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1.0 INTRODUCTION

In 2006, communities in the Upper Shenandoah River Basin began exploring options to begin working regionally in order to complete the requirements in conjunction with 9 VAC 25-780, Local and Regional Water Supply Planning. This requirement provides guidance to localities in developing a Water Supply Plan – a regulation that became mandated to all localities by the General Assembly. The final regulations became effective November 2, 2005 and made provisions for all localities electing to participate in a regional water supply planning effort to submit plans to the Department of Environmental Quality no later than November 2, 2011.

In early 2006, sub-regional groups began forming in the Upper Shenandoah Basin communities where Augusta-Staunton-Waynesboro formed one regional entity and Rockingham-Harrisonburg formed a separate one. During the summer of 2006, grants were announced to assist with assuming the cost of localities to do water supply planning work. The CSPDC was awarded a $50,000 for FY 2007 to perform water supply work. By this time, it had become evident to Upper Shenandoah Basin communities that in order to develop the best comprehensive planning document and also to make best use of fiscal resources, it made sense to join both groups to form one regional group. This provided a strong regional group that coincided with the political boundaries of the Upper Shenandoah Basin communities that fall within the service area of the Central Shenandoah Planning District Commission. During the late summer/early autumn, the many towns were invited to the regional table as they fell within the regulation to develop and maintain their individual or regional water supply plans.

Incorporated communities within the Upper Shenandoah Basin Planning Area:

- Augusta County
- Town of Bridgewater
- Town of Broadway
- Town of Craigsville
- Town of Dayton
- Town of Elkton
- Town of Grottoes
- City of Harrisonburg
- Town of Mount Crawford
- Rockingham County
- City of Staunton
- Town of Timberville
- City of Waynesboro

The staff of the CSPDC, DEQ and the localities within the planning area worked closely together to provide the necessary data and analysis to comply with the regulation. This Plan represents the compilation of these efforts.

Other Water Planning Efforts

At the same time the Upper Shenandoah Communities were forming a working committee or Technical Advisory Committee (TAC), there were water supply planning efforts underway on regional, sub-regional and macro-regional levels through the Shenandoah River Basin. The USGS is currently conducting a Minimum In-stream Flow (MIF) study of the South Fork of the Shenandoah River. The study is scheduled for completion in September 2010.

USGS has already completed a MIF for the North Fork of the Shenandoah River which covers the northernmost portion of Rockingham County. The majority of the planning area for this water supply plan falls within the watershed boundary of the South Fork Shenandoah River. With the MIF scheduled for completion in 2010, there was little information that could currently be utilized and integrated into the planning document. However, this report will be helpful in future updates/review of the water supply planning effort.

Currently underway on a macro-regional level is the Shenandoah Basin Water Strategic Plan that is being managed by the Northern Shenandoah Valley Regional Commission (NSVRC). There is great benefit to regional discussions regarding water resources throughout the basin as both the northern valley and central valley will be competing for water resources out of the same river particularly in an era of rapid growth for many localities within the planning area. However, while our localities are committed to participating in macro-regional discussions, and will continue to participate in the regional discussions of the Strategic Plan TAC and Policy Board, they are aware that the regulations that govern the development of the water supply plans are the foremost priority.

2.0 EXISTING WATER SOURCES (Section 70)

Section 70 requests localities within the planning area to submit information regarding their existing water sources, including groundwater, surface water reservoirs and stream intakes. Please note that all associated excel spreadsheets for Section 70 are attached as Appendix A and included on a cd at the back of this report.

2.1 Municipal Community Water Systems

For purposes of this plan, a community water system is one that is owned, operated, and/or maintained by a local government. Each community water system is described separately in the following sections. A summary table of publically-owned water systems in the planning region is provided in Table 2-1. Additional detailed water source information is included in Appendix A.

Table 2-1 Municipal Community Water Systems

Owner	Water System	Source
Augusta County	250 West Water	Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/North River Dam Interconnected System)
	Middlebrook	Groundwater – 1 well
	Augusta Springs	Groundwater – 1 well 1 Spring
	Blackburn	Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/North River Dam Interconnected System)
	Churchville	Groundwater – 5 wells
	Deerfield	Groundwater – 1 well 1 Spring
	Dooms	Groundwater – Vesper View well; Additional source water available from Waynesboro interconnection
	Estaline Valley	Purchased – Town of Craigsville (4 wells and 2 springs)
	Harriston (Harriston East Subdivision	Groundwater – 2 wells
	South River	Coles Run Reservoir, 6 groundwater wells
	Verona	Quick's Spring; Purchased water from City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/North River Dam Interconnected System)

Owner	Water System	Source
Augusta County	Weyer's Cave: Dice's Spring	Dice's Spring
Town of Bridgewater	Town of Bridgewater, Countryside Estates	North River
Town of Broadway	Town of Broadway	North Fork Shenandoah River/Linville Creek
Town of Craigsville	Town of Craigsville	Groundwater – 4 wells 2 springs
Town of Dayton	Town of Dayton	Groundwater – 2 wells Silver Lake Spring
Town of Elkton	Town of Elkton	Groundwater – 2 wells
Town of Grottoes	Town of Grottoes	Groundwater – 3 wells
City of Harrisonburg	City of Harrisonburg	Rawley Springs, Switzer Dam (Dry River intake) and North River
Rockingham County	Rosedale	Purchased water from Harrisonburg
	Harmany Hills	Purchased from City of Harrisonburg
	Mount Crawford	Owned by Town – water service provided and maintained by Rockingham County (South County system)
	RR Donnelly/Smith Creek	Purchased water from Harrisonburg
	Lilly Subdivision	Groundwater – 2 wells
City of Staunton	City of Staunton	Middle River, Gardner Spring and Elkhorn Lake/North River Dam (Interconnected System)
Town of Timberville	Town of Timberville	Groundwater – 2 wells 1 Spring
City of Waynesboro	City of Waynesboro	Groundwater – 3 wells

2.1.1 Augusta County (2006 Population: 70,910)

Public water and sewer service in Augusta County are provided by the Augusta County Service Authority (ACSA). The ACSA was chartered in March 1966 to centralize the provision of water and sewer service to County residents. As of June 30, 2006, the Service Authority's 101 employees served approximately 13,760 customers (14,188 water connections and 8,074 sewer connections). The number of active water and sewer accounts on 06/30/06 was approximately 13,900.

The water distribution system contains over 370 miles of water mains four inches and greater and approximately 1,826 fire hydrants. ACSA currently provides wastewater collection, conveyance (201 miles of mains 8" and up) and treatment through three (3) major facilities and six (6) smaller facilities. ACSA operates the Middle River Regional Wastewater Treatment Plant which is jointly owned with the City of Staunton. Other facilities operated by ACSA include the Augusta Regional Landfill and the Hugh Cassell school wastewater treatment plant.

The ACSA purchases water from the City of Staunton to supply several subdivisions in the County. These include:

- 250 West System
- Blackburn Community System
- South River System (in part)
- Verona System (in part)

The terms of the water purchase for these systems are defined in an Agreement between the City of Staunton and the Augusta County Service Authority dated August 22, 1992. (see Appendix B). The average annual water purchase from the City for all systems is approximately 1 mgd. It is stipulated in the contract that a maximum of 3 mgd are to be reserved for ACSA for the term of the agreement (January 1, 1997 through December 31, 2036).

The following is a description of the public water systems managed by the Augusta County Service Authority. The descriptions of these systems were found in the VDH Engineering Description Sheets, which are referenced at the end of each system description.

250 West System

The system's source is a purchase from the city of Staunton. Water service is provided to the Bon Lea subdivision just northwest of the city.

Middlebrook Community System

System Overview:
Middlebrook waterworks consists of a single drilled well, membrane filtration treatment, a 75,000-gallon gravity storage tank and approximately 2 miles of line located southwest of the City of Staunton.

Permitted capacity is based on storage capacity from 1977 permit. Storage from that time has since increased. However, the permitted system capacity cannot be changed without adding an additional source of supply. The permitted capacity is 19,600 gpd.

Source Water:
The source of supply for this waterworks is a drilled well 6 inches in diameter and 240 feet deep with casing and grout to 100 feet. The reliable well yield is unknown; however, from at least 1977 until 2006 a 7.5 hp pump, delivering 85 gpm, was utilized in the well. The source has been determined groundwater under the direct influence of surface water. Raw water is pumped from the well to the feed tank in the treatment building. (Virginia Department of Health, Engineering Description Sheet, September 21, 2007).

Augusta Springs Community System

System Overview:
The source for this system consists of a spring and well near northern-most intersection of Route 42 and Route 811. The permitted system capacity is limited by pumps and treatment capacity to 0.2448 MGD. The total source capacity, which cannot exceed the permitted capacity is 0.27776 MGD.

Source Water:
The spring, which is maintained as a back-up source, is located within the treatment building's fenced area. The spring is enclosed in a 3-foot diameter concrete cylinder and covered by a 24-inch square sealed and hinged aluminum shoebox-type access door with hasp and lock. The spring water flows by gravity from the spring to an adjacent 3-foot diameter manhole equipped as noted for the spring enclosure. The minimum reliable spring yield based upon historical records during drought conditions is 32,000 gpd. Water is pumped from this manhole through a 3-inch water line by a 3 hp submersible pump capable of delivering 104 gpm at a TDH of 21 feet to the membrane filter unit. The spring source has been determined to be groundwater under the direct influence of surface water (GUDI).

The well is located approximately 110 feet west of the water treatment building outside of the fenced area. The well is drilled to a depth of 147 feet, cased with 8-inch steel casing to a depth of 101 feet. The reliable well yield following a 140

hour yield test was 160 gpm. The well source has been determined to be groundwater under the direct influence of surface water (GUDI). (Virginia Department of Health, Engineering Description Sheet, February 15, 2008.

Per contract, ACSA can sell water from this system to the Town of Craigsville, at a max of 150,000 gpd. In addition, they can sell ACSA water for Augusta Springs (total for Augusta Springs including Estaline Valley is 75,000 gpd).

Blackburn Community System

System Overview:
The system is solely a metered purchase from the City of Staunton. This system is contained in the same contract with the 250 West System. The system also includes a booster pumping station and storage tank.

Churchville Community System

System Overview:
The Churchville system consists of 5 drilled wells, cartridge filtration and softening of Wells 1 & 2, and fluoridation and chlorination of Wells 1 through 4. A 500,000-gallon welded steel ground storage tank provides storage and pressure for the system. The design basis of this system is limited by the pumping capacities of Wells 1, 2, and 3 to 212,000 GPD.

Source Water:
Well No. 1: This well is 445 feet in depth, 15 inches in diameter to a depth of 38 feet, 12 inches in diameter from 38 to 119 feet, and $7^{7}/_{8}$ inches in diameter from 119 to 445 feet and is cased with 8-inch casing. A 72-hour pumping test of the well indicated a sustained yield of 94.3 GPM with a 356.45-foot drawdown. The pump was raised 80 feet and is now located at 365 feet. The well's discharge is metered within the treatment building. Provisions are made to discharge raw well water to waste at grade and each well has a separate meter. Water zones from 133 – 136 feet, 229 – 232 feet, 315 – 317 feet, and 351 – 354 feet.

Well No. 2: This well is 400 feet in depth, 10 inches in diameter to a depth of 115 feet, $8^{7}/_{8}$ inches in diameter from 115 to 168 feet, and 6 inches in diameter from 168 to 400 feet and is cased with 6-inch casing. The well is located on the south side of State Route 42 west of Churchville approximately ¼ mile east of its intersection with State Route 725. The well's discharge is metered within the treatment building. Provisions are made to discharge raw well water to waste at grade and each well has a separate meter. Water zones located at 235 feet and 261 – 263 feet.

