the policies or regulations necessary to protect watershed health.

Understanding the level of impervious surface within a watershed or subwatershed is important but calculating the impervious cover of community growth areas (CGAs) can provide another perspective. CGAs are places where the County and its municipalities want to direct growth and development. CGAs are generally more intensely developed than land outside growth areas. For example, although areas like the City of Brunswick or Urbana are within watersheds with less than 10% impervious surface, Table 4.02 illustrates how both communities are approximately 14% impervious within the growth area.

Analyzing impervious surface at the community growth area level is also useful because much of the County's impervious surface acreage has limited or no stormwater quality treatment. This is because older stormwater management facilities (SWMFs) approved pre-2002 typically only provide stormwater conveyance and storage and were not designed to provide treatment of stormwater runoff. Those SWMFs approved post-2002 are designed to provide water quality treatment on stormwater runoff. For the purposes of this analysis, only impervious surfaces within the drainage areas of SWMFs that were designed in 2002 or later are categorized as treated in the following tables and maps. Table 4.02 summarizes each community growth area, the percent of impervious surface that is not treated, and the health of the watershed(s) in the growth area as measured by the latest BIBI scores and is accompanied by the corresponding Map 14.

It is important to differentiate between treated and untreated impervious areas to understand which impervious areas have the greatest impact on water resources and to identify potential restoration opportunities. For example, community growth areas with greater than 15% untreated impervious area located within watersheds with a Benthic Index of Biotic Integrity (BIBI) score of Poor or lower could be prioritized for projects to add new or retrofit existing SWMFs. The following community growth areas fit these criteria: Ballenger Creek, Buckeystown, Frederick Southeast, Mount Airy, Point of Rocks, Spring Ridge/Bartonsville, and Woodsboro.

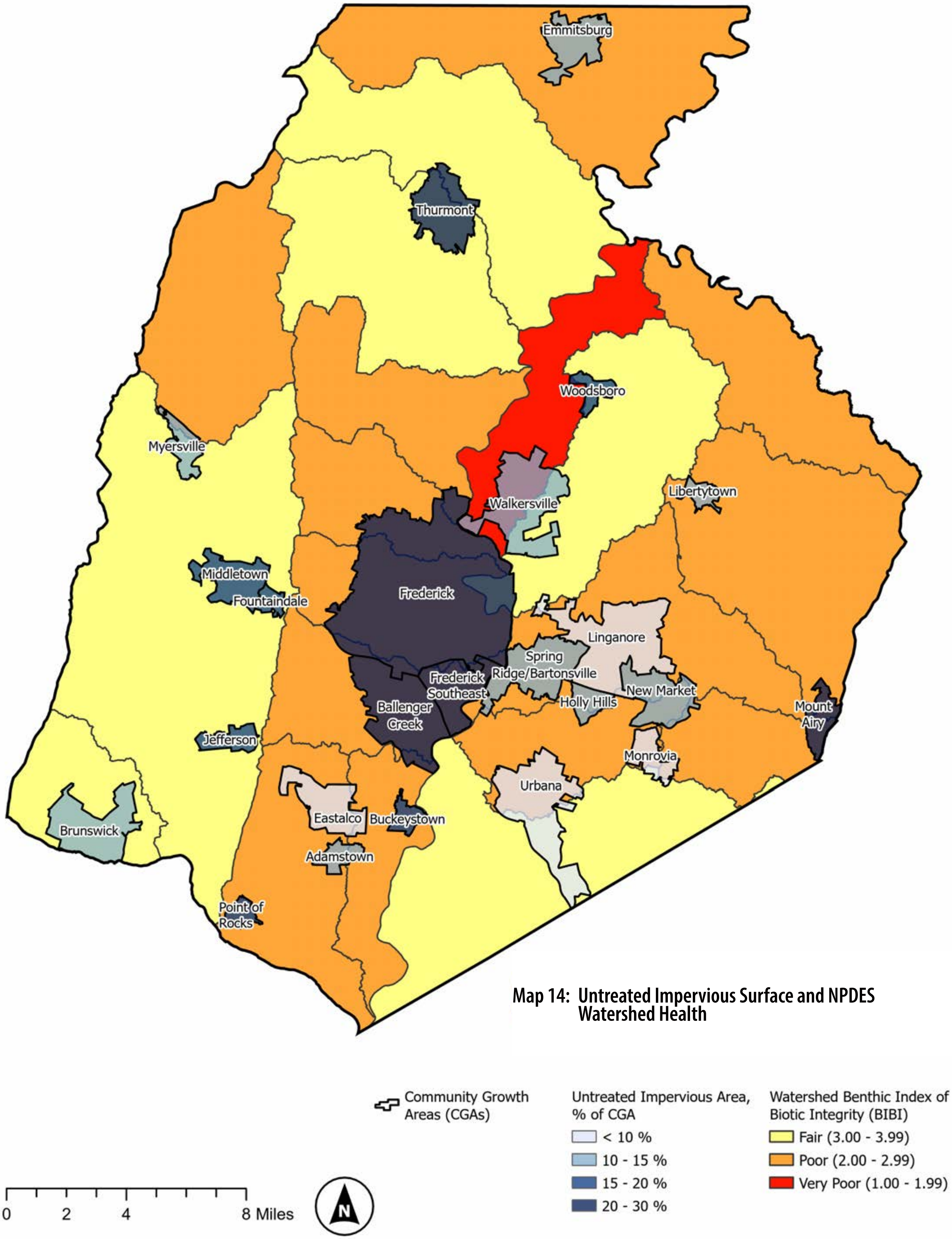
Table 4.02: Untreated Impervious Surface and NPDES Watershed Health

Community Growth Areas	% Total Impervious	% Total Untreated Impervious	NPDES Watershed BIBI
Adamstown	18.2%	13.0%	Poor
Ballenger Creek	34.6%	29.8%	Poor
Brunswick	14.2%	12.4%	Fair
Buckeystown	15.6%	15.6%	Poor
Eastalco	6.5%	5.3%	Poor
Emmitsburg	13.7%	13.0%	Poor
Fountaindale	21.8%	18.8%	Fair
Frederick	30.1%	28.9%*	Poor
Frederick Southeast	32.2%	29.2%	Poor
Holly Hills	11.4%	11.4%	Poor
Jefferson	17.8%	17.6%	Fair
Libertytown	10.5%	10.3%	Poor
Linganore	11.0%	9.4%	Poor
Middletown	18.4%	16.7%	Fair
Monrovia	10.1%	7.2%	Poor/Fair
Mount Airy	21.4%	21.4%	Poor
Myersville	14.5%	12.8%	Poor/Fair
New Market	16.7%	11.3%	Poor
Point of Rocks	28.4%	19.9%	Poor
Spring Ridge/Bartonsville	16.0%	14.9%	Poor
Thurmont	21.8%	20.8%	Fair
Urbana	14.7%	7.7%	Poor/Fair
Walkersville	12.2%	11.4%	Very Poor/Fair
Woodsboro	18.9%	18.1%	Very Poor/Fair

Sources: 2017-2018 Chesapeake Bay Land Use/Land Cover Data; Frederick County MS4 Facilities Geodatabase
**Estimate only. Not all BMP records had data for "Impervious Acres Treated."*

Land Use/Land Cover

Another measure of how land use can impact watershed health is a land cover analysis. It is not only impervious cover that delivers pollution to water resources. Pollution is also associated with certain agricultural uses, lawns, and extractive uses of land. A land cover analysis can provide insight into nonpoint sources. Nonpoint source pollution is pollution that does not discharge into a water body from an identifiable source, like a pipe.



Map 14: Untreated Impervious Surface and NPDES Watershed Health

Table 4.03 is calculated from the Chesapeake Bay Land Use and Land Cover (LULC) database, 2022 Edition. It was used to map LULC across Frederick County and to compile LULC statistics by watershed. The most recent (2017/2018) LULC data and estimated changes over time can be used to inform the future conditions analysis and which watersheds/community growth areas are most likely to require expanded stormwater management efforts. Map 15 shows the land use sectors across the County with growth areas mapped for reference. Methodology information can be found in Appendix C.

As Table 4.03 notes, there were an estimated 30,528 acres of urban impervious surface throughout Frederick County. While the 2017/2018 Land Use and Land Cover is the most recent and most comprehensive data available, Frederick County and its municipalities have experienced growth over that time. From 2018 through 2023, 14,041 housing units were permitted (this figure includes all municipalities). Thiry-eight percent were single family detached; 35% were single family attached, and 27% were in multifamily buildings. It is estimated these permitted dwelling units consisted of approximately 600 acres of new impervious surface. The assumptions are detailed in the chart below. For multi-family buildings, GIS data was used to identify the square footage of the building footprint. To account for parking in multi-family buildings, it is assumed there were 2 parking spaces per dwelling. Each parking space was assumed to create 300 square feet of impervious surface.

	Dwelling Units	Estimated Impervious	Total Estimated Impervious
Single Family Detached	5,340	3,000 sf / dwelling	368 ac.
Single Family Attached	4,877	1,250 sf / dwelling	140 ac.
Multi-Family	3,824	-	91 ac.
		Total:	599 ac.

For non-residential development from 2018-2023, Type I site development plans approved by the Frederick County Planning Commission were reviewed. Over this time, 119 site plans were approved and involved new construction or expansion. The total impervious surface was obtained for 61 plans. For the remaining 58 plans, a ratio was applied to the acres proposed to be developed (primarily 0.72 or 0.85). These ratios estimate runoff but are used as a stand-in for impervious surface in this analysis.

Total New Impervious (Site Plan Note)	147.5 acres
Estimated New Impervious (Stormwater Coefficient Applied)	402.5 acres
Total:	550 acres

With new residential development and non-residential growth, approximately 1,149 acres of new impervious surface were approved or permitted from 2018-2023.

POLLUTANT LOADING

Pollutant Loading Estimates

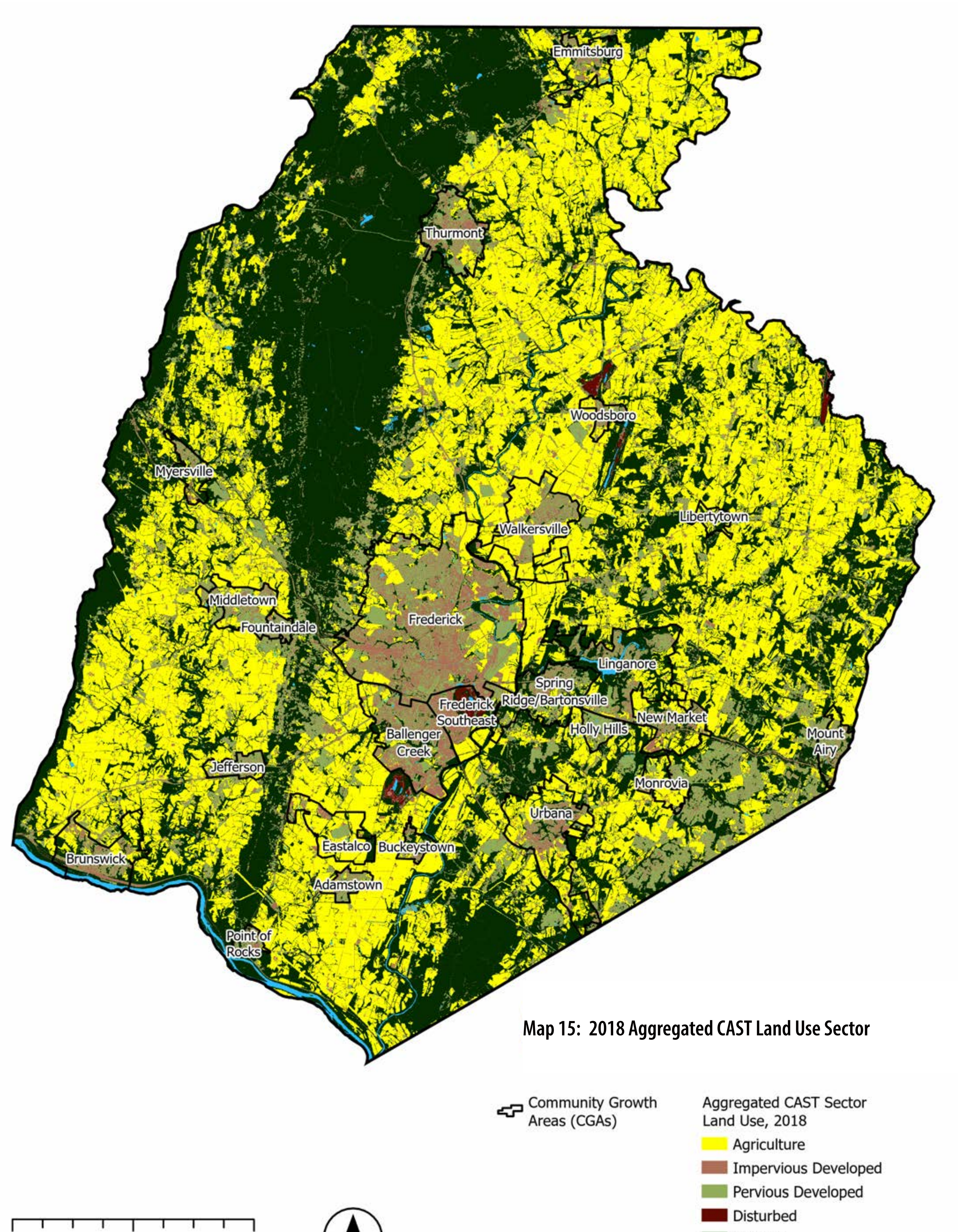
Most Frederick County watersheds have at least one Total Maximum Daily Load (TMDL). Local TMDLs include phosphorus, sediment, and bacteria. Frederick County is also part of the Chesapeake Bay TMDL which also includes limits on nitrogen (as well as phosphorus and sediment). Refer to Chapter 1 for more information on current TMDLs.

The following tables estimate the number of pounds per year of nitrogen, phosphorus, and suspended solids (sediment) that reach streams and rivers from CGAs. Table 4.04 shows the breakdown by CGA and combines all land uses. Table 4.05 shows the breakdown by land use and combines all CGAs.

Sediment comes from sources like topsoil runoff caused by construction activities, stream erosion, certain agricultural practices, and stormwater. Too much sediment makes the water murky where less sunlight reaches underwater plants and animals. The sediment itself can cause biological

Table 4.03 Land Cover Data by NPDES Watershed

	General Land Cover Type, Acres										
Frederick County Watershed	**Agriculture**	**Disturbed/ Extracted**	**Forest/Trees**	**Natural Succession**	**Turf Grass**	**Urban - Impervious**	**Urban - Other**	**Water**	**Wetlands, Forest/Tree**	**Wetlands, Non-Forested**	**Grand Total**
Ballenger Creek	4,240	264	2,924	414	2,558	3,170	1,014	116	123	28	14,852
Bennett Creek	10,166	3	14,030	348	3,670	1,703	449	241	368	99	31,077
Carroll Creek	2,097	29	2,461	190	3,660	4,826	1,425	87	52	24	14,852
Catoctin Creek	27,605	-	19,620	559	5,745	3,170	881	553	343	124	58,599
Fishing Creek	5,206	-	8,475	116	839	654	201	144	131	87	15,853
Glade Creek	9,940	1	2,071	92	1,232	923	308	123	66	40	14,796
Hunting Creek	6,477	-	16,267	287	1,772	1,276	466	116	258	52	26,971
Israel Creek	11,986	251	7,714	317	2,124	1,526	352	149	120	154	24,694
Little Catoctin Creek South	4,810	-	3,209	91	895	921	240	742	257	31	11,194
Little Pipe Creek	11,848	168	3,780	210	722	658	147	41	46	37	17,656
Lower Bush Creek	4,207	-	4,333	194	1,512	1,405	590	39	173	42	12,495
Lower Linganore Creek	8,430	6	8,328	371	3,885	2,067	524	297	172	55	24,135
Middle Creek	5,678	-	12,728	415	1,718	732	149	39	73	31	21,563
Monocacy Direct SW	6,150	146	1,952	197	437	684	132	155	74	40	9,967
Owens Creek	11,995	1	14,008	450	1,562	1,095	324	121	318	91	29,965
Potomac Direct	9,527	-	5,502	89	1,038	1,053	416	705	214	66	18,609
Toms Creek	14,577	2	11,643	466	1,560	1,244	523	150	189	108	30,462
Tuscarora Creek	2,426	-	5,522	138	1,741	1,256	370	45	129	16	11,643
Upper Bush Creek	2,142	-	2,552	158	2,561	932	305	25	153	41	8,869
Upper Linganore Creek	15,846	-	8,759	184	1,962	1,232	346	51	398	231	29,009
TOTAL	**175,352**	**872**	**155,882**	**5,284**	**41,195**	**30,528**	**9,160**	**3,940**	**3,653**	**1,396**	**427,261**



Map 15: 2018 Aggregated CAST Land Use Sector

harm to underwater life. Sediment increases the cost of making water safe to drink. Sediment can also accumulate to where it must be physically removed by dredging to restore the normal function and flow of the water – such as at Lake Linganore.

Nutrients come from sources like wastewater treatment plants, septic systems, and agricultural and residential fertilizers. There are many nutrients measured for water quality but the most common are nitrogen and phosphorous. Phosphorous primarily enters the water by binding to sediments. Nutrients are a concern because they spur plant and bacteria growth by altering the normal balance of an ecosystem. This negatively impacts other plants and animals, including humans. So called "algae blooms" often indicate excess nutrients.

Pathogens are microorganisms like viruses or bacteria. Not all microorganisms are harmful but those that cause disease are pathogens. Many different pathogens can exist in water but it is difficult and expensive to test for them all. However, certain bacteria groups like fecal coliform or *E. coli* are easier to detect. These pathogens come from human and animal waste and enter the water through wastewater treatment plants, septic systems, runoff from livestock, and pet waste.

The data in Table 4.04 and Table 4.05 are from the 2017/2018 Land Use Land Cover dataset from the Chesapeake Bay Program. This tool uses aerial imagery and assigns a land cover category at 1-meter resolution. GIS was used to analyze how many acres of each land cover category are within each CGA. Pollutant loading estimates per acre of land cover category were applied from the Phase 6 Chesapeake Assessment Scenario Tool (CAST) for nitrogen, phosphorus, and suspended solids (sediment). The numbers are a baseline scenario and do not account for Best Management Practices, or BMPs. Therefore, the numbers below are a worst-case current pollutant loading estimate. Methodology information can be found in Appendix C.

Estimating the current amount of pollutants reaching a stream or river is important to evaluate the potential impacts of land use change on efforts to restore local watersheds and the Chesapeake Bay. CGAs were focused on in this analysis because the Livable Frederick Master Plan envisions growth to be directed to these areas. Conditions outside of growth areas are anticipated to stay the same.

Table 4.04 calculates the estimated pollutant loading by community growth area. Some growth areas are planned for new development or redevelopment (such as Frederick Southeast and the City of Frederick). Other growth areas may see little redevelopment or land use change over the horizon of the Livable Frederick Master Plan. It is important to understand the baseline, so the County is able to grow responsibly and not jeopardize meeting TMDL goals. Communities where redevelopment or land use conversion is not anticipated but pollutant loading is a concern could be candidates for County- or municipal-led retrofits or restoration projects like reforestation or stream plantings.

Table 4.05 calculates the estimated current pollutant loading from CAST sectors within a Community Growth Area. This data shows how sectors tend to be more associated with a certain type of pollutant. For example, the agriculture sector produces more nitrogen and phosphorus while developed impervious produces more sediment.

Watershed Restoration

The County's Capital Improvement Project plan (CIP) allocates financial resources for watershed restoration activities required under the MS4 permit. These projects include stream restoration, reforestation, stormwater pond restoration, and outfall stabilization. The projects are identified and prioritized in the County's Watershed Studies. These cost-effective projects assist in improving water quality in Frederick County and beyond. In addition, smaller studies have been conducted in subwatersheds to build upon the larger watershed assessments in order to identify stream restoration and stormwater management controls that could cost-effectively improve watershed conditions.

Completed and anticipated restoration projects are located throughout the County including CGAs. However, growth directed into areas with watershed restoration projects should not be considered a detriment to the potential effectiveness of those projects in improving water quality within a watershed. Promoting smart growth, including infill and redevelopment, conserves land by limiting sprawl. Additionally, redeveloped properties must comply with stormwater management regulations in effect at the time of development. Current regulations address both the

Table 4.04: Estimated Current Pollutant Loading by Community Growth Area

	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)	Total Suspended Solids (TSS) (lbs/yr)
Adamstown	10,100	1,200	2,723,800
Ballenger Creek	82,900	7,900	21,426,600
Buckeystown	9,900	800	1,867,900
Eastalco	40,700	3,000	6,108,900
Fountaindale	5,000	700	1,655,100
Frederick Southeast	48,300	4,300	13,201,400
Holly Hills	10,200	1,000	1,930,600
Jefferson	11,900	1,300	3,011,500
Libertytown	9,800	700	1,607,600
Linganore	67,000	5,500	11,954,300
Monrovia	25,500	1,600	3,449,200
Point of Rocks	6,100	800	2,300,400
Spring Ridge/Bartonsville	38,800	3,500	8,148,000
Urbana	94,000	6,700	15,747,600
Municipalities			
Brunswick	38,400	3,800	9,419,500
Emmitsburg	37,600	2,900	6,569,600
Frederick	338,600	30,600	79,240,400
Middletown	28,400	3,100	7,252,500
Mount Airy	16,900	1,600	3,708,400
Myersville	10,700	1,200	2,815,500
New Market	44,100	3,300	7,880,200
Thurmont	43,500	4,100	9,825,800
Walkersville	107,700	7,300	16,296,600
Woodsboro	12,800	1,000	2,418,800
Grand Total	**1,138,900**	**97,900**	**240,560,200**

Source: CBP 2017-2018 Land Use/Land Cover and Chesapeake Assessment Scenario Tool (CAST) Model, Phase 6 (Edge of Stream, No Action Scenario). All numbers rounded to the nearest hundred.

Table 4.05: Estimated Current Pollutant Loading in Community Growth Area by Land Use

	Total Acres (within CGAs)	**Nitrogen Load (lbs/yr)**	**Phosphorus Load (lbs/yr)**	**Total Suspended Solids (TSS) (lbs/yr)**
Agriculture	15,700	495,000	27,300	53,858,400
Impervious Developed	15,000	360,400	38,600	146,042,700
Pervious Developed	20,400	248,600	29,500	34,755,900
Disturbed Land	300	9,200	800	3,207,300
Natural (water excluded)	10,500	19,400	1,600	2,695,700
Water	800	6,300	500	0

Source: CBP 2017-2018 Land Use/Land Cover and Chesapeake Assessment Scenario Tool (CAST) Model, Phase 6 (Edge of Stream, No Action Scenario). All numbers rounded to the nearest hundred.

quantity and quality of runoff from existing and proposed impervious surfaces. More information on modeling potential impacts to pollutant loading can be found later in this chapter under "Future Conditions – Stormwater and Pollutant Loading." The analysis models land use change under the four development scenarios of Livable Frederick and estimates the resulting changes in phosphorus, sediment, and nitrogen loading for watersheds. The analysis models the MS4 sector and at the larger scale of TMDLs.

How You Can Help Manage Stormwater

Do not pour chemicals or contaminants down storm drains.

If you live along a creek, don't mow to the bank's edge. Leave a buffer of streamside trees, grass, or other plants. If you don't have a buffer, consider planting one. Some County programs that can assist are Creek ReLeaf and the Conservation Reserve Enhancement Program (CREP).

Install rain barrels and/or rain gardens, swales, etc. Rain barrels capture water coming off the roof, which can be used to water lawns and non-edible plants or wash cars. Rain gardens collect and filter water through plants and grasses.

Be neighborly when directing runoff and avoid adverse impacts to nearby properties.

Consider pervious pavers or pavement for your next project. However, pervious materials are not recommended in karst areas which are found throughout Frederick County. It is recommended to consult with a relevant professional.

For more information, visit:
Low Impact Development Center, (www.lowimpactdevelopment.org)
University of Maryland Extension Service, including Bay-Wise Landscaping (www.extension.umd.edu)

WATER HAZARDS

Water is a vitally important resource, but it can also be dangerous. The following sections describe these water hazards, particularly flooding and dam safety. These topics are also discussed in detail in the County's 2022 Hazard Mitigation and Climate Adaptation Plan.

Fluvial & Pluvial Flooding

Frederick County experiences flooding. A flood occurs when an area that is normally dry becomes inundated with water. Flooding can occur at any time of the year, with peak volume in the late winter and early spring. Snowmelt and ice jam breakaway contribute to winter flooding, while seasonal rain patterns contribute to spring flooding. Torrential rains from hurricanes and tropical systems are more likely in late summer. Development of flood-prone areas tends to increase the frequency and degree of flooding. According to Risk Factor, a tool developed by the nonprofit First Street Foundation to communicate climate risks to the general public, 12% of all properties within the County face a 26% chance of being severely affected by flooding over the next 30 years.[1]

Fluvial flooding, also known as riverine flooding, occurs when excessive rainfall over a period causes a river or other water body to exceed its capacity. Heavy rain and large amounts of snow melt can cause riverine flooding. Riverine flooding is a longer-term event than flash flooding, maybe lasting days or weeks.

Pluvial flooding, also known as stormwater or flash flooding, occurs when heavy rainfall creates a flood event independent of an overflowing water body. For example, pluvial flooding may occur if drainage systems are over-capacity and excess water runoff cannot be adequately stored/ transported. Pluvial flooding also includes groundwater flooding. This type of flooding occurs when the ground becomes over-saturated and the water table rises, which causes water to seep through and accumulate over the surface.

The Frederick County Hazard Mitigation and Climate Adaptation Plan (HMCAP) (Table 5.6) identified the following as contributing causes to riverine flooding versus flash flooding.

1 https://riskfactor.com/county/frederick-county-md/24021_fsid/flood

Causes of Flooding	External Issues that Exacerbate Flash Flooding
Low lying, relatively undisturbed topography	Hilly/mountainous areas
High water tables	High velocity flows
Soil characteristics	Short warning times
Constrictions in the floodway or floodplain (filling)	Steep slopes
Obstructions in the floodway or floodplain (bridges)	Narrow stream valleys
Excess paved surfaces	Parking lots and other impervious surfaces
Poor drainage	Improper drainage

The County's 2022 HMCAP includes a flood exposure analysis for both types of flooding. The fluvial (riverine) flood analysis is based in part on FEMA flood maps. An additional analysis was performed to develop high level pluvial (stormwater/groundwater) flood risk maps for all of Frederick County.

The pluvial flood hazard is large and potentially growing due to climate and urbanization trends and is not currently represented by FEMA flood maps. Including analyses for both fluvial and pluvial flooding therefore provides an enhanced understanding of the overall flood risk exposure throughout Frederick County. The 2022 HMCAP pluvial flooding analysis used data from the National Oceanic and Atmospheric Administration (NOAA's) Atlas 14 for rainfall amounts. Five potential storm events were modeled and ranged from 10 to 100-year storm events with durations from six to 24 hours. The rainfall data was combined with topographic data and hydraulic equations in order to estimate at a high level the extent and depth of rainfall across the County. The Catoctin and Monocacy watersheds were modeled separately due to differences in precipitation amounts but are shown on the same map in Map 16. For a more detailed methodology of the pluvial flood analysis, refer to Appendix A of the 2022 Frederick County Hazard Mitigation and Climate Adaptation Plan.

Know Your Flood Risk: *The Federal Emergency Management Agency (FEMA) produces official flood maps for many communities. These maps depict different levels of flood risk which FEMA refers to as "zones." For example, zones starting with "A" (non-coastal) or "V" (coastal) are high-risk or "Special Hazard Flood Area" where there is at least a 1% annual chance of a flood event. Put another way, over the term of a 30-year mortgage these properties have about a one-in-four chance of flooding. FEMA also identifies low- and moderate-risk flood areas such as Zones B, C, and X. Zones B and X (shaded) have an approximately 0.5% annual chance of a flood event while zones C and X (unshaded) are considered to have less than 0.5% annual risk.*

FEMA periodically revises flood maps to reevaluate risk. Frederick County recently underwent such a revision and new maps and an updated floodplain management ordinance became effective August 1, 2023. There were 200.93 acres removed from the floodplain across 785 parcels and 766.79 acres were added to floodplains across 632 parcels. These numbers include properties in a municipality as well as unincorporated areas.

Property owners should be aware that even if their property is not in a mapped FEMA floodplain, it could still be at risk of flooding. In addition, home, renter, and business insurance policies typically do not cover damage from floods and separate flood insurance must be obtained. Insurance is available through the National Flood Insurance Program (NFIP) as well as private companies. Some properties are required by the mortgage lender to have flood insurance. A property does not need to be located in a FEMA flood zone in order to purchase flood insurance.

For more information, visit:
Federal Emergency Management Agency, FEMA (www.fema.gov)
National Flood Insurance Program, NFIP (www.floodsmart.gov)
Maryland Insurance Administration (www.insurance.maryland.gov)
Frederick County Zoning Administration (www.frederickcountymd.gov)]

Map 16 summarizes the fluvial and pluvial flood hazard areas at the County scale. Both types of flood hazards are represented by the 100-year 24-Hour flood areas, that is, flooding caused by a 24-hour long storm event with a 1% chance of occurrence each year. Specifically, the fluvial flood risk is represented by the FEMA 100-year floodplain (green), while the pluvial flood risk is represented by 100-year 24-hour flood areas that were modelled as part of the HMCAP flood analysis. The blue gradient represents the density of flood depth points to summarize pluvial flood risk at a higher scale.

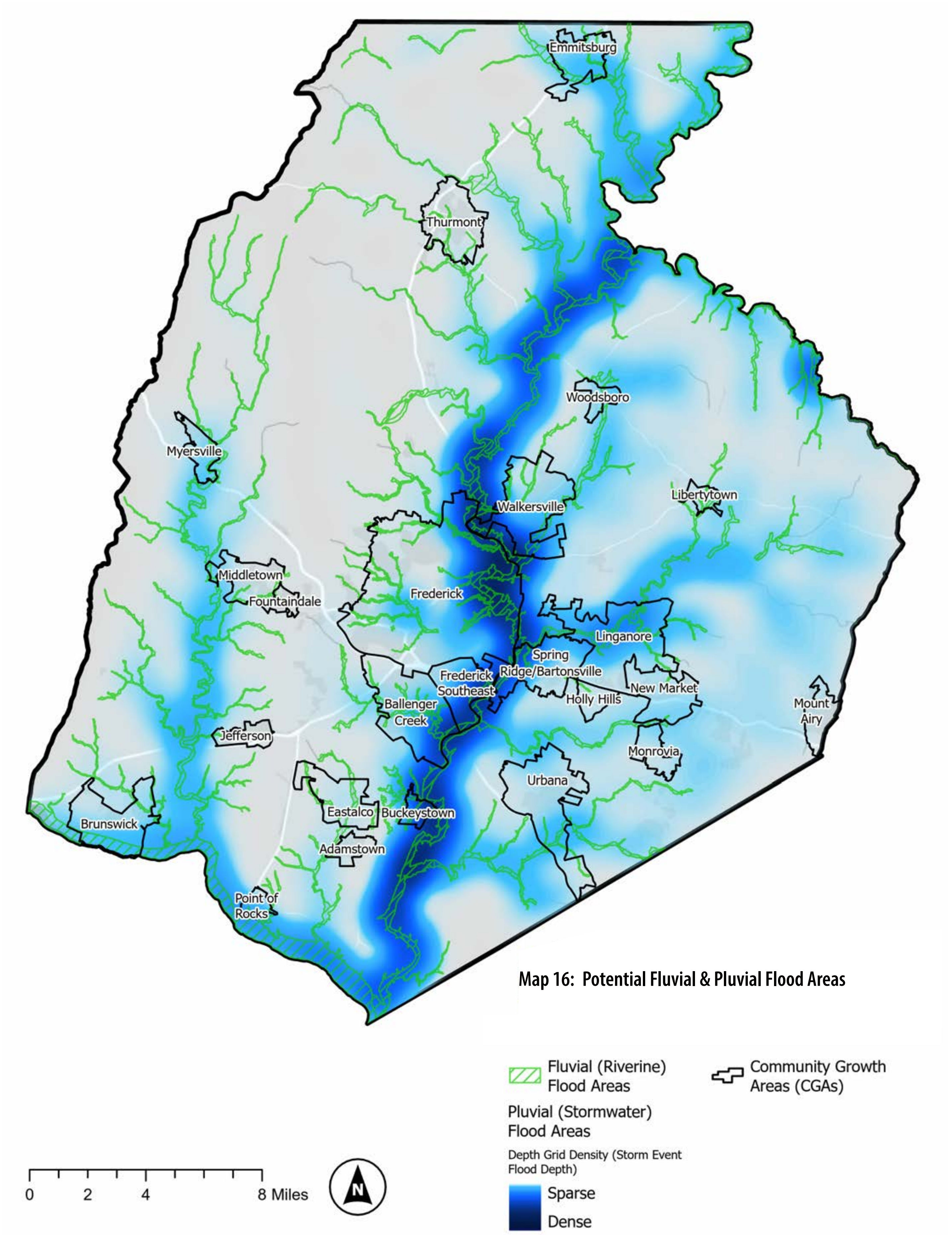
Many community growth areas contain both fluvial and pluvial flood hazard areas. What is especially notable is the areas that fall outside of the fluvial flood risk areas but may be exposed to pluvial flood hazards. This highlights the importance for stakeholders to evaluate their flood risk and prepare accordingly even if they are not located within a FEMA floodplain. These pluvial risk areas are especially concentrated in areas nearby the Monocacy River, in particular the City of Frederick, Frederick Southeast, Ballenger Creek, Spring Ridge/Bartonsville, Buckeystown, and Linganore and land adjacent to these growth areas.