Well No. 3: This well is 540 feet in depth, 8 inches in diameter, and is cased with 8-inch casing to a depth of 197 feet. A 100-hour pumping test of the well

indicated a sustained yield of 160 GPM with a 90.83-foot drawdown. Water is delivered from the well through 1,023 feet of 6-inch PVC pipe to the treatment building just to the south of the well. The well's discharge is metered within the treatment building.

Well No. 4: This well is 920 feet in depth, 6 inches in diameter, and is cased with 6-inch casing and cement grouted to a depth of 101 feet. A 99-hour pumping test of the well indicated a sustained yield of 45 GPM with a 219.92-foot drawdown. The well is located beyond the end of State Route 868 on a private gravel road approximately 600 feet east of Well No. 3. Water is delivered from the well through 300 feet of 2-inch D.I. pipe to the treatment building. The well's discharge is metered within the treatment building. Well No. 4 was determined to be restricted in its ability to provide a long-term sustainable supply. Therefore this well is considered as a backup source for emergency use and peak demand periods and is not considered in the determination of design basis.

Crawford Manor Well: This well is 145 feet deep, 10 inches in diameter to a depth of 110 feet, and 6¼ inches in diameter from 110 feet to a depth of 145 feet. The well is cased with 6-inch casing. The well yield is reported to be approximately 100 GPM. The well is located in a wooded area off State Route 720 approximately 1,200 feet northwest of the intersection of State Routes 42 and 720. This well was chlorinated when it was part of the Crawford Manor waterworks. This well is inactive, having no power connected, and is maintained as a standby source.(Virginia Department of Health, Engineering Description Sheet, February 3, 2004).

Deerfield Community System

System Overview:
The system consists of a well, spring, tank and distribution system to serve the community of Deerfield. There is no well ID number for the well. It is permitted for a design capacity of 36,000 gpd.

Source Water:
The spring source for this waterworks is located on the south side of State Route 600 adjacent to the Deerfield Community Center. The spring is enclosed in a 20-foot by 30-foot concrete spring box that is completely covered by a wood frame structure. The reliable spring yield is zero, as there was no spring flow during the summer drought of 2002. The United States Forest Service owns the spring and has granted water rights to the Augusta County Service Authority. The spring source has been determined groundwater under the direct influence of surface water.

The well is located approximately 50 feet west of the spring enclosure. The well is 13⅞ inches in diameter to a depth of 14 feet, 12 ¼ inches in diameter from 14

feet to 56 feet, 7⁄8 inches in diameter from 56 feet to 70 feet, and 6 inches in diameter from 70 feet to 175 feet which is the total depth of the well. The well is cased with 8-inch steel casing. The well source has been determined groundwater under the direct influence of surface water. (Virginia Department of Health, Engineering Description Sheet, January 22, 2008).

Dooms Community System

System Overview:
The system consists of a well, tank, and interconnection with the City of Waynesboro. This system has a total permitted capacity of 494,000 gpd.

The Augusta County Service Authority Dooms waterworks consists of two drilled wells, a 500,000 gallon water storage tank, a 3,400 gallon hydropneumatic storage tank, treatment equipment for disinfection and fluoridation, and a PRV vault. In addition, a connection to the City of Waynesboro waterworks is provided under a contractual agreement for 50,000 gpd.

Source Water:
The Vesper View Well is located approximately 2,000 feet east of U.S. Route 340 on Water Street and 300 feet south of Laurel Wood Road. The well is reported to be 360 feet deep and cased to a depth of 180 feet. The well discharge line passes through the treatment building and is equipped with a raw water sample tap, check valve, shutoff valves, blow-off line, and totalizing flow meter. The reported yield of the well following a 48 hour pump test is 330 gpm.

The Crimora Well is located off Crimora Mine Road (State Route 612). The well was originally drilled in 1944 and was re-worked (reamed and grouted) in 1997. The Crimora Well is 15 inches in diameter from ground level to a depth of 105 feet, 10 inches in diameter from 105 feet to a depth of 125 feet, and 8 inches in diameter from 125 feet to a depth of 372 feet. The well is cased with 10-inch steel casing to a depth of 125 feet and with 8-inch steel casing from 125 feet to a depth of 222 feet. Under normal operating conditions, the Crimora Well discharges directly into the 3,400 gallon hydropneumatic tank and supplies water to 45 residential connections that can not be adequately served off of the 500,000-gallon gravity tank. Water is pumped from the well by a submersible well pump capable of delivering 125 gpm and is controlled by the SCADA system based upon hydropneumatic tank pressure. The pump on condition is 64 psi and the pump off condition is 82 psi.

Additional source water is available via a connection to the City of Waynesboro waterworks. (Virginia Department of Health, Engineering Description Sheet, May 10, 2008).

Estaline Valley

ACSA purchases the Estaline Valley System water from the Town of Craigsville. The design capacity is 50,000 gpd.

A description of the source water is included in Section 2.1.4 the description of the Town of Craigsville system.

Harriston Community System (Harriston East Subdivision)

System Overview:
The system consists of two wells, storage, and distribution piping for the Harriston Area. The design capacity is 152,540 gpd.

Source Water:
Well #1 is the original well that served the subdivision. The well is six inches in diameter and is drilled to a depth of 400 feet. The reported yield of the well is 47.4 gallons per minute. Water is pumped from the well by means of a submersible pump. Well # 1 (107 124) Water Zones: 316 – 321 feet; 348 – 350 feet, 394 - 400 feet.

Well # 2 is 10 inches in diameter to a depth of 291 feet and 6 inches in diameter from 291 feet to 338 feet. The total well depth is 368 feet. The reported yield of the well is 143.4 gallons per minute. Water is pumped from the well by means of a submersible pump.

The design capacity is equal to 152,640 gpd, limited by the well yield.

(Virginia Department of Health, Engineering Description Sheet, May 15, 2007).

South River Community System

System Overview:
This water system consists of one surface water reservoir, six drilled wells, two of which are inactive, nine storage tanks, seven booster pumping stations, and distribution piping. There are no ID #s for the Hershey or Hurdis wells. Ridgeview Acres well is called the Stuarts Draft in the DEQ Water Withdrawal Report.

ACSA can also purchase water for this system from the City of Staunton, but does not typically do so.

The design capacity of this system is 4.23 mgd.

Source Water:

Coles Run Reservoir: The primary source is Coles Run Reservoir, which receives drainage from an isolated are of the George Washington National Forest. This water is impounded by an earthen dam with a capacity of 40 million gallons.

Ridgeview Acres Well: This well is 363 feet deep and is cased with a 12-inch diameter casing to a depth of 204 feet and with 10-inch diameter casing to a depth of 292 feet. The well is grouted to a depth of 292 feet. The well yield is 800 GPM based on pump capacity.

Lyndhurst Well: This well is 25 inches in diameter to a depth of 41 feet, 23 inches in diameter from 41 feet to a depth of 110 feet, 19 inches from 110 feet to a depth of 158 feet, 15 inches from 158 feet to a depth of 220 feet, 13 inches from 220 feet to a depth of 400 feet, and 10 inches from 400 feet to a depth of 449 feet. The well is cased with 24-inch diameter casing from 0 to a depth of 41 feet, 20-inch from 0 to 110 feet, 16-inch from 0 to 150 feet, 14-inch from 0 to 220 feet and 10-inch from 0 to 220 feet and from 380 to 900 feet. A mill slot screen is provided in the 10-inch casing from 220 feet to a depth of 380 feet. The well is grouted to a depth of 110 feet. The well is equipped with a variable speed turbine pump that is rated between 0 and 1400 gpm based on a 24-hour pumping test performed in 1972. Against system head, the well pump is capable of delivering 1000 gpm.

Hurdis Well: The Hurdis well was pre-existing and was purchased by the Augusta County Service Authority. The well was redeveloped and it is now 505 feet deep with 10-inch diameter casing and grouted to a depth of 292 feet; the hole size is 10-inches to a depth of 292 feet, 8½-inch diameter from 292 feet to 390 feet, and 6½-inch diameter from 390 feet to 505 feet. The well has been extensively studied by a geotechnical firm and has been yield tested at 1,050 gpm. The pump is rated at 550 gpm at 500 feet TDH. A VFD has been installed at this well.

Hershey Well: This well was is 8 inches in diameter to a depth of 315 feet and 6 inches in diameter from 315 feet to 405 feet. An over-reaming and grouting to 105 feet was performed in 1997. A 10-inch pitless adapter with a 10-inch x 8-inch reducer is welded to the existing casing. A 7-stage submersible pump powered by a 60 hp, three-phase electric motor with variable frequency drive rated at 435 gpm at 433 feet TDH is installed The pumping test of the well indicated a sustained pumping rate of 650 gpm with a 114-foot drawdown.

Plaza Well No. 2: The well is drilled to a depth of 500 feet and cased with 6-inch casing to 50 feet. The well is grouted to an unknown depth. The reported capacity of the well is 220 gpm. This source is inactive and is not considered in the design basis. This well has not been evaluated in accordance with the Surface Water Treatment Rule. This well has been abandoned and is now the site of the Greenville Avenue booster station.

Plaza Well No. 4: This well is drilled to a depth of 355 feet and cased with 6-inch casing to 183 feet. The well is grouted to a depth of 117 feet. The reported capacity of the well is 150 gpm. The submersible well pump has been removed. Chlorination had been provided for this well. The source is inactive and is not considered in the design basis. This well has not been evaluated in accordance with the **Surface Water Treatment Rule**.

The South River water distribution system serves the U.S. Route 250 corridor between the Cities of Staunton and Waynesboro, the U.S. Route 340 corridor south of the City of Waynesboro, the U.S. Route 11 corridor south of the City of Staunton, and the communities of Greenville, Stuarts Draft, and Sherando. The system consists of five major pressure zones (Main, Fishersville, White Hill, Jolivue and Greenville).

The Ridgeview Acres/Lyndhurst pressure zone (hereinafter called the main pressure zone) receives treated water from the three wells in the Ridgeview Acres area, including Ridgeview, Hurdis, Hershey, and one well at Lyndhurst. Primarily 12-, 10-, and 8-inch distribution lines transmit flow along State Routes 664, 610, and U.S. Route 340. The system is typically isolated from the systems serving the U.S. Route 250 and U.S. Route 11 corridors by a closed gate valve along State Route 608, a partially closed gate valve along State Route 640, and a booster station along State Route 654. The Hickory Hill and Lyndhurst tanks set the hydraulic grade for the main pressure zone.

The Fishersville pressure zone flow comes from the City of Staunton at U.S. Route 250, and from the main zone via the partially closed gate valve on State Route 640. City water flows east through a 12-inch water line to the City of Waynesboro. The water line is parallel to U.S. Route 250.

The White Hill pressure zone receives flow from the main pressure zone at the White Hill booster pumping station. The White Hill pressure zone then supplies the Mint Spring booster pumping station. The Mint Spring booster pumping station supplies the Jolivue pressure zone, which can also be fed from the City of Staunton by the Greenville Avenue booster pumping station.

The Jolivue pressure zone then supplies water along U.S. Route 11 to the Greenville pressure zone. The Greenville booster station can still be used if needed. (Virginia Department of Health, Engineering Description Sheet, December 8, 2003).

Verona Community System

System Overview:
The Verona Sanitary District obtains water from Quicks Spring and from the City of Staunton by way of two metered connections, one along U.S. Route 11 north of Staunton and the other along Spring Hill Road (State Route 613). There are approximately 46 miles of transmission and distribution lines, two storage tanks and two booster stations. There is an interconnection with the Weyer's Cave system. The Verona system can serve the Weyers Cave system but the Weyers Cave system can only serve the lower elevation areas of the Verona system.
The design capacity of this system is 0.72 mgd.