Data prepared for the HMCAP was used to identify the total percent of buildings in Community Growth Areas that are located in the FEMA fluvial and pluvial floodplains. Table 4.06 also summarizes the number of critical facilities located within the fluvial or pluvial floodplain. Critical facilities in the HMCAP include government and public safety facilities or infrastructure, transportation infrastructure, shopping centers, and more. Growth areas with higher percentages of buildings or critical facilities exposed to the pluvial floodplain may benefit from stormwater infrastructure installed as part of redevelopment, road reconstructions, or as part of a targeted stormwater retrofit program.

Table 4.06: Floodplain Exposure by Community Growth Area

Community Growth Area	% of Total Buildings Exposed to FEMA Fluvial Floodplain	% of Total Buildings Exposed to Pluvial Floodplain [2]	# of Critical Facilities Exposed to Fluvial or Pluvial Floodplain
Adamstown	0.27%	2.83%	0
Ballenger Creek	1.61%	3.37%	3
Brunswick	0.79%	4.86%	2
Buckeystown	8.00%	5.09%	0
Eastalco	4.62%	4.62%	0
Emmitsburg	2.22%	3.90%	4
Fountaindale	1.06%	4.10%	0
Frederick	1.47%	7.94%	23
Frederick Southeast	0.42%	16.35%	2
Holly Hills	0.25%	2.53%	0
Jefferson	0.00%	4.31%	1
Libertytown	10.87%	8.33%	0
Linganore	0.70%	2.25%	0
Middletown	0.17%	4.31%	1
Monrovia	0.00%	5.90%	0
Mount Airy	0.00%	2.42%	0
Myersville	0.15%	2.74%	0
New Market	0.28%	3.34%	1
Point of Rocks	4.94%	3.20%	0
Spring Ridge/Bartonsville	0.19%	2.52%	0
Thurmont	1.89%	4.84%	2
Urbana	0.03%	1.18%	1
Walkersville	0.48%	3.92%	1
Woodsboro	0.61%	7.51%	0

2 Percent of total buildings exposed to the pluvial floodplain excludes properties that are already in a mapped FEMA Fluvial Floodplain.



Map 16: Potential Fluvial & Pluvial Flood Areas

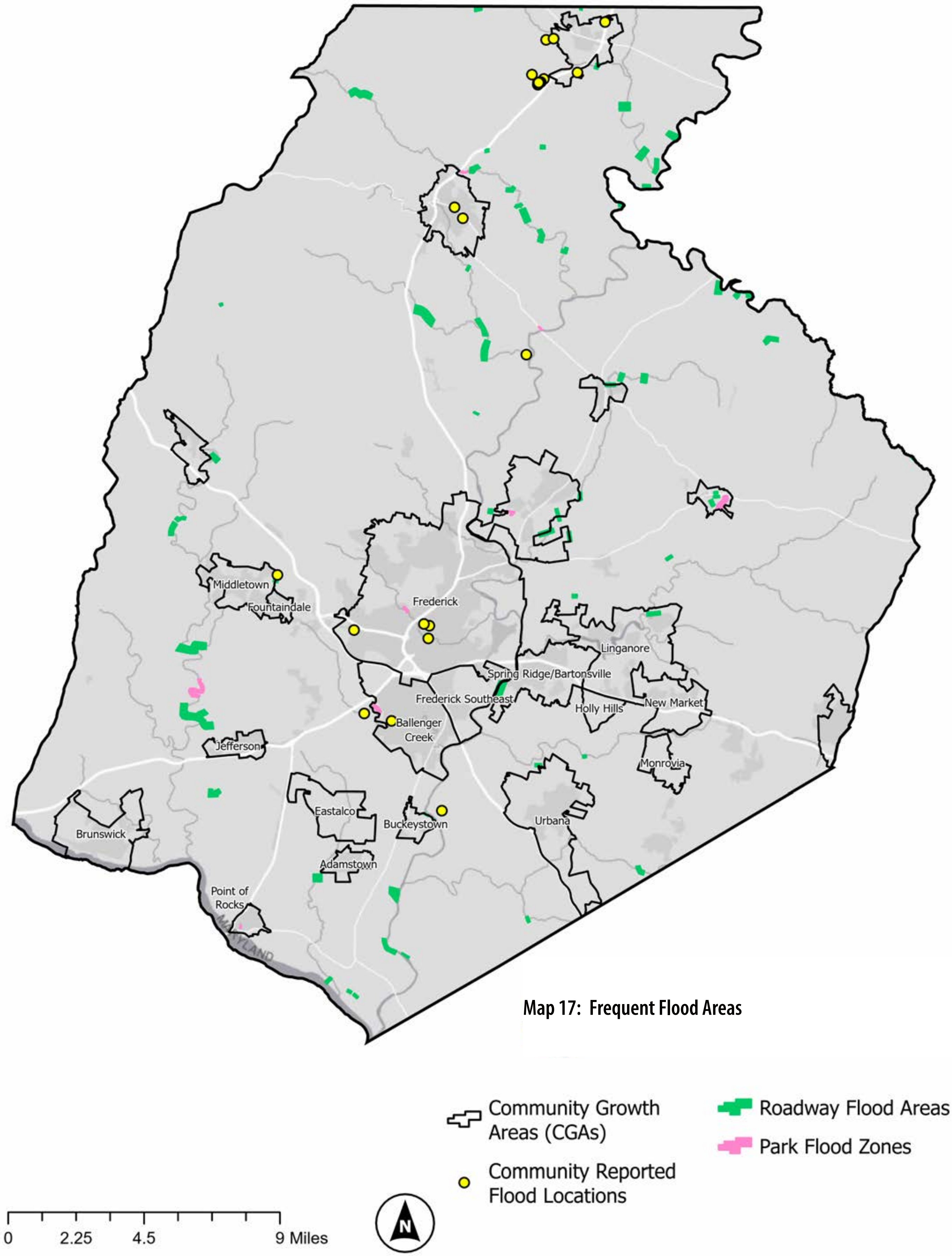
Recurrent Flooding Areas

Map 17 summarizes roadway and park flood areas, as well as community-reported flood areas that were received during development of the 2022 HMCAP. These are the known frequent flood areas. Community Growth Areas are also mapped for reference. These known frequent roadway and park flood areas occur throughout the county. For the most part, they are located outside of CGAs with the exception of Libertytown and areas adjacent to Walkersville and Emmitsburg.

The rivers and streams in Table 4.07 have more than one roadway flood area. The 2022 HMCAP contains an action item, FC-7, to develop structural corrective action plans (paving/elevation programs) for Frederick County's pre-identified frequently flooded roadways (Page 258).

Table 4.07: Known Roadway Flood Areas

Surface Water	Affected Roadways
Catoctin Creek	Brethren Church Rd Shank Rd Station Rd Poffenberger Rd Sigler Rd
Coppermine Branch	South St Jones Rd North St
Hunting Creek	Wilhide Rd Hessong Bridge Rd
Israel Creek	Coppermine Rd Hill Rd Stauffer Rd Water Street Rd Cash Smith Rd
Monocacy River	Sixes Bridge Rd Pinecliff Park Rd Greenfield Rd Mumma Ford Rd Michaels Mill Rd
Owens Creek	Frushour Rd Old Frederick Rd Hoovers Mill Rd Foxville Deerfield Rd Old Mill Rd Apples Church Rd Roddy Rd
Silver Hill Creek	Crum Rd
Toms Creek	Keysville Rd Grimes Rd Annandale Rd Sixes Rd Creamery Rd
Tuscarora Creek	Pleasant View Rd Noland Rd Nolands Ferry Rd



Map 17: Frequent Flood Areas

The map also identifies County parks located within the 100-Year (1% Annual Probability) FEMA floodplain. Parks can be designed to provide critical flood control functions, such as the City of Frederick's Baker Park. Floodplains are also a way to provide passive open space while protecting sensitive lands from development. However, parks still contain roads, parking lots, and facilities like playgrounds and shelters that can be damaged by floods even if these are not built in the mapped floodplains. The following parks are located within the 100-Year Floodplain:

- Ballenger Creek Park
- Buckeystown Park
- Carroll Park Manor
- Catoctin Creek Park and Nature Center
- Creagerstown Park
- Fountain Rock Park
- Libertytown Park
- Loy's Station Park
- Pinecliff Park
- Point of Rocks Community Park
- Roddy Road Park

Future capital improvements in these parks should consider the park's connection to the floodplain and identify opportunities for improved stormwater management. Development of facilities and roads should prepare for the impacts of climate change, such as more frequent and intense storms, in the design and siting of improvements.

Floodplain Management in Frederick County

Frederick County restricts development in certain locations that are at risk of flooding. These regulations are found throughout the County's subdivision and zoning ordinances and ensure buildings conform to state and federal environmental laws. In some cases, the County's rules exceed state and federal requirements for floodplain management.

- **Floodplain District:** The Floodplain District is a zoning overlay district. The limit is the most extensive of whichever is greater: the FEMA floodplain, flooding soils, and wetlands. It implements restrictions on where new construction can be located within the district and setback requirements from floodplains or streams. More information can be found in Chapter 1-19, Zoning, Article IX, Division 1 (Floodplain District Regulations) of the Frederick County Code of Ordinances.
- **Resource Conservation:** The Resource Conservation (RC) district is a base zoning district in Frederick County. Although floodplain management is not the primary purpose of this district, it plays an important role in preserving sensitive environmental features such as steep slopes (existing slopes > 25% grade) and the habitats of threatened or endangered species. By protecting these features from intensive development, the Resource Conservation district protects the natural flow and function of drainage and waterways, reducing the risk of streambank erosion and steep slope erosion.

  The County has primarily deployed the RC zone (and corresponding Natural Resource comprehensive plan land use designation) in sensitive areas such as the Catoctin Mountain range, the Sugarloaf Mountain area, and along primary rivers such as the Monocacy River and Catoctin Creek and other creeks and runs. While development is not prohibited in the Resource Conservation zone, it is very limited in terms of uses that are allowed. Only a limited number of the County's many residential and nonresidential uses are allowed in RC. In addition to allowing fewer uses, RC is also the most restrictive zoning district in the County in terms of lot standards. Minimum lot size and setbacks requirements are the highest in RC compared to any other County zone. These standards help to limit the scale and intensity of uses that are built and ensure compatibility with natural resource areas.

- **Waterbody Buffer:** Parcels seeking subdivision approval by the County must comply with the waterbody buffer requirements. A waterbody buffer must be provided along both sides of a waterbody. Buffers must be kept in a natural vegetative state or used for reforestation/afforestation requirements or other environmental enhancement projects. The minimum buffer is 100' but can be up to 175' or more depending on the exact site conditions. Septic systems and infrastructure approved after August 2008 must be located outside of the waterbody buffer.

What is now the Point of Rocks Community Commons Park on Clay Street was once a block of homes and businesses. These properties were subject to repeat flooding and participated in a flood buyout program under the Federal Emergency Management Administration (FEMA). Demolition was completed in 2007.[1] The park includes an obelisk monument which documents historic flood levels of the Potomac River.

Buyouts are a form of "managed retreat" from flood risk. When a property repeatedly floods and mitigation actions are not possible or have not succeeded, demolishing or moving the structure out of the floodplain is a last resort. From 1989 through 2017, there were approximately 43,000 FEMA-funded voluntary buyouts across the United States.[2] Flood risk is an environmental justice issue and is greater in communities of color as well as low-income neighborhoods.[3,4] Flood buyouts similarly have been found to be located "in relatively poorer, less densely populated areas, also with relatively lower education levels, lower English language proficiency, and greater racial diversity."[5] However, participating in a buyout program understandably has a profound impact on both people who leave and people who stay behind through a loss of culture, traditions, social networks, and a sense of place.[6,7] For more information on equity and environmental justice, refer to Page 4-26.

1 https://www.fredericknewspost.com/news/economy_and_business/tourism/construction-begins-on-point-of-rocks-park-slated-to-open-this-fall/article_1be7cc38-0261-5d9f-a30e-29121d8298ec.html
2 https://knowledge.uli.org/en/reports/research-reports/2021/on-safer-ground-floodplain-buyouts-and-community-resilience
3 https://knowledge.uli.org/en/reports/research-reports/2021/on-safer-ground-floodplain-buyouts-and-community-resilience
4 https://www.bloomberg.com/graphics/2021-flood-risk-redlining/
5 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6785245/
6 Caroline M. Kraan1 & Miyuki Hino2,3 & Jennifer Niemann4,5 & A. R. Siders6,7 & Katharine J. Mach4,5 https://link.springer.com/article/10.1007/s13412-021-00688-z
7 https://knowledge.uli.org/en/reports/research-reports/2021/on-safer-ground-floodplain-buyouts-and-community-resilience pg 17

Dam Safety

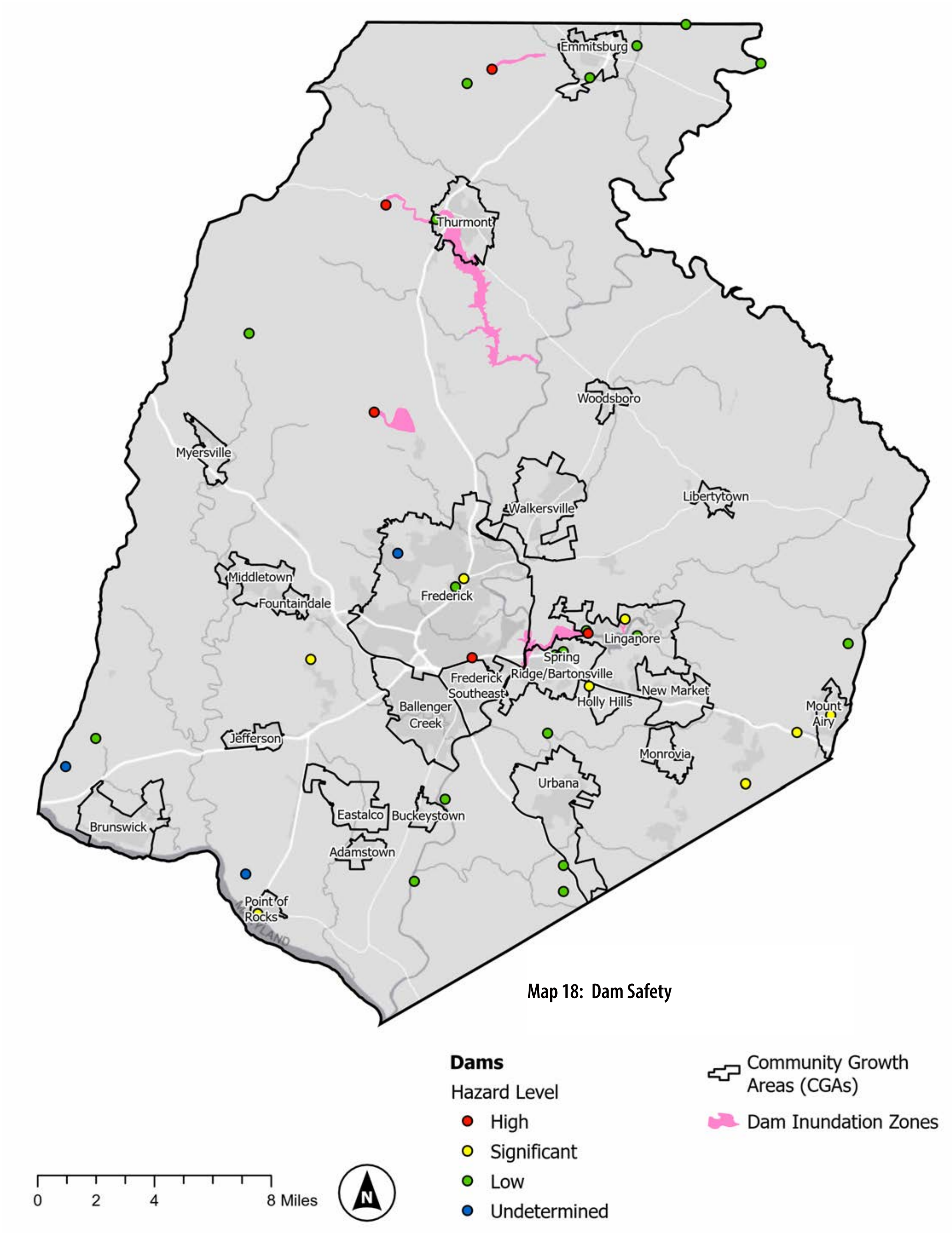
The word 'dam' may bring to mind a large concrete power generating facility or drinking water reservoir. But a dam is simply a structure built of any material with the intent to store or divert water. According to MDE, "the average dam in Maryland is about 26 feet high, 60 years old, and built out of compacted soil (earth embankment)."[3]

If a dam fails, there can be devastating consequences. Maryland began regulating dams in 1934 in order to protect drinking water supplies and established the Dam Safety Division in 1978.[4] Federal coordination on dam safety efforts began in 1979 with the publishing of *Federal Guidelines for Dam Safety* (for federally owned dams) and in 1980 the Interagency Committee on Dam Safety was formed, which still meets quarterly and is a forum to coordinate federal efforts for dam safety and security.[5] The National Dam Safety Program was authorized in 1996 and is the primary federal support for state dam safety programs.[6, 7]

According to a 2021 FEMA publication, most dams in the United States (64%) are privately owned and 70% of dams are regulated by states.[8] A dam owner is responsible for maintaining and financing their dam. In Maryland, MDE's Dam Safety Program maintains a dam inventory, issues permits for dam construction or repair, conducts safety inspections for specific facilities (taller than 20 feet and/or drain more than one square mile), and ensure Emergency Action Plans (EAPs) are in place for High or Significant hazard dams.

The Maryland Department of the Environment's Dam Safety Program uses a Hazard Classification system "based on the downstream damage that would result if the dam were to fail. The hazard classification has no relationship to the condition of the dam, its structural integrity, operational status, or flood storage capability. In general accordance with dam safety practices nationally, Maryland uses three categories to classify dams: High, Significant, and Low hazard:

3 https://mde.maryland.gov/programs/water/DamSafety/Pages/What-is-a-dam.aspx
4 https://mde.maryland.gov/programs/water/DamSafety/Pages/What-is-a-dam.aspx
5 https://www.fema.gov/sites/default/files/2020-08/national-dam-safety-25-years.pdf
6 https://crsreports.congress.gov/product/pdf/IF/IF10606
7 https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants
8 https://www.fema.gov/sites/default/files/documents/fema_nsdp-overview-fact-sheet.pdf



Map 18: Dam Safety

- High Hazard Dam - Failure would likely result in loss of human life, extensive property damage to homes and other structures, or cause flooding of major highways such as State roads or interstates.
- Significant Hazard Dam - Failure could possibly result in loss of life or increase flood risks to roads and buildings, with no more than 2 houses impacted and less than six lives in jeopardy.
- Low Hazard Dam - Failure is unlikely to result in loss of life and only minor increases to existing flood levels at roads and buildings is expected."

According to the State of Maryland's 2021 Hazard Mitigation Plan, there are 31 dams in Frederick County. Five dams are High Hazard, eight dams are Significant Hazard, and 18 are Low Hazard. Map 18 shows the location and hazard classification of dams in the County and their inundation areas (if mapped) in relationship to Community Growth Areas. Frederick County also maps 3 additional dams which have an "Undetermined" hazard classification.

There are 16 dams within Community Growth Areas: High Hazard (1), Significant (5), Low (9) and Undetermined (1). These dams are located with the City of Frederick, Spring Ridge/Bartonsville, Linganore, Point of Rocks, and the Town of Thurmont Community Growth Areas. The Point of Rocks dam is scheduled to be decommissioned in 2024.

The State of Maryland's Hazard Mitigation Plan (HMP) analyzes both State Assets and Critical Facilities. State Assets are owned by the state of Maryland whereas critical facilities are not state-owned but "must continue to operate before, during, and after an emergency and/or disaster." These critical facilities are defined and mapped in Appendix I of the State's HMP. Frederick County has 34 critical facilities which could be affected by dam failures. Table 3.19 in the State's HMP estimates total losses between building value and content value were $721,416,300 in 2020 dollars. Table 3.20 shows there are 20 state assets which could be impacted by dam failures with estimated total losses (building and content values) at $62,914,111 in 2020 dollars.

Frederick County's Hazard Mitigation and Climate Adaptation Plan identified six critical facilities located in dam inundation areas in Table 5.4. These facilities include dry hydrant (1), interchange (1), library (1), shopping center (2), and wastewater treatment plant (1).

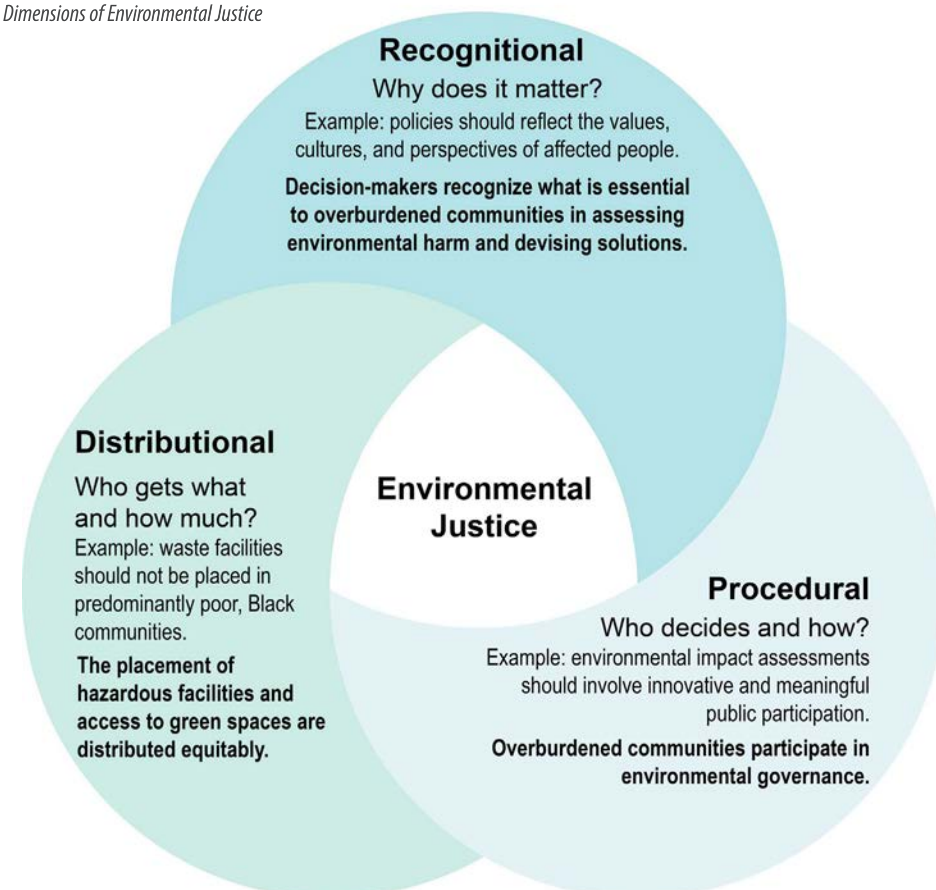
EQUITY AND STORMWATER

Where we live affects our quality of life and can have profound impacts for our future. Inherent in this concept should be a recognition that the differing geographies in which people live are not equal. This notion is well illustrated by statistical tools that have been developed over the past few decades, including the Opportunity Atlas (www.opportunityatlas.org) that clearly illustrate how the zip code in which someone lives can have long-term impacts on their cost of housing, their earning potential, and their chances of being incarcerated. Decades of federal, state, and local policies shaped our neighborhoods, resulting in patterns of socioeconomic and racial segregation which persist today. These patterns have impacted the quality of life for different racial, ethnic, and socioeconomic groups across things like public education, housing, and the environment. This concept is also sometimes referred to as "zipcode destiny." The concept of environmental justice has developed as one means to counteract the potential impacts of zipcode destiny.[9]

The Maryland Department of the Environment (MDE) defines environmental justice as "equal protection from environmental and public health hazards for all people regardless of race, income, culture, and social status."[10] While laudable, *equality* does not account for the disparate impacts that certain groups of people have experienced. MDE's environmental justice website uses the term "underserved and overburdened communities" when talking about the need to particularly focus on these communities in the pursuit of environmental justice. Demographic characteristics of each community (described more in the following paragraphs) are defined in State law and measured at the census tract level.[11] In this way, the measure of underserved and overburdened communities is both people- and place-based. This is more in line with *equity* which recognizes that not everyone experiences the same conditions or constraints. While there are many criteria that can be used to define underserved or overburdened communities, it is undeniable that there are groups in the United States who are "disproportionately impacted by environmental hazards."[12]

9 https://www.npr.org/2018/11/12/666993130/zipcode-destiny-the-persistent-power-of-place-and-education
10 https://mde.maryland.gov/Environmental_Justice/Pages/Landing%20Page.aspx
11 https://mde.maryland.gov/Environmental_Justice/Pages/EJ-Screening-Tool.aspx
12 https://nca2023.globalchange.gov/chapter/20#key-message-1

Figure 5: Three Dimensions of Environmental Justice



"Environmental justice" can still seem like a vast topic. The figure above, published in the Fifth National Climate Assessment, summarizes three dimensions (recognitional, distributional, and procedural).[1]

1 https://nca2023.globalchange.gov/chapter/20#fig-20-1

The negative effects on "underserved and overburdened communities" can manifest many different ways. These neighborhoods may experience disinvestment on both regular maintenance and infrastructure upgrades. There may be reduced resources towards environmental investigations and enforcement in underserved areas. There is also a history of disproportionate siting of undesirable land uses in or near these communities.[13] Neighborhoods with these characteristics also may have higher rates of impervious surface coverage and have less tree canopy and other green infrastructure.[14, 15] For example, a study published in 2023 of green stormwater infrastructure installed in Baltimore found that practices built to comply with stormwater regulations were found twice as often in white neighborhoods. Meanwhile, voluntarily constructed green infrastructure "in under-privileged neighborhoods were relatively few and small in scope."[16]

Underserved Community is defined as a census tract that meets one of the following criteria: at least 25% are low-income; or at least 50% are nonwhite; or at least 15% have limited English proficiency. The table below summarizes the number of census tracts in Frederick County that meet these State criteria. Data is calculated from the 2020 5-Year Estimates from the American Community Survey and was accessed from the MDE's Environmental Justice Screening Tool Version 2.0 Beta.[17]

13 https://nca2023.globalchange.gov/chapter/20#key-message-1
14 https://css.umich.edu/publications/factsheets/sustainability-indicators/environmental-justice-factsheet
15 https://nca2023.globalchange.gov/chapter/12#key-message-2
16 https://www.bayjournal.com/news/pollution/green-stormwater-projects-less-likely-in-black-neighborhoods/article_d70ea1ec-da58-11ed-93e0-c3f5cf10c64b.html
17 The WRE uses the underserved community definition from Maryland statute. However, the overall "EJ Score" compiled by MDE for a census tract encompasses more indicators such as pollution exposure and health. Since the passage of HB1200 in 2022, this composite "EJ Score" must be included in any permit application requiring a public hearing under the Environment Article (§1-601), including discharge permits into waters of the State.

MDE Underserved Community Indicator	Number of Frederick County Census Tracts
Census Tracts >25% Low-Income	11
Census Tracts >50% Nonwhite	7
Census Tract >15% LEP	1
Census Tracts >50% Percentile Distribution Statewide	11

The MDE EJ tool averages the percentile measurements for poverty, nonwhite, and limited English proficiency (the first three indicators in the table above) to calculate a combined socioeconomic and demographic score. This score is then compared to the scores of all census tracts in Maryland (the fourth indicator in the table above). Frederick County has 11 census tracts within the top 50th percentile which means the score is higher than the median state-wide. Put another way, these census tracts have a higher concentration of underserved populations. These 11 tracts are located in the City of Frederick and the surrounding unincorporated area of the County.

The MDE definition is only one of many ways to quantify or describe an underserved population. For example, the Metropolitan Washington Council of Governments first used "Equity Emphasis Areas" (EEA) in the *Visualize 2045* long range transportation plan to evaluate for disproportionate or adverse impacts to low-income or minority groups. Instead of using threshold demographic criteria like the MDE definition, the EEA looks at whether these groups are concentrated in a census tract when compared to their make-up of the region as a whole. As different departments within Frederick County Government look at their services and capital projects to ensure equitable investments, different definitions or areas of emphasis may arise. The WRE is not intended to limit future studies or resources only to these specific indicators. It is also not intended to minimize the struggles other groups not described here experience.

The table below describes challenges different demographic groups may experience with stormwater from an environmental justice perspective. It is important to note these groups and environmental justice impacts are not mutually exclusive.

Households with limited English proficiency	• Receiving emergency information about storm events or flash flooding • Reporting infrastructure problems such as a clogged storm drain or polluters (illicit discharges)
Low-income households	• Affording adequate insurance for their home, business, and property • Fewer financial resources to evacuate before a disaster or to replace/rebuild after a disaster, negatively impacting community resilience • Restricted housing choice which may limit a household to occupy older housing, older neighborhoods, areas prone to flooding, areas with less green infrastructure, and/or an area with more polluters • Financially constrained communities are less able to maintain or upgrade stormwater infrastructure
Nonwhite households	• Underrepresented in government including appointed boards, elected officials, and staff • Impacts from historic and ongoing financial disinvestment by private capital and government • Distrust in the political process • As with low-income neighborhoods, nonwhite communities have higher likelihood of being an overburdened community – more impervious surface, less green infrastructure, more pollution risk

This chapter of the WRE has reviewed current and projected conditions related to impervious surface, watershed health, age of stormwater facilities, fluvial and pluvial flood risk, and more. The following trends emerge with respect to census tracts meeting the MDE-defined "underserved community" criteria:

- These are places with higher concentrations of total impervious surface and untreated impervious surface combined with poor indicators of watershed health (refer to Table 4.02). Community growth areas include Ballenger Creek and Frederick Southeast.
- There is increased risk from "unmapped" floodplains caused by pluvial (stormwater) flooding. Both Ballenger Creek and Frederick Southeast growth areas are affected. While Map 16 shows a higher percentage of Frederick Southeast included in the modeled pluvial floodplain than Ballenger Creek, the Ballenger Creek growth area has more existing residential dwellings that could be at risk.
- Critical facilities exposed to the fluvial or pluvial floodplains are highly concentrated within the City of Frederick (Table 4.06). Not all facilities are necessarily located in an underserved community census tract, but they undoubtedly serve the people who live in those areas due to the nature of these facilities and the role of the City of Frederick as an economic, population, and political hub of the County. While the City has its own planning and zoning authority and MS4 permit, this emphasizes the continued need for interjurisdictional cooperation between Frederick City and Frederick County to protect facilities and services that are in proximity to underserved populations.

Equity and Redevelopment of the South Frederick Corridors area

Some areas within the unincorporated census tracts are located within the South Frederick Corridors Plan planning area. The South Frederick Corridors Plan (SFCP), adopted April 2, 2024, calls for a gradual, incremental, and coordinated transformation into a vital and livable urban district (Page 8). Redevelopment in this area is beneficial for many reasons including already existing infrastructure (like roads, water, and sewer). Redevelopment that is more urban in form will also preserve more undeveloped areas of the County and prevent a corresponding increase in impervious surface from greenfield development.

When it comes to stormwater infrastructure in the SFCP, the two Community Growth Areas of Ballenger Creek and Frederick Southeast have the highest percentage of untreated impervious surface (WRE, Table 4.02). This is because much of the development in this area occurred before the 2000 Maryland Stormwater Design Manual. Therefore, redevelopment represents an opportunity to improve the treatment and quantity management of stormwater in these areas.

The SFCP identifies three stormwater management actions in the plan's implementation section. For more details on these implementation actions, see Page 86 under "Facilities and Services" of the SFCP.

- **FC5** – Develop a coordinated, area-wide plan for stormwater management based upon new or updated watershed plans for the lower Ballenger Creek and Monocacy Direct Southwest Watersheds.
- **FC6** – Institute a system for creating shared community stormwater management facilities.
- **FC7** – Develop a concept plan for integrating stormwater management facilities and accessible green infrastructure in the South Frederick Corridors.

In addition to these specific stormwater actions, the SFCP intentionally plans for proposed parks and green infrastructure (SFCP Page 13, Map 2) and a connecting "Green Lattice" corridor (SFCP Page 14, Figure 4). More information about these features can be found in each chapter of the plan as it relates to the nested geographic scales of the Planning Area, Sectors, Districts, and Subdistricts.

The plan also includes street and road designations and cross sections for the existing and proposed road network (SFCP Pages 65-68). Streets and roads will include areas for planted medians (where appropriate) and street trees. This will reduce impervious cover and increase tree canopy coverage – which is especially lacking in the Frederick Southeast Community Growth Area. These implementing regulations for the SFCP are anticipated to be developed through 2024.

FUTURE CONDITIONS - STORMWATER AND POLLUTANT LOADING

Frederick County is currently the fastest growing county in Maryland. How that growth occurs, where it occurs, and what it looks like all have impacts on infrastructure and our environment, including water resources. This section of the Water Resources Element considers whether the implementation of the comprehensive plan would affect the pollutant reduction goals mandated by TMDLs (Total Maximum Daily Loads, or 'pollution diets').

Current pollutant loads were discussed earlier in Chapter 4 (beginning on Page 4-10). This analyzed 2017/2018 Chesapeake Bay Land Use and Land Cover and applied nutrient loading estimates based on aggregated land use categories generated from the Phase 6 Chesapeake Assessment Scenario Tool (CAST) watershed model. This model is used to measure progress on the Bay TMDL goals. This same methodology from earlier in this chapter is being applied to the future pollutant loading analysis in the following section. Methodology information can be found in Appendix C.

The first step to estimate future pollutant loads is to project the amount of land use change. Because Livable Frederick evaluated four planning scenarios, the Water Resources Element returns to those four scenarios to evaluate the impacts of potential growth and development patterns on pollutant loading. These four scenarios were 1 – Business as Usual; 2 – City Centers Rise; 3 – Suburban Place Making; 4 – Multi-Modal Places and Corridors.

Under each of the four scenarios, the amount, type, and location of growth that could occur through 2035 was estimated. This analysis was limited to county and municipal Community Growth Areas since land use change is anticipated to be minimal outside of CGAs. Community Growth Areas consist of approximately 61,500 acres and represent around 14% of the total land area of the County. Some growth would be from new development and involve the conversion of agricultural or natural land while other growth would be from redevelopment.

Overall, variation between the four development scenarios is minimal. Scenario 2 (City Center Rise) and Scenario 4 (Multi-Modal Places and Corridors) result in slightly less area shifting towards developed land uses. Multi-Modal Places and Corridors also preserves more agricultural land compared to the other three scenarios.

Table 4.08 Estimated Land Use Change through 2035 in Community Growth Areas

		Percent Change from Current Conditions in Community Growth Areas Through 2035 by CAST Load Sector			
	Total Affected Acres	**Agriculture**	**Impervious Developed**	**Pervious Developed**	**Natural**
Business as Usual 75% Greenfield 25% Redevelopment	7,422	-28.42%	13.27%	17.30%	-10.12%
City Centers Rise 65% Greenfield 35% Redevelopment	7,684	-24.63%	13.22%	14.03%	-9.36%
Suburban Place Making 80% Greenfield 20% Redevelopment	7,802	-30.69%	15.16%	19.25%	-13.24%
Multi-Modal Places and Corridors 60% Greenfield 40% Redevelopment	8,058	-23.78%	12.98%	14.21%	-10.65%

The second step was to apply the CAST Phase 6 pollutant loading rates to the estimated land use change in the four scenarios in Table 4.08 above. The pollutants analyzed were Total Nitrogen (TN), Total Phosphorous (TP), and sediment (TSS) in pounds per acre per year. The purpose of this analysis is as a planning exercise to provide insight into the impacts of development over time. This includes whether additional water quality treatment will be needed and how much, which watersheds to prioritize for additional treatment, and the relative impacts to water resources of each development scenario. It is important to note this is not intended as a Use Attainability Analysis or to supplant information in the County's MS4 permit annual report or other related documents such as watershed assessments or restoration activities.

The Maryland portions of three local watershed TMDLs (Catoctin Creek, Lower Monocacy, Upper Monocacy) as well as the Chesapeake Bay TMDL were evaluated. The Double Pipe Creek TMDL was not evaluated because it does not contain any CGAs. TMDLs account for both point source and nonpoint source pollution. The pollutant reductions that would be required to achieve the TMDL are similarly broken out by point and nonpoint sources. These are sometimes referred to as "sectors." Figures 6 through 8 evaluate the impacts from the four scenarios on TMDL baselines only for the MS4 sector. The Lake Linganore phosphorus and sediment TMDLs do not include a wasteload allocation for MS4 stormwater and therefore this TMDL is not analyzed in Figures 6 – 8.

Figure 6: Anticipated Changes in MS4 Phosphorus Loads Relative to Baseline

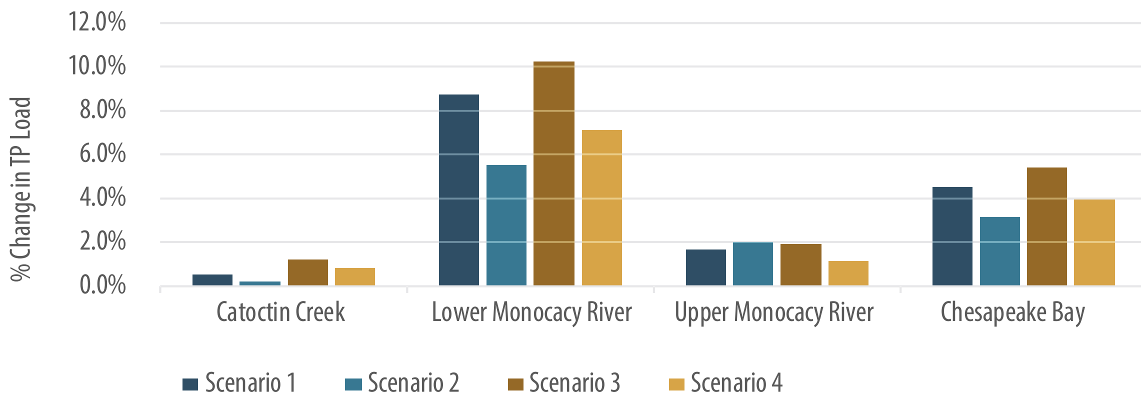


Figure 7: Anticipated Change in MS4 Sediment Loads Relative to Baseline

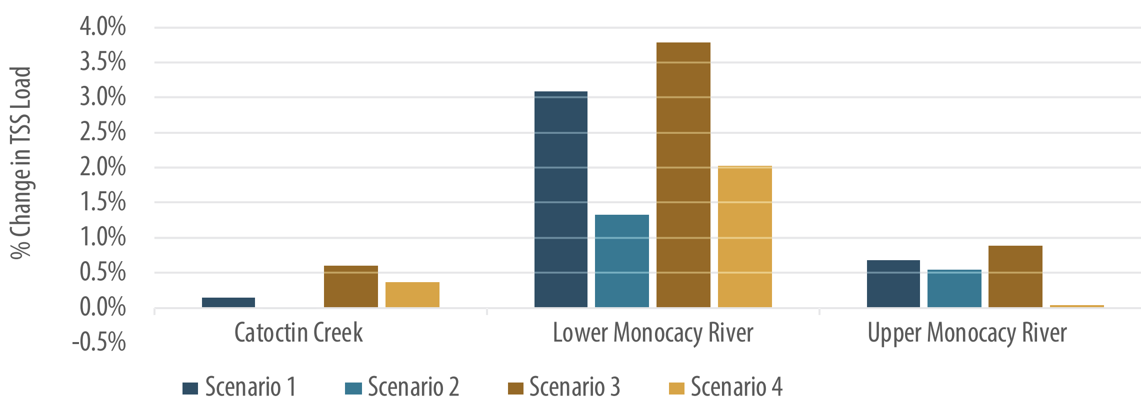
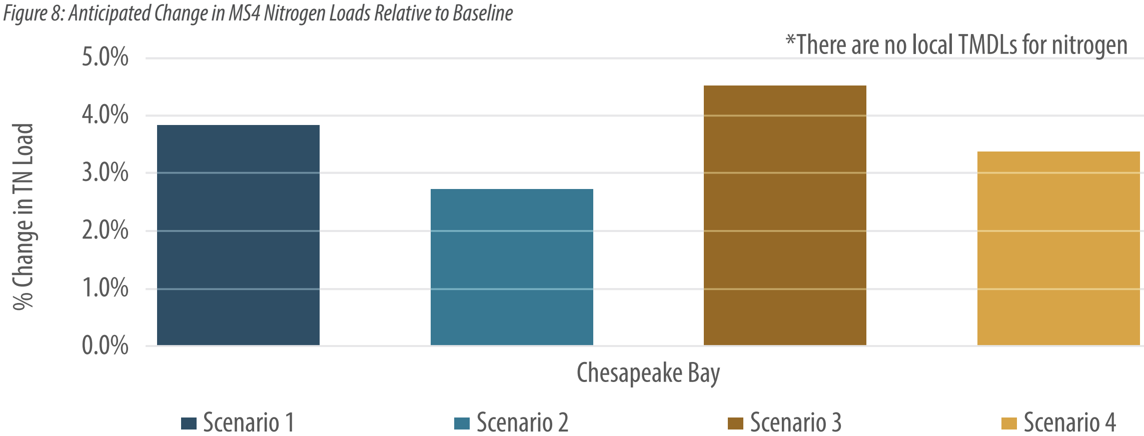
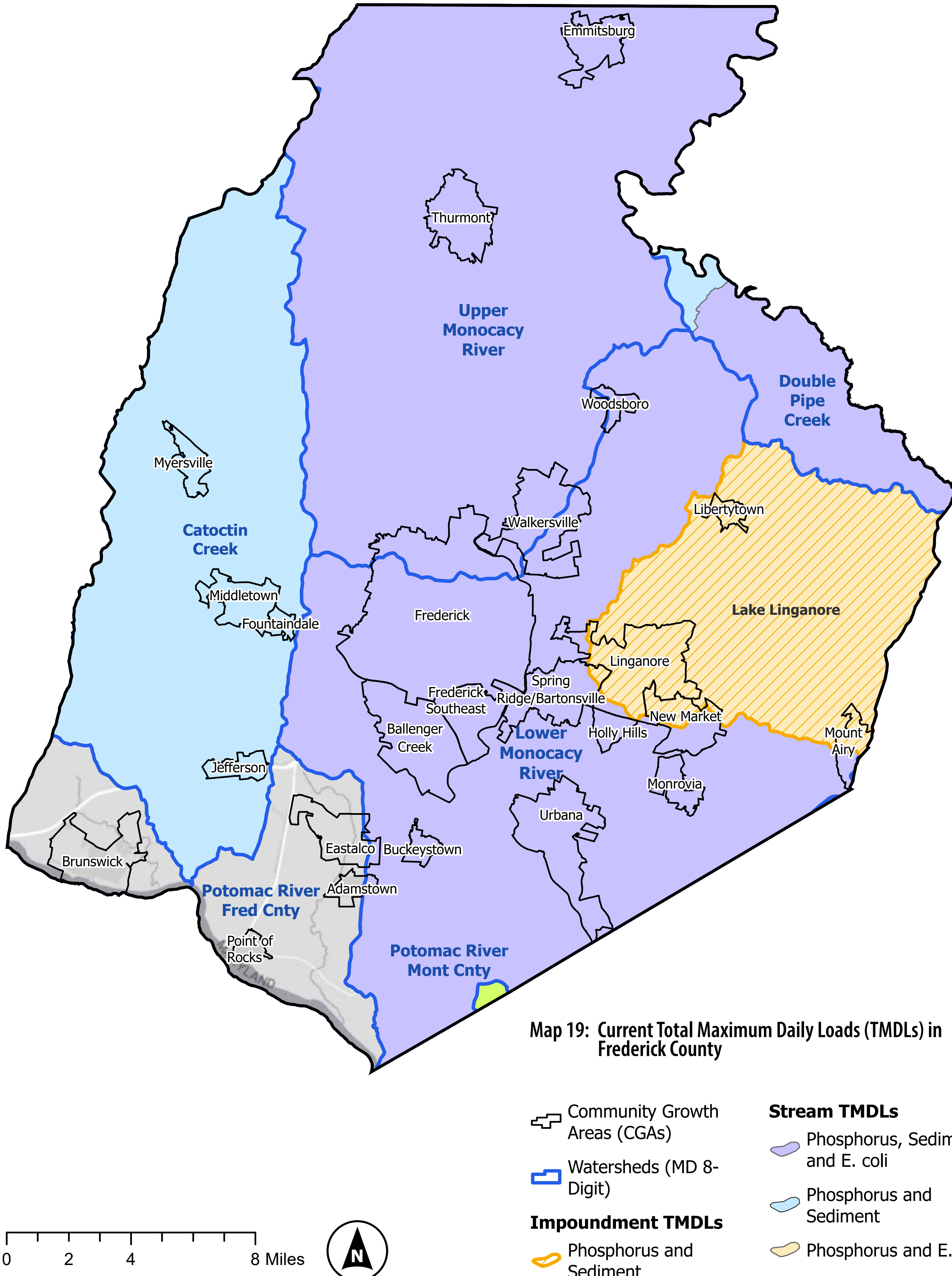


Figure 8: Anticipated Change in MS4 Nitrogen Loads Relative to Baseline





Map 19: Current Total Maximum Daily Loads (TMDLs) in Frederick County

Community Growth Areas (CGAs)

Watersheds (MD 8-Digit)

Impoundment TMDLs

Phosphorus and Sediment

Stream TMDLs

Phosphorus, Sediment, and E. coli

Phosphorus and Sediment

Phosphorus and E. coli

Sediment

The largest increase in baseline phosphorus and sediment loads is within the Lower Monocacy River watershed with an average increase of 7.9% in baseline phosphorus loading and 2.6% in baseline sediment loading across all scenarios. The I-70 and I-270 corridors that include CGAs with the greatest anticipated future development are located within the Lower Monocacy River watershed, which likely explains the largest increase in estimated loads.

Scenario 2 (City Center Rise) and Scenario 4 (Multimodal Places and Corridors) generally result in the smallest increase to baseline loads for all pollutants. The land use change analysis determined these scenarios result in slightly less developed area than the other two scenarios, which likely explains this result. In the Upper Monocacy River watershed, Scenario 4 results in the smallest increase to baseline pollutant loads, since under this scenario development would be focused further south along the I-270 and MARC rail corridors rather than expansion of city centers for towns located within the Lower Monocacy watershed. These insights can help tailor components of the overall strategy to best suit the conditions and needs in each watershed as development occurs.

As noted, the MS4 or stormwater sector is only one piece of a TMDL. While Figures 6 through 8 show increases in nutrients and sediment for urban stormwater, Figures 9 and 10 show that future development within CGAs has a smaller impact when considering the TMDL at the scale of the watershed. Therefore, Figures 9 and 10 include all sectors, not only MS4/stormwater. Since this portion of the pollutant loading analysis assesses a much larger area, the impact of future development within CGAs has a different impact on baseline pollutant loads. Phosphorus pollutant loading across all scenarios remains relatively unchanged compared to baseline loads, ranging from no change in the Catoctin Creek watershed to a 0.3% reduction in the Lower Monocacy watershed. The average baseline sediment loads across all scenarios decrease in all four watersheds evaluated, with the greatest declines occurring in the Lower Monocacy River (-7.6%) and Lake Linganore (-6.0%) watersheds. This can likely be explained by the development of agricultural lands and the assumed sediment treatment efficiency for BMPs implemented to meet required stormwater treatment of impervious areas for new development, which results in a net decrease in loading rate on an acre-by-acre basis.

Figure 9: Anticipated Change in Overall TMDL Phosphorus Loads Relative to Baseline

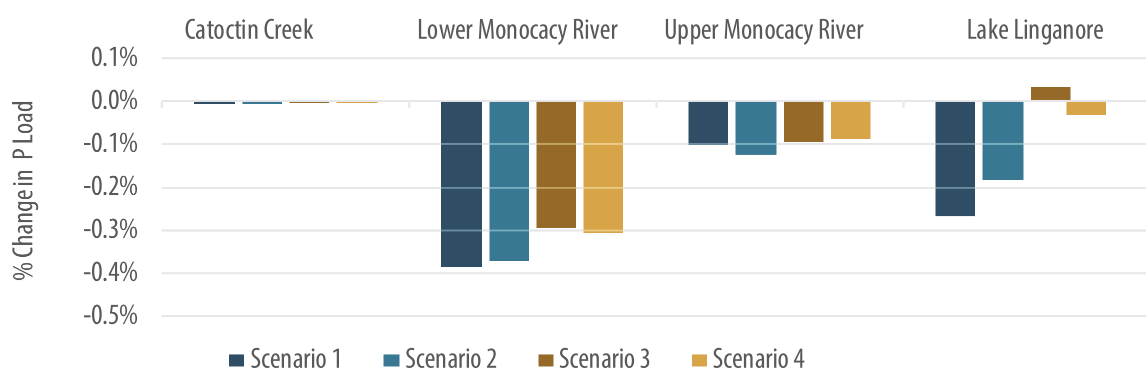
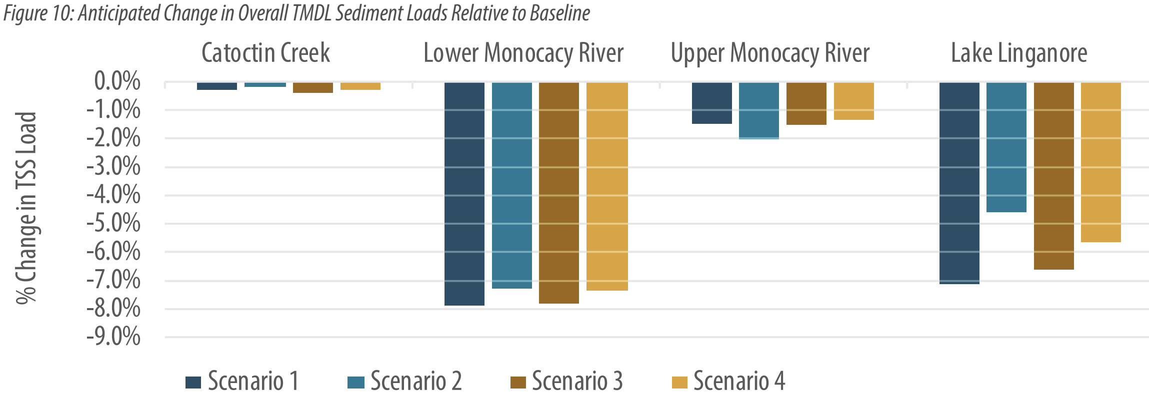


Figure 10: Anticipated Change in Overall TMDL Sediment Loads Relative to Baseline



18 There are no local TMDLs for nitrogen.

These two sets of figures illustrate the issue's complexity. On the one hand, redevelopment can generally be anticipated to reduce pollutant loading. This is from a combination of factors, such as the Maryland stormwater requirement to treat 50% of existing impervious surface with a BMP after redevelopment. Also, if there are existing BMPs, they are more likely to be from older generations of design. When these older features are replaced with modern practices this can be another pollutant reduction benefit. In new/greenfield development situations, since 100% of new impervious surface must be treated to meet state stormwater requirements this can be a pollutant reduction when considering previous land uses (i.e., agriculture).

On the other hand, while greenfield development may result in untreated agricultural production transitioning to highly-treated urban land uses, this represents a shift in the overall burden of pollutant load reduction towards MS4 jurisdictions as urban area is added due to the new development. The benefits of the decreased pollutant loads is much more complex on a larger and longer scale. The increased impervious area from development can alter watershed hydrology such that the volume and flashiness of discharges increase, and therefore overall pollutant loading increases. This combined with a potential decrease in the efficacy of stormwater treatment BMPs due to increased stormwater volume may negate BMP pollutant reductions. Since this is a planning level analysis, these types of impacts are not fully reflected in this analysis.

Overall, this analysis of the Livable Frederick Master Plan scenarios demonstrates the benefits and efficiencies of directing growth to places in the County where it already exists and promoting infill and redevelopment. This limits the creation of new impervious surface and can improve the quality of stormwater management practices post-redevelopment. However, even scenarios with more focus on redevelopment and compact growth increase pollutant loading, particularly in the Lower Monocacy watershed. This watershed in particular may need to be targeted for increased retrofits and other water quality improvement projects.

CLIMATE CHANGE AND STORMWATER

According to the National Oceanic and Atmospheric Administration (NOAA), 2023 was Earth's warmest year on record.[19] Increases in greenhouse gases in the atmosphere, associated with the use of fossil fuels, continues to be a primary driver of this warming trend.[20] In Maryland, and the rest of the Northeast, climate change is exhibiting through more extreme weather, especially heat, flooding/storms, and drought.[21] Climate change is also an environmental justice issue because impacts exacerbate existing inequality faced by historically burdened communities including racial and ethnic minorities, people of lower socioeconomic status, and older adults.[22]

Frederick County has recognized the threat posed by climate change through actions of the Frederick County Council, the County Executive, and efforts of private citizens. On July 21, 2020, the Frederick County Council passed Resolution 20-22 in recognition of the climate emergency and also formed the Climate Emergency Mobilization Workgroup. The workgroup published the final report (Climate Response and Resilience) in August 2021.[23] Recent planning efforts have included the 2023 Frederick County Climate and Energy Action Plan for Internal Government Operations, which focused on climate change impacts to Frederick County Government operations and how those operations can change to mitigate contributions to climate change (for example, reducing greenhouse gas emissions) as well as how to make County operations resilient in an uncertain future.

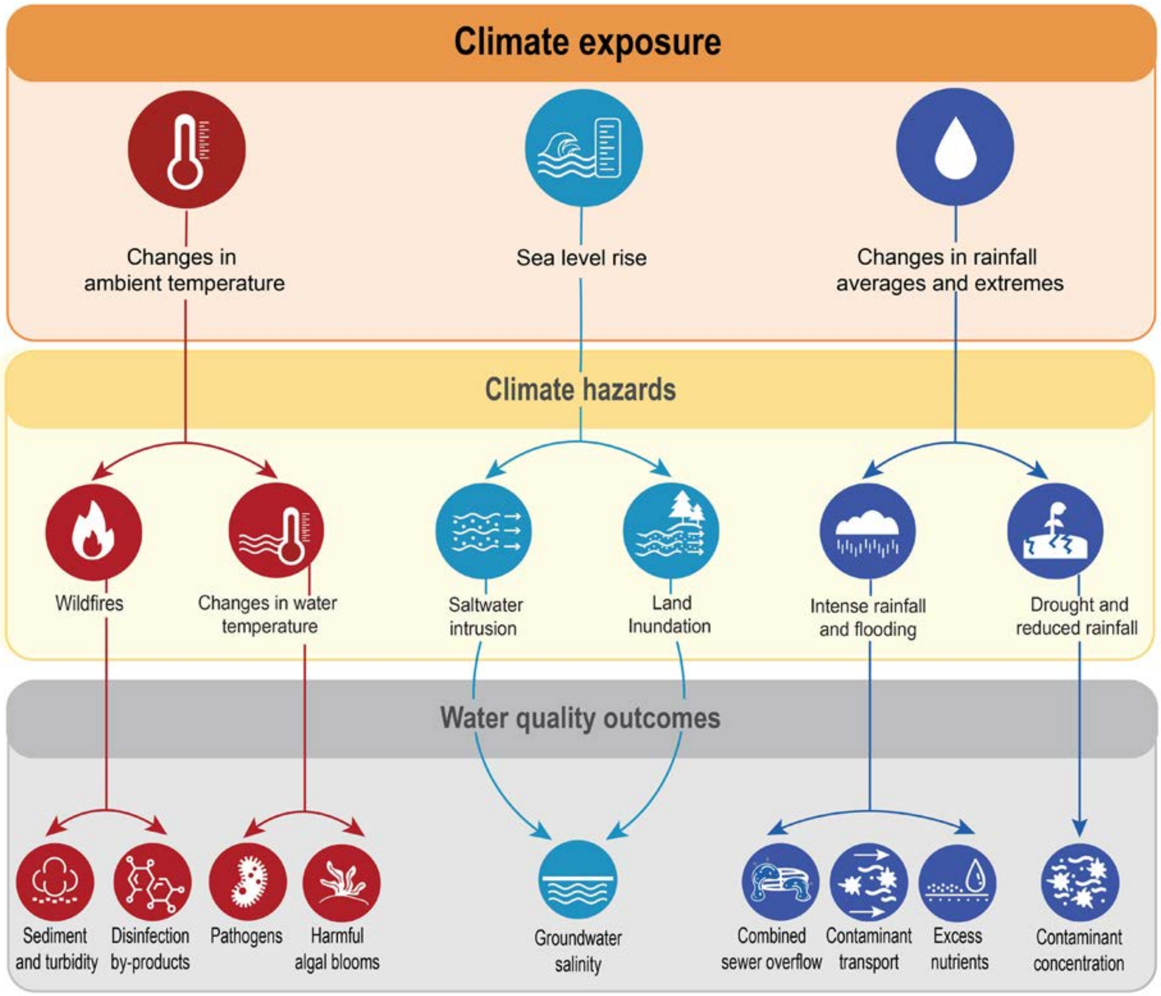
Modeling climate change scenarios and specific impacts to Frederick County streams and infrastructure is beyond the scope of a comprehensive plan element. Where available, information is sourced from the Fifth National Climate Assessment (which includes projections at the county level nationwide) and existing Frederick County plans or studies. The WRE considers the higher-level impacts that can be expected on water resources and suggests policies and recommendations to adapt to a changing climate.

19 https://www.noaa.gov/news/2023-was-worlds-warmest-year-on-record-by-far
20 https://earthobservatory.nasa.gov/images/152313/five-factors-to-explain-the-record-heat-in-2023
21 https://nca2023.globalchange.gov/chapter/21/
22 https://nca2023.globalchange.gov/chapter/21/
23 https://frederickcountymd.gov/8113/Climate-Emergency-Mobilization-Workgroup

The increasing frequency and extremes of high temperature days, drought, and precipitation influence stormwater management and receiving waters.

Figure 11: Climate Change Impacts to Water Quality

Source: Fifth National Climate Assessment, Chapter 4 Water, Figure 4.2



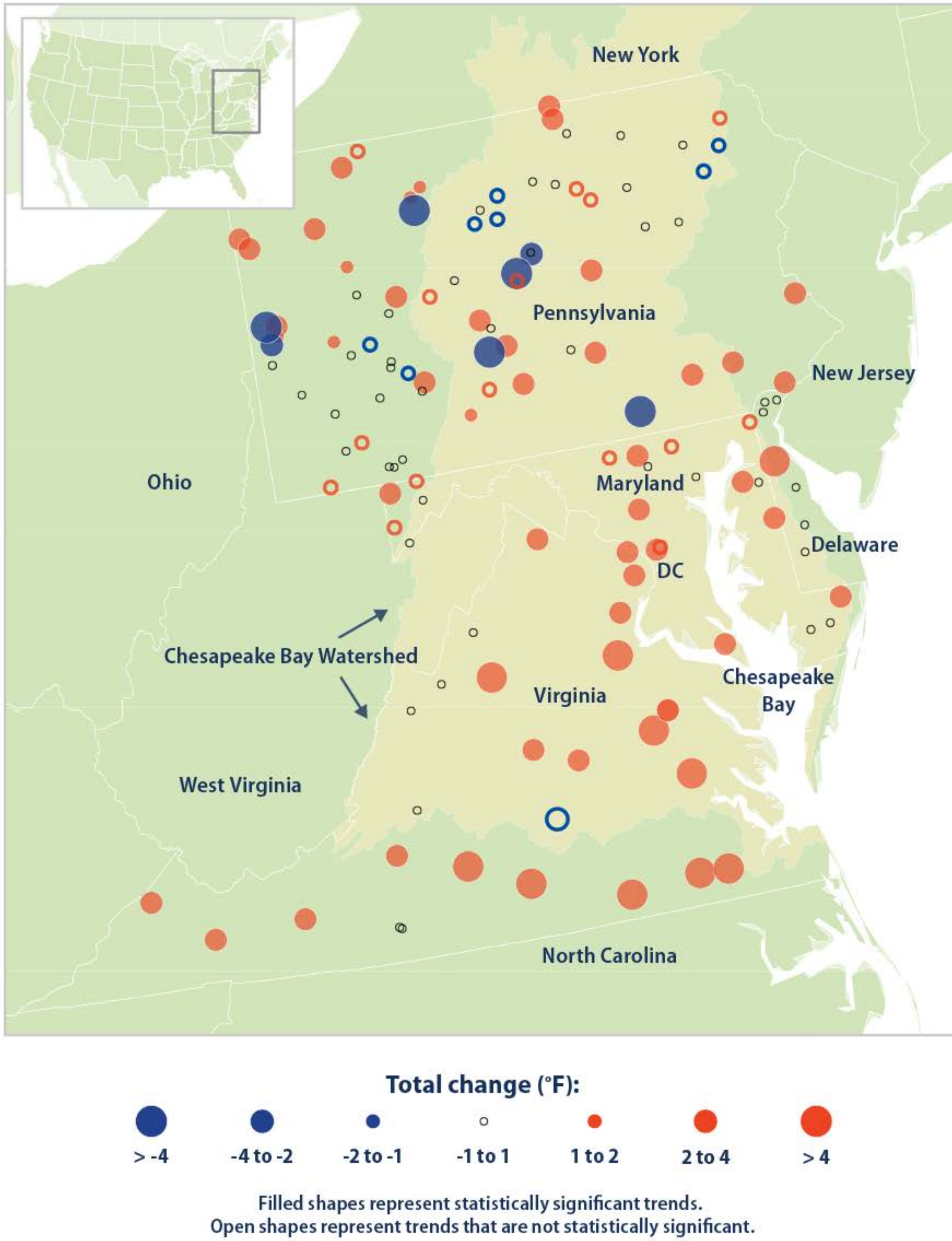
Heat

"***The frequency of extreme heat days [in Frederick County] roughly tripled in just under 30 years***." Frederick County Climate and Energy Action Plan for Internal Government Operations, Chapter 4 – Climate Risk and Vulnerability Assessment, Page 53

Increasing heat is often discussed in terms of human health or agricultural production. Air temperature also influences stream health. An EPA summary about rising stream temperatures in the Chesapeake Bay watershed since 1960 describes how "rising air temperatures cause stream temperatures to rise, [and] warmer stream water coming into the bay can stress plants and animals and worsen the effects of nutrient pollution."[24] These stresses include lower levels of dissolved oxygen and conditions favorable for algae blooms.[25] This is due to the fact that high temperatures provide optimal growth conditions for cyanobacteria (several of which are toxin-producing).[26] Frederick County's coldwater resources then are particularly threatened by climate change (see Chapter 1, Map 1: Water Quality Standards and Special Designations and

24 https://www.epa.gov/climate-indicators/climate-change-indicators-stream-temperature#ref2
25 Footnote above as well as https://nca2023.globalchange.gov/chapter/4/
26 Paerl, H. (2014). Mitigating Harmful Cyanobacterial Blooms in a Human- and Climatically-Impacted World. Life (Basel, Switzerland). 4. 988-1012. 10.3390/life4040988.