Source Water:
Quicks Spring is located on the west side of State Route 626 at the northern portion of the Berry Farm approximately 0.6 mile south of its intersection with State Route 612. The spring outcrop is enclosed in a corrugated aluminum building equipped with lighting and ventilation. From the spring, water flows by gravity approximately 50 yards to the treatment building, which is a painted, corrugated metal structure. Duplicate, alternating, vacuum primed, centrifugal service pumps, powered by 100 H.P. motors and rated to deliver approximately 500 GPM each, deliver water through the treatment process and to the system. The vacuum system consists of dual vacuum pumps mounted atop an approximately 40-gallon primer tank. Permitted capacity is 0.72 MGD and limited by the Quick's Spring pump. (Virginia Department of Health, Engineering Description Sheet, January 9, 2003).

Weyer's Cave: Dice's Spring

System Overview:
The system includes the spring at Dice's Spring and the Weyer's Cave storage tank. There are approximately 20 miles of distribution and transmission lines in the system.

Permitted Capacity of the system is 0.288 MGD, is currently limited by the raw water pumping capacity. The source capacity of the spring is unknown.

The design capacity of this systems is 0.288 mgd.

Source Water:
The water from Dices Spring flows by gravity across State Route 694 to a water softening and chlorination building. From a pump sump, the water is pumped by two raw water pumps through a softener. The pumps are rated at 200 gpm each. Supplemental supply is available from the City of Staunton via the Verona/Mount Sidney connection. (Virginia Department of Health, Engineering Description Sheet, March 1, 1978 - Revised December 20, 2005).

2.1.2 Town of Bridgewater (2006 Population: 5,413)

System Overview:
Service area is the Town of Bridgewater and Countryside Estates which is located on the northwest side of Bridgewater on Route 257. The stabilized yield of the town's well is 1040 gpm.

Source Water:
The water supply is taken from the North River with the intake located approximately 500 feet northwest of the filter plant. More detailed information on North River is included in Appendix A, Section 70D. A raw water well has been developed on the bank of the North River near the raw water pump station. The well is drilled to a depth of 390.5 feet. The well hole is 12 inches in diameter from 0 to 98 feet, and 8 inches in diameter from 98 feet to 390.5 feet. The well is located outside of a building which contains the controls and transfer pumps.

The water filtration plant is of conventional design with capacity of 1.5 mgd. There is also an interconnection with the Rockingham County distribution system and the town is credited with 1/3 of the 1.5 MG Kaylor Hill tank volume. Virginia Department of Health, Engineering Description Sheet, July 2, 2001).

2.1.3 Town of Broadway (2006 Population: 2,460)

System Overview:
The Town of Broadway serves 1,389 connections serving 3,200 people.
Broadway receives its water for community service from one intake on the North Fork of the Shenandoah River/Linville Creek.

Source Water:
The Broadway water treatment plant receives raw water primarily from the North Fork Shenandoah River upstream of its confluence with Linville Creek. More detailed information on North Fork Shenandoah River is included in Appendix A, Section 70D. A backup source of raw water is Linville Creek. The intake consists of a headwall with slotted T-screen. A 12-inch ductile iron pipe carries water by gravity to the North Fork Shenandoah River raw water pumping station. (Virginia Department of Health, Engineering Description Sheet, November14, 2002).

2.1.4 Town of Craigsville (2006 Population: 1,025)

System Overview:
The Town of Craigsville has four wells and two springs. The two springs are located on Little North Mountain. They were originally developed in 1932. Two enclosed and protected individual springs are piped to a common collection box.

Source Water:
Springs: The two springs, located on Little North Mountain on Route 682, were originally developed in 1932.

Two enclosed and protected individual springs are piped to a common collection box. Each spring has been improved to divert surface drainage away from the enclosures. The water enters the first chamber of the collecting box through a bar screen, with 1-inch open spaces, which is covered with a fine mesh screen cloth. Water enters the 4-inch transmission line through a variable orifice float valve. A fine mesh screen is placed over the effluent line for final screening. The chamber is provided with a screened overflow.

Well No. 1: This well was originally developed in 1957-58. The artesian well is connected and valved for standby use and produces 55 gpm. There is also an underground overflow line that carries the excess flow directly from the well below ground level to the drainage ditch nearby. Casing depth is 251 feet. It was drilled to a depth of 627 feet. Due to clay streams, a 2" stainless steel screen and gravel pack was installed and the pump moved to 147', also two (2) filters are used decreasing capacity to approximately 50 GPM. The wellhead is equipped with a screened vent , sanitary seal sample tap, pressure gauge, water meter and air line, and is housed in a 8'x8' block building.

Well No. 2: This well is drilled to a depth of 220 feet and is cement grouted to a depth of 100 feet. The well is cased with 6-inch diameter casing to a depth of 100 feet. A 48-hour pump test indicated a sustained yield of 68 gpm.

Well No. 3: This well is drilled to a depth of 255 feet and is cement grouted to a depth of 100 feet. The well is cased with 6-inch diameter casing to a depth of 100 feet. A 48-hour pump test indicated a sustained yield of 78 gpm. The well head and building is the same as Well #2.

Well No. 4: This well is drilled to a depth of 306 feet and is cement grouted to a depth of 100 feet. The well is cased with 6-inch diameter casing to a depth of 125 feet. A 48-hour pump test indicated a sustained yield of 87 gpm. The well head is housed in a 8'x10' block building.

Wells 1, 2, and 3 have 5 horsepower pumps. Well #4 has a 15 horsepower pump. The well water goes to a booster station where it is chlorinated and pumped to the 250,000 gallon tank on Brown Ridge.

Craigsville also has an agreement to purchase water from Augusta County Service Authority in the event if it were needed in the amount of 150,000 gallons per day. (Virginia Department of Health, Engineering Description Sheet, February 23, 2001).

2.1.5 Town of Dayton (2006 Population: 1,347)

System Overview:
This water system consists of the Silver Lake Spring, two groundwater wells, a membrane treatment facility, three storage tanks, two booster pumping stations, and distribution piping. The service area includes the Town of Dayton and portion of Rockingham County north of the town limits to the City of Harrisonburg southern limits, and extending west on 256 approximately one mile.

The Town has an agreement with Rockingham County to purchase water if needed, however, there are no fixed terms as the limits of withdrawal depend on the County's need.

Source Water:
Silver Lake Spring: This is a subterranean source that has no surface signature. Approximately 500 feet of 12-inch diameter water line delivers water from the spring to the suction side of the booster pumps. The spring has a reported safe yield in excess of 2,000 gpm. The booster pumps are located in a 10-foot x 21-foot building adjacent to Silver Lake. The first level of the building contains control equipment and is located at grade. The second level is below grade and contains dual parallel booster pumps. With both pumps operating, a flow of approximately 1,800 gpm is delivered to the treatment facility.

Well No. 1: Well No. 1 is located off of State Route 732 and has 12-inch diameter casing from the surface to a depth of 217 feet and 6-inch diameter casing from 205 feet to a final depth of 450 feet. The overall depth of the well is 626 feet. Pump testing of the well indicated a safe yield of 800 gpm. A well house is provided for valving, metering, turbidimeter, and a blow-off.

Well No. 2: Well No. 2 is located off of State Route 257 and has 10-inch diameter casing from the surface to a depth of 385 feet and 6-inch diameter slot screen from a depth of 205 feet to a final depth of 725 feet. Pump testing of the well indicated a safe yield of 600 gpm. A well house is provided for valving, metering, turbidimeter, and a blow-off. (Virginia Department of Health, Engineering Description Sheet, September 17, 2003).

2.1.6 Town of Elkton (2006 Population: 2,606)

System Overview:
This system is composed of two drilled wells and a spring. The well has historically served as the primary source of water while the spring has been used exclusively as a backup source.

The Town of Elkton serves 903 residences, 157 commercial businesses. The Town provides sewer services to 825 residences and 150 commercial businesses.

Source Water:
Well # 1 is a single drilled well located in the park, north of town, near the railroad. The drilled well is 12 inches in diameter and 352 feet deep. The well house is 10 feet by 20 feet provided by a concrete floor and a floor drain to atmosphere.

Elk Run Spring is located approximately 0.6 miles east of town on State Route 623 adjacent to Elk Run. The spring originates in a 15 feet by 30 feet concrete collecting basin which has been partially filled with gravel. Water flows through several rough screen to the pump house which is located directly west of the spring. Elk Run Spring is leased from W.E. and J.H. Kite. The lease grants the town control of the spring and provides an access easement to the site. (Virginia Department of Health, Engineering Description Sheet, March 9, 1978, revised October 23, 1992). The spring was declared Groundwater Under Direct Influence of Surface Water (GUDI), and disconnected from the system.

To replace the spring as a source, The Town has constructed a second well, the Elkwood Well. The well was drilled in 2006 to a depth of 435 feet. The well is cased with 8 inch steel casing to a depth of 313 feet and is grouted with cement grout to a depth of 100 feet. The reliable well yield following a test in 2009 was 650 gpm. The source is not permitted, to date, but is still in the construction phase.

Another well, the Life Well, was purchased in 2005, with the intent of upgrading the well for use. However, the well did not meet the requirements of a public well and is not in use.

2.1.7 Town of Grottoes (2006 Population: 2,177)

System Overview:
The Town of Grottoes is served by two wells both of which have a permitted capacity of 0.4 MGD by the VDH. In addition, a third well (Shifflett Well) is being privately developed in association with the town and will be deeded to the town upon completion.

Source Water:
Well number 1 is drilled to a depth of 303 feet. The well is 12 inches in diameter from zero to 217 feet and is 8 inches in diameter from 217 to 303 feet. The well is housed in a brick well house and a water meter measures total water flow from the well. The well was pump tested at a rate of 200 gpm for a continuous 24 hour period.

Well number 2 is drilled to a depth of 343 feet. The well is 13 ¾ inches in diameter from zero to 338 feet, 7 inches and it is 10 inches in diameter from 338 feet, 7 inches to 343 feet. The well was pump tested at a rate of approximately

390 gpm for greater than 48 hours. Water is pumped from the well head through an 8 inch diameter water line to a brick and block well house. Housed in this building is a water meter measuring total water flow from the well and a continuous monitoring turbidimeter that bypasses excessively turbid water to waste before it can enter the distribution system.

Well number 3 (Shifflet Well) will connect to an existing eight inch water line along Route 661, Black Rock Road. The Town of Grottoes intends to use the Shifflett Well in rotation with the two existing wells. The Shifflett Well is a 420 feet drilled well located approximately 75 feet from Black Rock Road. A 48 hour pump test indicated the well yield is 820 gpm. The well head is located 15 feet from the well building. The well building is a 12 feet by 12 feet square block building with an 8 inch concrete floor. (Virginia Department of Health, Engineering Description Sheet, December 7, 2007).

2.1.8 City of Harrisonburg (2006 Population: 44,039)

System Overview:
The city of Harrisonburg utilizes water from Rawley Springs, Silver Lake, Switzer Dam and the North River.

Source Water:
Raw water is received from an infiltration gallery at Rawley Springs, the pump station at Silver Lake, and from a screened intake located mid-stream in North River at the raw water pump station. The Silver Lake pump station has a capacity of 1.6 mgd at 441 feet TDH. The Silver Lake source has an estimated raw water capacity of 1.5 mgd. Approximately 0.6 mgd is available from Silver Lake due to the lease agreement with the Town of Dayton, which allows them the first use of water withdrawal until the year 2014. The raw water pump station at North River is equipped with a chain belt traveling screen and three vertical turbine pumps having a capacity of 2.5 mgd each at 640.5 feet TDH. A recording instrument measures the flow of each individual stream. In addition, a separate indicating, totalizing, and recording instrument measures the combined flow as used in conjunction with paced chemical addition equipment. A supervisory control center located in the plant building houses the indicating and totalizing equipment and the controls operating the butterfly valves located in the individual flow streams so that a positive control of raw water being received from either source can be maintained.

Additionally, 1.5 billion gallons of water is in storage at Switzer Lake. This can be released to stabilize the Rawley Springs source. An intake screen and approximately 2,275 linear feet of 30-inch diameter raw water line are present at the Rawley Spring source to increase the available source capacity during release from Switzer Lake. This source has a raw water withdrawal capacity of 10 mgd.

Switzer Dam: Calculations by DEQ indicated the 2005 safe yield of Switzer Dam to be 8.3 MGD but studies conducted by the City of Harrisonburg suggest that the safe yield should be 5.5 mgd. This dam is located 5 miles upstream of the Harrisonburg intake and requiring overland flow for water to reach the Dry River Intake.

River Intakes:
North River: The North River data has been obtained at 71.2% of the Burketown Gage Station records.
Period of Record: 1926-1992
Mean Annual Flow: 170.0 mgd (263.0 cfs)
Safe Yield: 13.7 mgd (21.2cfs)

In late 1989 the Town of Bridgewater petitioned for a Surface Water Management Area pursuant to Code of Virginia 62.1-242. By letters dated March 28, 1993 and February 27, 1997, the City of Harrisonburg had stated its recognition for the competing interests in North River. In response it has rechanneled its effort to find alternative water sources. With respect to the regulation, the City has a protected withdrawal capacity of 5.6 MGD through its North River Pump Station.

Silver Lake: By legal contrast, the Town of Dayton has first rights to this source until 2014. For the stated reason, Harrisonburg does not recognize this source currently. In addition, the pump facilities require rehabilitation prior to active use.

Period of Record: 1962-1985
Mean Annual Flow: 5.0 mgd (7.74 cfs) observation by City of Harrisonburg during use.
Safe Yield: 1.5 mgd (2.32 cfs) VDH stated position in Harrisonburg supply recognition.

Dry River: The Dry River data has been obtained from the City's knowledge of this operation using this source since 1898.
Period of Record: 1898-2006
Mean Annual Flow: 31.0 mgd (48.0 cfs)
Safe Yield: 0.5 mgd (0.77 cfs)

Harrisonburg's intake consists of a 100-foot dam across Dry River at Riven Rock that was constructed in 1921. In 1934, the dam was extended an additional 900 feet across the valley floor to an adjacent mountain toe and thereby creating an underground collection gallery. The conveyance network to move raw water into the City treatment plan is a total gravity driven pipeline system. The source is augmented by on-line storage from upstream Switzer Dam.

South Fork Shenandoah River: The Shenandoah River data has been obtained from the USGS Lynwood Gage Station records.

Period of Record: 1931-1988
Mean Annual Flow: 677 mgd; range 256-1,306 (1,048 cfs; range 397 to 2,020)
Mean Annual Flow: 677 mgd; 65-41,044 (1,048 cfs; range 100 to 63,500)
Safe Yield: 78 mgd (120 cfs)

Harrisonburg has not yet constructed this intake and pump station, but holds VW Permit #19-1672 which has a unique provision/stipulation that allows 4.0 MGD withdrawal, and up to 8.0 MGD, provided Harrisonburg's total withdrawal from its other sources does not exceed 8.0 MGD. This source is Harrisonburg's response to the North River SWMA activity as it is located in the lower drainage basin and includes a recycle concept in that water is discharged upstream through the HRRSA wastewater plant. (Virginia Department of Health, Engineering Description Sheet, January 23, 1995).

2.1.9 Rockingham County (2006 Population: 73,524)

System Overview:
There are seven community systems operating within the County of Rockingham. The County's Department of Public Works has purview over water infrastructure and resource development.

Rosedale System.

This system serves areas southeast of the City of Harrisonburg. Rockingham County purchases water from the City of Harrisonburg to serve the Rosedale Community. Water purchased is not to exceed 500,000 gallons a day for all combined systems purchased from the City of Harrisonburg.

Countryside Sanitary District

This system is a purchase from the Town of Bridgewater.

Harmany Hills System.

This system serves areas north of the City of Harrisonburg and is a purchase from the City of Harrisonburg

Mount Crawford System.

This system serves the Town of Mount Crawford and is owned by the Town. Water service is maintained and provided by Rockingham County.

RR Donnelly/Smith Creek System.

Serves the area north of the City of Harrisonburg on route 11 to Gravels Road and along Gravels Road for approximately 1 mile. This is a purchase fro the City of Harrisonburg

Three Springs Community System.

Serving communities east of Harrisonburg along Route 33 to McGaheysville, extending south to Mount Crawford through the Pleasant Valley Area. The sources of supply for this system are two drilled wells which are both under the direct influence of surface water.

Well No. 1 is located at an elevation of 1,047 feet above MSL. The total depth of the well is 330 feet with a static water level at 32.2 feet. The well is cased from 0-124 feet with 16-inch diameter steel casing. In addition, the well is cased to 43 feet with 20-inch diameter steel casing. The well is cement grouted to 124 feet.

A March 2005 24-hour pumping test indicated a sustained yield of a minimum of 3,015 gpm with a 6-foot drawdown.

Well No. 2 is located at an elevation of 1,043 feet above MSL. The total depth of the well is 220 feet with a static water level at 40.3 feet. The well is cased from 0 - 106.25 feet with 16-inch diameter steel casing. In addition, the well is cased to 34.5 feet with 20-inch diameter steel casing. The well is cement grouted to 106.25 feet. A March 2005 24-hour pumping test indicated a sustained yield of a minimum of 2,762 gpm with a 6-foot drawdown.

The two well houses are identical, each immediately adjacent to, but do not enclose their respective well heads. Each has exterior dimensions of 12 feet by 16 feet. The buildings are of exposed aggregate precast concrete with concrete floors. Concrete roofs are provided with 4-foot square skylights. The wells are manually alternated in operation. (Virginia Department of Health, Engineering Description Sheet, December 6, 2005).

Lilly Subdivision System

This system serves the Lilly and Sunset subdivisions west of the City of Harrisonburg near Clover Hill, and is served by two wells.

Well No. 1 is a 10-inch diameter drilled well 151 feet deep. The hole is 14 inches in diameter from 0 to 51.5 feet and 10 inches in diameter from 51.5 to 151 feet. Based on a 48-hour pump test, the well is capable of producing 102 gallons per minute. The well is equipped with a 3 hp submersible pump which is rated at 34 gallons per minute and discharges to the dual 10,000-gallon atmospheric tanks.

Well No. 2 is drilled to a depth of 205 feet. The well is 12 inches in diameter from 0 to 105 feet and 6 1/8 inches from 105 to 205 feet. Water is pumped from the well by means of a submersible pump rated at 19 gallons per minute at 180 feet TDH. A 48-hour pump test shows that the well is capable of producing a sustained water flow of 26 gpm. Water is pumped from the well through a 1-inch water line into the dual 10,000-gallon storage tanks. Tank level controls are set such that 6325 gallons of each tank is usable storage capacity. Both wells discharge into a 10-foot x 16-foot floor shed where chlorination takes place prior to the two storage tanks. (Virginia Department of Health, Engineering Description Sheet, June 9, 2000).

2.1.10 City of Staunton (2006 Population: 23,834)

System Overview:
The City of Staunton serves the City of Staunton and portions of Augusta County. A description of the portions of Augusta County to which the City provides water is included in Section 2.1.1. The City has an interconnected system with three sources, including the Middle River, Gardner Spring, and Elkhorn Lake/North River Dam. The VDH permitted capacity of the waterworks is 8 mgd.

Source Water:
Source water is obtained from the Middle River, Gardner Spring, and the Elkhorn Lake/North River Dam Interconnected system. North River is impounded initially at Elkhorn Lake behind an earthen dam constructed by the Soil Conservation Service. The reservoir has a surface area of 53.5 acres and a capacity of approximately 200 million gallons for water supply purposes. From Elkhorn Lake, water flows down North River to another impoundment which has a storage capacity of approximately 100 million gallons. A concrete dam and intake structure forms the impoundment. These two reservoirs are interconnected. The water is conveyed to the City of Staunton water treatment facility by approximately 7,022 feet of 20-inch diameter concrete pipe, a 5,600-foot tunnel under Lookout Mountain, and 13.5 miles of 16-inch diameter cast iron transmission main. The carrying capacity of the line is approximately 2.5 MGD.

The Gardner Spring – Middle River raw water pump station draws water from Gardner Spring from an intake located in the center of Middle River. With three pumps in operation, the station is capable of delivering a flow of 7.2 MGD to the treatment plant. Water is conveyed to the treatment facility by a 16-inch diameter steel transmission main.

At the treatment plant, separate lines [North River line and Gardner Spring /Middle River line] deliver water through a common meter vault to the chemical building. Individual magnetic flow meter installations monitor the two raw water flows. The lines combine within the chemical building. Each raw water line is

monitored for turbidity; pH is monitored only for combined raw flow. (Virginia Department of Health, Engineering Description Sheet, January 20, 2005).

2.1.11 Town of Timberville (2006 Population: 1,705)

System Overview:
The Town of Timberville provides drinking water to approximately 2,100 residents. Water is not only supplied to town residents but also to properties located outside of the town's corporate limits. Out of town service is provided to areas on all sides of the town: southeast along American Legion Drive extending to the Legion Hills Subdivision, east along Route 211 supplying homes immediately adjacent to Route 211 extending to Piney Woods Rd. approximately 1 ¼ miles outside the town limits; northeast along Evergreen Valley Rd. extending approximately 1/3 mile outside the town limits; west along Spar Mine Rd. extending to the Timbercrest subdivision approximately 1/3 mile outside the town limits; and south along Route 42 approximately ¼ mile outside the town limits. Water is also supplied to a number of residences northwest of the Town along Route 881 Orchard Drive. These residences are supplied off of the main line running from the filtration facility and storage tank into Town.

The VDH permitted capacity of the waterworks is 392,000 gpd.

Source Water:
The sources of supply for this system are a spring, which is under the direct influence of surface water, and two drilled wells. Cartridge filtration is provided for the spring and all sources are chlorinated and fluoridated. Storage is provided by a 228,420-gallon concrete water storage reservoir for raw spring water, a 390,000-gallon steel ground finished water storage tank, and a 300,000-gallon bolted steel, glass-lined finished water storage tank at the site of the spring's cartridge filtration system.

The spring is located approximately three miles northwest of Timberville off State Route 881. The spring is enclosed in a concrete and steel frame structure and has a reported safe yield of approximately 100 gpm.

Well No. 1: This well is located off Maple Avenue and C Street. It is drilled to a depth of 270 feet, is cased to a depth of 102 feet with 6-inch casing, and is grouted to a depth of 100 feet. Water is pumped from the well by a turbine pump powered by a 15 H.P. electric motor located outside the treatment building. The well's reported yield is 100 gpm and the well pump is capable of delivering approximately 75 gpm.

Well No. 2: This well is located off State Route 211 east of the junction with State Route 952. It is drilled to a depth of 418 feet and is cased to a depth of 144 feet with 16-inch casing, to a depth of 179 feet with 12-inch casing, and to a depth of

222 feet with 10-inch casing. The well's reported yield is 210 gpm and the well pump is capable of delivering approximately 250 gpm. (Virginia Department of Health, Engineering Description Sheet, March 22, 2004).