Figure 12: Changes in Stream Water Temperatures in the Chesapeake Bay Region, 1960-2014 *Source: EPA "Climate Change Indicators in the United States."*



Data source: Jastram, J.D., and K.C. Rice. 2015. Air- and stream-water-temperature trends in the Chesapeake Bay region, 1960–2014. U.S. Geological Survey Open-File Report 2015-1207. https://pubs.er.usgs.gov/publication/ofr20151207.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

Map 2: Maryland Trout Watersheds and Temperature Impaired Streams). The Maryland Chapter of Trout Unlimited estimates brook trout could disappear from all Maryland streams (except for in one county) over the next 100 years due to warming water trends.[27]

Drought

"Although the total annual precipitation is projected to increase, the risk of drought is expected to grow through the end of the century due to warming temperatures, earlier snowmelt, and precipitation variability." Frederick County Climate and Energy Action Plan for Internal Government Operations, Chapter 4 – Climate Risk and Vulnerability Assessment, Page 58

Drought is another hazard worsened by climate change and is often discussed in terms of inadequate water supplies for all users (individuals, business, agriculture, etc.). But low supply has a number of cascading effects including "increased water temperature and salinity, reduced nutrients, lower oxygen levels, concentrated contaminants, loss of surface and groundwater connections, and declining productivity."[28] In other words, if a stream is a receiving water for wastewater treatment or stormwater runoff, there is less ability of the water system to assimilate those pollutants. Declining water levels in rivers and streams also may expose the bottom to sunlight, leading to growth of benthic plants, including toxin-producing attached cyanobacteria discussed previously in Chapter 2, Drinking Water. This occurred in the Potomac River in 2017.[29] Higher pollution levels affect plant and animal life, recreation, and drinking water quality if it is used as a water supply, making water treatment more expensive.

Perhaps counterintuitively, once precipitation begins to return to areas affected by drought, particularly over a longer period of time, soil becomes less able to absorb water which can cause flash flooding.[30] This can be exacerbated in areas with stormwater drainage issues.[31] Severe drought conditions are an identified high-consequence risk for stormwater management in the 2023 Frederick County Climate and Energy Action Plan (page 65) because of the potential to dry out large ponds or small-scale stormwater practices.

Precipitation & Flooding

"Frederick County is projected to experience more precipitation falling in short-duration, high-intensity precipitation events. This means it will rain less frequently, but when it does rain, it will be a heavier rain event." Frederick County Climate and Energy Action Plan for Internal Government Operations, Chapter 4 – Climate Risk and Vulnerability Assessment, Page 55

"Increases in the frequency and intensity of strong rains means that the County's stormwater infrastructure capacity will be exceeded more frequently during storms... Further, stormwater drainage conveyance systems in the County are typically directly connected or flow to waterbodies, which means that pollutants in runoff can enter directly into waterbodies without treatment." Frederick County Climate and Energy Action Plan for Internal Government Operations, Chapter 4 – Climate Risk and Vulnerability Assessment, Page 65

The minimum stormwater design standards set in the 2000 Maryland Stormwater Design Manual (and updated in 2010) are based on precipitation data collected from 1938 – 1957 and published in 1961.[32] The Maryland General Assembly passed SB277 in 2021 which directed MDE to review flooding events in the state since 2000 and update stormwater regulations to respond to the increasing flooding risk. The Livable Frederick Master Plan (2019) also raised the potential need to reexamine stormwater standards at the state or local level.[33]

Over the last few years, MDE has convened various stakeholder groups under the umbrella of "Advancing Stormwater Resiliency in Maryland (A-STORM)." MDE has proposed three iterations of regulation revisions to the stakeholder groups during this time. The regulation revisions

27 https://www.bayjournal.com/news/fisheries/groups-work-to-stop-brook-trout-from-being-the-fish-that-got-away/article_d0ffc713-01b2-5046-8a09-4b51a80c4ed8.html
28 https://nca2023.globalchange.gov/chapter/4#key-message-2
29 https://api.mdsoar.org/server/api/core/bitstreams/5f448386-5153-418a-9cff-2262002ae17e/content
30 https://frederickcountymd.gov/DocumentCenter/View/337780/2022-Frederick-County-Hazard-Mitigation-and-Climate-Adaptation-Plan---for-Adoption?bidId= Page 120
31 https://frederickcountymd.gov/DocumentCenter/View/337780/2022-Frederick-County-Hazard-Mitigation-and-Climate-Adaptation-Plan---for-Adoption?bidId= Page 122
32 https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/AStoRM/SWM%20Regulation%20Proposal%20for%20Stakeholder%20Group%207_26_2023.pdf
33 LFMP Page 181

acknowledge the need to update the precipitation assumptions for stormwater management, noting that precipitation patterns have not only changed since 1961, but will continue to do so based on the extent of climate change.[34] The most recent proposal available while this WRE was under development was published March 1, 2024. Among other things, it proposes using precipitation data from the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14. Atlas 14 is a more recent and comprehensive source for precipitation frequency and duration data.

There should also be considerations for how much rainfall may fall in the future, so systems designed today are not inadequate. For example, MDE's June 2023 report describes calculations from the Mid-Atlantic Regional Integrated Sciences and Assessments (MARISA) tool. MARISA uses the Atlas 14 precipitation data and models different climate change scenarios. A higher-emissions scenario (leading to more warming in the atmosphere) is predicted to increase the total rainfall during both the 1-year and 2-year 24-hour design storm by 13%.

In the March 1, 2024 proposed regulations, Frederick County is proposed to be split into two rainfall zones, Catoctin and Frederick. MDE proposes to use the NOAA Atlas 14 as a baseline but adjust for anticipated impacts from climate change as informed by the MARISA tool.

Table 4.09 Frederick County Rainfall Depths

	1-year, 24-hour storm	**2-year, 24-hour storm**	**10-year, 24-hour storm**	**100-year, 24-hour**
Maryland Stormwater Design Manual (Current)	2.5	3.1	5.0	7.0
Frederick – Catoctin (Proposed)	2.54 (Atlas 14) 2.92 (Adjusted)	3.05 (Atlas 14) 3.59 (Adjusted)	4.51 (Atlas 14) 5.31 (Adjusted)	7.44 (Atlas 14) 8.75 (Adjusted)
Frederick – Frederick (Proposed)	2.54 (Atlas 14) 2.92 (Adjusted)	3.07 (Atlas 14) 3.59 (Adjusted)	4.63 (Atlas 14) 5.31 (Adjusted)	7.94 (Atlas 14) 8.75 (Adjusted)

Another potential impact from climate change on stormwater design practices discussed by the June 2023 report is the use of stormwater quality practices. The report finds that these water quality practices do not always adequately manage intense rainfall events. The report recommends a more balanced approach between stormwater quality and stormwater quantity practices to reduce erosion risk and provide flood control, and ensuring adequate capacity in a stormwater conveyance system. Some suggested changes to meet this need for a more balanced approach as of the March 2024 included increasing the amount of runoff that must be treated on-site to 2.0 inches (for Frederick County), representing a capture rate of 95% of the annual average rainfall; requiring channel protection to be managed in structural practices; and requiring analysis to ensure downstream conveyance of stormwater does not create new or additional negative impacts to properties due to inadequate systems.

It is important to note this MDE report does not represent final changes to stormwater design regulations. However, it has been summarized in the WRE to highlight current challenges and opportunities in the face of climate change as identified by Maryland stormwater professionals.

Climate Mitigation Benefits

Mitigation means taking efforts to reduce contributing factors to climate change, such as reducing emissions or sequestering carbon.[35] Best management practices primarily intended to reduce urban and agricultural runoff to protect water quality provide many climate mitigation co-benefits.[36]

34 https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/AStoRM/SWM%20Regulation%20Proposal%20for%20Stakeholder%20Group%207_26_2023.pdf
35 https://climate.nasa.gov/solutions/adaptation-mitigation/
36 https://nca2023.globalchange.gov/chapter/32/

- Agricultural practices such as cover crops and reduced tillage improve soil health. Healthy soils require less fertilizer and can be less susceptible to erosion, thereby reducing sediment and sediment-bound phosphorus loads to waterways. These practices can also sequester carbon in the soil.
- Crops are not able to take up all the nitrogen in fertilizer. Nitrogen that is not absorbed by a plant can leach – adding nitrogen pollution to our waters – or be released into the air as nitrous oxide, a greenhouse gas. Applying fertilizer at the right time during a crop's growth cycle reduces the amount of fertilizer needed which by extension reduces runoff and emissions.
- Trees provide many benefits from storing carbon and cleaning our air and water by filtering runoff.[37] Reforestation or afforestation in agricultural and developed settings alike provide these benefits, with tree and shrub buffer widths or median strips and parking lots expanded to capture sediments and nitrogen transported in surface runoff in major storms. Frederick County's Division of Energy and Environment (DEE) administers the Creek ReLeaf program that is designed to increase the total amount of forested area within Frederick County on public or private property through the planting of new, permanent conservation easements. As of 2024, more than 575 acres have been reforested through this program.

Development patterns can either hinder or promote climate goals. Creating built environments where people do not have to travel so far to go to work or meet their daily needs – or can make those trips in something other than a personal vehicle – is a form of climate mitigation.[38] Directing growth to developed areas to create more mixed use, multimodal neighborhoods is a key component of the Livable Frederick Master Plan (for more information, refer to "The Primary Growth Sector," Pages 39-45). The LFMP also identifies some suburban areas of the County as "retrofit" opportunities as part of the Secondary Growth Sector (Page 47). Retrofit districts are existing suburban communities where infill and redevelopment can create "more opportunities to walk, shop, work and recreate closer to home." These projects would be strategic and targeted and are not envisioned to be large-scale neighborhood redevelopments. Among many other benefits, these actions will prevent the conversion of unmanaged lands, like natural forests, grasslands, and wetlands – preserving their environmental and climate-controlling benefits.[39]

Climate Adaptation Actions

Where climate mitigation refers to actions to reduce human contributions toward climate change, climate *adaptation* means responding to changes in the environment that are already taking place or are expected to take place.[40] The Livable Frederick Master Plan's *A Vision for Our Environment* (page 177) calls for both climate mitigation and adaption actions:

"It is the year 2040. Our county has maintained the commitment to respond to our ongoing climate change crisis in a manner that reflects the magnitude of the threat to our community and our share of the responsibility for the problem. We have been resolute and innovative in our efforts to reduce our contribution to greenhouse gas emissions, to sequester carbon, and to be adaptive and resilient in the face of the changes and challenges associated with our changing climate."

Adaptation has tended to be incremental, such as lifting structures out of a flood plain or using more air conditioning when it's hot. But incremental actions are not expected to be enough, and cooperation is needed across sectors and silos to take larger-scale transformative actions.[41] Climate change is also an environmental justice issue and adaptation will need to consider equity in investments (and impacts).[42] Some example adaptations to address climate change impacts on suitable receiving waters are described below.

Heat

- Recognize the role and location of heat island effects. Heat islands affect urbanized areas because impervious surface like roads, rooftops, and parking lots absorb heat. Instead of only responding to heat by operating cooling centers or running more air conditioning, heat within urbanized areas can be reduced by things like tree planting, natural landscapes, and green roofs.[43, 44] These improvements provide stormwater management benefits through green infrastructure.

37 https://agnr.umd.edu/sites/agnr.umd.edu/files/files/documents/Hughes%20Center/Maryland%20Forest%20Technical%20Study_Use_Final_Web.pdf
38 https://www.huduser.gov/portal/periodicals/em/Summer22/highlight2.html
39 https://nca2023.globalchange.gov/chapter/32/
40 https://climate.nasa.gov/solutions/adaptation-mitigation/
41 https://nca2023.globalchange.gov/chapter/31/
42 https://nca2023.globalchange.gov/chapter/31/ KM 2
43 https://www.scientificamerican.com/article/how-we-can-adapt-to-live-with-extreme-heat/
44 https://www.epa.gov/heatislands/adapting-heat

Drought

- When designing stormwater management facilities, consider the secondary hazards drought can have on flooding risk due to a decreased ability for soil and vegetation to absorb rainwater.[45]
- Instead of viewing it as a negative and something that needs to be handled, stormwater can be a benefit. Stormwater capture could reduce the need for potable water for uses like agricultural or residential irrigation or even indoor uses like flushing toilets (greywater).[46, 47]

Precipitation

- Use technology such as sensors to help monitor stormwater facilities and conveyance systems in order to identify maintenance issues, provide "early warning" about system failures, and provide day-to-day real-time data.[48]
- Constructing stormwater management to accommodate anticipated rainfall for storms of the future.

SUITABLE RECEIVING WATERS & WATER HAZARDS POLICIES & RECOMMENDATIONS

To achieve water resources goals related to the Suitable Receiving Waters and Water Hazards Assessment, the following policies and action items have been identified. Completion of the action items and adherence to the policies will be monitored by the County through future review of and updates to the Water Resources Element and the Livable Frederick Master Plan.

Policies

- As part of the construction of new County roads, government buildings and facilities use innovative stormwater management practices and technologies.
- Integrate watershed planning and management in the comprehensive planning process.
- Encourage and promote the use of innovative technologies for stormwater management.
- Promote development patterns that minimize impervious cover related to new development.
- Protect water resources for future generations by implementing climate resiliency and climate adaptation strategies.

Recommendations

- Develop a strategy for protecting native brook trout populations that includes an impervious cover threshold, minimum distance between roads and habitats, and reduced road density for those watersheds where native brook trout are present.
- Continue to retrofit untreated impervious surface area in the County with stormwater management in accordance with the NPDES permit.
- Continue to explore and implement new techniques and technologies to reduce the impacts to streams during mass grading for development and stormwater management post-development.
- Continue to implement MS4 requirements including but not limited to annual reporting, watershed assessments, stream restorations, etc.
- Design restoration, retrofit, and other green infrastructure projects with a "margin of error" to account for the fact that the exact degree of climate change impacts cannot be predicted.
- Continue to implement and expand programs to increase riparian buffers along creeks, streams, and rivers as well as programs to ensure the continued survival of those buffers through the mitigation of impacts resulting from mechanical disturbance or overpopulated/invasive species (both plants and wildlife).
- Conduct a study (or expand current efforts) to identify and prioritize watersheds for investments of additional riparian buffers. These efforts could focus on high-quality waters and/or rare or important aquatic resources like brook trout.
- Develop a monitoring system of local ground water conditions, aquifer recharge, watersheds and streams.
- Consider policies to enhance the protection of riparian buffers as part of the Frederick County Green Infrastructure Plan to be drafted in 2025.

45 *https://www.cisa.gov/sites/default/files/publications/Drought_and_Infrastructure_A_Planning_Guide_508c.pdf*
46 *https://www.lcsun-news.com/story/news/2016/09/18/stormwater-necessity-drought-management/90633996/*
47 *https://www.epa.gov/green-infrastructure/build-resiliency-drought*
48 *https://ascelibrary.org/doi/10.1061/JSWBAY.SWENG-533*

Policies and Recommendations from Related Plans

The topics covered in this Water Resources Element are highly interconnected with existing planning efforts. The following are policies and action items from these plans with page numbers or recommendation references noted. The policies and recommendations below are hereby adopted as part of the Frederick County Water Resources Element.

Climate Response and Resilience Report, August 2021 (Volume 2, Technical Recommendations) - Frederick County and City Climate Change Working Group

Recommendation #31: Upgrade stormwater and wastewater conveyance and storage management (pages 193-197).

Relevant WRE Action Item:

- "Establish a public fund for homeowners whose homes were built prior to current stormwater regulations that can be used to upgrade existing flood prevention technologies (foundation sealants, backflow valves, etc.) as well as reimbursement for flood damages experienced through inadequate neighborhood provision of public conveyance or storage systems." (Page 181 and 197). Such a fund as recommended by the CRRP is likely to be a complex undertaking. However, the County could take initial steps such as creating a pilot program for incentives to help offset costs associated with such retrofits.

Recommendation #32: Build new and retrofit existing infrastructure to withstand anticipated threats (pages 198-202).

Relevant WRE Action Item:

- "Investigate the feasibility and implications of a stormwater utility or water quality protection fee to fund stormwater retrofits as well as inspection and enforcement operations."

Frederick County Hazard Mitigation and Climate Adaptation Plan

Recommendation FC-5: Implement the recommendations of the Maryland Department of the Environment in "Advancing Stormwater Resiliency in Maryland: Maryland's Stormwater Management Climate Change Action Plan", as required. (Pages 256-257)

Recommendation FC-7: Develop structural corrective action plans (paving/elevation programs) for Frederick County's pre-identified frequently flooded roadways. (Page 258)

Recommendation FC-12: Conduct a flood issues study (watershed plan for climate-related stormwater flooding per the Maryland Department of the Environment's Municipal Separate Storm Sewer System program). (Pages 261-262)

Recommendation FC-13: Expand on the pluvial flood analysis that was completed as a part of the 2022 HMCAP update with a goal of following the recommended enhancements outlined in Chapter 5 of the HMCAP. (Page 262)

Recommendation FC-16: Work with the Maryland Department of the Environment, dam owners, and state regulators to determine the hazard classification of any dams that have an undetermined ranking. Create an Emergency Action Plan for all dams with a hazard potential of "significant" or higher that do not already have one. (Page 264)

Recommendation FC-30: Implement physical mitigation projects that will result in the protection of public or private property from natural hazards. (Page 274)

Recommendation FC-34: Create a plan and implement projects to increase culvert (and other stormwater infrastructure) capacity throughout the County based on the State's updated regulations. Provide technical assistance to municipalities to replace undersized or deteriorated culverts to make them resilient to future climate impacts and flooding conditions. (Page 277)

Recommendation FC-37: Increase water storage in stormwater infrastructure during the retrofitting of ponds without creating any high hazard dams. Increase infiltration in stormwater retrofits as possible within site constraints. (County completed dredging project in Lake Linganore in 2021). Eliminate high hazard dams when possible through retrofitting. (Page 278-279)

Frederick County Climate and Energy Action Plan for Internal Government Operations, March 2023

Strategy 1: Ensure resilience efforts are equitable and support environmental justice. (Page 86)

Action 4A: Implement green infrastructure monitoring. Implement monitoring of green infrastructure for stormwater and heat resilience in Frederick County owned and managed facilities, buildings, and transportation assets. Track projects that have climate mitigation and other co-benefits in addition to stormwater runoff volume alleviation (such as reducing carbon footprint, providing shade, reducing heat from roof surfaces, reducing thermal impacts of stormwater, and contributing to improved air quality). Continue to refine a list of priority green infrastructure solutions for application in the County, in coordination with the Complete Streets Manual that Planning and Permitting is developing. Evaluate and coordinate with Chesapeake Bay Trust Fund program's pooled monitoring to incorporate climate related stormwater management studies when designing County facilities. (Pages 92-93)

Strategy 5: Build in resilience considerations into budgeting and capital improvement processes. (Pages 94-98)

Action 5B: Integrate climate resilience into existing division-level CIP processes. Review existing division-level CIP processes (e.g., DEE's program to help meet NPDES MS4 permit requirements; DPW's review of bridge replacements, drainage improvements, and pavement management) for opportunities to prioritize projects that not only address current needs, but also incorporate future-looking climate projections to estimate and address future risks. For example, this may include prioritizing stormwater pond retrofits in locations that are expected to experience increased flooding or that are designed to withstand a greater flood volume than current standards. (Page 96)

Action 5D: Review existing division operations budgets to identify opportunities for resilience. The Operating budget is determined by both recurring expenses and new expenses as approved by the County Executive. Therefore, adding resilience into Operating appeal criteria could be approved by reviewing existing line items in divisions' proposed Operating budgets for alignment with climate risk and resilience. DEE can help divisions use the findings of the Climate Risk and Vulnerability Assessment chapter above to understand if existing expenses (such as facilities and infrastructure maintenance; emergency training) could also be used to address climate risks. (Page 97)

Action 5E: Conduct regular monitoring and maintenance of facilities. Conduct regular monitoring and preventative maintenance of critical Countymanaged facilities and assets; conduct cost tracking to identify potential damage trends related to inundation, extreme heat, or other climate hazards. (Page 97)

Action 5F: Integrate resilience into retrofit programs and maintenance. Integrate resilience into retrofit programs and maintenance/repair schedules. Identify which County assets are more vulnerable to climate risks and budget for increased frequency of maintenance or earlier replacement as needed. (Page 98)

Strategy 14: Increase resilience of County infrastructure to extreme heat. (Page 113)

Appendix A: Water Service Area Profiles

NEW DESIGN SERVICE AREA

The New Design Water Treatment Plant (WTP) is the County's largest system and has a Potomac River allocation of 16 mgd (daily average) and 26 mgd (month of maximum use). This system serves multiple communities within Frederick County and provides water to the City of Frederick as defined in the Potomac River Water Service Agreement (PRWSA). The following communities, served by the New Design WTP, are described in the following section of this Appendix:

Adamstown	Frederick Southeast	Town of New Market
Ballenger Creek	City of Frederick	Linganore
Buckeystown	Holly Hills	Spring Ridge/Bartonsville
Eastalco	Urbana	Point of Rocks
Frederick City (PRWSA)	Monrovia	

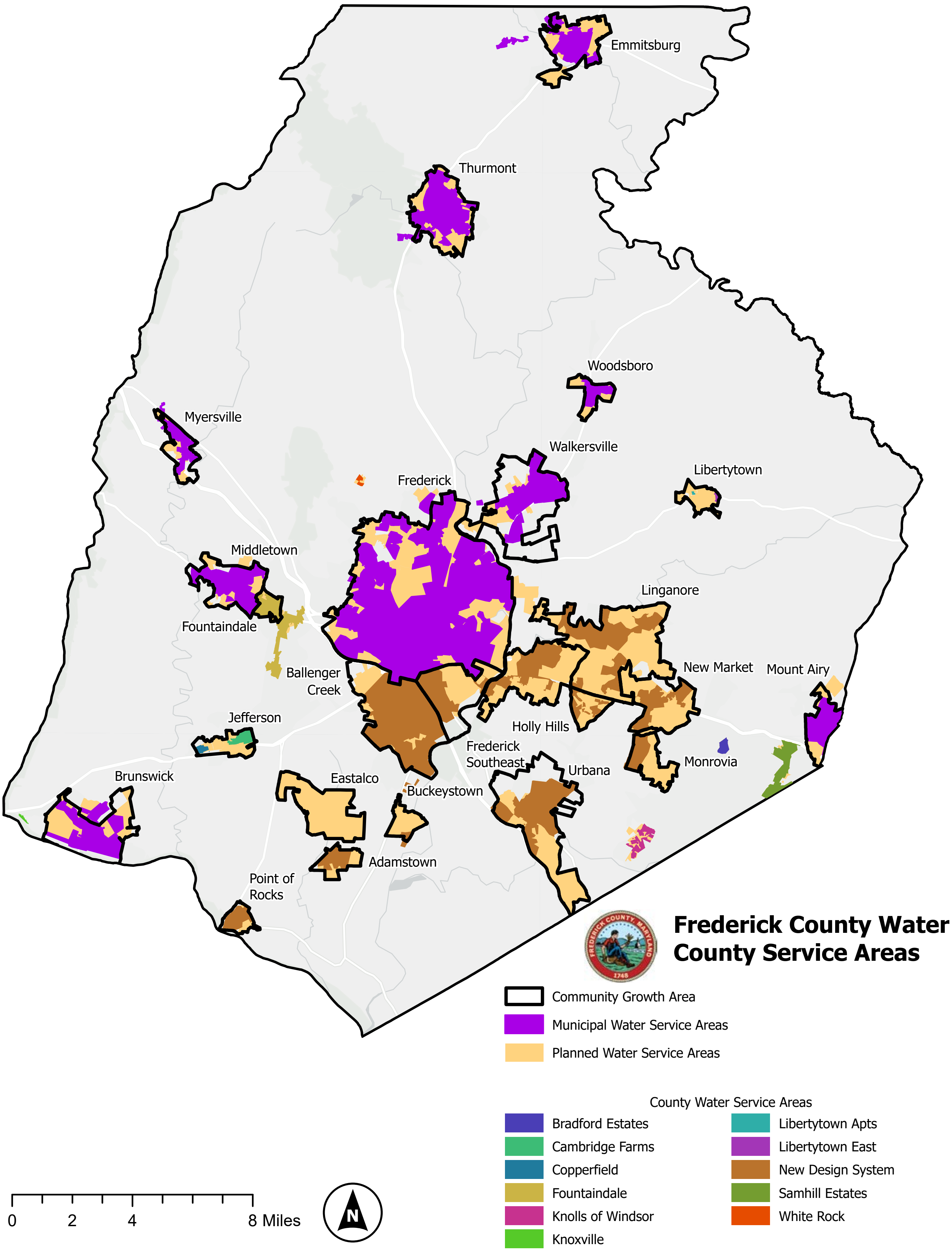
DWSU's Facility Plan for the New Design Road WTP is based on providing an ultimate 45 mgd maximum day capacity. The Water Appropriation and Use Permit (WAUP) for the Potomac River supply currently allows the withdrawal of up to 26 mgd, providing the New Design Road WTP with a permitted treatment capacity of 25 mgd to meet maximum day demands. A series of New Design Water Transmission Main projects and Linganore waterline loop projects have facilitated the interconnection of Lake Linganore, New Market, and Monrovia to the New Design System (and Potomac River) water supply.

Adamstown

The Adamstown community, population 2,329 (Frederick County estimate, 2024), was connected to a public water system due to local groundwater contamination. The community includes the village of Adamstown and the newer developments of Adamstown Commons and Greenhill Manor. At present, there are approximately 717 existing dwellings and 39 dwelling units in the development pipeline in Adamstown.

Ballenger Creek

The Ballenger Creek community includes significant areas of residential development, such as Wellington Trace, and Robin Meadows, as well as office/industrial developments along the MD 85 corridor. As of December 2023, there are an estimated 7,698 existing dwelling units and 18,145 people residing in the Ballenger Creek area (Frederick County estimate, 2024). There are approximately 337 dwelling units in the residential development pipeline associated with projects like the Jefferson Tech Park MXD, Ballenger Run PUD, and the Westview South MXD.


Frederick County Water
County Service Areas
Emmitsburg
Thurmont
Woodsboro
Myersville
Walkersville
Libertytown
Frederick
Middletown
Linganore
Fountaindale
Ballenger
Creek
New Market
Mount Airy
Holly Hills
Jefferson
Frederick
Southeast
Monrovia
Urbana
Brunswick
Eastalco
Buckeystown
Adamstown
Point of
Rocks
Community Growth Area
Municipal Water Service Areas
Planned Water Service Areas
County Water Service Areas
Bradford Estates
Cambridge Farms
Copperfield
Fountaindale
Knolls of Windsor
Knoxville
Libertytown Apts
Libertytown East
New Design System
Samhill Estates
White Rock
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2
4
8 Miles
N

Buckeystown

Currently, Buckeystown relies on individual wells for its 522 dwellings, 1,072 residents (Frederick County estimate, 2024) and businesses, except for the Buckingham's Choice nursing home/retirement community. The long-term plan is to have the entire community connected to the New Design system. Until such time as this connection occurs, additional development potential in the community of Buckeystown is limited.

Eastalco

The Eastalco Growth Area encompasses the site of the former Alcoa "Eastalco" Works, where aluminum was manufactured from 1969 to 2005. Originally granted M-2 Industrial zoning in December 1967, much of the property was rezoned to General Industrial during the 1977 Countywide Comprehensive Rezoning. The area of the property zoned GI and LI was expanded, resulting in the current land-use and zoning designations, as part of the 2012 Comprehensive Plan update. Additional areas to the west of Ballenger Creek Pike, including the Windridge, Mullinix Agro, Stanford Industrial Park, and Noffsinger properties were also incorporated into this growth area and underwent partial rezoning as part of the 2012 Comprehensive Plan update. It is important to note that, while the growth area is referred to as "Eastalco," the extent of the planning area is more significant than the single, former aluminum plant site.

A subdivision of the former Alcoa "Eastalco" property was approved in two phases, in 2021 and 2023, to facilitate the establishment of a Critical Data Infrastructure (Data Center) campus. The project will be served by a network of public and private water mains and has the potential to incorporate two separate water distribution systems, one for domestic and fire service (potable) and the other for cooling water only. Future phases include water supply capacity for use as cooling water from either the New Design Road Water Treatment Facility or through utilization of non-potable wastewater from the Ballenger-McKinney Wastewater Treatment Plant. For the purposes of capacity planning, development in the Quantum Loophole (Quantum Frederick) property Eastalco Growth Area has been capped at 1.3 MGPD of potable water during periods of maximum demand. Any additional capacity above-and-beyond that allocation would be supplied through the secondary cooling/non-potable water supplies. It should be noted that the County has budgeted for a water and sewer study to address the potential needs of the industries that exist or that are slated to be developed in the Eastalco Growth Area as part of the FY2024 – FY2029 Capital Improvement Program update.

Linganore, Holly Hills, & Spring Ridge/Bartonsville

Each of these community growth areas are currently served by the New Design system. These areas received drinking water from Lake Linganore until April 2007, at which time they were connected to the New Design WTP. Major developments within these growth areas include the Linganore Planned Unit Development (PUD), Spring Ridge PUD, and Greenview PUD.

There are 25,228 people residing in the Linganore community (Frederick County estimate, 2024). The Linganore, Holly Hills, & Spring Ridge/ Bartonsville CGAs have the greatest residential development potential, with 4,234 total potential dwelling units in the residential development pipeline.

Monrovia

The Monrovia CGA encompasses the Landsdale Planned Unit Development (PUD), which has seen significant build-out since the adoption of the 2010 Water Resources Element. Currently, 27 of the 1,100 dwelling units allocated to the Lansdale PUD remain for permitting and/or construction. Frederick County estimates set the total number of dwellings at 1,219 and the population of the Monrovia Growth Area at 3,855 residents (Frederick County estimate, 2024).

Town of New Market

The Town of New Market, population 1,614 (MDP estimate, 2023), currently relies on a combination of privately-owned legacy wells and water lines connected to the County's New Design System to serve the Town's historic core. The Town's newer developments are served by public water from the New Design System. There are currently 1,005 dwelling units in the residential development pipeline within the Town of New Market. The majority if these are associated with the Calumet development.

Point of Rocks

The community of Point of Rocks is situated along the Potomac River and currently has 649 dwellings and 1,886 residents (Frederick County estimate, 2024). The Canal Run PUD, which was the largest development in the community, has completed build-out and there are no residential development pipeline projects identified in the community at this time.

Urbana

The Urbana service area spans developments such as Villages of Urbana and Urbana Highlands PUD's. There are approximately 4,595 dwellings and 15,503 people (Frederick County estimate, 2024), residing in the Urbana CGA. There are an additional 238 dwelling units in the residential development pipeline.

FOUNTAINDALE SERVICE AREA

The 2010 County Comprehensive Plan designated Fountaindale as its own community growth area separate from the adjoining Town of Middletown. It is located on the western slope of the Catoctin Mountain just east of Middletown. It is comprised of several residential subdivisions that were developed in the 1970s. There is also a cluster of commercial uses at the intersection of Hollow Road and US 40-A.

The Fountaindale Water System is owned by Frederick County (DWSU) and provides water service to the Fountaindale and Braddock Heights communities. The current system was established in 2002 following the merging of areas previously served by the private Braddock Water Company with those served by Frederick County through the Fountaindale system. The total population of the area is approximated at 3,136 (Frederick County Estimate, 2024), with a portion of that population residing within the Fountaindale Community Growth Area and the adjacent Braddock Heights community that lies outside of the Fountaindale Service Area. The estimated population served by the system is 2,630 residents, with the remaining residents utilizing groundwater wells.

The water system service area has a few large undeveloped properties, which may be developed in the future, but only to the extent that the existing groundwater appropriations and supply could support same. The Fountaindale Water Treatment Plant was upgraded in 2019, and an additional well was incorporated into the system at that time, bringing the total number of contributing wells/well sites to eight (8).

JEFFERSON SERVICE AREA

Jefferson, which is unincorporated, is designated as a Community Growth Area (CGA). Existing development includes the subdivisions of Briercrest Heights, Copperfield, Woodbourne Manor, and Cambridge Farms, as well as several commercial uses along MD 180 and Lander Road. There are approximately 52 dwellings in the development pipeline. The population of the Jefferson Service Area is estimated at 2,958 (Frederick County estimate, 2024).

The Jefferson CGA is currently served by two community water systems for the Copperfield and Woodbourne Manor communities and the Cambridge Farms subdivision, as well as a private system for the Briercrest Apartment complex. These are groundwater-based systems in the Catoctin Metabasalt, Granodiorite, and Biotite/Granite/Gneiss aquifers, which are not suited for consistent community supplies. The remaining portions of the community are served by individual wells. A replacement for Valley Elementary School is scheduled for construction starting in 2024, and, while the former school was supplied by a groundwater well, the new school building will be connected to public water. The existing school building is served by public sewer, and the future building will also be served by public sewer.