2.1.12 City of Waynesboro (2006 Population: 21,656)

System Overview:
The City of Waynesboro serves the City's population from three sources. The VDH permitted capacity of the system is 4.82 mgd. The overall utility consists of the following systems:

Source Water:
Coyner Spring: Coyner Spring is a large, concrete enclosed spring and catchment basin with adjacent pump house containing pumps, chlorinators, and two fluoridators. Water is pumped from the spring with two 1250 gpm pumps. Water is pumped from this small spring into the catchment basin of the large spring and, from there, is pumped into the system by the 1250 gpm pumps. Water from this small spring is used only during periods of drought. The safe yield of both springs combined is estimated to be 1666 gpm.

Jefferson Avenue Well No. 1: The well is drilled to a depth of 432 feet. The well hole is 15 inches in diameter from 0 to 185 feet, 12 inches in diameter from 185 feet to 191 feet, 10 inches in diameter from 191 feet to 235 feet, and 8 inches in diameter from 235 feet to 432 feet. The well was pump tested at a rate of 1192 gpm for 48 hours. The pump installed in the well will pump 1000 gpm at the design TDH of 240 feet. The well head is housed in a 15-foot by 12-foot by 7-foot concrete block building.

Jefferson Avenue Well No. 2: The well is drilled to a depth of 735 feet. The well is cased with 14-inch diameter steel casing to a depth of 256 feet, and is cased from a depth of 236 feet to a depth of 380 feet with 8-inch diameter casing. A 72-hour pumping test indicated a safe yield of 1200 gpm. This well is connected to the existing city distribution system by 120 feet of 10-inch diameter water line. The well head is housed in a 20-foot by 24-foot block building with separate rooms housing chlorination and fluoridation equipment.

B Street Well: The well is drilled to a depth of 509 feet. The well is cased with 16-inch diameter steel casing to a depth of 114 feet and 12-inch diameter steel casing from a depth of 114 feet to 320 feet. A 72-hour pumping test indicated a safe yield of 940 gpm. This well is connected to the existing city distribution system by 180 feet of 10-inch diameter water line. The well head is housed in a 20-foot by 24-foot block building with separate rooms housing chlorination and fluoridation equipment. (Virginia Department of Health, Engineering Description Sheet, April 2, 2001).

The B Street well was never put on line, there were problems with the test pumping and it was never used (Nate Litteral, 2009).

2.2 Private Community Systems Using Groundwater

2.2.1 Black Rock Mobile Home Park, LLC

System Overview:
This water system located in Rockingham County, consists of two drilled wells, a 10,000-gallon storage tank, dual booster pumps, and a 2,000-gallon hydropneumatic tank.

Source Water:
The old well is reportedly drilled to depth of 300 feet, cased with 6-inch diameter casing to a depth of 280 feet and grouted to a depth of 50 feet. A sustained yield of 40 gpm was reportedly obtained after a 48-hour pump test.

The new well is located behind the park office and is drilled to a depth of 385 feet, cased with 6-inch diameter casing to 270 feet, and grouted to a depth of 103 feet. A stabilized yield of 61 gpm was obtained following a 48-hour yield and drawdown test.

2.2.2 Blue Ridge Mobile Home Park

System Overview:
This water system, located in Augusta County, consists of one drilled well and five 88 gallon pressure tanks.

This waterworks is limited to a capacity of 292 gpd due to limited storage. However, the waterworks has a history of satisfactory performance and is, therefore, permitted for the existing 87 mobile home connections and one office building.

Source Water:
The well is located at the corner of Colby Avenue and Blue Ridge Road, which is approximately ¼ mile north of Crimora on the east side of Route 340 within the mobile home park. The well is housed in a three-foot square concrete block structure. Additional well construction details, well pump capacity and well yield are not known. No information is available on the depth of the casing.

2.2.3 Cardinal House

System Overview:
The Cardinal House system is located in Augusta County and consists of two wells and two pressure tanks.

Source Water:
Well No. 1 is located in the field between Building No. 1 and U.S. Route 340. The 6-inch diameter steel well casing extends approximately 18 inches above grade and is surrounded by a concrete pad. The pump is set at 168 feet with a pumping level of 50 feet. No information is available on pumping capacity or source capacity. Well No. 1 pumps to an approximately 80-gallon pressure tank located in a closet, accessed from outdoors, in the northeast corner of Building No. 2.

Well No. 2 is located approximately 25 feet in front of Building No. 1. The 6-inch diameter steel well casing extends approximately 12 inches above grade and is surrounded by a concrete pad. No information is available on pumping capacity or source capacity.

The plumbing systems of Buildings No. 1 and No. 2 are reported to be connected; however, it appears that Well No. 1 primarily supplies only Building 2 and Well No. 2 primarily supplies Building No.1.

2.2.4 Country Estates Mobile Home Park

System Overview:
This water system is located in Augusta County and consists of two wells and two storage tanks.

The design basis for the overall system is the sum of the original system plus the expansion or 93 mobile homes plus 101 mobile homes which equals 194 mobile homes.

Source Water:
Well number one is located on the park's main road, approximately 0.3 miles east of Route 340. The well is housed in a 8 foot by 12 foot concrete block building. Total well depth is 360 feet. The well is cased with 6 inch diameter steel casing to a depth of 100 feet and grouted to a depth of 100 feet. The well yield is reported to be approximately 200 gallons per minute.

Well number two is located east of the power lines that cross the eastern part of the park. The well is adjacent to the well house. The well casing does not extend above to a 6 foot square concrete pad. Total depth is 225 feet with a static water level of 90 feet. The well is cased with 6 inch diameter steel casing to a depth of 218 feet. The well has a demonstrated a 52 gallon per minute capacity.

2.2.5 Eastside Trailer Court

System Overview:
This system, which is located in Rockingham County, consists of one drilled well, chlorination treatment, and two 80-gallon pressure tanks.

This waterworks is limited to service to the existing 44 mobile homes due to the lack of storage capacity and lack of information on source capacity.

Source Water:
The well is located approximately 10 feet from the entrance road to the trailer park and is provided with a pitless adapter and a 4-foot by 4-foot concrete pad. The well casing extends approximately 6 inches above the concrete pad and it is equipped with a sanitary seal. No information is available on the depth of the casing. No information is available on the submersible pump.

Disinfection is by chlorine injection at the well discharge. Water is pumped from the well into two 80-gallon pressure tanks. The pressure tanks are located in an 8-foot by 6-foot by 8-foot tall concrete block building located about 20 feet from the well.

2.2.6 Ferguson's Mobile Home Park

System Overview:
This waterworks, located in Rockingham County, consists of three drilled wells, hypochlorination, UV disinfection, a water storage tank, and the distribution system serving the facility.

The design basis of this waterworks is limited to service to 40 existing mobile home spaces due to the source capacity of Wells 1 and 2 and the pumping capacity of Well No. 3.

Source Water:
Well No. 1 is drilled to a depth of 500 feet. It is cased with 6-inch diameter steel casing and cement grouted to a depth of 100 feet. The well pumps approximately 10 gpm for approximately 15 minutes every hour if called upon to produce.

Well No. 2 is drilled to a depth of 920 feet. It is cased with 6-inch diameter steel casing and cement grouted to a depth of 100 feet. The well is equipped with a 5 hp submersible pump that is rated to pump approximately 25 gpm but is throttled to a flow of 17 gpm.

Well No. 3 is drilled to a depth of 1,295 feet. It is cased with 6-inch diameter steel casing to a depth of 141 feet. The well casing is cement grouted to a depth of 141 feet. The well is equipped with a 2 hp submersible pump that is rated to pump 5 gpm.

2.2.7 Harrisonburg Men's Diversion Center

System Overview
This system, located in Rockingham County, consists of two drilled wells, chorine disinfection and a 7,000-gallon gravity storage tank.

Source Water:
Well No. 1 is drilled to a depth of 390 feet. It is 10 inches in diameter to a depth of 94 feet, and 6 ¼ inches in diameter from 94 to 390 feet. A submersible pump with a capacity of 20 gpm is set at a depth of 252 feet.

Well No. 2 is drilled to a depth of 615 feet. It is 12 inches in diameter to a depth of 130 feet and 8 inchese in diameter from 130 feet to 615 feet. Water is withdrawn using a submersible pump rated at 35 gpm. However, the well has a measured yield of 155 gpm.

2.2.8 Harrisonburg Mobile Home Park

System Overview:
This system, located in Rockingham County, consists of a single drilled well and a storage tank.

Design basis is limited by storage and unknown source capacity to the existing 31 mobile homes and 4 apartments.

Source Water:
The source of supply for this system is a drilled well with an unknown capacity. The well is drilled to a depth of 665 feet and is cased with 6-inch casing and grouted to a depth of 50 feet.

2.2.9 Jollett Springs Mobile Home Park

System Overview:
This water system is located in Augusta Countyy, and consists of one drilled well, continuous disinfection, and three pressure tanks.

The waterworks is permitted to serve the existing 54 mobile home connections.

Source Water:
The well is located approximately 75 feet southeast of the pump house. The well was drilled to a depth of 300 feet and cased with 6-inch steel casing to a depth of 107 feet in 1987. Bedrock was encountered at 35 feet. The static level was noted to be 10 feet and drawdown to 112 feet.

2.2.10 Leisure Living Estates

System Overview:
The source of supply for this system consists of two drilled wells. The system is located in Rockingham County. Other features consist of cartridge filtration facilities, chlorination facilities, and a 20,000-gallon steel storage tank used as a combined clearwell/finished water storage tank.

The design capacity for this system will be limited by storage; therefore, the design capacity for this system will be 20,700 gpd or 69 mobile homes.

Source Water:
Well No. 1 is located inside the building housing the water treatment facility. The well is drilled to depth of 316 feet and is cased with 10-inch diameter casing to a depth of 48 feet and 7-inch diameter casing to a depth of 208 feet. It is grouted to a depth of 100 feet. The well was test pumped at 104 gpm for 10 hours.

Well No. 2 is located between Lot No. 50 and Lot No. 51. The well is drilled to a depth of 970 feet and is cased with 6-inch diameter casing to a depth of 118 feet. It is grouted to a depth of 118 feet. The well was test pumped at a sustained yield of 50 gpm for 56 hours

2.2.11 Madison Run Terrace Subdivision

System Overview:
This water system is located in Rockingham County and consists of one drilled well and a single storage tank.

This water system is limited to 16,000 gpd based on source and pumping capacity.

Source Water:
The source of supply is a drilled well 215 feet deep. The well is 10 inches in diameter from 0 to 100 feet and 6 inches from 100 to 215 feet. The hole is cased with 6 inch diameter casing to a depth of 212.5 feet and pressure grouted to a depth of 100 feet. A sustained yield of 20 gpm was obtained from the well during a 48 hour pump test.

2.2.12 Massanutten Village

System Overview:
This system is located in Rockingham County. The water supply is obtained from three drilled wells and is divided into five pressure zones. Water is pumped to each zone and can flow by gravity from the upper pressure zone to the base of the mountain.

Based on the above evaluation, this waterworks is permitted for a design capacity of 1,360,800 gpd or 3,402 ERC based upon the capacity of the high service pumps.

Source Water:
Well No. 10 is contained in a wooden well house along with the automated pump controls, hypochlorination, fluoridation, and Aqua Mag facilities. The well pump is rated at 800 gpm at 485 feet TDH. The well was developed in 1982 to a depth of 570 feet and a 48-hour pump test yielded 1,002 gpm. The well is cased and grouted to a depth of 106 feet. Well construction and connection to the distribution system was completed in December 1985

Well No. 20, located near Well No. 10, is contained in a wooden well house and is equipped with a meter, sample tap, and blow-off. This well is rated at 440 gpm. Well No. 20 is a back-up well for Well No. 10 and the controls are interconnected. The well was developed in November 1988 and yielded 550 gpm after a 48-hour pump test. The well has a total depth of 500 feet and is cased and grouted to a depth of 105 feet.