As noted in the 2010 Water Resources Element, the County's plan for the future is to combine the ground water systems in Jefferson into a single community water system that will incorporate existing wells, developments, County facilities, and private systems (such as the Briercrest Apartments) when possible. As all sources of water in the Jefferson Service Area are groundwater-based, and there are multiple Wellhead Protection Areas (WHPAs) encompassing several hundred acres.

LIBERTYTOWN SERVICE AREA

Libertytown is an unincorporated community and designated growth area with a population of 988 (Frederick County estimate, 2024). Most residents are served by individual wells. However, Liberty East and Libertytown Apartments are serviced by two separate community systems operated by the Frederick County Division of Water and Sewer Utilities. Liberty Elementary School currently maintains a separate community water system (supplied by two wells) for its own use. Wells have been drilled in the Liberty Village PUD on the south side of MD-26, but water quality issues associated with the yield have precluded utilization of those wells.

Residents of Libertytown receive drinking water from ground water sources in the Wakefield Marble, Ijamsville Formation, and Metarhyolite aquifers. Generally, the underlying aquifers are low yielding, except for the Wakefield Marble, which has the potential for a high production well that could benefit the entire community.

The current Libertytown Apartments water system will be combined with certain planned improvements associated with the future Mayne, Mill Creek, and Daysville Glen developments. Additional wells, updated treatment infrastructure, and an elevated water storage tank added to the system intended to provide capacity for the Libertytown Apartments and the Mayne, Mill Creek, and Daysville Glen developments. Plans associated with the storage tank were approved by Frederick County in 2021 and the Mayne and Mill Creek property wells have been permitted. Construction of the Mayne, Mill Creek, and Daysville Glen developments has yet to begin. There are 443 dwellings in the residential pipeline associated with these projects and the Libertytown Gardens development.

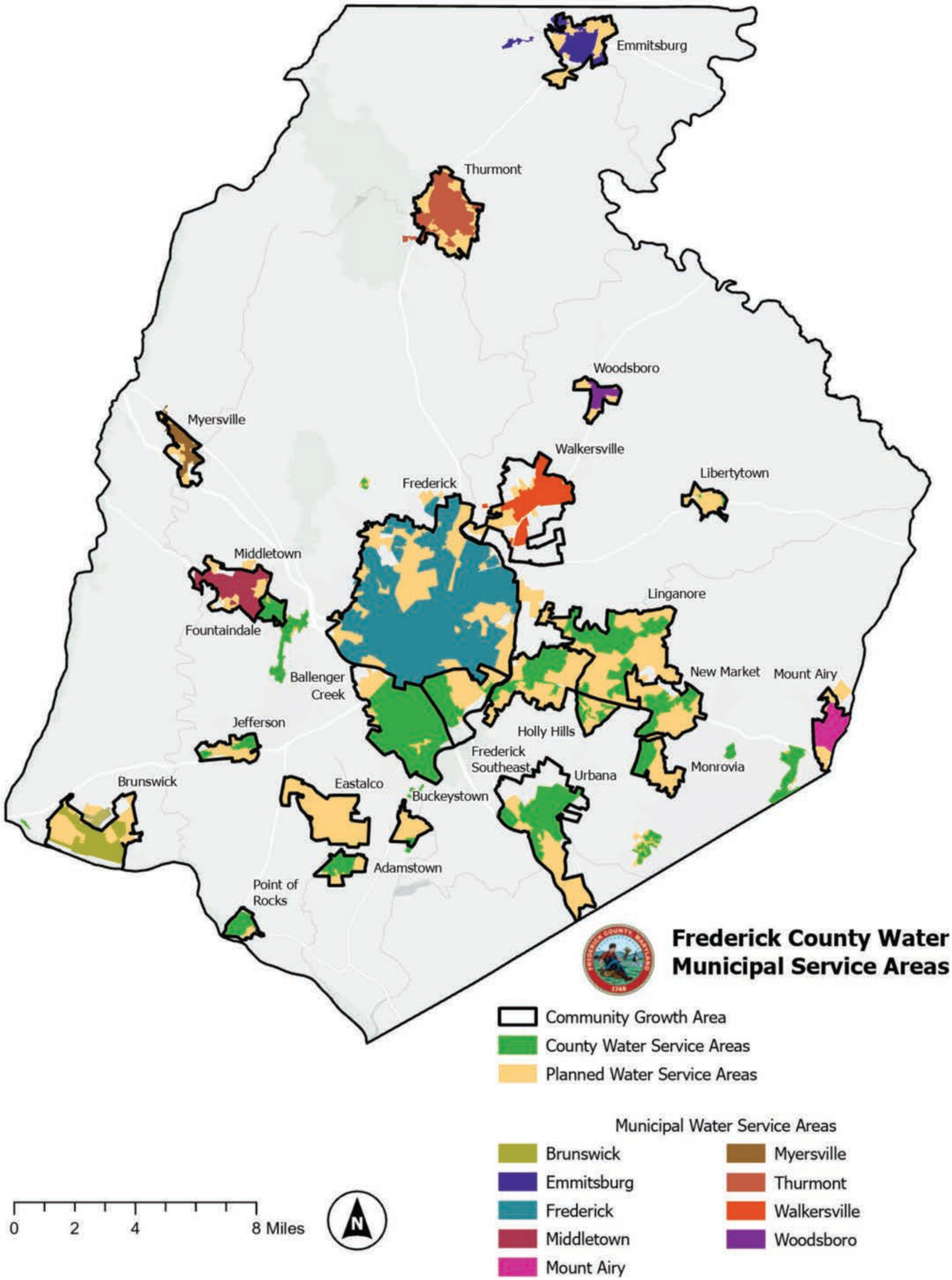
CITY OF BRUNSWICK SERVICE AREA

The City of Brunswick obtains its drinking water supply from the Potomac River and Yourtee Springs in Washington County, MD. Water service is also provided to several areas outside of the City including portions of Knoxville, New Addition, Washington County (Brownsville area) and the Village of Rosemont. The drinking water supply system draws from both the Potomac River and Yourtee Springs and serves a population of approximately 8,211 residents (MDP Estimate, 2023) with a current demand of 0.596 mgd.

The City has a Potomac River permit for a daily average withdrawal of 1.600 mgd with a maximum daily withdrawal of 2.00 mgd. Yourtee Springs is permitted for 0.350 mgd (daily average) and 0.500 mgd (max day demand). In 2018, the Yourtee Springs were determined to be under the direct influence of surface water, and upgrades to the spring were completed in December of 2021 to mitigate the potential for future surface water intrusion.

The full buildout of Brunswick Crossing, which will add a total of 1,505 residential dwelling units as well as commercial and office uses to the community, will increase the drinking water demand by 0.450 mgd for a total average daily demand of 0.990 mgd and 1.620 mgd maximum daily demand, according to the County's Water and Sewer Plan (2021). To handle the additional demands of Brunswick Crossing, a 1-million-gallon water tank was built. Currently, there are 449 dwellings remaining in the residential development pipeline associated with Brunswick Crossing. Approximately 1,056 dwellings have been developed or permitted.

In 2012 the WTP was upgraded to treat an approximate capacity of 2.0 mgd. In addition to the expanded capacity, a 300,000-gallon pre-sedimentation tank was added to allow the plant to operate more efficiently. In 2013, the Rosemont Water Supply Agreement was executed between the City of Brunswick and the Frederick County Board of Commissioners. The agreement states that the City will set aside and provide to the County capacity to serve a maximum of 150 equivalent dwelling units (EDUs), based on 250 GPD (average daily demand) with a maximum daily demand capacity of 400 GPD per EDU, exclusive of fire protection.


Emmitsburg
Thurmont
Woodsboro
Myersville
Walkersville
Libertytown
Frederick
Middletown
Linganore
Fountaindale
Ballenger
Creek
New Market
Mount Airy
Jefferson
Holly Hills
Frederick
Southeast
Urbana
Monrovia
Brunswick
Eastalco
Buckeystown
Adamstown
Point of
Rocks
Frederick County Water
Municipal Service Areas
Community Growth Area
County Water Service Areas
Planned Water Service Areas
Municipal Water Service Areas
Brunswick
Emmitsburg
Frederick
Middletown
Mount Airy
Myersville
Thurmont
Walkersville
Woodsboro
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Village of Rosemont

Rosemont has a population of 272 (Frederick County estimate, 2024), and it receives drinking water service from the City of Brunswick's system. Rosemont is not considered a growth area. In 2013, Frederick County partnered with the City of Brunswick to replace aged and corroded water lines to improve the quality of drinking water and expansion fire suppression capacity within the community through a boost in pressure and the expansion of hydrant capacity. The upgrade also facilitated the connection of several properties that had been served by private wells to the public system.

TOWN OF EMMITSBURG SERVICE AREA

The Town, population 2,921 (MDP Estimate, 2023), has two surface water sources. Rainbow Lake is a 33-million-gallon reservoir located on Turkey Creek. The Town also owns a 3-million-gallon reservoir that is currently not in use. There are also five groundwater wells (#1-5) with allocations in the Catoctin Metabasalt aquifer.

Two additional wells, Well 7 and Well J, are in the Gettysburg Shale aquifer and are not currently in use, though both have appropriation permits issued by MDE. The current capacity of their water treatment facility is 0.432 mgd. With an existing demand of only 0.243 mgd in 2023, a permitted withdrawal of 0.612 mgd, and a treatment capacity of 0.432 mgd, there is additional capacity for new service connections.

Drinking water service is provided to residents outside of Town along Mt. View Road, Waynesboro Road, and Old Gettysburg Road. In addition to residential users, the system serves a major institutional user in the form of the National Emergency Training Center. The Town believes that their greatest drinking water concerns are protecting sources, preserving clarity, and providing reliable quantities of water to support existing demand.

Regarding future demand, there are currently 15 dwelling units in the development pipeline in Emmitsburg associated with the Brookfield and Southgate communities. Currently, the Town owns more than 1,000 acres in the Turkey Run watershed for source water/watershed protection.

The current water treatment plant was brought online in January 2003, and a water clarifier was added in 2022. A second water treatment plant and a water storage tank, both located within the Town boundary, are currently in the preliminary planning phase. These facilities would allow the town to process water from Well 7 and Well J, and to maximize performance of the town's water system.

Mount Saint Mary's University operates a private water system, which is interconnected with the Town's system for emergency purposes. The Town has a contract extending until 2040 with the Mount to purchase 0.1 mgd of drinking water on demand, though this contract was suspended in 2023 due to issues related to detected levels of PFAS (specifically PFSD). The Mount's system uses three wells, the Roddy Quarry, and Grotto Spring located in the Grove, Harper's, and Frederick Limestone.

CITY OF FREDERICK SERVICE AREA

The City of Frederick, population 82,175 (MDP Estimate, 2023), utilizes four sources for treated water supply: The Monocacy River, Linganore Creek, Fishing Creek Reservoir, and the Potomac River. Although the safe yield of the Monocacy source has been reduced to zero (MDE Consent Order, 2002), the City has gained the use of up to 8 mgd (maximum day) from the County's Potomac River New Design Water Treatment Plant. The combined safe yield of the surface water sources listed above is 14.890 mgd.

The Potomac River Water Service Agreement (PRWSA) between the City and County allows Frederick City to purchase 8 mgd of water immediately and ultimately 12 mgd, which is provided through the New Design system. As part of the Agreement, established in 2006, the City agreed to contribute to the construction costs of the County's New Design WTP upgrade and associated transmission lines.

Presently, the City manages three permanent water treatment plants: the Monocacy WTP, Linganore Creek WTP, and Lester Dingle WTP. The Monocacy WTP has a design capacity of 3.0 mgd and is located on the Monocacy River south of MD 26. The Linganore Creek WTP has a design capacity of 7.2 mgd, a safe-yield of 6.0 mgd, and is located downstream of Lake Linganore, on Linganore Creek. A 50-million-gallon reservoir located on Fishing Creek supplies the Lester Dingle WTP, which has a current treatment capacity of 3.2 mgd.

In the past, the City also operated groundwater wells in two production well fields, but these fields were officially abandoned as of 2022 per MDE requirements.

The City's greatest drinking water concerns are lack of available supply; providing reliable quantities of water to support future growth; and expansion of public water supply services. Other concerns include contamination of groundwater from spills or pollutant releases; declining stream flows; and protection of water sources for public water supplies. In the early 2000's, the City faced serious limitations to its drinking water service when the Monocacy River dropped below its flow by requirement. The seasonal variation in flow on the Monocacy River has limited its use, particularly in the summer.

FORT DETRICK

The Fort Detrick military installation, located within the City of Frederick, maintains its own system serving approximately 278 housing units, 152 barrack units, and 7,900 employees. Fort Detrick has an appropriation from the Monocacy River and has a water treatment plant (WTP) immediately downstream from the City's WTP. The Monocacy River is their sole source of drinking water; the Fort is permitted to withdraw 2.0 mgd (average daily demand) and 2.6 mgd during the month of maximum use.

The Fort is connected to the City of Frederick's system and an agreement is in place to exchange water through the City's system in an emergency or drought situation. The Fort's WTP has a maximum processing capacity of 4.25 mgd. In addition to their surface water supply, the Fort has a ground water appropriation from the Harpers Formation aquifer. The permit allows for a daily average of 8,000 gpd and a maximum withdraw of 12,000 gpd.

TOWN OF MIDDLETOWN SERVICE AREA

The Middletown Water System presently serves a population of approximately 5,239 people (MDP Estimate, 2023) with a current demand of about 0.387 mgd (maximum use of 0.504 mgd). The system has 23 municipal wells, one of which is only being used as a peaking well (well #17). In 1997, the Town completed construction of a 400,000-gallon water storage tank and distribution line improvements, as well as the relocation of the water treatment plant to the reservoir. In 1999, the Town completed a Surface Water Treatment Rule Testing program with the cooperation of MDE and received ground water certification of all the spring sets currently in use by the Town. This testing may be required in the future to maintain ground water certification of the Town's springs.

Seasonal variation in groundwater table level is a primary limitation to its use as a reliable water supply. In 2006 when MDE performed an evaluation of the Catoctin Creek watershed, it was concluded that groundwater may be an adequate source for the Town during average precipitation years, but under drought conditions groundwater supplies are not adequate to meet existing demand and support the biological and natural resources of the watershed. It is for this reason that the Town now requires that all new annexations must bring the water they need for their development along with a 10% reserve capacity. Groundwater supply limitations are typically accentuated annually from mid-June through mid-September, which is historically the driest time of the year, and groundwater supply declines significantly.

With the adoption of a 2023 update to its Comprehensive Plan, the Town included a goal under its Water Resources Element that states that existing capacity will be reserved for existing lots of record within the Town. Any future development proposal must first identify how adequate capacity, equal to 250 gallons-per-day-per-dwelling, will be provided.

TOWN OF MOUNT AIRY SERVICE AREA

The Town of Mount Airy, located in both Frederick and Carroll counties, provides drinking water to town residents from ten wells located in three separate watersheds. The current Town population is estimated at 9,819 (MDP Estimate, 2023), and the Frederick County portion is estimated at 3,528 (Carroll County estimate, 2023). The major aquifers are the Ijamsville Formation and Marburg Schist.

According to the Town, the treatment capacity of their drinking water supply is 1.000 mgd (yearly average) and 1.387 mgd maximum safe yield. The existing permitted daily average use is 0.927 mgd (yearly average).

The Town projects that total anticipated use of water for existing, pipeline, potential, and infill projects will be 1.092 mgd (yearly average). To meet short-term demand, the Town is moving forward on additional well field development. The Town has been working with Carroll County and MDE toward the approval of four wells (#1, #3, #12, and #18) on the Harrison/Leishear properties in Carroll County, which may yield up to 0.152 mgd based on preliminary testing. These wells are located in the Middle Run stream subshed, and area adjacent to the Town's Water Station #2. Annexation of the property containing the wells is currently in process.

The primary vulnerability of Mt. Airy's drinking water supply is the reliance on ground water sources that may be susceptible to surface water influence. In February, 2023, the Town took two wells offline after notification that the yield from those wells tested positive for trace amounts of PFAS/PFOS. The Town is also limited by the lack of reliable surface water sources in the vicinity and the limited amount of open space in their growth area to account for ground water recharge. Low yielding aquifers and the expense of a reservoir to meet ultimate demand for drinking water are other limitations. Mount Airy has had a wellhead protection ordinance in effect since 1997 that extends beyond the incorporated limits of the Town.

TOWN OF MYERSVILLE SERVICE AREA

The Town has a ground water supply system consisting of multiple wells and one spring in the Catoctin Metabasalt Formation and a surface water intake on Little Catoctin Creek. The total water supply is permitted for 0.256 mgd (average daily) and 0.481 mgd (maximum daily). The water treatment plant's design capacity is 0.300 mgd and current water demand in Town is 0.115 mgd. As of 2022, there were approximately 1,854 residents in Town (MDP Estimate, 2023).

The Town's primary concerns are declining stream flows, protection of their drinking water sources, and provision of reliable quantities of water to support future growth. Also of interest is the feasibility of surface water impoundments in appropriate areas for water storage and replacement of aging water line infrastructure to reduce water loss from the system. There are currently approximately 25 dwellings in the residential development pipeline in the Town of Myersville.

TOWN OF THURMONT SERVICE AREA

The Town of Thurmont provides drinking water service to 6,588 people (MDP Estimate, 2023). The source of drinking water is six wells in the Frederick Limestone and Gettysburg Shale aquifers with only five of the wells being in active service. The wells in service can produce an average of 1.209 mgd, and the existing, average demand for water service is 0.426 mgd.

The projected 2030 population of 7,700 people or 2,600 households will demand 0.392 mgd residential (72%), 0.115 mgd commercial (21%), and 0.037 mgd industrial (7%) for a total estimated 2030 demand of 0.544 mgd. According to the Town, the existing treatment capacity of their plant is 1.200 mgd and the ultimate demand on the system will be 1.3 mgd at build-out of their land use plan. There are currently 151 dwellings in the residential development pipeline in the Town of Thurmont.

Thurmont has experienced groundwater contamination of Well 5 (not in service) and in Wells 7 and 8 from underground gasoline storage tanks. Wells 7 and 8 use air strippers to purify water to meet drinking water standards.

The Town's primary drinking water limitation is providing supply to meet demand. Additionally, the Town is impacted by elevation differences between their well sites and storage tanks, and five of the Town's wells are in an area without adequate storage.

TOWN OF WALKERSVILLE SERVICE AREA

The Walkersville Service Area provides water service to a diverse mix of residential, commercial, and institutional users. The service area includes the Town of Walkersville, three County subdivisions adjacent to the Town (Glade Manor I, Discovery, and Spring Garden Estates), and the County-owned Fountain Rock Park. The Town's 2022 population is 6,521 (MDP Estimate, 2023).

The Town treats water from three (3) wells located in the Grove Limestone Formation; together the wells are permitted for 1 mgd (yearly average) and 1.500 mgd (month of maximum use). Average water use in the service area is 0.635 mgd; current demand rarely exceeds 1.000 mgd. The average water usage in the highest month was 715,000 gpd. The Town also owns a reservoir on Grape Creek, located approximately 2½ miles east of Town. The lines connecting the reservoir to the Town have been abandoned. This reservoir originally served as the Town's water source but was abandoned in 1966 when high-yield production wells were located within the Town limits.

The Town's water supply is particularly vulnerable to contamination due to the limestone formation and the resulting karst geology where surface contaminants can enter the groundwater very quickly. There have been two incidents that have required the construction of a temporary, emergency connection to the County's distribution line. One incident was due to the damage of a sewer line within the Town in 1999 and the second was due to a manure spill at a farm outside of the Town limits in 2008. In both instances, the emergency connection was removed when the contamination passed out of the supply aquifer. In response to these incidents, Walkersville opened a new water treatment facility in 2020. The new facility is one of the first drinking water Integrated Membrane Systems (IMS) in the State of Maryland. It consists of pretreatment for protection of membranes, Microfiltration (MF) for turbidity and pathogens removal, Reverse Osmosis (RO) for reduction of Nitrate and hardness, chlorine primary disinfection, UV secondary disinfection, fluoridation, and post pH adjustment.

Fountain Rock Spring, a perennial spring located in the County's Fountain Rock Park, is another potential future water supply for the Town. The spring has a reported yield of between 1.500 and 3.000 mgd. An analysis of water from the spring indicated that it is likely from the same limestone formation as the Town's wells.

As a result of a wellhead tracer study, the Town of Walkersville has delineated a Wellhead Protection Area which extends to the north beyond the Town boundaries, to the Town of Woodsboro. The Town of Walkersville has adopted a wellhead protection ordinance. Sinkholes are a common occurrence in the Wellhead Protection Area. Much of the Town's water supply has a greater susceptibility to contamination because the Karst terrain (limestone geology) present in this area creates conditions where the groundwater is under the direct influence of surface water (GWUDI). Potential contaminants can travel quickly to the Town wells. Travel times encountered during dye tracing ranged from a few hours to a few days.

TOWN OF WOODSBORO SERVICE AREA

The Town of Woodsboro provides water to 1,156 residents (MDP Estimate, 2023), and an additional nine residential properties outside of the Town boundary on MD 550 and Gravel Hill Road. Most water service customers are residential households, though an elementary school and various commercial establishments are included in the service area. The Town's system includes five active wells and one standby well in the Grove Limestone Formation and one inactive well in the Frederick Limestone Formation. The Town's average water consumption is 0.85 mgd. They are permitted to withdrawal 0.128mgd (average daily) and 0.178 mgd maximum daily for the month of maximum use. There are currently nine dwellings in the residential development pipeline in the Town of Woodsboro.

In 1997, the Maryland Department of the Environment's Public Drinking Water Program developed a Wellhead Protection Plan for the Town. The 1997 Plan found that Woodsboro's wells were highly susceptible to contamination due to the limestone bedrock and made recommendations on strategies for wellhead protection. MDE also completed a Source Water Assessment for the Town in 2002, which included identifying potential sources of contaminants, designating a formal source water assessment area, and completing a susceptibility analysis for each public groundwater source of water. In 2013, MDE published an update to the Source Water Assessment report, which included an update to the source water assessment area with expanded data and recommendations.

The Town's water supply originates from limestone aquifers and are susceptible to surface water infiltration. Several sources of potential contamination exist in Town, which could affect the wells. Wellhead protection areas were delineated by the state in 1997. Another vulnerability to drinking water in Woodsboro is the impact from nearby quarries. The Maryland Department of the Environment (MDE) has established a zone of dewatering influence around the Barrick and LeGore quarries north of Town. Any measurable impact to groundwater wells or households in place before the delineation would be subject to compensation by the quarry owners.

TOWN OF BURKITTSVILLE

The Town of Burkittsville, located on the west side of the County, is the only municipality solely served by individual wells for all its residents. There are 66 existing wells serving the 150 residents (MDP Estimate, 2023) of Burkittsville. Burkittsville is not considered a growth area and has no residential development potential as most of the undeveloped land within the Town is part of larger farms under agricultural preservation easements. The Town is located within the Hydrologic Unit III, which is characterized by average to below average ground water capacity. Specifically, Burkittsville is within the Piedmont Crystalline hydrogeomorphic region, which has average year yields of 630 gallons/day/acre and drought year yields of 390 gallons/day/acre. In addition to ground water quantity issues, there have also been reports of well contamination in the eastern portion of the Town, likely from failing septic systems.

Appendix B: Wastewater System Profiles

CENTRAL FREDERICK SEWERAGE SERVICE AREA

The Central Frederick Sewerage Service Area covers approximately 63 square miles in the center of the County including the following community growth areas:

The City of Frederick (only a portion of the City)	Eastalco	Linganore
Town of Walkersville	Buckeystown	Spring Ridge/Bartonsville
Ballenger Creek	Urbana	Libertytown
Frederick Southeast	Monrovia	Walkersville
Adamstown	New Market	

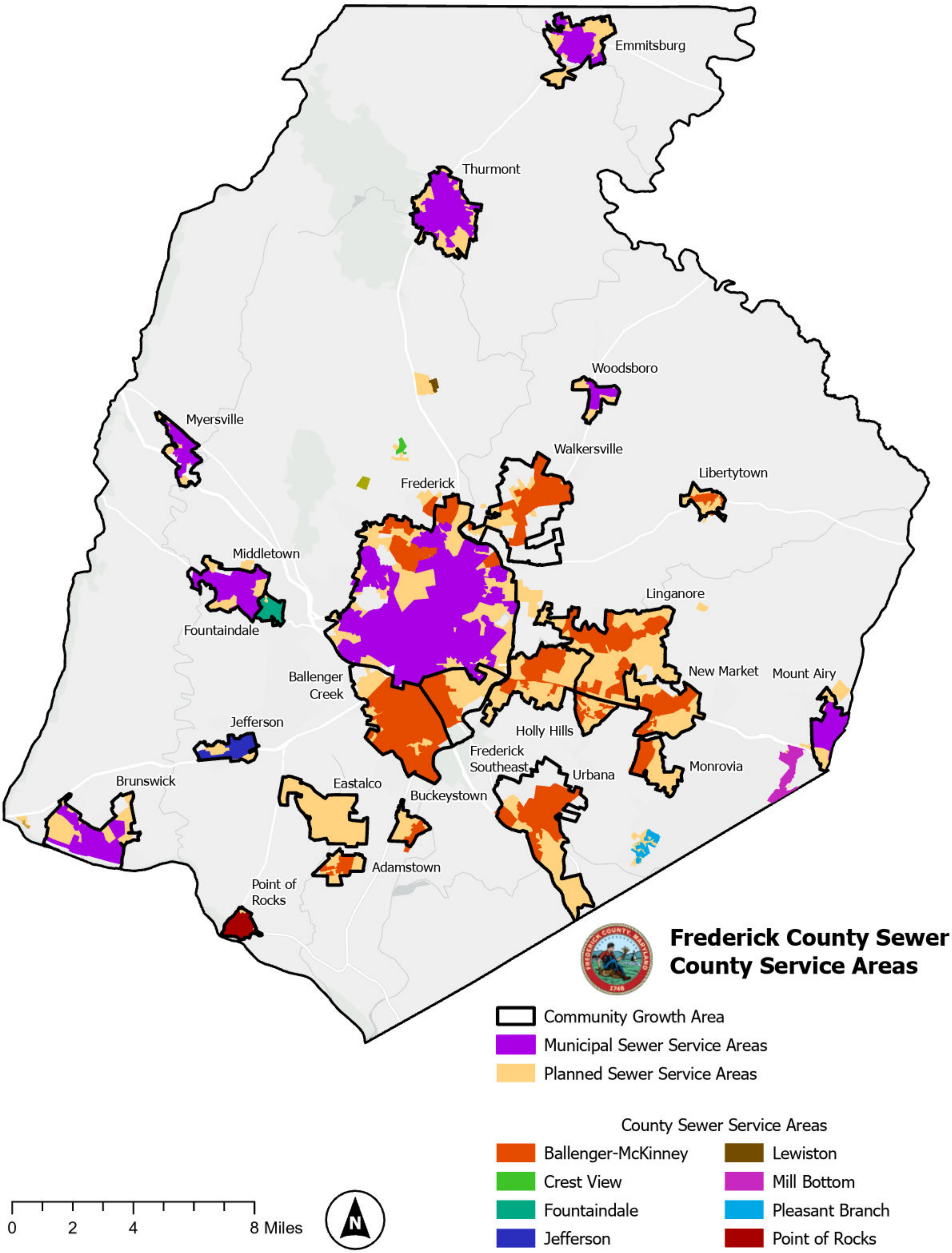
This sewerage service area has a collection system that conveys raw sewage to the WWTP and currently discharges directly into the Monocacy River. The growth areas served are Adamstown, Ballenger Creek, Linganore, Libertytown, Holly Hills, Spring Ridge/Bartonsville, Walkersville, Urbana, and portions of the City of Frederick (as per the Central Frederick Sewer Service Area Agreement or CFSSAA). Two residential areas in Buckeystown are served by this system, and the remainder of that community utilizes onsite septic systems.

The Ballenger-McKinney WWTP plant meets Enhanced Nitrogen Removal (ENR) treatment requirements, and MDE has approved a maximum-average daily design flow of 18 mgd, which is based on a maximum nutrient loading allocation of 219,280 lbs./year total nitrogen (TN) and 16,446 lbs./year total phosphorus (TP). It is important to note that this is a separate wastewater system, with no components of the wastewater system combined with stormwater conveyance, treatment, or discharge. The phased construction of the project, which included the construction of a bridge across Ballenger Creek, effectively created one large single treatment complex to provide the best available technology to meet ENR treatment requirements.

The existing treatment plant is permitted a maximum 15 mgd discharge to the Monocacy River through the current outfall. Any discharges beyond the 15 mgd discharge capacity, but below the 18 mgd treatment capacity, require the additional discharge to be diverted through a treated effluent conveyance to the Potomac River. While a portion of the infrastructure for this 10.2-mile outfall system currently exists in the form of a former water supply line, the full system has not been fully designed or permitted at this time. The Potomac River outfall will allow the County to expand in the future based on loading requirements, but any expansion beyond 18 mgd would require additional nutrient allocation.

The Central Frederick Sewerage Service Area is comprised of multiple, smaller, contributing collection systems. These include the Monocacy Collection System and the Ballenger Creek Collection System.

The Monocacy Collection System is a County-owned system which transports wastewater through a portion of the City's sewage collection system to the City's Gas House Pike WWTP, where it is then pumped to the County's Ballenger-McKinney WWTP for treatment. Operation of the collection system started in 1968 and has grown throughout the years to include the Town of Walkersville, Discovery PUD, Spring Garden Estates, and Dublin Estates, and recently annexed portions of the City of Frederick.


Frederick County Sewer
County Service Areas
Emmitsburg
Thurmont
Woodsboro
Myersville
Walkersville
Frederick
Libertytown
Middletown
Linganore
Fountaindale
Ballenger
Creek
New Market
Mount Airy
Jefferson
Holly Hills
Frederick
Southeast
Urbana
Monrovia
Brunswick
Eastalco
Buckeystown
Adamstown
Point of
Rocks
Community Growth Area
Municipal Sewer Service Areas
Planned Sewer Service Areas
County Sewer Service Areas
Ballenger-McKinney
Crest View
Fountaindale
Jefferson
Knoxville
Lewiston
Mill Bottom
Pleasant Branch
Point of Rocks
White Rock
0
2
4
8 Miles
N

The Ballenger Creek Collection System is located south of the City of Frederick and centers on the I-270 corridor. This area, along with the City, has the highest concentration of industrial and commercial development in the County. The commercial/industrial developments include Westview Corporate Campus, Omega Center, McKinney Industrial Park, Bowman Plains, Wedgewood Industrial Park, Westview South MXD, and the Westview Promenade shopping center. The Ballenger Creek CGA also includes a significant concentration of medium and high-density residential developments. Subdivisions include Crestwood/Mountain Village, Kingsbrook, Farmbrook, Foxcroft, Hannover, Stuart Mechanic, Ballenger Creek Meadows, Robin Meadows, Wellington Trace, Linton, Ballenger Crossing and Countryside. Many of these industrial and residential developments comprise the following Community Growth Areas (CGAs), as designated in the County Comprehensive Plan: Ballenger Creek, Frederick Southeast, Urbana/I270 Employment Corridor, Adamstown, Buckeystown, and Ballenger Creek.

A brief description of the growth areas identified within the Central Frederick Sewerage Service Area is provided below:

Frederick Southeast

This community growth area includes lands bounded by I-270, I-70, and the Monocacy River. The primary development area is referred to as the MD 85/355 corridor, which includes the area bounded by I-270, the Lafarge quarry, and I-70. This corridor includes approximately 5.2 million square feet of existing building area comprised of commercial/retail, office/industrial, motels, and auto related uses. The MD 85/355 corridor is also targeted as a primary redevelopment area under the South Frederick Corridors Plan, which is intended to leverage the existing infrastructure to covert a primarily commercial and retail corridor into a mixed-use corridor that incorporates a variety of housing types and multi-modal transportation opportunities.

Urbana/I-270 Employment Corridor

The Urbana community growth area includes the Villages of Urbana/Urbana Highlands PUD, the Urbana Town Center MXD, the Urbana Office/Research Center MXD, and the I-270 Employment Corridor. In 2017 proposed employment uses in the Urbana Town Center MXD and the Urbana Office/Research Center MXD were replaced with residential uses.

Adamstown

Adamstown was originally planned for independent future service area WWTPs. The existing subdivisions, Green Hill Manor and Adamstown Commons, as well as the proposed Carroll Manor PUD, are pumped to the Ballenger-McKinney WWTP. Additional areas within the community of Adamstown are planned to be served at the Ballenger-McKinney WWTP in the future.

Buckeystown

The Buckeystown community is currently served by individual septic systems. Several of these systems are located in the 100-year floodplain. Only two developments in the community are currently served by the Ballenger-McKinney WWTP, the Buckingham Hills subdivision and Buckingham's Choice retirement/assisted living facility.

Town of New Market/Monrovia Service Area

The New Market/Monrovia service area is comprised of two community growth areas, the Town of New Market Municipal Growth Area and the Monrovia Unincorporated Growth Area. This service area is expected to see industrial and commercial development in addition to residential development.

The New Market community growth area includes the Town of New Market and surrounding county developments including New Market West, Woodspring, and The Meadow. As noted in the description of these communities under the New Design WTP service area, the Town's 2022 population was estimated at 1,614 (MDP estimate, 2023). The Monrovia growth area is currently comprised of the Landsdale PUD which was approved for 1,100 dwellings. The Lansdale PUD has seen significant build-out, and currently only 27 dwellings remain in the residential development pipeline. The population of the Monrovia Service Area is estimated at 3,855 (Frederick County estimate, 2024).

Lake Linganore, Holly Hills, and Spring Ridge/Bartonsville

This service area is comprised of three separate community growth areas as designated in the County Comprehensive Plan. The Spring Ridge/ Bartonsville growth area includes the Spring Ridge PUD, and the Bartonsville area south of MD 144. This growth area also includes some surrounding low density residential areas. The Linganore growth area includes the Eaglehead/Linganore PUD, the Greenview PUD and other low-density areas along Old National Pike. The third growth area is Holly Hills, which includes the golf course and surrounding residential developments between Ijamsville Road and Mussetter Road.

As stated under the description of the New Design Water Treatment Plant's service area, the Linganore, Holly Hills, and Spring Ridge/Bartonsville CGAs have the greatest development potential of all CGA's with 4,234 total dwelling units in the residential development pipeline.

LIBERTYTOWN SERVICE AREA

The Libertytown Service Area is approximately 0.5 sq. mi. in size encompassing the unincorporated community of Libertytown, which is designated as a community growth area in the County's Comprehensive Plan. Wastewater that was previously treated by the now-decommissioned Libertytown WWTP has been diverted, via a pump station and 10-inch force main, to the County's Lake Linganore collection system, which is a tributary to the County's Ballenger-McKinney WWTP.

This diversion eliminated the WWTPs outfall into Town Branch, a tributary of Linganore Creek, and allowed connection of the Linganore High School (which had a failing septic system that was being pumped out daily). With this exception, the planned pumped conveyance system is Denied Access between the two growth areas. Following the installation of the necessary pumping and conveyance infrastructure, the Mill Creek property, Mayne property, and Daysville Glen developments are also intended to be served by the Ballenger-McKinney WWTP.

TOWN OF WALKERSVILLE SERVICE AREA

Wastewater treatment for the Town of Walkersville is provided by Frederick County. Sewage from Walkersville flows through the Ceresville pumping station to Frederick City's Gas House Pike WWTP. Once wastewater reaches the Gas House Pike WWTP, it is redirected through the Monocacy pump station to the Ballenger-McKinney WWTP. The northeastern limits of the Town of Walkersville are collected at the College Run Pump Station for conductance to the Ceresville Station and on to the Ballenger-McKinney WWTP.

POINT OF ROCKS SERVICE AREA

The County-operated Point of Rocks WWTP serves the unincorporated Point of Rocks community situated on the Potomac River. The system was developed in the early 1980s and has a 0.230 mgd capacity with discharge to the Potomac River. Generally, the plant has no difficulties in meeting its permit requirements. The population of Point of Rocks is 1,886 (Frederick County estimate, 2024) following completion of the Canal Run PUD.

JEFFERSON SERVICE AREA

The first Jefferson WWTP and collection system was built in 1968 and upgraded and expanded over the years to its present capacity of 0.300 mgd. In 1995, the facility was provided with Intermittent Cycle Extended Aeration System (ICEAS) capabilities. The current plant is owned and operated by Frederick County as a separate wastewater system, with no system components combined with stormwater conveyance, treatment, or discharge. The Jefferson WWTP collection system includes three pumping stations, and the outfall conveys treated effluent to Catoctin Creek.

The population of the service area is currently 2,973 (Frederick County Estimate, 2024). The plant currently receives an average daily flow of 0.137 mgd, which leaves an excess capacity of 0.163 mgd.

LEWISTOWN SERVICE AREA

The Lewistown Service Area was established by Frederick County in 2016 to address issues with individual, private wastewater (septic) systems that had been observed by the Frederick County Health Department over an extended period of years. The project, funded under the 2017 CIP, is comprised of a series of pumps and low-pressure mains, with an estimated treatment capacity of 0.027 mgd average annual flow.

This system was designed, specifically, to address perennial issues related to the suitability of the soils in and around Lewistown for private wastewater disposal systems. This system was not intended as a tool for facilitating future development or growth in or around Lewistown, which is not a designated Community Growth Area. Future developments of any significant size in the Lewistown Area would be responsible for permitting separate wastewater systems of any size through the Frederick County Health Department and the Maryland Department of the Environment.

FOUNTAINDALE SERVICE AREA

The Fountaindale WWTP is a 250,000-gallon per day (gpd) Sequencing Batch Reactor (SBR) that was reconstructed in 2008. It is owned and operated by Frederick County as a separate wastewater system, with no components combined with stormwater conveyance, treatment, or discharge. The County acquired Fountaindale Services, a private water and wastewater utility, in 1983. From 1983 to 1995 the County (DWSU) made numerous small improvements to the water and wastewater infrastructure. The Fountaindale WWTP has a current treatment capacity of 0.250 mgd, a permitted discharge of 0.200 mgd, and an average flow of 0.107 mgd.

Approximately 70 existing properties in the southern section of the neighboring community of Braddock Heights have experienced septic problems for some years. The proximity of the Fountaindale system represents an opportunity to extend service to Braddock Heights, although a small pump station would be required to serve the eastern half of Braddock Heights.

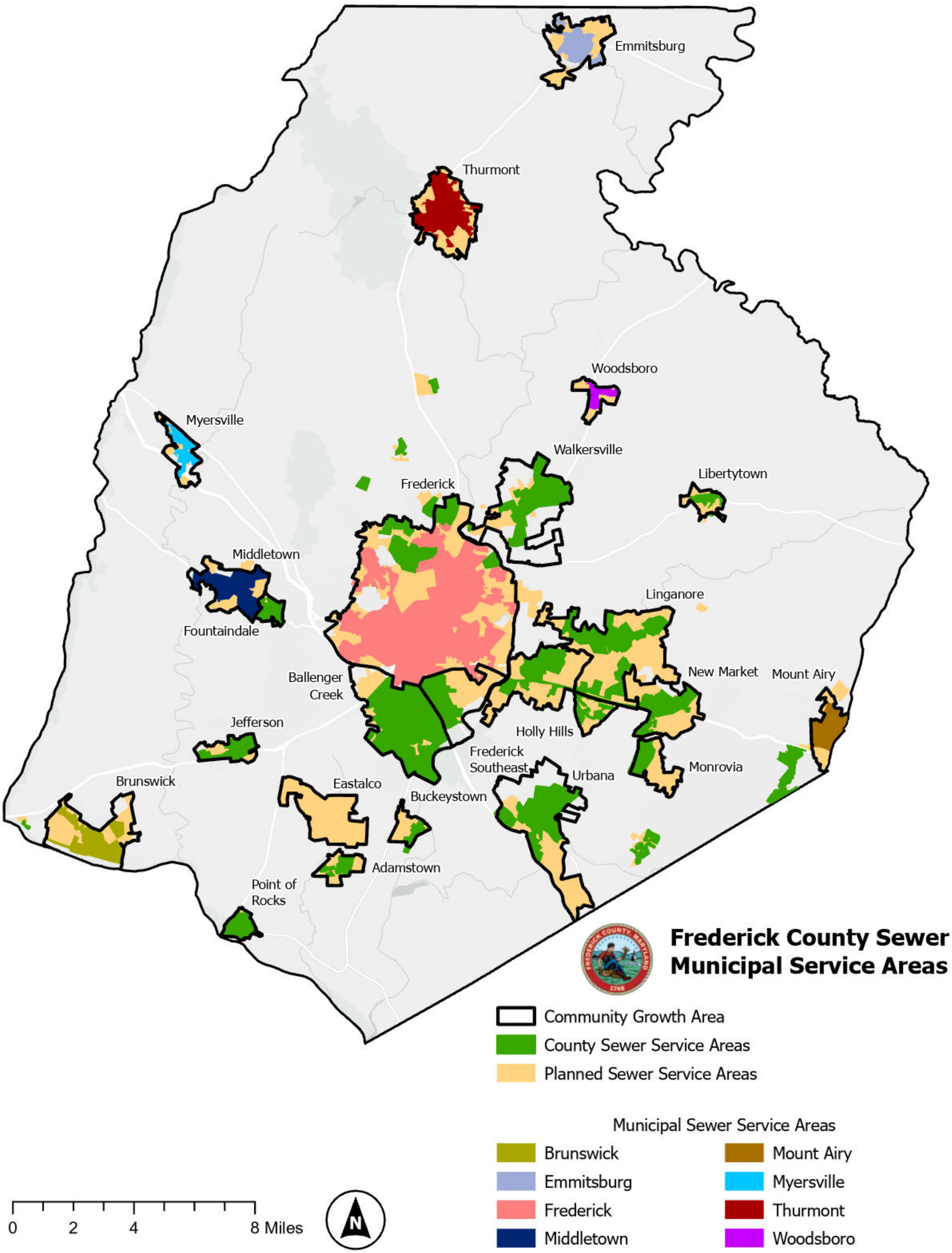
CITY OF FREDERICK WWTP SERVICE AREA

The City of Frederick operates a wastewater treatment plant (WWTP) located on Gas House Pike at the confluence of Carroll Creek and the Monocacy River. The plant, located above the 100-year floodplain elevation, has been in service for over 45 years. Improvements to the plant to comply with requirements of the MDE Enhanced Nutrient Removal program were completed in 2020.

The plant serves an estimated population of 82,175 people (MDP Estimate, 2023), with the current design capacity of the plant at 8.0 mgd. The plant currently receives an estimated average flow of 5.810 mgd. The most recent agreement with Frederick County, reached in 2014 and referred to as the Central Frederick Sewer Service Area Agreement (CFSSAA), includes a provision to provide preliminary treatment for approximately 2.500 mgd of wastewater in emergency conditions. The CFSSAA also provides for a diversion of 1.36 mgd to the County Ballenger-McKinney WWTP (as needed), with a provision for an additional 0.510 mgd in emergency capacity to be granted following the Ballenger-McKinney WWTP's establishment of the full 15.0 mgd capacity.

To continue to meet demand, the City is evaluating inflows to the plant. In particular, they are reviewing peak flows and future/projected flows. The City is also looking at the feasibility of expanding the capacity of its WWTP versus investing in capacity through the County's Ballenger-McKinney WWTP. In addition to WWTP capacity, the City also uses up to 300,000 gpd (44,500 gpd avg.) of treated effluent for spray irrigation at its Clustered Spires Municipal golf course annually, from March 1 through November 30.

Several subdivisions in and near the City that currently utilize on-lot septic systems have experienced reported failures in the past. These subdivisions, which are to the north and west of the City, include Sunset Hills, Indian Springs, Boot-Jack Springs, Mt. Laurel Estates, Brookmere, Edgewood, Rocky Spring Road, Old Receiver Road, and Grove Hill. On-lot rehabilitation was recommended for these subdivisions in a study performed in 1982, but system growth since that time has brought the collection system closer. Annexation with subsequent connection to the sewer system may be more feasible for most areas identified as in need.


Emmitsburg
Thurmont
Woodsboro
Myersville
Walkersville
Libertytown
Frederick
Middletown
Fountaindale
Linganore
Ballenger
Creek
New Market
Mount Airy
Jefferson
Holly Hills
Frederick
Southeast
Urbana
Monrovia
Brunswick
Eastalco
Buckeystown
Adamstown
Point of
Rocks
Frederick County Sewer
Municipal Service Areas
Community Growth Area
County Sewer Service Areas
Planned Sewer Service Areas
Municipal Sewer Service Areas
Brunswick
Emmitsburg
Frederick
Middletown
Mount Airy
Myersville
Thurmont
Woodsboro
0
2
4
8 Miles
N

FORT DETRICK WWTP SERVICE AREA

Fort Detrick maintains its own system serving approximately 278 housing units, 152 barrack units, and 7,900 employees. The design capacity of the Fort Detrick WWTP is 2.00 mgd with an average daily flow of 0.770 mgd. Raw sewage flows by gravity to a pumping station located at the southwest corner of the post. From there it is pumped to the treatment plant located on the Monocacy River upstream of the City's WWTP. All biological waste is decontaminated prior to entering the wastewater system.

CITY OF BRUNSWICK/KNOXVILLE SERVICE AREA

The City of Brunswick provides sewerage service to an estimated 8,211 residents (MDP Estimate, 2023). It is a separate wastewater system, with no components combined with stormwater conveyance, treatment, or discharge.

In addition to the municipality, the service area includes the community of Knoxville located approximately one mile west of Brunswick and the New Addition subdivision just west of the City, along the north side of Knoxville Road. (MD 478). The Knoxville and New Addition communities were connected to the Brunswick system in 1991 to address failing septic systems.

The design capacity of the plant following upgrades completed in 2008 is 1.400 mgd. It discharges directly to the Potomac River 10.2 miles upstream from the County's New Design Road WTP intake and is 1,050 ft. downstream from Brunswick's water treatment plant intake. As part of the 2008 upgrades, the plant became Frederick County's first Enhanced Nitrogen Removal (ENR) treatment facility.

Brunswick officials anticipate that demand will reach 1.800 mgd by 2045. The WWTP is located between the C&O Canal National Historical Park towpath and the Potomac River; treated effluent is discharged to the Potomac. In addition, the City has contracted with consultants to do a complete analysis of the WTP and WWTP to bring the treatment capacity to 2.200-2.500 mgd.

There are approximately 12 existing septic systems located within city limits per the 2024 Water and Sewerage Plan. The City of Brunswick continues to work with these individuals to bring them into the City's system. The City also oversees a continuous sewer maintenance program that identifies and eliminates inflow and infiltration (I&I) issues.

TOWN OF EMMITSBURG SERVICE AREA

The Town of Emmitsburg owns and operates a 0.750 mgd wastewater treatment built in 2015, which utilizes Class 5A ENR, Biolac Reactors, clarifiers, denitrification, and post aeration to achieve permit requirements. It discharges into Toms Creek that drains into the upper Monocacy River. Average demand was 0.501 mgd in 2023 per the Town of Emmitsburg. Remaining capacity was 0.249 mgd.

The Emmitsburg Sewerage System, a separate system not combined with stormwater conveyance, treatment, or discharge, serves a population of 2,921 (MDP Estimate, 2023) plus 71 residences outside of town. It also serves the FEMA/NETC facility, which is outside the municipal limits.

Mount St. Mary's University

Mount St. Mary's University is served by a private wastewater treatment plant located northeast of the junction of US 15 and College Lane and consisting of 2 trains of MBR reactors. The plant was constructed in 2015 with a design capacity of 160,000 gpd. Effluent from the plant is de-chlorinated prior to being discharged into St. Mary's Run, which flows into Toms Creek. Sludge is either applied on land or hauled for further treatment and disposal to another facility. Most sewage flows by gravity to the WWTP but there are also 3 lift stations to aid in getting the wastewater to the WWTP. The treatment plant receives an average daily flow of 60,000 gpd during the academic year.

The adjacent Mountain Manor rehabilitation facility was granted a waiver by MDE to connect to the university system in 2008 due to their failing septic system. The Mountain Manor flow is forced to the WWTP by one of the 3 lift stations previously mentioned. MDE considers the Mount St. Mary's University system as a community system because it serves more than one lot. The county recognizes it as a "legacy" community system but maps it as a Multi-Use system under the Water and Sewerage Plan to reflect the private ownership and operation of the system.

TOWN OF MIDDLETOWN SERVICE AREA

The Town of Middletown operates two treatment plants (East and West WWTPs) that serve properties within its corporate limits. Both treatment plants have a permitted capacity of 0.500 mgd and a combined treatment capacity of 0.600 mgd. Average daily demand to the systems is currently 0.430 mgd.

The West WWTP (discharging to Catoctin Creek) was constructed in 1976 and has a design capacity of 0.250 mgd. It is a separate wastewater system, with no stormwater facilities contributing to the system. The Town has identified upgrades to this facility as a need in 2023, as the facility is an older lagoon style facility that is located within a delineated floodplain.

The East WWTP (discharging to Hollow Creek) has a design capacity of 350,000 gpd but is permitted to discharge 250,000 gpd. The plant was constructed in 2000 to reduce flows to the older West WWTP. The plant was designed so that it can be expanded to a 700,000 gpd plant in the future, subject to permit requirements. Construction of a new aeration tank and clarifier would be required. The Town is currently exploring the redirection of all flow from the West WWTP to this facility as part of the decommissioning of the West WWTP.

The current population of Middletown is 5,239 (MDP Estimate, 2023). While Middletown can provide wastewater service to its current population, expansion and upgrades will be required to meet their 2030 demand. The Town conducts inflow and infiltration (I & I) studies and corrective construction on a 5-year rotating basis.

TOWN OF MOUNT AIRY SERVICE AREA

The Town of Mount Airy operates a wastewater treatment plant that is in Carroll County, Maryland, and discharges to the South Branch of the Patapsco River. The facility employs BNR treatment technology and has a 1.200 mgd design and permitted discharge capacity. A Severn-Trent Denitrification Filtration System that meets Enhanced Nutrient Removal (ENR) requirements of 3.0 mg/l Total Nitrogen and 0.3mg/l Total Phosphorus was incorporated into the system in 2011.

Average treatment flow reported by the Town for 2021-2022 was approximately 0.732 mgd, and the Town notes that significant progress was made on inflow and infiltration (I & I) in 2022 by installing 3.5 miles of cured-in-place-pipe liners. The Town acknowledges that potential, future development areas, including the Harrison-Leishear property, may require future expansion of the WWTP, as well as upgrades to the 15" gravity sewer main serving it.

An evaluation in the fall of 2022 was completed that identified potential, additional "process intensifying" improvements that could be made to the system to increase treatment capacity by as much as 50%, and those improvements are under consideration by the Town.

TOWN OF MYERSVILLE SERVICE AREA

The Town of Myersville, population 1,854 (MDP Estimate, 2023), provides sewer service to households and businesses within its corporate limits. The Myersville WWTP has a design capacity of 0.300 mgd and discharges into Grindstone Run, which is a tributary of Catoctin Creek. The plant uses a Sequence Batch Reactor (SBR) and experiences an average flow of 0.132 mgd per the Town. The wastewater system is separate from the stormwater management system.

The most recent upgrade to the system occurred in 1999. The transmission lines along Main Street are newly installed PVC lines, constructed as part of the Main Street renovation project. The Town replaced nearly one mile of old clay sewer lines on the south end of Town in 2015, eliminating a large portion of the infiltration and intrusion into the system. The wastewater treatment plant has an excess capacity and, therefore, can meet the 20-year demand needs of the area.

TOWN OF THURMONT SERVICE AREA

The Town of Thurmont owns and operates the sewerage system, which primarily serves the municipality. The Town's estimated population in 2022 was 6,588 (MDP Estimate, 2023). Service outside the municipal boundary is also provided to Catoctin High School and the Catoctin Mountain Park Visitors Center, Camp Airy, Camp Misty Mount, and to Cunningham Falls State Park since 1977. There were eleven individual septic systems grandfathered in town as of 2021.

Wastewater is treated at the Thurmont WWTP, which was upgraded for biological nutrient removal (BNR) in 1996. The plant has a treatment capacity of 1 mgd. Effluent from the facility is discharged to Hunting Creek, a tributary of the upper Monocacy River. Enhanced Nutrient Removal (ENR) technology was incorporated into the plant as part of a subsequent upgrade in 2012.

The average flow to the plant for the period from 2021 – 2023 was 0.555 mgd. Remaining capacity in per the plan was 0.445 mgd. The town projects that demand will increase to 0.945 mgd by 2030. To accommodate growth projected by the Town, the Town is considering expansion of its treatment capacity to 1.330 mgd.

The Town's wastewater collection system has been identified as a constraint on growth in Thurmont. The system is a "separate" sewer system with no components of the stormwater system contributing additional flows. However, the system has a documented infiltration and inflow (I & I) problem that presents capacity problems at the treatment plant during heavy rain events. Water enters the system through cracks in pipes and through manhole covers in the street. Sewage backups in residences have resulted from the I & I problem and treatment has been compromised at the plant. The Town has completed multiple phases of a five-phase program to address issues related to I & I, with the final phase scheduled to be completed in 2025. Work under this effort may likely have contributed to a decrease in the average demand on the system observed between the 2010 Water Resources Element, the 2021 Water and Sewerage Plan, and beyond.

TOWN OF WOODSBORO SERVICE AREA

The Town of Woodsboro, population 1,156 (MDP Estimate, 2023), constructed its sewerage system in 1980 in response to failing septic systems. Initially the plant was constructed to serve approximately 650 people. An upgrade in 2004 increased the design capacity to 0.250 mgd. The improvements provide capacity for 1,000 sewer connections. Therefore, development of Woodsboro's growth area is not constrained by sewer service. The system does not currently serve any properties outside of the municipal boundary.

The WWTP is a Sequencing Batch Reactor (SBR) system plant located at the end of Council Drive discharging to Israel Creek, a tributary of the Monocacy River. Discharge is approximately 9.5 miles north of the City of Frederick and Fort Detrick water intakes on the Monocacy.

TOWN OF BURKITTSVILLE

All the existing 74 residences and other uses in Burkittsville rely on individual septic systems and there are no plans to develop a community wastewater treatment system. There is virtually no development potential for new residential uses, as almost all the undeveloped land in the Town is part of larger farms under agricultural preservation easements. A town survey conducted in 1996 indicated some degree of concern by residents with the adequacy of both septic systems and wells. There have been reports of septic system failures and well contamination, though no formal surveys have been conducted by the Health Department to document the extent of the problems. There are several factors that will contribute to septic issues in Burkittsville:

- Average lot sizes are less than the one (1) acre minimum currently required for well/septic systems
- Age of the existing systems
- Soil conditions

Appendix C: Current and Future Land Use and Stormwater Pollutant Load Estimates Methodology

To better understand the potential impact of planned future development on the County's water resources, changes in land use and pollutant loading in community growth areas (CGAs) between 2022 and 2035 are estimated for the four development scenarios outlined in the 2019 Livable Frederick Master Plan. The analysis establishes a current (baseline) scenario using existing land use data and a Maryland Department of the Environment (MDE) approved non-point source pollution nutrient model to determine loading rates for Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS). Land use changes from future development, as envisioned in the four different planning scenarios, are then used together with the loading rates to estimate future pollutant loads. The results provide insight to the potential impact of future development in CGAs on meeting and maintaining Total Maximum Daily Loads (TMDLs), and will also help identify where implementation measures to achieve load reductions are most needed.

Land Use

The Chesapeake Bay Program (CBP) Chesapeake Bay Land Use and Land Cover (LULC) Database, 2022 Edition was used to estimate current land use within the CGAs (CBP, 2022). The CBP LULC database is the most comprehensive and recent land cover database currently available for the Chesapeake Bay watershed. The database contains 13 Land Cover (LC) classes and 54 LULC classes for all counties within or adjacent to the Chesapeake Bay watershed at a one-meter resolution, based on 2017/18 imagery. Additionally, 54 LULC classes are generalized into 18 LULC classes for ease of visualization and communication of LULC trends. The database was also used as the LULC input for the Phase 6 Watershed Model component of the Chesapeake Assessment Scenario Tool (CAST), which allows for classification of impervious surfaces, agriculture, turfgrass, and other land cover types that are consistent with CAST pollutant unit area loads.

To simplify the process of estimating land use changes and pollutant loading in the future scenarios, the 16 general LULC classes found within the CGAs were aggregated into six LULC classes based on CAST Sector and Load Sources. A cross-walk of the general LULC classes to CAST Sector and Load Sources is provided in **Table 1**.

Table 1. Crosswalk Between General Land Use Classes and CAST Load Sources

General Land Use	CAST Sector/Load Source
Pasture/Hay	Agriculture
Cropland	
Impervious Structures	Impervious Developed
Impervious, Other	
Impervious Roads	
Tree Canopy over Impervious	
Tree Canopy over Turf Grass	Pervious Developed
Tree Canopy, Other	
Turf Grass	
Pervious Developed, Other	
Forest	Natural, water excluded
Natural Succession	
Wetlands, Riverine Non-forested	
Wetlands, Terrene Non-forested	
Water	Water
Extractive	Construction/Disturbed

This process allows for a more manageable estimate of land use changes for each future scenario, since only four aggregated land use classes need to be tracked (agriculture, impervious developed, pervious developed, and natural). It is assumed that water and disturbed land uses will remain constant over time within CGAs. Land uses outside of CGAs remain constant over time as part of this analysis since development is assumed to be limited to CGAs.

Land use changes are estimated for the following four development scenarios that were modelled for the Livable Frederick Master Plan to determine 2035 land use within CGAs:

> **Scenario 1 - Business as Usual:** This scenario assumes that we maintain the trajectory of our current planning policies, establishing a future direction that reflects past trends.
>
> **Scenario 2 - City Centers Rise:** This scenario acknowledges the City of Frederick, and developed county land surrounding the city, as a major regional center for business, institutions, residential living, and culture. This scenario assumes that the growth potential of areas within and surrounding the city is maximized to create an even stronger urban center boasting walkable neighborhoods, historic character, and thriving commercial districts.
>
> **Scenario 3 - Suburban Place Making:** In this scenario, our suburban communities are recognized as vital places, loved by generations of Frederick County residents. This scenario assumes a pattern of reinvestment in suburban areas of the county in order to create additional opportunities to shop, work, and play closer to home.
>
> **Scenario 4 - Multi-Modal Places and Corridors:** This scenario focuses on our physical connections to places beyond and within our borders. Existing rail and highway corridors connect Frederick County to the larger Baltimore-Washington Region and this model assumes a development pattern that makes efficient use of these transportation systems to move people, build new mixed use places, and catalyze the redevelopment of aging retail and office developments. The two primary corridors in this model – the CSX/MARC Frederick Branch and the I-270 Corridor – provide a framework for future development and redevelopment in the southern half of the county.

To determine land use changes in each CGA under each scenario, a template was set up to estimate land use changes among the four aggregated land use classes (**Figure 1**). First, the additional area to be developed by 2035 is estimated as a percent of the overall CGA. Developed areas are assumed to be either new development or redevelopment; this ratio is estimated for each CGA. For new development, land use changes are conversion from either agricultural or natural land uses into developed land uses (impervious and pervious). A percent breakdown of each land use change is estimated for the new development area, and then the following formula is used to estimate the land use changes from new development in acres:

$$\textit{CGA Area} * \%\ \textit{Developed} * \%\ \textit{New Development} * \%\ \textit{LU Change}_i$$

where

> *CGA Area* = the total CGA area in acres
>
> *% Developed* = percent of the total CGA area where additional development will occur by 2035
>
> *% New Development* = percent of the additional development that is new development
>
> *% LU Change*$_i$ = Possible land use changes expressed as a percent of new development area, where *i* is one of four land use changes (agriculture to impervious developed, agriculture to pervious developed, natural to impervious developed, or natural to pervious developed).

For redevelopment areas, land use changes can only occur between developed impervious and developed pervious land use classes. An estimate is made for the percent impervious area of the redeveloped areas before and after redevelopment occurs in each CGA, which is then used to estimate the net change in pervious to impervious area within redevelopment areas using the following formula:

$$(CGA\ Area * \%\ Developed * \%\ Redevelopment) * (\%\ Imperv_{after} - \%\ Imperv_{before})$$

where

CGA Area = the total CGA area in acres

% Developed = percent of the total CGA area where additional development will occur by 2035

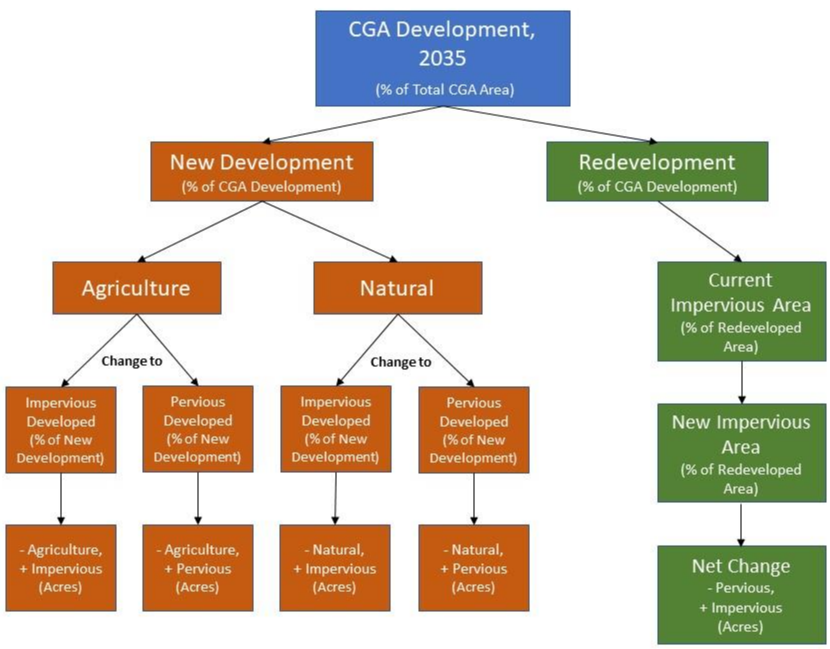
% Redevelopment = percent of the additional development that is redevelopment

$\%\ Imperv_{after}$ = percent of redeveloped area that is impervious after redevelopment

$\%\ Imperv_{before}$ = percent of redeveloped area that is impervious before redevelopment

The land use changes are then aggregated to calculate the net gain/loss for each of the four land use classes, which is then added to the baseline land uses to calculate land use acreages for each future scenario. The percent changes that are estimated for total development, new development verses redevelopment, etc. are based on trends in spatial, social, and economic data for each CGA and were determined by the County.

Figure 1. Template for Future Scenario Land Use Change Estimates



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Pollutant Loads

Load Estimation

CAST Phase 6 loading rates are used together with current and future estimated land use to estimate annual loads inside CGAs for each watershed with an established TMDL. Loads are also estimated for areas outside of CGAs within TMDL watersheds, assuming a constant land use over time. Adding the CGA and non-CGA loads for each TMDL watershed allows for an informal assessment of how development within CGAs may impact achievement of TMDL goals. TN, TP, and TSS loading rates (lbs/acre/year) were generated for the two 8-digit watersheds that align with TMDL watersheds in Frederick County (MD-02070008, Middle Potomac – Catoctin; MD-02070009, Monocacy). Only watershed areas within the state of Maryland are included. The Double Pipe Creek watershed was not assessed since there are no CGAs within its boundaries.

The CAST Phase 6 '2010 No Action' model scenario is used to estimate pollutant loads for the current and future scenarios. The '2010 No Action' model scenario assumes no best management practices (BMPs) are implemented and uses 2010 historic trend base conditions. This allows for a lateral comparison of pollutant load estimates across future development scenarios, where the difference in loading between current land use and future land use can be expressed relative to a constant baseline (TMDL/MS4 baseline load, required reductions). The change in pollutant loads relative to the baseline loads provides insight to the impacts of additional development over time. This includes whether additional water quality treatment will be needed and how much, which watersheds to prioritize for additional treatment, and the relative impacts to water resources of each development scenario. Load reductions from currently implemented BMPs, as well as anticipated load reductions from planned/proposed BMPs, can be compared to the estimated load changes under each development scenario to gauge potential future restoration needs.