Well No. 30 - This well is drilled to a total depth of 1070 feet. The well bore is 23 inches in diameter from 0 to 39 feet below ground, 17½ inches in diameter from a depth of 39 feet to a depth of 152 feet, and 11⅞ inches in diameter from a depth of 152 feet to a depth of 1070 feet. The well is cased with 12-inch in diameter steel casing from 2 feet above ground to a depth of 152 feet. The well was pump tested at 422 gpm for a period of 48 hours with a drawdown of 765 feet.

2.2.13 Meadow Rue Mobile Home Park

System Overview:
This water supply consists of two wells, three storage tanks, booster pumping, a hypochlorinator, and a distribution system to serve a mobile home park. It is located in Augusta County.

Based on the calculations above, this waterworks is limited to a capacity of 32,734 gpd or 109 mobile homes due to storage capacity limitations.

Source Water:
Well No. 1: This well is drilled to a depth of 264 feet. It is cased and grouted to a depth of 100 feet. The reported yield is 300 gpm and the 7.5 hp submersible pump delivers 93 gpm against system head.

Well No. 2: This well is drilled to a depth of 445 feet. The well is cased with 6-inch in diameter casing to a depth of 223 feet. The well is cement grouted to a

depth of 100 feet. The well was pump tested at 75 gpm for a period of 48 hours. The well is manually controlled.

2.2.14 National Coach Estates

System Overview:
This water system, located in Rockingham County, consists of two drilled wells, two 14,500-gallon storage tanks, a booster pump, two 120-gallon hydropneumatic tanks, hypochlorination, UV disinfection, and a distribution system to serve the mobile home park.

Based on the above evaluation, this water system is limited to service to the 100 existing mobile home sites due to the unknown booster pump capacity and insufficient well pump capacity.

Source Water:
Well No. 1 is drilled to a depth of 300 feet. The well is cased with 6-inch diameter steel casing to a depth of 100 feet and the well is cement grouted to a depth of 100 feet. The well casing extends approximately 18 inches above a 4-foot square concrete pad. The well has an estimated yield of 27 gpm.

Well No. 2 is drilled to a depth of 260 feet. The well is cased with 6-inch diameter steel casing to a depth of 100 feet and the well is cement grouted to a depth of 100 feet. The well has an estimated yield of 88 gpm.

2.2.15 North 340 Mobile Home Park

System Overview:
This system is located in Augusta County and consists of one drilled well and an 80-gallon hydropneumatic tank.

This waterworks is limited to a capacity of service to the existing 32 mobile home units until information on well yield and pump capacity is provided and the need for additional storage is evaluated.

Source Water:
The well is located near the eastern border of the mobile home park and is enclosed in a 4-foot by 6-foot concrete block structure with a removable wood framed aluminum roof. The well is 6 inches in diameter and drilled to an approximate depth of 200 feet. It is cased with 6-inch steel casing to 50 feet. Water is pumped from the well by a 1 hp submersible well pump of unknown capacity into an 80-gallon hydropneumatic tank located in the enclosure. The reliable well yield is unknown.

2.2.16 Rockwood Mobile Home Park

System Overview:
This system is located in Augusta County and consists of a single drilled well, a ground storage tank, a transfer pump station, and four pressure tanks.

This water system is limited to 18,400 gpd due to source capacity.

Source Water:
The well is 10 inches in diameter to a depth of 104 feet and 6 inches in diameter from 104 feet to 295 feet, the total depth of the well. It is cased with 6 inch casing to a depth of 104 feet and pressure grouted with cement to the same depth. The well casing terminates 12 inches above a 6 feet, 6 inch square concrete pad that is 6 inches thick. The well has a yield of 23 gpm based on a 48 hour pump test.

2.2.17 Saint Stephens Park

System Overview:

This water system is located in Rockingham County, and consists of a well, three 100-gallon hydropneumatic pressure tanks, an indicating and totalizing water meter, and an emergency generator.

The design basis for this system is limited to service to 32 trailers and 1 house due to the lack of water storage capacity.

Source Water:
The well is drilled to a depth of 145 feet. The well is cased with 6-inch diameter casing to a depth of 116 feet and is grouted to an unknown depth. The well has a reported yield of 35 gpm.

2.2.18 Shenandoah Acres

System Overview:
This water system is located in Augusta County, and consists of one drilled well, one 22,000-gallon atmospheric standpipe, and two booster pumping stations.

The design basis is limited to service to 12 existing housing complexes and 45 existing campsite connections due to the lack of information on source and pumping capacities.

Source Water:
The well is located approximately 100 feet behind the office. The well was drilled to a depth of 386 feet and cased with 5-inch steel casing to a depth of 290 feet in

1964. Bedrock was encountered at 275 feet. The static level was noted to be 190 feet.

The water system was meant to operate by gravity using the stand-pipe. However, additional housing complexes were built with multi-levels and adequate pressures could not be supplied to the higher levels. Therefore, two booster pumping facilities were installed.

2.2.19 Valley View Mobile Home Court

System Overview:
This system is located in Rockingham County and consists of two wells, a well house and distribution system to serve the park. The design basis of the system is 3,600 gpd.

Source Water:
No descriptive information on the existing two wells was available from the VDH.

As of March 2003, this system connected to the Rickingham County water system and all lines were disconnected from the existing wells.

2.2.20 Woodlawn Mobile Home Park

System Overview:
This system is located in Augusta County and consists of a well, concrete storage reservoir, well house and treatment facilities, and a distribution system to serve the mobile home park.

The design basis of this system is limited to service to 49 ERC (65 mobile homes) or 19,600 gpd due to the single source of water.

Source Water:
The well is drilled to a depth of 593 feet and is cased with 6-inch diameter steel casing to a depth of 50 feet. The well casing is cement grouted to a depth of 50 feet. A yield and drawdown test showed the well to have a sustained yield of 100 gpm with no drawdown of the water level.

2.3 Other Community Systems Using Surface Water

There are no other community systems using surface water beyond those described above.

2.4 Other Community Systems Using Stream Intakes

2.4.1 Food Processors Water Cooperative, Inc.

This user withdraws water from the North Fork Shenandoah River at a location where the drainage area is 278 square miles in size. The pump station is designed to withdraw 1.96 mgd, while the treatement facility at this location is permitted for 2.17 mgd.

2.5 Water Purchased or Available for Purchase Outside of the Geographic Planning Area

There is no groundwater or surface water purchased from outside the geographic boundaries of the planning area.

There are no existing contracts or known current planning efforts to purchase water from outside the geographic boundaries of the planning area.

2.6 Large Self-Supplied Users of More than 300,000 gallons per month of surface water for non-agricultural uses.

Information on self-supplied users of more than 300,000 gallons per month of surface water is included in Appendix A, Section 70E. Data is presented for the years 2002, 2003, and 2006. For some users, data is not listed for all three years. This indicates that those users either did not withdraw surface water in that given year, or their withdrawals were less than 300,000 gallons per month.

Table 2-2 - Large Self-Supplied Users of Surface Water by Year

		Year		
Water User	**Location**	**2002**	**2003**	**2006**
Invista	Waynesboro	X	X	X
Country Club of Staunton	Staunton	X	X	X
Waynesboro Country Club	Waynesboro	X	X	X
Brett Aggreegates Inc.	Rockingham County	X	---	X
Lakeview Development Corportation Golf Course	Rockingham County	X	X	X
Massanetta Springs	Rockingham County	X	--	----

Spottswood Country Club	Rockingham County	X	X	X
Augusta Lumber, LLC	Augusta County	---	----	X

2.7 Large Self-Supplied Users of More than 300,000 gallons per month of groundwater for non-agricultural uses.

Information on self-supplied users of more than 300,000 gallons per month of groundwater is included in Appendix A, Section 70F. Data is presented for the years 2002, 2003, and 2006. For some users, data is not listed for all three years. This indicates that those users either did not withdraw surface water in that given year, or their withdrawals were less than 300,000 gallons per month.

Table 2-3 - Large Self-Supplied Users of Groundwater by Year

		Year		
Water User	**Location**	**2002**	**2003**	**2006**
Invista	Waynesboro	X	X	X
Ingleside Hotel	Augusta County	X	X	X
Skyline Swannanoa, Inc.	Augusta County	X	X	X
Adolph Coors Co.,	Rockingham County	X	X	X
Alcoa Flexible Packaging	Augusta County	X	X	X
Merck & Co.	Rockingham County	X	X	X
Lakeview Development Corportation Golf Course	Rockingham County	---	---	X
Spottswood Country Club	Rockingham County	X	X	X
Valley Proteins, Inc.	Rockingham County	X	X	X

2.8 Large Agricultural Users of more than 300,000 gallons per month

Information on large agricultural users of more than 300,000 gallons per month of groundwater or surface water is included in Appendix A, Section 70I. Data is presented for the years 2002, 2003, and 2006. For some users, data is not listed for all three years. This indicates that those users either did not withdraw surface water in that given year, or their withdrawals were less than 300,000 gallons per month.

In 2002, there were 26 agricultural users of more than 300,000 gallons per month recorded by VDEQ. In 2003, this number dropped to 9. In 2006, the number of users who reported was recorded at 19.

2.9 Self-Supplied Users of Groundwater on Individual Wells

Information on self-supplied users on individual wells is presented in Appendix A, Section 70J.

INSERT HERE

2.10 Source Water Assessment Plans and Wellhead Protection Programs for Municipal Community Water Systems

As required by the DEQ regulations this section provides a summary of findings and recommendations from all source water assessment plans and wellhead protection programs. The following information was obtained from Virginia Department of Health Source Water Assessment Reports.

2.10.1 Augusta County Service Authority—Augusta Springs

Susceptibility to Contamination High/Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 20, 2002)

2.10.2 Augusta County Service Authority—Churchville

Susceptibility to Contamination is High at wells 3, 4, and Crawford Manor Well: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. Susceptibility to Contamination is high at wells 1 and 2: Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 20, 2002)

2.10.3 Augusta County Service Authority—Dooms

Susceptibility to Contamination is High at Vesper View well/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of

contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002)

2.10.4 Augusta County Service Authority – Harriston

Susceptibility to Contamination is High at wells 1 and 2: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas (Virginia Department of Health, Source Water Assessment Report, March 21, 2002)

2.10.5 Augusta County Service Authority—Middlebrook

Susceptibility to Contamination is High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002)

2.10.6 Augusta County Service Authority—South River

Susceptibility to Contamination Moderate/Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with no land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, April 10, 2002)

2.10.7 Augusta County Service Authority—Weyers Cave

Susceptibility to Contamination is High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 24, 2002)

2.10.8 Town of Bridgewater—River Intake

Susceptibility to Contamination High at the river intake: water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydraulic and atmospheric conditions with land use activities of concern in Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 27, 2002)

2.10.9 Town of Bridgewater—Well

Susceptibility to Contamination High at the well: Groundwater source constructed in an area that promotes migration of contaminates with land use activiities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, July 22, 2002)

2.10.10 Town of Broadway

Susceptibility to contamination is high at both intakes: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area (Virginia Department of Health, Source Water Assessment Report, April 9, 2002)

2.10.11 Town of Craigsville

Susceptibility to Contamination is High at wells 1, 2, and 3: Groundwater source constructed in an area that promotes migration of contaminants with potential conduits to groundwater in the Zone 1 assessment area. Susceptibility to Contamination is Medium at well 4 and the spring source: groundwater source constructed in an area that promotes migration of contaminants with no land use activities of concern or potential conduits to groundwater in the Zone 1 assessment area nor potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Program, March 16, 2002)

2.10.12 Town of Grottoes

Susceptibility to contamination is high at both wells: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Program, May 30, 2002)

2.10.13 City of Harrisonburg

Susceptibility to contamination is high at all three intakes: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area (Virginia Department of Health, Source Water Assessment Program, April 8, 2002)

2.10.14 Rockingham County – Three Springs Regional Water System

Susceptibility to contamination is high at both wells: Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Program, June 5, 2002)

2.10.15 City of Staunton

Susceptibility to contamination is high at Middle River: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. Susceptibility to contamination is moderate at North River Dam: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with no land use activities of concern in the Zone 1 assessment area. Susceptibility to contamination is high at Gardner Spring: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Program, April 9, 2002)

2.10.16 Town of Timberville

Susceptibility to contamination is high at both wells: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in the Zone 2 assessment area. Susceptibility to contamination is high at the spring source: Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Program, June 5, 2002)

2.10.17 City of Waynesboro

Susceptibility to contamination is high at Jefferson Wells 1 and 2: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. In addition, Well #2 has potential sources of contamination in the Zone 1 or Zone 2 assessment areas. Susceptibility to contamination is high at Coyner Springs: Groundwater source constructed in an area that promotes

migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Program, June 5, 2002)

2.11 Source Water Assessment Plans and Wellhead Protection Programs for Private Community Water Systems

As required by the DEQ regulations this section provides and summary of findings and recommendations from all source water assessment plans and wellhead protection programs. The following information was obtained from Virginia Department of Health Source Water Assessment Reports.