CAST Phase 6 provides a separate load source for stream bed and bank (STB) loads, while the previous phase of the model included these stream loads implicitly into the upland load sources. Since the STB load estimate includes loads from agriculture, development, etc., this load should be disaggregated for each load source sector to get a better representation of loading rates for each land use. STB loads are disaggregated for each generalized land use category using the following approach provided by the CBP and available in the MDE guidance document, *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2021). For each pollutant, the Load Source-specific ratio was calculated between the CAST scenario edge-of-stream (EOS) load output not including STB and the calibration average EOS load not including STB. Next, the calculated ratio was multiplied by the STB base source-specific load. For the total suspended sediment (TSS) STB load only, an additional 4/3 of the CAST scenario EOS impervious TSS load was added, consistent with the Phase 6 Model methodology. These equations are summarized below:

$$TN\ STB\ Load = \left(\frac{Scenario\ EOS\ without\ STB\ TN}{CAL\ EOS\ without\ STB\ TN}\right) \times STB\ Base\ TN$$

$$TP\ STB\ Load = \left(\frac{Scenario\ EOS\ without\ STB\ TP}{CAL\ EOS\ without\ STB\ TP}\right) \times STB\ Base\ TP$$

$$TSS\ STB\ Load = \left\{\left(\frac{Scenario\ EOS\ without\ STB\ TSS}{CAL\ EOS\ without\ STB\ TSS}\right) \times STB\ Base\ TSS\right\} + \left(\frac{4}{3} \times Scenario\ Impervious.\ TSS\right)$$

The disaggregated STB loading rates were then calculated and added to the loading rates for each load source sector to obtain the adjusted loading rates. A summary of the adjusted CAST pollutant loading rates used in the analysis is provided in **Table 2**.

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Table 2. Summary of Adjusted CAST Load Source Unit Area Loading Rates

8-Digit Watershed	CAST Load Source	EOS Load Rates (Lbs/Ac/Yr)		EOT Load Rates (Lbs/Ac/Yr)	
		TP	TSS	TN	TP
Middle Potomac-Catoctin	Agriculture	1.443	2,501.644	17.791	0.894
	Impervious Developed	2.431	10,857.215	15.699	1.507
	Pervious Developed	1.542	1,776.999	7.548	0.956
	Natural (water excluded)	0.141	264.528	1.177	0.088
	Disturbed Land	2.755	11,925.574	16.010	1.708
	Water	0.603	0	6.509	0.374
Monocacy	Agriculture	1.810	3,655.933	23.865	1.023
	Impervious Developed	2.593	9,598.963	17.485	1.465
	Pervious Developed	1.423	1,687.738	8.987	0.804
	Natural (water excluded)	0.149	255.934	1.356	0.084
	Disturbed Land	2.857	11,296.874	23.021	1.614
	Water	0.612	0	5.923	0.346

Note: Only loading rates required for TMDLs/MS4 goals included.

To estimate pollutant loads for each scenario, the adjusted CAST '2010 No Action' model scenario loading rates are multiplied by the acreage of each aggregated land use class in each CGA to obtain a total load (lbs/year) for each load source. The same process is applied for non-CGA areas, only the land use acreages are assumed constant for all scenarios. The CGA and non-CGA loads are then added together for each load source to calculate the total annual pollutant load in each watershed.

For the four future development scenarios, it is also assumed that any new development and redevelopment within the CGAs will meet existing state stormwater management regulatory requirements at a minimum. Current state requirements indicate that stormwater BMPs must provide treatment for 100% of new impervious surfaces within the limit of disturbance (LOD) (both new development and redevelopment) and 50% of existing impervious surfaces within the LOD (redevelopment only) (MDE, 2018).

To account for this in the future scenario pollutant load estimates, new and existing impervious acreage subject to state stormwater management requirements are calculated for each watershed to estimate pollutant load reductions.

To calculate pollutant load reductions from required treatment of impervious surfaces within new development and redevelopment areas, the total impervious area requiring treatment (IART) is calculated by adding together 100% of new impervious acreage from both new development and redevelopment and 50% of the existing impervious acreage from redevelopment. Pollutant removal efficiencies for TN, TP, and TSS were based on MDE and CBP guidance on stormwater BMP eras, which defines treatment at the maximum extent practicable (MEP) for different BMP design eras (**Table 3**; MDE, 2009). BMP pollutant removal efficiencies for new development are based on BMPs developed in the post-2010 design era. For redevelopment, it is assumed that the existing development is at least partially treated by older (pre-2002) design era BMPs. The pollutant reduction efficiencies for existing impervious area in redevelopment areas are therefore reduced to account for some level of existing treatment.

Table 3. Maximum Extent Practicable (MEP) Stormwater BMP Treatment Efficiencies

Development Type	TN	TP	TSS
New Development	50%	60%	90%
Redevelopment	25%	35%	65%

The pollutant reduction efficiencies were applied to the adjusted pollutant loading rates for the developed impervious land use class from the CAST '2010 No Action' model scenario to estimate the expected annual load reduction from new development and redevelopment.

The pollutant load reductions from required treatment of new development and redevelopment impervious areas are calculated using the following formula, and are then subtracted from the total annual loads for the developed impervious land use class for each future scenario.

$$((\textit{New Impervious} * \textit{Loading Rate}_i) * (\textit{Treatment Efficiency}_i)) + ((\textit{Existing Impervious} * \textit{Loading Rate}_i) * (\textit{Treatment Efficiency}_i))$$

where

New Impervious = 100% of new impervious area from new development and redevelopment (acres)

Existing Impervious = 50% of existing impervious area from redevelopment (acres)

$\textit{Loading Rate}_i$ = Adjusted CAST '2010 No Action' scenario loading rate (lbs/ac/yr), where *i* is one of three pollutants (TN, TP, TSS)

$\textit{Treatment Efficiency}_i$ = Maximum Extent Practicable (MEP) Stormwater BMP Treatment Efficiency, where *i* is one of three pollutants (TN, TP, TSS)

In order to also assess the potential impact of future development on meeting MS4 reduction goals, the above steps were repeated and applied only to the County's MS4 jurisdiction within each TMDL watershed area (the entire MS4 area was assessed for the Chesapeake Bay TMDL).

Load Comparison

Once the pollutant loads for the CGAs and non-CGA areas are estimated for all scenarios, the two components are added together for each watershed to get the total pollutant load for each scenario. Changes in the future scenario loads relative to the current land use scenario can then be compared to the established baseline loads and TMDLs/MS4 goals for each watershed. A summary of the TMDLs included in this analysis are included in **Table 4**.

Table 4. TMDL Summary for CGA Load Analysis

8-Digit Watershed	TMDL Watershed	TMDL Pollutant	TMDL Baseline (lbs/yr)	TMDL* (lbs/yr)	TMDL Required Reductions (lbs/yr)
Middle Potomac-Catoctin	Catoctin Creek	Phosphorus	86,320	81,155	5,165
		Sediment	57,544,000	28,626,000	28,918,000
Monocacy	Lower Monocacy	Phosphorus	246,586	205,730	40,856
		Sediment	93,942,000	45,456,000	48,486,000
	Upper Monocacy	Phosphorus	178,227	173,414	4,813
		Sediment	85,618,000	45,924,000	39,694,000
	Lake Linganore	Phosphorus	51,129	5,288	45,841
		Sediment	23,170,000	14,146,000	9,024,000

* TMDLs include only nonpoint source and regulated urban (MS4) allocations since only stormwater loads are compared for this analysis. The wastewater analysis performed in Chapter 3 indicates that existing WWTP capacity is adequate for planned development, so no additional wastewater treatment discharges beyond the existing permitted capacity are anticipated.

Additionally, MS4 goals for TMDLs included in the 2021 Frederick County Stormwater Restoration Plan (Frederick County, 2021) were used to compare changes in load estimates among the future development scenarios. The Double Pipe Creek TMDL was not included since no CGAs are located within its watershed. MS4 reduction goals included in the analysis are summarized in **Table 5**.

Table 5. MS4 Load Summary for CGA Load Analysis

TMDL Watershed	TMDL Pollutant	MS4 Baseline (lbs/yr)	MS4 Target * (lbs/yr)	MS4 Required Reduction (lbs/yr)
Catoctin Creek	Phosphorus	13,886	12,359	1,527
	Sediment	22,864,764	11,638,165	11,226,599
Lower Monocacy	Phosphorus	43,746	31,497	12,249
	Sediment	86,466,215	33,894,756	52,571,459
Upper Monocacy	Phosphorus	14,741	14,151	590
	Sediment	21,600,212	11,016,108	10,584,104
Chesapeake Bay	Phosphorus *	56,487	44,795	11,692
	Nitrogen	769,812	685,902	83,910

* If the phosphorus TMDL for the Chesapeake Bay is met, the sediment TMDL is assumed to have also been met.

Since the land use change analysis only considers pollutant loading via stormwater runoff, only nonpoint sources and regulated urban (MS4) allocations are included at this stage. Wastewater and septic loads under current and future conditions will be added in and compared to the entire TMDL for each watershed.

It should be noted that this is an informal assessment of the impact of future development on meeting water resources restoration goals. Due to the complex nature of estimating anticipated future impacts of development on water resources, this assessment makes several necessary assumptions regarding future changes in land use and pollutant loading rates. Therefore, the results of the assessment are not meant to be interpreted as a Use Attainability Analysis or compared to annual reporting for the County's Phase I NPDES MS4 permit. However, the results of the analysis can still be used for general planning purposes and to better understand how future development scenarios may impact pollutant loading.

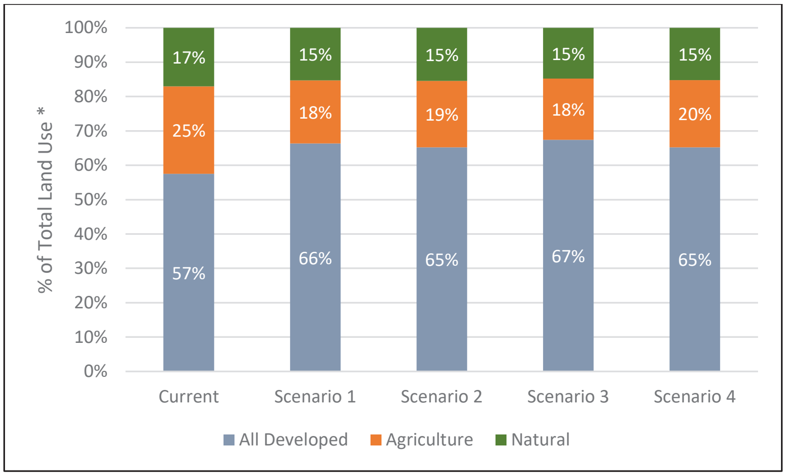
Results

Land Use

A summary of the estimated land use change by 2035 within all CGAs is presented in **Figure 2**. Overall, variation between the four development scenarios is minimal, although Scenario 2 (City Center Rise) and Scenario 4 (Multi-Modal Places and Corridors) result in slightly less area shifting towards developed land uses. Scenario 4 also preserves more agricultural land compared to the other three scenarios. Changes in natural land uses are consistent across all four scenarios.

On average, future development within all CGAs is expected to increase developed land uses from the current 57% of total area to 66% of total area. Development is expected to take place mostly on agricultural land, with agricultural land uses decreasing from the current 25% of total area to 19%. Some development of natural land uses will occur, decreasing natural land uses from 17% to 15% of total area. CGAs located along the I-70 and I-270 corridors are expected to experience the greatest shift in developed areas by 2035.

Figure 2. Summary of Expected Land Use Change in Community Growth Areas by 2035



* Excludes water and disturbed land uses

Pollutant Loads

Changes in baseline pollutant loads due to future development were estimated for each TMDL watershed (Maryland only), as well as Frederick County's Phase I MS4 jurisdiction within each TMDL watershed. A summary of the changes in the MS4 baseline pollutant loads is presented in **Figure 3** through **Figure 5**.

The largest increase in baseline phosphorus and sediment loads is within the Lower Monocacy River watershed with an average increase of 7.9% in baseline phosphorus loading and 2.6% in baseline sediment loading across all scenarios. The smallest increase is within the Catoctin Creek watershed, with an average increase under 1% for both phosphorus and sediment loading across all scenarios. The I-70 and I-270 corridors that include CGAs with the greatest anticipated future development are located within the Lower Monocacy River watershed, which likely explains the largest increase in estimated loads.

Scenario 2 and Scenario 4 generally result in the smallest increase to baseline loads for all pollutants. The land use change analysis determined these scenarios result in slightly less developed area than the other two scenarios, which likely explains this result. In the Upper Monocacy River watershed, Scenario 4 results in the smallest increase to baseline pollutant loads, since under this scenario development would be focused further south along the I-270 and MARC rail corridors rather than expansion of city centers for towns located within the Lower Monocacy watershed. Even if one overall development approach is applied for the County, these insights can help tailor components of the overall strategy to best suit the conditions and needs in each watershed.

The average increase to phosphorus and nitrogen baseline loads within the County MS4 area across all scenarios for the Chesapeake Bay TMDL is 4.2% and 3.6%, respectively.

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Figure 3. Anticipated Changes in MS4 Phosphorus Loads Relative to Baseline

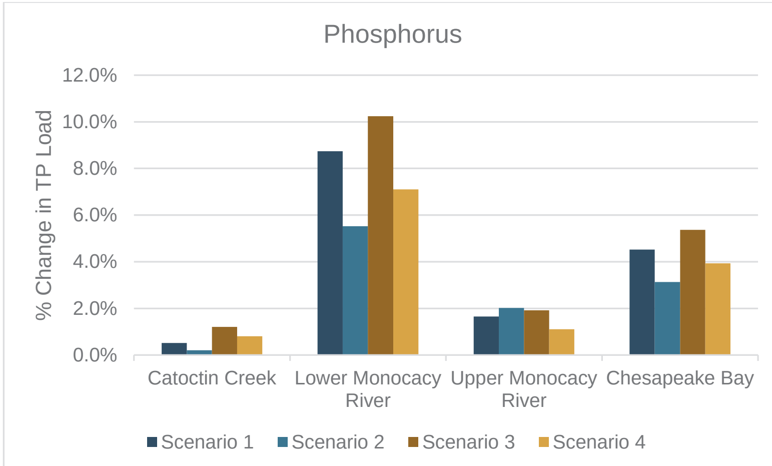

Figure 4. Anticipated Change in MS4 Sediment Loads Relative to Baseline

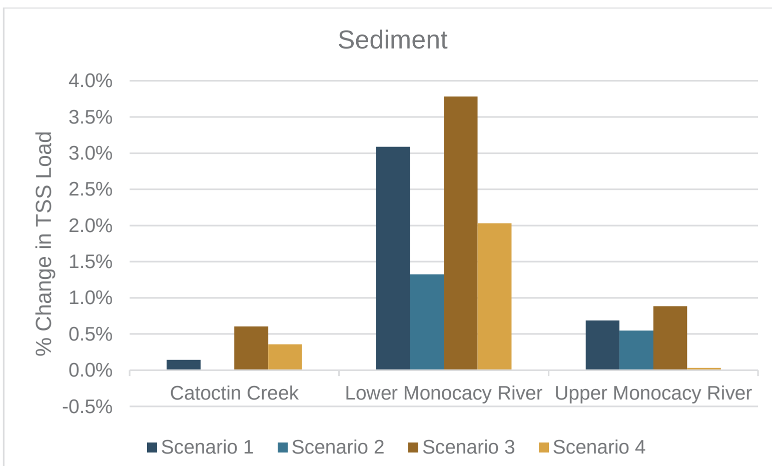

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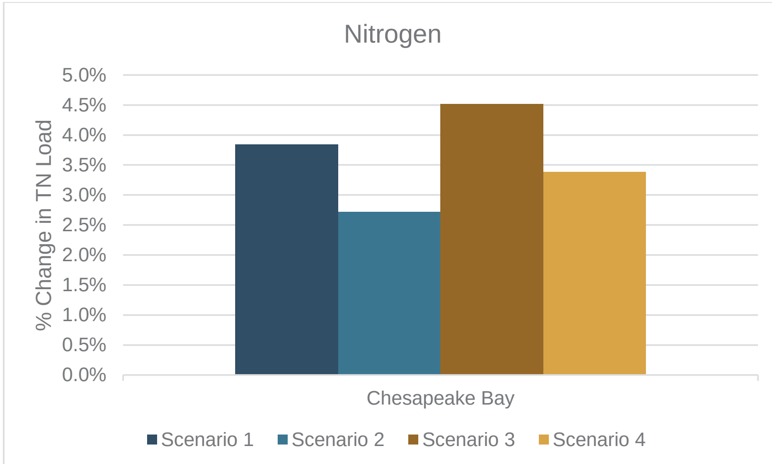
Figure 5. Anticipated Change in MS4 Nitrogen Loads Relative to Baseline



A summary of changes in baseline pollutant loads for the entire Maryland portion of each TMDL watershed is presented in **Figure 6** and **Figure 7**.

Since this portion of the pollutant loading analysis assesses a much larger area, the impact of future development within CGAs has a different impact on baseline pollutant loads. Phosphorus pollutant loading across all scenarios remains relatively unchanged compared to baseline loads, ranging from no change in the Catoctin Creek watershed to a 0.3% reduction in the Lower Monocacy watershed.. The average baseline sediment loads across all scenarios decrease in all four watershed evaluated, with the greatest declines occurring in the Lower Monocacy River (-7.6%) and Lake Linganore (-6.0%) watersheds. This can likely be explained by the development of agricultural lands and the assumed sediment treatment efficiency for BMPs implemented to meet required stormwater treatment of impervious areas for new development, which results in a net decrease in loading rate on an acre by acre basis.

When comparing changes in baseline pollutant loads between the TMDL and MS4 analyses, it is evident that the overall burden of pollutant load reduction shifts towards MS4 jurisdictions as urban area is added due to the new development. Additionally, even though a shift from untreated agricultural production to highly-treated urban land uses can result in decreased pollutant loads it is much more complex on a larger and longer scale. The increased impervious area from development can alter watershed hydrology such that the volume and flashiness of discharges increase, and therefore overall pollutant loading increases. This combined with a potential decrease in the efficacy of stormwater treatment BMPs due to increased stormwater volume may negate BMP pollutant reductions if areas are overdeveloped beyond a reasonable capacity. Since this is a planning level analysis, these types of impacts are not fully reflected in this analysis.

Figure 6. Anticipated Change in Overall TMDL Phosphorus Loads Relative to Baseline

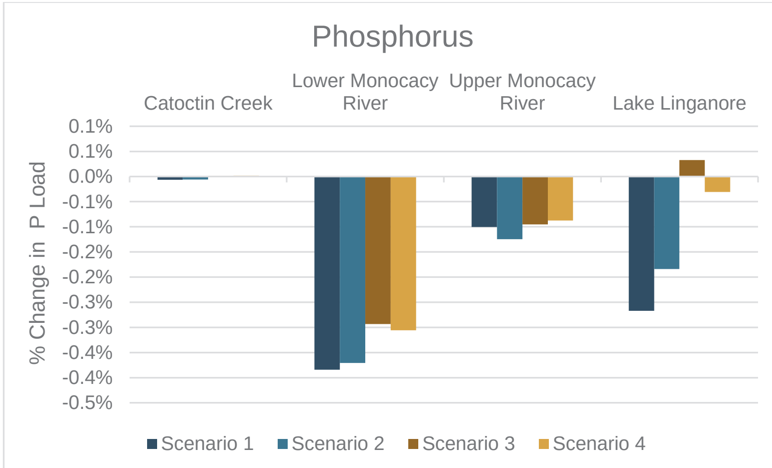
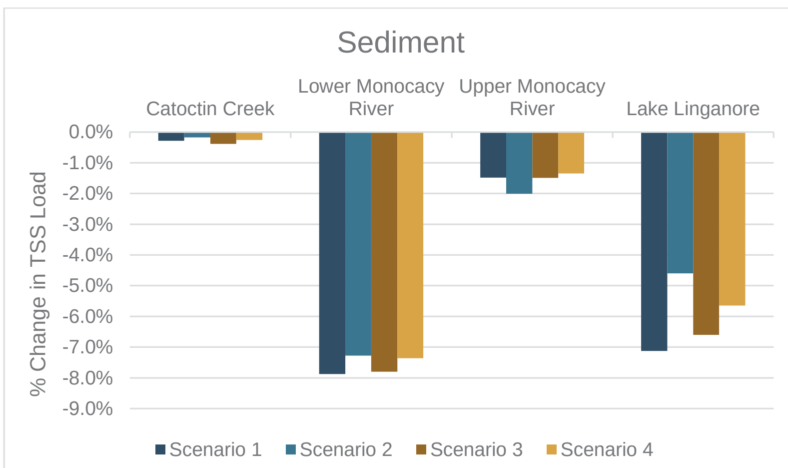


Figure 7. Anticipated Change in Overall TMDL Sediment Loads Relative to Baseline



Climate Impacts

Climate change can exacerbate the impacts of future development on stormwater management by altering precipitation patterns and increasing the frequency and intensity of storms. Warmer temperatures can lead to more frequent and intense rainfall events, further amplifying stormwater runoff and flooding risks. Specifically, there are several impacts of climate change on stormwater management:

- **Decreased Efficacy of BMPs** - More intense rainfall events associated with climate change can overwhelm BMPs, reducing their effectiveness. For example, BMPs may overflow during extreme rainfall events, allowing untreated runoff to enter water bodies. BMPs may also become saturated, leaving them more susceptible to erosion and sedimentation. Higher temperatures may also accelerate the degradation of stormwater infrastructure and reduce the effectiveness of green infrastructure practices by causing stress to BMP vegetation and altering the timing and volume of runoff.

- **Changes in Pollutant Composition** - Intense rainfall events can mobilize pollutants that were previously trapped in the soil or on surfaces, leading to increased pollutant loading in stormwater runoff. These pollutants can include sediment, nutrients (such as phosphorus and nitrogen), heavy metals, and pathogens. Additionally, climate change can alter land use patterns and introduce new sources of pollutants, such as increased use of fertilizers and pesticides for landscaping in response to changing growing seasons.
- **Increased Erosion** - Climate change can exacerbate soil erosion, especially in areas prone to heavy rainfall and flooding. Erosion can release sediment and associated pollutants into waterways, degrading water quality and harming aquatic ecosystems. This sedimentation can also reduce the storage capacity of reservoirs and water bodies, increasing the risk of flooding downstream.
- **Altered Hydrology** - Climate change can disrupt natural hydrological cycles, leading to changes in streamflow patterns and groundwater recharge rates. These changes can affect the availability of water resources for drinking, irrigation, and ecological functions. Additionally, altered hydrology can impact the distribution and abundance of aquatic species, further affecting ecosystem health.

To address these impacts of climate change on stormwater management, the County may need to reassess existing BMPs and infrastructure designs to ensure they are resilient to changing climatic conditions. This may involve incorporating climate projections into the design and siting of BMPs, implementing adaptive management strategies, and promoting nature-based solutions that enhance ecosystem resilience and provide multiple benefits, such as flood mitigation, water quality improvement, and habitat restoration. Practices that enhance the capacity of existing stormwater infrastructure will also be critical. Collaboration between stakeholders at the local and regional levels is essential to effectively address the complex challenges posed by climate change on stormwater management.

References

Chesapeake Bay Program (CBP). 2022. Chesapeake Bay Land Use and Land Cover Database 2022 Edition: U.S. Geological Survey data release. Available at: https://doi.org/10.5066/P981GV1L.

Frederick County. 2021. Frederick County Stormwater Restoration Plan. Available at: https://frederickcountymd.gov/DocumentCenter/View/336326/FR_2021-Stormwater-Restoration-Plan

Maryland Department of the Environment (MDE). 2009. Maryland's Urban Stormwater Best Management Practices by Era. Available at: https://mde.maryland.gov/programs/water/TMDL/Documents/www.mde.state.md.us/assets/document/Appendix_F_MD_Stormwater_Management_By_Era.pdf

Maryland Department of the Environment (MDE). 2018. Stormwater Management Overview for State and Federal Projects. Technical Memorandum #10. Available at: https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/Technical%20Memorandum%20No.%2010%20-%20SWM%20Overview.pdf

Maryland Department of the Environment (MDE). 2021. Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits. Available at: https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/Final%20Determination%20Dox%20N5%202021/MS4%20Accounting%20Guidance%20FINAL%2011%2005%202021.pdf

Appendix D: Methodology Narrative

Current and Future Land Use and Water and Wastewater Demand Estimates

Draft Methodology Narrative

To better understand the potential impact of planned future development on the County's water resources, changes in land use and Community Growth Areas (CGAs) between 2022 and 2050 were estimated by Livable Frederick staff in accordance with the 2019 Livable Frederick Master Plan. These estimates establish future scenarios using population projections and Transportation Analysis Zones (TAZs). The projections are then used together with unit demand and flow to estimate future water demand and wastewater flow. The results provide insight to the potential impact of future development in CGAs on treatment and permit capacity. This analysis will help identify where permit capacity improvements are most needed. It is not anticipated that overall treatment allocation will exceed treatment volume during the planning horizon, therefore no environmental impacts are anticipated. Frederick County (and municipal) staff will continue to monitor and improve system capacity as needed.

Livable Frederick Population Projections

Livable Frederick staff completed population projections for the purpose of projecting water and sewer usage through the planning horizon. Water and sewer capacity projections are identified for the 10-year (2035), and the 25-year (2050) planning horizon. Estimates of future capacity needs reflect projections developed by Livable Frederick staff utilize local planning knowledge, residential pipeline data, and Round 10.0 of the Metropolitan Washington Council of Governments (MWCOG) Cooperative Forecast. Growth projections are intentionally aggressive so that weaknesses or inadequacies in the infrastructural and environmental systems serving our communities may be identified, studied, and remedied before significant problems arise.

Future non-residential wastewater generation is based on employment projections identified in the Round 10.0 Cooperative Forecast. To correlate employment trends to corresponding growth areas in Frederick County, Transportation Analysis Zones (TAZs) have been utilized because they are geographic basis for projections in the Cooperative Forecast. Zones are constructed using census block information so that transportation models can take advantage of available socio-economic data. For the purposes of this growth allocation exercise, CGAs are associated with TAZs to allow for the integration the MWCOG Cooperative Forecasting data. TAZs allow for a variety of data to be brought to bear upon this exercise.

It should be noted that TAZ boundaries do not necessarily follow municipal boundaries or CGA boundaries. For that reason, the approximate percentage of each TAZ that falls within a County or Municipal CGA boundary was approximated, and results were apportioned accordingly. In some cases, the analysis internalized specific knowledge about the developability of certain land areas to reflect the amount of development in the TAZ that would be attributable to the specific CGA. While it is primarily an estimate of land area, other factors such as the geographic likelihood of development/redevelopment in specific subareas is also considered in certain circumstances to more accurately reflect potential land development activity in the study period.

Municipal or County (unincorporated) CGAs are largely defined through the County's Comprehensive Plan Map and Municipal Growth Boundary Maps. The Water Resources Element does include several water and sewer service areas that are located outside of existing County or Municipal CGAs, but many of these systems have seen limited increases in utilization (within the limits of their intended and permitted capacity) or have remained unexpanded since the adoption of the Livable Frederick Master Plan in October 2019.

Each Municipal or County CGA is identified through the underlying TAZs that make up its geography. This allows access to the regional Cooperative Forecast data which provides an alternative means to describe future economic activity that may influence public water and sewer infrastructure. For each CGA, the corresponding TAZ is listed by their identifying numerical codes, and the broadly estimated amount of land in each TAZ that occurs within the growth boundary of that community. This percentage is then used as a basis for determining the amount of forecasted economic activity that will occur in that area.

The complete County Growth Area/Growth Allocation & TAZ Equivalence chart is included as **Attachment A**. The complete Municipal Growth Area/Growth Allocation & TAZ Equivalence chart is included as **Attachment B**.

Residential Growth

Residential growth is expressed in Dwelling Units and is measured in 5-year increments from 2025 - 2050, with totals included for 2023-2035, and 2023 – 2050. These numbers represent incremental gains in the number of additional dwelling units in that jurisdiction during each 5-year period. The total, therefore, represents the number of new dwelling units developed within the study period 2023-2050. Residential growth estimates are based upon the Livable Frederick Master Plan's Development Framework, Municipal Comprehensive Plans, internal staff discussion regarding growth allocation policies, and the Round 10.0 MWCOG Cooperative Forecast (June 2023).

For County CGAs, although there are variations, the 2023-2025 increment assumes development of approximately 10% of the total 2023-2035 growth, the 2025-2030 increment assumes development of approximately 40% of the total 2023-2035 growth, and the 2030-2035 increment assumes development of approximately 50% of the total growth between 2023 and 2035.

The 2035-2040 increment assumes development of approximately 40% of the total 2035-2050 growth, the 2040-2045 increment assumes development of approximately 20% of the total 2035-2050 growth, and the 2045-2050 increment assumes development of approximately 20% of the total growth between 2035 and 2050.

For Municipal CGAs, although there are variations, the 2023-2025 increment assumes no development of the 2023-2035 growth total, the 2025-2030 increment assumes development of approximately 40% of the total 2023-2035 growth, and the 2030-2035 increment assumes development of approximately 60% of the total growth between 2023 and 2035.

The 2035-2040 increment assumes development of approximately 50% of the total 2035-2050 growth, the 2040-2045 increment assumes no development of the 2035-2050 growth total, and the 2045-2050 increment assumes development of approximately 50% of the total growth between 2035 and 2050.

Employment Growth

Employment growth represents economic development and is expressed in terms of Equivalent Dwelling Units (EDUs) for the purpose of estimating water/sewer impacts over the term of the study period. When necessary to break the total into modeled increments, the same generalized growth rates for each increment that have been established for residential activity may be used (see Residential Growth above).

For all CGAs, employment growth is presented as a total from 2025 - 2035 and is further measured in 5-year increments from 2035 - 2050. These numbers represent incremental gains in the number of additional EDUs in that jurisdiction during each 5-year period. Negative values for EDUs indicate a shift in the economic character of some portion of the jobs in a particular TAZ, and do not generally indicate net job losses in that CGA or in the County overall.

Employment growth for all CGAs is calculated using four economic sectors defined in the Regional Cooperative Forecast methodology. Retail EDUs are generated (or lost) through shifts in retail activity and use an average of 0.18 EDU/Job. Office EDUs are generated (or lost) through shifts in office activity and use an average of 0.052 EDU/Job. Industrial EDUs are generated (or lost) through shifts in industrial activity and use an average of 0.14 EDU/Job. Any remaining employment EDUs are generated (or lost) through shifts in the economic activity category defined as 'Other' and use an average of 0.25 EDU/Job.

All Municipal employment growth is anticipated by 2035. Therefore, the same growth projections are used for both the 2035- and 2050-time step.

The summarized projected drinking water growth in EDUs is shown in **Table 1**, and **Table 2**. System growth in 2035 represents total cumulative growth from 2025 – 2035. System growth in 2050 represents cumulative system growth from 2025 – 2050.

Table 1. County Service Area Drinking Water Growth Projection (EDU)

	2035			2050		
Service Area	Residential	Employment	Total	Residential	Employment	Total
Rosemont	0.00	0.00	0.00	0.00	0.00	0.00
Copperfield	35.00	7.00	42.00	165.00	17.00	182.00
Cambridge Farms	0.00	0.00	0.00	0.00	0.00	0.00
Fountaindale South	105.00	-7.00	98.00	275.00	6.00	281.00
White Rock	0.00	0.00	0.00	0.00	0.00	0.00
Samhill Estates	0.00	0.00	0.00	0.00	0.00	0.00
Bradford	0.00	0.00	0.00	0.00	0.00	0.00
Knolls of Windsor	0.00	0.00	0.00	0.00	0.00	0.00
Libertytown West	340.00	10.00	350.00	460.00	18.00	478.00
Libertytown East	0.00	0.00	0.00	0.00	0.00	0.00
Waterside	0.00	0.00	0.00	0.00	0.00	0.00
Clover Hill	0.00	0.00	0.00	0.00	0.00	0.00
New Design	7,353.00	6,065.20	13,418.20	18,687.00	8,092.20	26,779.20
Total	7,833.00	6,075.20	13,908.20	19,587.00	8,133.20	27,720.20

Table 2. Municipal Service Area Drinking Water Growth Projection (EDU)

	2035			2050		
Service Area	Residential	Employment	Total	Residential	Employment	Total
Brunswick	490.00	33.70	523.70	982.00	33.70	1,015.70
Emmitsburg	530.00	3.90	533.90	1,050.00	3.90	1,053.90
Frederick	6,450.00	1,258.40	7,708.40	12,600.00	1,258.40	13,858.40
Middletown	265.00	21.40	286.40	425.00	21.40	446.40
Myersville	190.00	5.20	195.20	480.00	5.20	485.20
Mount Airy	40.00	26.70	66.70	90.00	26.70	116.70
Thurmont	580.00	66.30	646.30	1,080.00	66.30	1,146.30
Walkersville	200.00	36.70	236.70	725.00	36.70	761.70
Woodsboro	50.00	2.70	52.70	150.00	2.70	152.70
Total	8,795.00	1,455.00	10,250.00	17,582.00	1,455.00	19,037.00

The summarized projected wastewater growth in EDUs is shown in **Table 3**, and **Table 4.** System growth in 2035 represents total cumulative growth from 2025 – 2035. System growth in 2050 represents cumulative system growth from 2025 – 2050.

Table 3. County Service Area Wastewater Growth Projection (EDU)

	2035			2050		
Service Area	Residential	Employment	Total	Residential	Employment	Total
Lewistown	0.00	0.00	0.00	0.00	0.00	0.00
Crestview	0.00	0.00	0.00	0.00	0.00	0.00
White Rock	0.00	0.00	0.00	0.00	0.00	0.00
Fountaindale	105.00	-7.00	98.00	275.00	6.00	281.00
Pleasant Branch	0.00	0.00	0.00	0.00	0.00	0.00
Mill Bottom	0.00	0.00	0.00	0.00	0.00	0.00
Jefferson	35.00	7.00	42.00	165.00	17.00	182.00
Point of Rocks	85.00	4.00	89.00	235.00	14.00	249.00
Ballenger-McKinney	9,513.00	6,107.90	15,620.90	22,792.00	8,132.90	30,924.90
Knoxville New Addition	0.00	0.00	0.00	0.00	0.00	0.00
Total	9,738.00	6,111.90	15,849.90	23,467.00	8,169.90	31,636.90

Table 4. Municipal Service Area Wastewater Growth Projection (EDU)

	2035			2050		
Service Area	Residential	Employment	Total	Residential	Employment	Total
Brunswick	490.00	33.70	523.70	982.00	33.70	1,015.70
Emmitsburg	530.00	3.90	533.90	1,050.00	3.90	1,053.90
Frederick City	4,750.00	1,258.40	6,008.40	9,450.00	1,258.40	10,708.40
Middletown West	0.00	0.00	0.00	0.00	0.00	0.00
Middletown East	265.00	21.40	286.40	425.00	21.40	446.40
Myersville	190.00	5.20	195.20	480.00	5.20	485.20
Mount Airy	40.00	26.70	66.70	90.00	26.70	116.70
Thurmont	580.00	66.30	646.30	1,080.00	66.30	1,146.30
Woodsboro	50.00	2.70	52.70	150.00	2.70	152.70
Fort Detrick	0.00	0.00	0.00	0.00	0.00	0.00
Total	6,895.00	1,418.30	8,313.30	13,707.00	1,418.30	15,125.30

System Demand and Flow Projections

Methodology

The methodology used to predict future utilization is identical for both the drinking water and wastewater assessments. Water use and wastewater generation by existing development is assumed to be captured by the existing average flow experienced by each system. The impact of future residential development is tallied using the total number of new dwellings within a CGA. Municipal projections forecast changes in dwelling units and jobs through 2035; but only residential changes for the period 2035 – 2050. County projections forecast changes in dwelling units and jobs through both 2023 - 2035 and 2035 – 2050. The total number of new dwelling units in each growth area for target years 2035 and 2050 were developed and provided by Livable Frederick staff, as discussed in previous sections.

Drinking Water

The impact of future development on the drinking water system is quantified using the total number of EDUs multiplied by the equivalent of 250 gallons-per-day-per-dwelling (gpd per EDU). 250 gpd per EDU is used for planning purposes. While different household types or businesses may use more or less, this estimate is intentionally aggressive so that weaknesses or inadequacies in the systems can be identified.

In accordance with the Water & Sewerage Plan, water systems must have adequate source water and treatment capacity to be able to meet the maximum day demand (MDD). The maximum day demand is the day (24-hour period) with the highest demand within a calendar year. The MDD is determined by multiplying the average daily demand (ADD) by a peak factor. ADD is calculated by adding the total demand on the water system and dividing by the number of days. A peak factor was determined for each service area by comparing the existing ADD to the existing MDD. Livable Frederick staff directed Dewberry to apply the calculated peak factor for the New Design service area to all service areas. Therefore, for all service areas, a peak factor of 1.88 is used.

The existing drinking water ADD, and projected MDD in million gallons per day (MGD) is shown in **Table 5**, and **Table 6**.

The existing average demands for County systems represent the average of 2021 - 2023 water treatment plant (WTP) flow data, unless otherwise noted in the WRE, which was provided by the Frederick County Division of Water and Sewer Utilities (DWSU). Demands for Municipal systems were provided by the respective Municipality.

Table 5. County Service Area Drinking Water Demand Projection (MGD)

Service Area	Existing Average Daily Demand	2035 Maximum Day Demand	2050 Maximum Day Demand
Rosemont	0.010	0.023	0.024
Copperfield	0.046	0.106	0.172
Cambridge Farms	0.042	0.078	0.078
Fountaindale/Braddock	0.167	0.360	0.446
White Rock	0.022	0.041	0.041
Samhill Estates	0.088	0.165	0.165
Bradford Estates	0.012	0.023	0.023
Knolls of Windsor	0.066	0.124	0.124
Libertytown West	0.003	0.170	0.231
Libertytown East	0.007	0.013	0.013
New Design	6.537	18.596	24.876
Total	7.000	19.700	26.194

Table 6. Municipal Service Area Drinking Water Demand Projection (MGD)

Service Area	Existing Average Daily Demand	2035 Maximum Day Demand	2050 Maximum Day Demand
Brunswick	0.596	1.367	1.598
Emmitsburg	0.243	0.708	0.952
Frederick	6.270	15.411	18.301
Middletown	0.308	0.714	0.789
Myersville	0.115	0.308	0.444
Mount Airy	0.704	1.355	1.378
Thurmont	0.426	1.105	1.340
Walkersville	0.635	1.305	1.552
Woodsboro	0.085	0.185	0.232
Total	9.382	22.456	26.586

The water demands for the Mount Airy WTP were provided by municipal staff and received March 26, 2024. The water demands for the Woodsboro WTP were not provided, and the average demand was obtained from the Frederick County Water & Sewerage Plan - Approved - February 2, 2021 (as amended August 25, 2023) - Table 3.04. The existing average demand for the Emmitsburg Service Area reflects 2023 average demands due to a leak repaired in 2022. Demand has since decreased; therefore, 2021 and 2022 demands were removed as they were believed to be erroneously indicative of excess demand.

Wastewater

The impact of future development on the wastewater system is quantified using the total number of EDUs multiplied by the equivalent of 250 gpd per EDU. 250 gpd per EDU is used for planning purposes. While different household types or businesses may use more or less, this estimate is intentionally aggressive so that weaknesses or inadequacies in the systems can be identified.

The summarized projected average daily wastewater flow in MGD is shown in **Table 7**, and **Table 8**.

The existing average flows for County systems represent the average of 2021 - 2023 wastewater treatment plant (WWTP) flow data, which was provided by the Frederick County DWSU. Flows for Municipal systems were provided by the respective Municipality. Flows for Fort Detrick were provided by Garrison personnel.

Table 7. County Service Area Wastewater Flow Projection (MGD)

Service Area	Existing Average Daily Flow	2035 Average Daily Flow	2050 Average Daily Flow
Lewistown	0.002	0.012	0.015
Crestview	0.018	0.018	0.018
White Rock	0.010	0.010	0.010
Fountaindale	0.107	0.132	0.177
Pleasant Branch	0.055	0.055	0.055
Mill Bottom	0.066	0.066	0.066
Jefferson	0.137	0.148	0.183
Point of Rocks	0.095	0.117	0.157
Ballenger-McKinney	7.340	11.245	15.071
Knoxville New Addition	0.030	0.032	0.035
Total	7.860	11.823	15.787

Table 8. Municipal Service Area Wastewater Flow Projection (MGD)

Service Area	Existing Average Daily Flow	2035 Average Daily Flow	2050 Average Daily Flow
Brunswick	0.687	0.818	0.941
Emmitsburg	0.501	0.634	0.764
Frederick City	5.810	7.312	8.487
Middletown West	0.192	0.192	0.192
Middletown East	0.247	0.319	0.359
Myersville	0.132	0.181	0.253
Mount Airy	0.732	0.749	0.761
Thurmont	0.555	0.717	0.842
Woodsboro	0.077	0.090	0.115
Fort Detrick	0.770	0.770	0.770
Total	9.703	11.781	13.484

Capacity Projections

Drinking Water

To evaluate the remaining capacity of existing ground and surface water systems as they relate to planned growth, Dewberry compared the existing maximum day permit withdrawal limits, to the MDD projections discussed in previous sections. The remaining permitted withdrawal capacity in MGD is shown in **Table 9,** and **Table 10**. The permitted withdrawal information was obtained from the Frederick County Water & Sewerage Plan - Approved - February 2, 2021 (as amended August 25, 2023) - Table 3.04.

Water for the Rosemont Service Area is supplied by the City of Brunswick, the maximum withdrawal reflects the Rosemont Water and Sewer Service Area Agreement. The Copperfield permitted withdrawal allocation includes approved allocations for the Woodbourne Manor Wells including permit numbers FR2004G103(02) & FR2004G003(02). The Libertytown Apartments withdrawal allocation includes approved allocations for the Mill Creek and Mayne Wells including permit numbers are FR2013G004(01) and FR2006G004(06).

Table 9. County Service Area Permitted Withdrawal Capacity (MGD)

Water Treatment Facility	Maximum Day Permitted Withdrawal	Remaining Max Day Permitted Withdrawal Capacity 2035	Remaining Max Day Permitted Withdrawal Capacity 2050
Rosemont	0.060	0.037	0.036
Copperfield	0.124	0.017	***-0.048***
Cambridge Farms	0.100	0.022	0.022
Fountaindale	0.420	0.060	***-0.026***
White Rock	0.045	0.004	0.004
Samhill Estates	0.260	0.095	0.095
Bradford	0.028	0.005	0.005
Knolls of Windsor	0.177	0.053	0.053
Libertytown West	0.147	***-0.023***	***-0.083***
Libertytown East	0.024	0.011	0.011
New Design	26.000	7.404	1.124
Total	27.385	7.684	1.191

Based on these calculations, the Libertytown West system withdrawal capacity will be exceeded in the 2035-time step, and the Copperfield, and Fountaindale withdrawal capacity will be exceeded in the 2050-time step. All other facilities have adequate permitted withdrawal capacity for the duration of the planning horizon.

Table 10. Municipal Service Area Permitted Withdrawal Capacity (MGD)

Water Treatment Facility	Maximum Day Permitted Withdrawal	Remaining Max Day Permitted Withdrawal Capacity 2035	Remaining Max Day Permitted Withdrawal Capacity 2050
Brunswick	2.000	0.633	0.402
Emmitsburg	0.994	0.286	0.042
Frederick	19.344	3.933	1.043
Middletown	0.504	***-0.210***	***-0.285***
Myersville	0.481	0.173	0.036
Mount Airy	1.387	0.032	0.008
Thurmont	1.209	0.104	***-0.131***
Walkersville	1.500	0.195	***-0.052***
Woodsboro	0.178	***-0.006***	***-0.053***
Total	27.596	5.141	1.011

Based on these calculations, the Middletown, and Woodsboro system withdrawal capacities will be exceeded in the 2035-time step, and the Thurmont and Walkersville withdrawal capacities will be exceeded in the 2050-time step. All other systems have adequate permit withdrawal capacity for the duration of the planning horizon.

Although there are systems that are projected to exceed the permitted withdrawal capacity during the planning horizon, the overall permitted withdrawal will not be exceeded during the planning horizon, therefore no environmental impacts are anticipated. Where a system does exceed withdrawal capacity, permit limits should be reviewed and increased, or infrastructure improvements should be implemented to convey capacity from a system with additional capacity. Potential alternatives for systems approaching capacity thresholds are discussed within the Water Resources Element.

Wastewater

To evaluate the remaining capacity of existing wastewater systems as they relate to planned growth, Dewberry compared the existing permit discharge limits to the average daily flow (ADF) projections discussed in previous sections. The remaining permitted discharge capacity in MGD is shown in **Table 11,** and **Table 12**. The permitted discharge capacity information was obtained from the Frederick County Water & Sewerage Plan - Approved - February 2, 2021 (as amended August 25, 2023) - Table 3.04.

The Knoxville-New Addition Service Area is served by the City of Brunswick. The permit capacity reflects the Brunswick and Frederick County Operational Agreement dated August 26, 1993, as amended March 9, 2020.

Table 11. County Service Area Wastewater Permitted Discharge Capacity (MGD)

Wastewater Treatment Facility	Receiving Stream	Existing Permit Capacity	Remaining Permit Capacity 2035	Remaining Permit Capacity 2050
Lewistown	Fishing Creek	0.027	0.015	0.012
Crestview	Muddy Run	0.036	0.018	0.018
White Rock	Tributary of Tuscarora Creek	0.050	0.040	0.040
Fountaindale	Hollow Creek	0.200	0.069	0.023
Pleasant Branch	Tributary of Bennett Creek	0.100	0.045	0.045
Mill Bottom	Bush Creek	0.100	0.034	0.034
Jefferson	Catoctin Creek	0.300	0.153	0.118
Point of Rocks	Potomac River	0.230	0.113	0.073
Ballenger-McKinney	Monocacy River	15.000	3.755	***-0.071***
Knoxville New Addition	-	0.100	0.068	0.065
Total	-	16.143	4.309	0.356

Based on these calculations, the Ballenger-McKinney permit capacity will be exceeded in the 2050-time step. All other County facilities have adequate permit discharge capacity for the duration of the planning horizon.

Table 12. Municipal Service Area Wastewater Permitted Discharge Capacity (MGD)

Wastewater Treatment Facility	Receiving Stream	Existing Permit Capacity	Remaining Permit Capacity 2035	Remaining Permit Capacity 2050
Brunswick	Potomac River	1.400	0.582	0.459
Emmitsburg	Toms Creek	0.750	0.116	***-0.014***
Frederick City	Monocacy River	8.000	0.688	***-0.487***
Middletown West	Catoctin Creek	0.250	0.058	0.058
Middletown East	Hollow Creek	0.250	***-0.069***	***-0.109***
Myersville	Grindstone Run	0.300	0.119	0.047
Mount Airy	Patapsco River	1.200	0.451	0.439
Thurmont	Hunting Creek	1.000	0.283	0.158
Woodsboro	Israel Creek	0.250	0.160	0.135
Fort Detrick	Toms Creek Tributary	2.000	1.230	1.230
Total	-	15.400	3.619	1.916

Based on these calculations, the Middletown East permit capacity will be exceeded in the 2035-time step, and the Emmitsburg, and Frederick City permit capacities will be exceeded in the 2050-time step. All other Municipal Service Areas have adequate permit discharge capacity for the duration of the planning period.

Although there are systems that are projected to exceed the permitted discharge capacity during the planning horizon, the overall permitted withdrawal will not be exceed during the planning horizon, therefore no environmental impacts are anticipated. Where a system does exceed discharge capacity, permit limits should be reviewed and increased, or infrastructure improvements should be implemented to convey flows to an adjacent system with additional capacity. Potential alternatives for systems approaching capacity thresholds are discussed within the Water Resources Element.

Attachments

Attachment A: Non-Municipal Growth Area/Growth Allocation & TAZ Equivalence Chart
Attachment B: Municipal Growth Area/Growth Allocation & TAZ Equivalence Chart

Attachment A

Non-Municipal Growth Area/Growth Allocation & TAZ Equivalence Chart

County Service Area - New Dwellings Planned For Growth Area 2023-2035 (DU's)								
Growth Area	Taz	Water Service Area	Sewer Service Area	% Taz	2025	2030	2035	2035 Total
Adamstown	2942	New Design	Ballenger-McKinney	30%	11	44	60	115
Adamstown	2945	New Design	Ballenger-McKinney	5%	0	0	0	0
Ballenger Creek North	2933	New Design	Ballenger-McKinney	25%	6	26	35	67
Ballenger Creek North	2937	New Design	Ballenger-McKinney	50%	0	0	3	3
Ballenger Creek North	2938	New Design	Ballenger-McKinney	65%	17	63	83	163
Buckeystown	2943	New Design	Ballenger-McKinney	15%	1	4	5	10
Buckeystown	2945	New Design	Ballenger-McKinney	5%	0	0	0	0
Eastalco/Quantum Loophole	2940	New Design	Ballenger-McKinney	25%	3	13	17	33
Eastalco/Quantum Loophole	2942	New Design	Ballenger-McKinney	15%	5	24	28	57
Eastalco/Quantum Loophole	2943	New Design	Ballenger-McKinney	10%	0	2	3	5
Fountaindale/Braddock Heights	2828	Fountaindale South	Fountaindale	10%	1	2	4	7
Fountaindale/Braddock Heights	2829	Fountaindale South	Fountaindale	40%	6	27	33	66
Fountaindale/Braddock Heights	2836	Fountaindale South	Fountaindale	35%	3	13	16	32
Jefferson	2826	Copperfield	Jefferson	15%	2	5	6	13
Jefferson	2941	Copperfield	Jefferson	10%	2	4	6	12
Jefferson	2949	Copperfield	Jefferson	5%	2	3	5	10
Libertytown	2873	Libertytown West	Ballenger-McKinney	15%	2	2	3	7
Libertytown	2876	Libertytown West	Ballenger-McKinney	35%	2	50	128	180
Libertytown	2882	Libertytown West	Ballenger-McKinney	25%	1	48	100	149
Libertytown	2892	Libertytown West	Ballenger-McKinney	15%	0	2	2	4
Linganore-Holly Hills-Spring Ridge-Bartonsville	2910	New Design	Ballenger-McKinney	75%	36	73	73	182
Linganore-Holly Hills-Spring Ridge-Bartonsville	2913	New Design	Ballenger-McKinney	75%	0	6	12	18
Linganore-Holly Hills-Spring Ridge-Bartonsville	2915	New Design	Ballenger-McKinney	100%	19	45	45	109
Linganore-Holly Hills-Spring Ridge-Bartonsville	2909	New Design	Ballenger-McKinney	100%	86	160	160	406
Linganore-Holly Hills-Spring Ridge-Bartonsville	2916	New Design	Ballenger-McKinney	75%	87	170	170	427
Linganore-Holly Hills-Spring Ridge-Bartonsville	2884	New Design	Ballenger-McKinney	100%	43	80	80	203
Linganore-Holly Hills-Spring Ridge-Bartonsville	2883	New Design	Ballenger-McKinney	75%	33	55	55	143
Linganore-Holly Hills-Spring Ridge-Bartonsville	2885	New Design	Ballenger-McKinney	10%	2	5	5	12
Monrovia	2903	New Design	Ballenger-McKinney	5%	1	2	3	6
Monrovia	2905	New Design	Ballenger-McKinney	25%	4	14	16	34
Monrovia	2906	New Design	Ballenger-McKinney	35%	0	0	0	0
Point of Rocks	2947	New Design	Point of Rocks	10%	1	3	4	8
Point of Rocks	2948	New Design	Point of Rocks	25%	7	25	31	63
Point of Rocks	2949	New Design	Point of Rocks	5%	0	3	5	8
Point of Rocks	2941	New Design	Point of Rocks	5%	0	2	4	6
South Frederick Corridors	2935	New Design	Ballenger-McKinney	100%	100	400	505	1,005
South Frederick Corridors	2914	New Design	Ballenger-McKinney	60%	50	195	250	495
South Frederick Corridors	2936	New Design	Ballenger-McKinney	100%	80	320	400	800
South Frederick Corridors	2937	New Design	Ballenger-McKinney	50%	15	60	75	150
South Frederick Corridors	2943	New Design	Ballenger-McKinney	40%	0	20	30	50
Urbana Corridors	2911	New Design	Ballenger-McKinney	75%	0	200	300	500
Urbana Corridors	2899	New Design	Ballenger-McKinney	100%	25	0	100	125
Urbana Corridors	2900	New Design	Ballenger-McKinney	100%	0	50	200	250
Urbana Corridors	2901	New Design	Ballenger-McKinney	100%	90	60	0	150
Urbana Corridors	2902	New Design	Ballenger-McKinney	100%	0	0	150	150
Urbana Corridors	2903	New Design	Ballenger-McKinney	20%	0	100	250	350
Urbana Corridors	2906	New Design	Ballenger-McKinney	20%	0	100	225	325
Feagaville/Mt. Zion Road	2939	New Design	Ballenger-McKinney	80%	0	0	0	0
Walkersville	2860	-	Ballenger-McKinney	5%	0	0	0	0
Walkersville	2878	-	Ballenger-McKinney	35%	0	0	0	0
Walkersville	2859	-	Ballenger-McKinney	70%	0	0	0	0
Walkersville	2879	-	Ballenger-McKinney	100%	5	25	175	205
New Market	2887	New Design	Ballenger-McKinney	5%	0	200	200	400
New Market	2886	New Design	Ballenger-McKinney	100%	0	10	15	25
New Market	2885	New Design	Ballenger-McKinney	50%	0	200	200	400
New Market	2909	New Design	Ballenger-McKinney	10%	0	50	50	100
New Market	2908	New Design	Ballenger-McKinney	25%	0	0	0	0
Frederick (City)	2841	-	Ballenger-McKinney	100%	0	50	100	150
Frederick (City)	2842	-	Ballenger-McKinney	75%	0	50	100	150
Frederick (City)	2843	-	Ballenger-McKinney	45%	0	100	300	400
Frederick (City)	2858	-	Ballenger-McKinney	100%	0	100	300	400
Frederick (City)	2914	-	Ballenger-McKinney	5%	0	50	50	100
Frederick (City)	2919	-	Ballenger-McKinney	100%	0	50	100	150
Frederick (City)	2920	-	Ballenger-McKinney	100%	0	0	50	50
Frederick (City)	2932	-	Ballenger-McKinney	100%	0	0	100	100
Frederick (City)	2859	-	Ballenger-McKinney	10%	0	100	100	200

1. Hyphenated columns for Walkersville and Frederick City are served by municipal systems and are included in projections in Appendix B

County Service Area - New Dwellings Planned For Growth Area 2040 - 2050 (DU's)						
Growth Area	**Water Service Area**	**Sewer Service Area**	**2040**	**2045**	**2050**	**2050 Total**
Adamstown	New Design	Ballenger-McKinney	30	35	35	215
Ballenger Creek North	New Design	Ballenger-McKinney	200	90	160	683
Buckeystown	New Design	Ballenger-McKinney	5	6	6	27
Eastalco/Quantum Loophole	New Design	Ballenger-McKinney	40	70	50	255
Fountaindale/Braddock Heights	Fountaindale South	Fountaindale	25	45	100	275
Jefferson	Copperfield	Jefferson	45	45	40	165
Libertytown	Libertytown West	Ballenger-McKinney	40	40	40	460
Linganore-Holly Hills-Spring Ridge-Bartonsville	New Design	Ballenger-McKinney	350	250	150	2,250
Monrovia	New Design	Ballenger-McKinney	25	50	25	140
Point of Rocks	New Design	Point of Rocks	30	60	60	235
South Frederick Corridors	New Design	Ballenger-McKinney	3,000	2,000	2,500	10,000
Urbana Corridors	New Design	Ballenger-McKinney	450	350	350	3,000
Feagaville/Mt. Zion Road	New Design	Ballenger-McKinney	32	0	0	32
Walkersville	-	Ballenger-McKinney	260	0	265	730
New Market	New Design	Ballenger-McKinney	460	0	465	1,850
Frederick (City)	-	Ballenger-McKinney	650	0	800	3,150

1. Hyphenated columns for Walkersville and Frederick City are served by municipal systems and are included in projections in Appendix B

2. 2050 Total DUs are inclusive of 2025 - 2035

County Service Area - Employment Growth by 2025 - 2050 (EDU's)							
Growth Area	**Water Service Area**	**Sewer Service Area**	**2025-2035**	**2040**	**2045**	**2050**	**Total**
Adamstown	New Design	Ballenger-McKinney	4.0	2.0	2.0	2.0	10.0
Ballenger Creek North	New Design	Ballenger-McKinney	-10.0	23.0	14.0	23.0	50.0
Buckeystown	New Design	Ballenger-McKinney	6.0	3.0	1.0	6.0	16.0
Eastalco/Quantum Loophole	New Design	Ballenger-McKinney	5,210.0	8.0	6.0	13.0	5,237.0
Fountaindale/Braddock Heights	Fountaindale South	Fountaindale	-7.0	4.0	4.0	5.0	6.0
Jefferson	Copperfield	Jefferson	7.0	3.0	4.0	3.0	17.0
Libertytown	Libertytown West	Ballenger-McKinney	10.0	3.0	3.0	2.0	18.0
Linganore-Holly Hills-Spring Ridge-Bartonsville	New Design	Ballenger-McKinney	49.0	29.0	55.0	16.0	149.0
Monrovia	New Design	Ballenger-McKinney	7.0	5.0	4.0	4.0	20.0
Point of Rocks	New Design	Point of Rocks	4.0	3.0	4.0	3.0	14.0
South Frederick Corridors	New Design	Ballenger-McKinney	-14.0	355.0	270.0	448.0	1,059.0
Walkersville	-	Ballenger-McKinney	36.7	0.0	0.0	0.0	36.7
New Market	New Design	Ballenger-McKinney	43.2	0.0	0.0	0.0	43.2
Urbana Corridors	New Design	Ballenger-McKinney	667.0	252.0	269.0	135.0	1,323.0
Feagaville/Mt. Zion Road	New Design	Ballenger-McKinney	99.0	20.0	25.0	27.0	171.0

1. Hyphenated Walkersville water column is served by a municipal system projected in Appendix B

Attachment B

Municipal Growth Area/Growth Allocation & TAZ Equivalence Chart

Municipal Service Area - New Dwellings Planned For Growth Area 2023-2050 (DU's)										
Growth Area	Taz	Water Service Area	Sewer Service Area	% Taz	2030	2035	2035 Total	2040	2050	2050 Total
Emmitsburg	2869	Emmitsburg	Emmitsburg	50%	100	180	280	125	135	540
Emmitsburg	2868	Emmitsburg	Emmitsburg	50%	150	100	250	125	135	510
Emmitsburg	2871	Emmitsburg	Emmitsburg	5%	0	0	0	0	0	0
Emmitsburg	2870	Emmitsburg	Emmitsburg	10%	0	0	0	0	0	0
Thurmont	2851	Thurmont	Thurmont	75%	0	10	10	5	5	20
Thurmont	2865	Thurmont	Thurmont	50%	100	170	270	100	100	470
Thurmont	2854	Thurmont	Thurmont	5%	0	0	0	25	0	25
Thurmont	2852	Thurmont	Thurmont	75%	150	150	300	100	165	565
Myersville	2948	Myersville	Myersville	100%	30	80	110	80	80	270
Myersville	2949	Myersville	Myersville	35%	30	50	80	80	50	210
Woodsboro	2860	Woodsboro	Woodsboro	5%	5	20	25	25	25	75
Woodsboro	2877	Woodsboro	Woodsboro	10%	5	20	25	25	25	75
Walkersville	2860	Walkersville	-	5%	0	0	0	10	10	20
Walkersville	2878	Walkersville	-	35%	0	0	0	25	30	55
Walkersville	2859	Walkersville	-	70%	0	0	0	0	0	0
Walkersville	2879	Walkersville	-	100%	25	175	200	225	225	650
Middletown	2831	Middletown	Middletown East	60%	75	75	150	50	50	250
Middletown	2833	Middletown	Middletown East	65%	50	50	100	25	25	150
Middletown	2824	Middletown	Middletown East	50%	0	0	0	0	0	0
Middletown	2829	Middletown	Middletown East	65%	10	5	15	5	5	25
Mount Airy	2895	Mount Airy	Mount Airy	40%	15	25	40	25	25	90
Brunswick	2820	Brunswick	Brunswick	75%	250	240	490	250	242	982
Rosemont	2821	Brunswick	Brunswick	20%	0	0	0	0	0	0
Rosemont	2820	Brunswick	Brunswick	10%	0	0	0	0	0	0
Burkittsville	2825	-	-	5%	0	0	0	0	0	0
Burkittsville	2822	-	-	5%	0	0	0	0	0	0
New Market	2887	-	-	5%	200	200	400	200	200	800
New Market	2886	-	-	100%	10	15	25	10	15	50
New Market	2885	-	-	50%	200	200	400	200	200	800
New Market	2909	-	-	10%	50	50	100	50	50	200
New Market	2908	-	-	25%	0	0	0	0	0	0
Frederick (City)	2834	Frederick	Frederick City	5%	250	250	500	100	100	700
Frederick (City)	2837	Frederick	Frederick City	100%	50	100	150	100	100	350
Frederick (City)	2838	Frederick	Frederick City	100%	200	200	400	200	200	800
Frederick (City)	2839	Frederick	Frederick City	100%	200	200	400	200	200	800
Frederick (City)	2840	Frederick	Frederick City	75%	100	50	150	50	50	250
Frederick (City)	2841	Frederick	-	100%	50	100	150	100	100	350
Frederick (City)	2842	Frederick	-	75%	50	100	150	100	100	350
Frederick (City)	2843	Frederick	-	45%	100	300	400	100	100	600
Frederick (City)	2858	Frederick	-	100%	100	300	400	100	100	600
Frederick (City)	2880	Frederick	Frederick City	35%	150	200	350	100	100	550
Frederick (City)	2914	Frederick	-	5%	50	50	100	50	50	200
Frederick (City)	2916	Frederick	Frederick City	10%	50	50	100	50	50	200
Frederick (City)	2917	Frederick	Frederick City	100%	200	200	400	200	200	800
Frederick (City)	2918	Frederick	Frederick City	100%	200	200	400	200	200	800
Frederick (City)	2919	Frederick	-	100%	50	100	150	50	100	300
Frederick (City)	2920	Frederick	-	100%	0	50	50	50	50	150
Frederick (City)	2921	Frederick	Frederick City	100%	0	50	50	50	50	150
Frederick (City)	2922	Frederick	Frederick City	100%	25	75	100	75	75	250
Frederick (City)	2923	Frederick	Frederick City	100%	25	75	100	75	75	250
Frederick (City)	2924	Frederick	Frederick City	100%	100	150	250	150	150	550
Frederick (City)	2925	Frederick	Frederick City	100%	100	150	250	150	150	550
Frederick (City)	2926	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2927	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2928	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2929	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2930	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2931	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2932	Frederick	-	100%	0	100	100	0	100	200
Frederick (City)	2933	Frederick	Frederick City	15%	50	50	100	50	50	200
Frederick (City)	2934	Frederick	Frederick City	100%	50	50	100	50	50	200
Frederick (City)	2835	Frederick	Frederick City	10%	100	150	250	150	150	550
Frederick (City)	2913	Frederick	Frederick City	10%	0	50	50	50	50	150
Frederick (City)	2915	Frederick	Frederick City	10%	0	50	50	50	50	150
Frederick (City)	2859	Frederick	-	10%	100	100	200	100	100	400

1. 2030 EDUs are inclusive of 2025

2. 2050 EDUs are inclusive of 2045

3. Hyphenated columns for Walkersville, Frederick City, and New Market are served by County systems and included in projections in Appendix A

Municipal Service Area - Employment Growth by 2035 (EDU's)							
Growth Area	Water Service Area	Sewer Service Area	Retail	Office	Industrial	Other	Total
Emmitsburg	Emmitsburg	Emmitsburg	-1.1	8.1	-2.8	-0.3	3.9
Thurmont	Thurmont	Thurmont	42.1	-7.1	49.1	-17.8	66.3
Myersville	Myersville	Myersville	-20.7	-1.6	39.3	-11.8	5.2
Woodsboro	Woodsboro	Woodsboro	-0.2	-0.2	1.1	2.0	2.7
Walkersville	Walkersville	-	-23.0	-0.3	86.8	-26.8	36.7
Middletown	Middletown	Middletown East	-0.2	5.9	-4.1	19.8	21.4
Mount Airy	Mount Airy	Mount Airy	-13.1	-0.2	3.5	36.5	26.7
Brunswick	Brunswick	Brunswick	11.2	2.2	2.7	15.0	31.1
Rosemont	Brunswick	Brunswick	0.0	0.3	0.0	2.3	2.6
Burkittsville	-	-	-0.2	0.1	0.0	0.8	0.7
New Market	-	-	7.9	-1.6	-1.4	38.3	43.2
Frederick (City)	Frederick	Frederick City	428.6	216.7	275.9	337.2	1,258.4

1. Hyphenated columns for Walkersville and New Market are served by County systems and included in projections in Appendix A

Division of
Planning and Permitting

Livable Frederick Planning and Design Office

Frederick County
Government Maryland