2.11.1 Augusta County – Blue Ridge Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 17, 2002)

2.11.2 Augusta County – Cardinal House

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 17, 2002)

2.11.3 Augusta County – Country Estates Mobile Home Park

Susceptibility to Contamination High at well 1/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. Susceptibility to Contamination High at well 2/Groundwater source constructed in an area that promotes migration of contaminants with potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002)

2.11.4 Augusta County – Jollett Springs Mobile Home Park

Susceptibility to Contamination High at well 1/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination

in the Zone 1 or Zone 2 assessment areas. Susceptibility to Contamination High at well 2/Groundwater source constructed in an area that promotes migration of contaminants with potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002)

2.11.5 Augusta County – Meadow Rue Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002)

2.11.6 Augusta County – North 340 Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 20, 2002)

2.11.7 Augusta County – Rockwood Mobile Home Park

N.I.

2.11.8 Augusta County – Shenandoah Acres

N.I.

2.11.9 Augusta County – Woodlawn Village Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 24, 2002)

2.11.10 Rockingham County – Black Rock Mobile Home Park

Susceptibility to Contamination High at both wells: Groundwater source constructed in an area that promotes migration of contaminants with potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002)

2.11.11 Rockingham County – Eastside Mobile Home Park

Susceptibility to contamination is high: groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002)

2.11.12 Rockingham County – Furguson Mobile Home Court

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, May 30, 2002)

2.11.13 Rockingham County – Food Processors Water Cooperative, Inc.

N.I.

2.11.14 City of Harrisonburg – Men's Diversion Center

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 19, 2002)

2.11.15 City of Harrisonburg – Harrisonburg Mobile Home Park

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, July 15, 2002)

2.11.16 Rockingham County – Leisure Living Estates

N.I.

2.11.17 Rockingham County – Madison Run Terrace

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern

in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, May 30, 2002)

2.11.18 Rockingham County – Massanutten Village

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, May 31, 2002)

2.11.19 Rockingham County – National Coach Estates

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 3, 2002)

2.11.20 Rockingham County – Saint Stevens Park

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002)

2.11.21 Rockingham County – Valley View Mobile Home Park

N.I.

3.0 EXISTING WATER USAGE (Section 80)

Section 80 of the regulation requires a description of existing water use. These data are compiled from several sources: VDH permit compliance reports, VDEQ water withdrawal reports, and the individual localities and water purveyors. Please note that all related spreadsheets for Section 80 work are attached as Appendix A included on a cd at the back of this report. A detailed description of water usage within the planning area for Years 2002, 2003, and 2006 are included in the Section 80 spreadsheets included as Appendix A. Years 2002 and 2003 were chosen to indicate differences in usage and source water availability during a drought year followed directly by a wet water year. The Year 2006 was chosen to represent the most current data for all systems. The TAC also determined that the community systems would provide historic disaggregated water consumption by use for year 2006.

3.1 Municipal Community Water Systems

There are 12 public community water systems within the planning area, as described in Section 2.0. Augusta County itself, has 12 independent systems, Rockingham County has 6 independent systems (including the Town of Mr. Crawford), and the remaining 10 localities each have their own individual systems. Water sources within the planning area include groundwater, surface water reservoirs, surface springs, and stream intakes. The total year 2010 population for the study area is 243,730.

3.1.1 Augusta County

The Augusta County Service Authority served an estimated population of 32,218 in 2006. As defined in Section 2, ACSA operates multiple water systems. Usage for each system for the study years is presented in Appendix A, Section B1-B3.

Table 3-1 lists the average withdrawal as a whole by the ACSA for the study years.

Table 3-1
ACSA Water Usage Production - 2002, 2003, 2006

Year	Average Daily Withdrawal (MGD)
2002	4.439
2003	4.070
2006	4.009

Disaggregation of water usage for each of the ACSA systems is included in Appendix A, Section 80 B9. ACSA disaggregated uses for all the systems as an average is presented in Table 3-2 for the Year 2006.

Table 3-2
ACSA 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	659.56	1.807	45
Commercial	410.99	1.126	28
Industrial	0	0	0
Military	0	0	0
Production Processes	43.44	0.119	3
Other	0	0	0
Lost and Unaccounted	341.64	0.936	23
Sale to Other Communities	8.03	0.022	1
Total	**1463.66**	**4.009**	**100**

3.1.2 Town of Bridgewater

The Town of Bridgewater served an estimated population of 5,203 in 2006. Table 3-3 reveals the average daily withdrawal by the Town for the study years.

Table 3-3
Bridgewater Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.901
2003	0.871
2006	0.830

Table 3-4 reveals the Town of Bridgewater's disaggregated use for the Year 2006.

Table 3-4
Town of Bridgewater 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	14.14	0.29	34.99
Commercial	9.29	0.19	23
Industrial & production processes*	12.93	0.27	32
Military	0	0	0
Other	0	0	0
Lost and Unaccounted	4.04	0.083	10
Sale to Other Communities	0.004	0.0008	0.01
Total	**40.40**	**0.85**	**100**

Note: Water used during production processes is included in the values presented for Industrial.

3.1.3 Town of Broadway

The Town of Broadway served an estimated population of 2,060 in 2006. Table 3-5 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-5
Broadway Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.285
2003	0.316
2006	0.433

Table 3-6 reveals the Town of Broadway's disaggregated use for the Year 2006.

Table 3-6
Town of Broadway 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	105.85	0.29	67
Commercial	26.65	0.073	17
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	25.55	0.07	16
Sale to Other Communities	0	0	0
Total	**158.05**	**0.433**	**100**

3.1.4 Town of Craigsville

The Town of Craigsville served an estimated population of 1,051 in 2006. Table 3-7 reveals the average daily withdrawal by the Town for the study years.

Table 3-7
Craigsville Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.355
2003	0.383
2006	0.355

Table 3-8 reveals the Town of Craigsville's disaggregated use for the Year 2006.

Table 3-8
Town of Craigsville 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	28.47	0.078	35
Commercial	50.37	0.138	62
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0		0
Lost and Unaccounted	1.46	0.004	2
Sale to Other Communities	1.46	0.004	1
Total	**81.76**	**0.224**	**100**

3.1.5 Town of Dayton

The Town of Dayton served an estimated population of 1,525 in 2006. Table 3-9 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-9
Dayton Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	1.512
2003	1.546
2006	1.635

Table 3-10 reveals the Town of Dayton's disaggregated use for the Year 2006.

Table 3-10
Town of Dayton 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	76.65	0.21	13
Commercial	10.95	0.03	2
Industrial	478.15	1.31	80
Military	0	0	0
Production Processes	7.30	0.02	1
Other	0	0	0
Lost and Unaccounted	25.55	0.07	4
Sale to Other Communities	0	0	0
Total	**596.68**	**1.635**	**100**

3.1.6 Town of Elkton

The Town of Elkton served an estimated population of 2,606 in 2006. Table 3-11 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-11
Elkton Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.022
2003	0.398
2006	0.353

Table 3-12 reveals the Town of Elkton's disaggregated use for the Year 2006.

Table 3-12
Town of Elkton 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	109.5	0.300	84
Commercial	4.015	0.011	3
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	16.79	0.046	13
Sale to Other Communities	0	0	0
Total	**128.77**	**0.353**	**100**

The totals presented in Table 3-12 are taken from VWUDS data. The Town does not have metered data with which to calculate the disaggregated percentage. Therefore, the percentage breakdown per user category is estimated based on observed development in the Town.

3.1.7 Town of Grottoes

The Town of Grottoes served an estimated population of 2,177 in 2006. Table 3-13 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-13
Grottoes Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.276
2003	0.301
2006	0.245

Table 3-13 reveals the Town of Grottoes' disaggregated use for the Year 2006.

Table 3-14
Town of Grottoes 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	75.07	0.206	84
Commercial	2.68	0.007	3
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	11.62	0.031	13
Sale to Other Communities	0	0	0
Total	**89.37**	**0.245**	**100**

* Notes: Residential: 5.7 MG is due to Standpipe Sales (which is sold at Residential prices). The Commercial percentage is an approximate figure due to the fact that the Town Hall, the Town Park, and the Wastewater Treatment Plant were not metered in 2006. These institutional uses began being metered in 2008. During 2006 the Town experienced two significant water main breaks, which contribute considerably to this figure.

3.1.8 City of Harrisonburg

The City of Harrisonburg served an estimated population of 43,500 in 2006. Table 3-15 reveals the average and maximum daily withdrawal by the City for the study years.

Table 3-15
Harrisonburg Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	6.780
2003	6.508
2006	6.479

Table 3-16 reveals the City of Harrisonburg's disaggregated use for the Year 2006.

Table 3-16
City of Harrisonburg 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	378.39	1.04	16
Commercial	354.74	0.97	15
Industrial	165.55	0.45	7
Military	0	0	0
Production Processes	780.43	2.14	33
Other	0	0	0
Lost and Unaccounted	638.53	1.75	27
Sale to Other Communities	47.30	0.13	2
Total	**2364.93**	**6.479**	**100**

3.1.9 Rockingham County

Rockingham County served an estimated population of 8,705 in 2006. Table 3-17 reveals the average daily withdrawal by the City for the study years.

Table 3-17
Rockingham County Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	1.060
2003	1.084
2006	2.007

Table 3-18 reveals the City of Harrisonburg's disaggregated use and number of connections per disaggregated use for the Year 2006.

Table 3-18
Rockingham County 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	26.81	0.07	30
Commercial	56.30	0.15	63
Industrial	0	0	0
Military	0	0	0
Production Processes	0.89	0.002	1
Other	0	0	0
Lost and Unaccounted	3.57	0.01	4
Sale to Other Communities	1.79	0.06	2
Total	**732.63**	**2.007**	**100**

Note - With respect to Mt. Crawford - Water comes from the Three Springs System. There is no master meter serving this system. The only information available is for water actually billed out

3.1.10 City of Staunton

The City of Staunton served an estimated population of in 2006. Table 3-19 reveals the average daily withdrawal by the City for the study years.

Table 3-19
Staunton Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	4.319
2003	4.139
2006	3.910

Table 3-20 reveals the City of Staunton's disaggregated use and number of connections per disaggregated use for the Year 2006??

Table 3-20
City of Staunton 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	884.91	2.42	62
Commercial	285.45	0.78	20
Industrial	71.36	0.20	5
Military	0	0	0
Production Processes	0	0	0
Other	0	0	
Lost and Unaccounted	185.55	0.51	13
Sale to Other Communities	0	0	0
Total	**1427.27**	**3.910**	**100**

3.1.11 Town of Timberville

The Town of Timberville served an estimated population of 1,705 in 2006. Table 3-21 reveals the average daily withdrawal by the Town for the study years.

Table 3-21
Timberville Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.201
2003	N/I
2006	0.221

Table 3-22 reveals the Town of Timberville's disaggregated use and number of connections per disaggregated use for the Year 2006.

Table 3-22
Town of Timberville 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	56.36	0.15	70
Commercial	4.03	0.01	5
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	20.13	0.06	25
Sale to Other Communities	0	0	0
Total	**80.52**	**0.221**	**100**

3.1.12 City of Waynesboro

The City of Waynesboro served an estimated population of 21,656 in 2006. Table 3-23 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-23
Waynesboro Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	2.779
2003	2.566
2006	3.256

Table 3-24 reveals the City of Waynesboro's disaggregated use for the Year 2006.

Table 3-24
City of Waynesboro 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	891.26	2.44	75
Commercial	118.83	0.33	10
Industrial	23.77	0.07	2
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	154.48	0.42	13
Sale to Other Communities	0	0	0
Total	**1188.34**	**3.256**	**100**

3.2 Other Community Water Systems on Groundwater

There are 18 other community water systems within the planning area, as described in Section 2.0. Usage data for these systems is presented in the Section 80 spreadsheet in Appendix A.

3.3 Other Community Systems Using Surface Water

There are no other community systems using surface water beyond the public water systems described above.

3.4 Other Community Systems Using Stream Intakes

There are 16 other community water systems using stream intakes within the planning area, as described in Table 3-25. Usage data for these systems is presented in Section 80 spreadsheet in Appendix A.

Table 3-25
Other Community Water Systems Using Stream Intakes

Locality	Water System	Source
Augusta County	Augusta County Service Authority - Augusta Springs	Augusta Springs
	Augusta County Service Authority - Deerfield	Deerfield Spring
	Augusta County Service Authority - Verona	Quicks Spring
	Augusta County Service Authority - Weyer's Cave	Dice's Spring
Town of Bridgewater	Town of Bridgewater	North River
Town of Broadway	Town of Broadway	North Fork Shenandoah & Linville Creek
Town of Craigsville	Town of Craigsville	Spring 1 Spring 2
Town of Dayton	Town of Dayton	Silver Lake Spring
Town of Elkton	Town of Elkton	Elk Run Spring
City of Harrisonburg	City of Harrisonburg	North River
	City of Harrisonburg	Dry River (Rawley Springs Intake)
	City of Harrisonburg	Shenandoah River (South Fork)
City of Staunton	City of Staunton	Gardner Spring Middle River
Town of Timberville	Town of Timberville	SPRING
City of Waynesboro	City of Waynesboro	Coyner Spring
Town of Broadway	Food Processors Water Cooperative, Inc., Rockingham	North Fork Shenandoah River

4.0 EXISTING RESOURCE INFORMATION (Section 90)

Section 90 of the regulation requests a description of existing resource conditions to include geologic, hydrologic, and meteorological conditions in the planning area. In addition, a description of existing environmental conditions must be included that pertains to, or may possibly affect in-stream uses, and water supply sources currently serving the area.

4.1 Geology

The study area is part of the Valley and Ridge Physiographic Province, which is characterized by gently rolling and hilly valleys, as well as gradual mountain slopes. The extreme eastern edge of the planning area is within the Blue Ridge Physiographic Province which is distinguished by mountain peaks, The western edge of the planning area is distinguished by high, narrow, mountain ridges that run northeast to southwest forming relatively narrow river valleys. Elevations range from a high of 4,463 feet above sea level at Elliott's Knob to a low of 900 feet above sea level near the Rockingham and Page County boarder.

Soils in the planning area range from carbonate soils to alluvial soils along rivers and streams. Colluvial soils resulting from the weathering of the sandstone and shale mountains are found in the foothills paralleling the valley. The mountain areas are covered with shallow, rocky, excessively drained soils that derive from the weathering of acidic sandstone, shale, quartz and granite parent material. The predominant geological structure underlying the Region is a complex formation of limestone, calcareous shale and dolomite with smaller amounts of sandstone, conglomerate and chert. These karst areas provide suitable geologic conditions for the formation of productive aquifers, it also poses a significant pollution potential for wells and springs which may be subject to surface water influence.

4.2 Hydrology

The study area has a high quality of hydrological resources. A narrow belt along the western toe of the Blue Ridge Mountains has a particularly high potential for groundwater because of favorable geologic and recharge conditions. High capacity wells have been developed successfully throughout the planning area. Surface springs in the area result from significant sources of groundwater. These springs vary in quantity, ranging from a few gallons per minute to in excess of 1,000 gallons per minute. Springs have historically been an important source of water in the region and currently augment a number of the public water supplies in the area.

The entire study area is situated in the Shenandoah River drainage basin. The major waterways are the North and South Forks of the Shenandoah River which flow through the northern and western portions of Rockingham County. These two rivers are part of the Potomac River Basin which flows to the Chesapeake Bay. The North River which

passes through the south central portions of Rockingham and the northwest portion of Augusta County and the South River which passes through the southeastern section of Rockingham and the eastern section of Augusta County and the Middle River flowing through the north central portion of Augusta County.

4.3 Meteorology and Climate

The climate of the study area is classified as modified continental with mild winters and warm summers. The mountains and elevation are major factors controlling the climate. Climate information is recorded at two stations in Rockingham County; Dale Enterprise Station is located in southwestern Rockingham County, while the Timberville Station is located in the northern portion of the County. Annual normal temperatures average 53 degrees and annual precipitation averages 35 inches.

The GIS department within CSPDC worked to combine databases from numerous state and federal agencies in gathering the data as outlined by the regulation. Using the data collected, CSPDC staff then created GIS Layers to provide mapping of the natural resources within the planning area. Descriptions of each resource are presented below with references to the appropriate maps.

4.4 State or Federal Listed Threatened or Endangered Species or Habitats of Concern (Section 90 B.1)

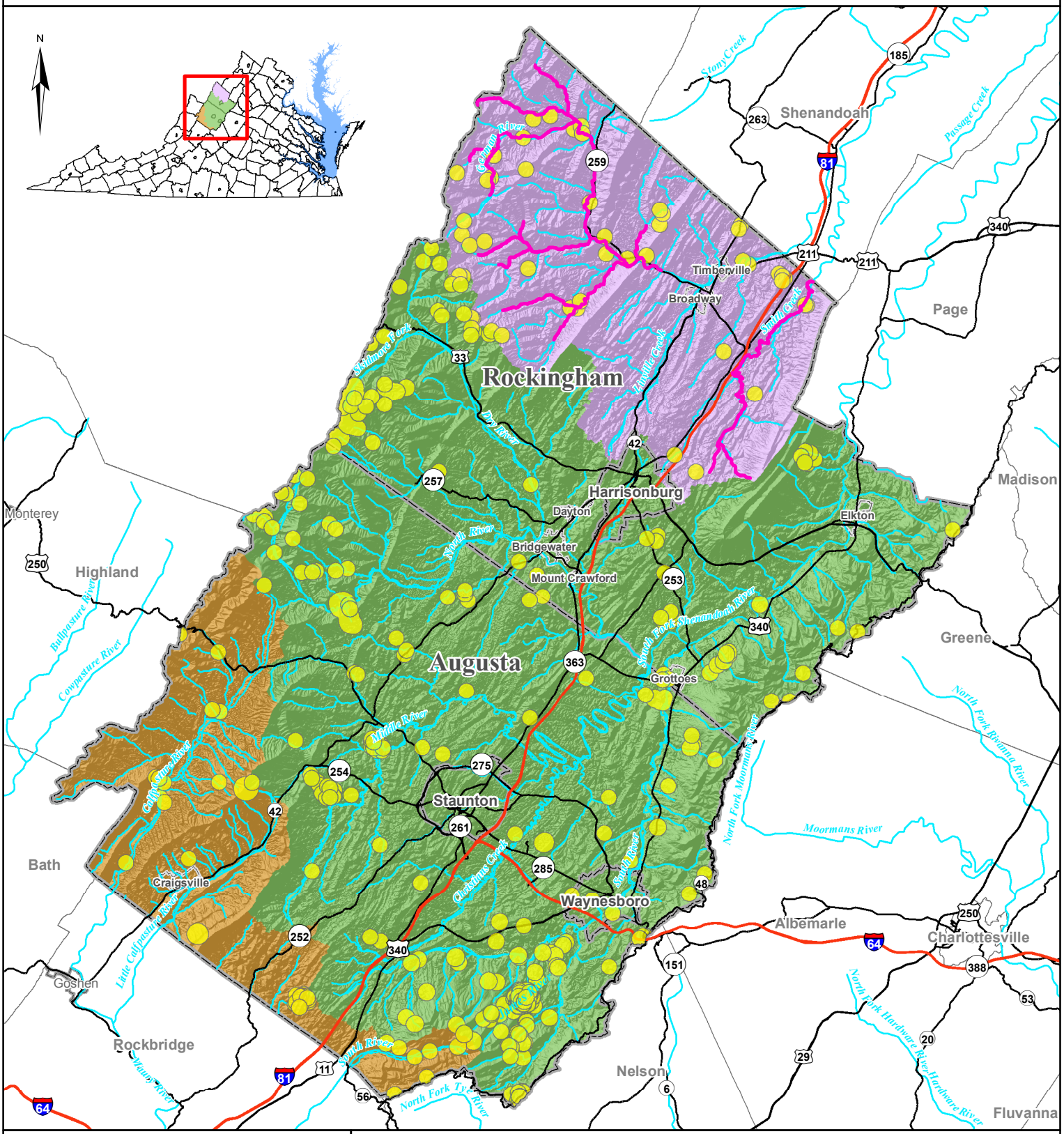
The Virginia Department of Game and Inland Fisheries maintains information on threatened and endangered species within Virginia. Figure 4-1 identifies known locations of species, or where sitings of a specific species occurred. These locations are buffered on the map so as to protect the integrity of the site and the species associated with it.

Threatened and Endangered Species that may be located within the planning area are listed in Table 4-1.

Table 4 -1
Threatened and Endangered Species

			Status	
Taxonomic Group	Genus and Species	Common Name	Federal Status	VA State Status
amphibian	Plethodon punctatus	Cow Knob Salamander	FSC	SC
bird	Thryomanes bewickii	Bewick's Wren	FSC	E
bird		Winter Wren		SC
bird	Asio otus	Long-eared Owl	FT	T
bird	Empidonax alnorum	Alder Flycatcher		SC
bird	Catharus guttatus	Hermit Thrush		SC
bird	Certhia americana	Brown Creeper		SC
bird	Dendroica magnolia	Magnolia Warbler		SC
bird	Haliaeetus leucocephalus	Bald Eagle	FT	T
bird	Lanius ludovicianus	Loggerhead Shrike		T
bird	Loxia curvirostra	Red Crossbill		SC
bird	Nyctanassa violacea	Yellow-crowned Night-heron		SC
bird	Oporornis philadelphia	Mourning Warbler		SC
bird	Regulus satrapa	Golden-crowned Kinglet		SC
bird	Sitta canadensis	Red-breasted Nuthatch		SC
bird	Spiza americana	Dickcissel		SC
bird	Tyto alba	Barn Owl		SC
bird	Vermivora chrysoptera	Golden-winged Warbler		SC
fish	Noturus gilberti	Orangefin Madtom	FSC	T
fish	Notropis semperasper	Roughhead Shiner	FSC	SC
mammal	Sorex palustris	Water Shrew	FSC	E
mammal	Glaucomys sabrinus	Virginia Northern Flying Squirrel	FE	E
mammal	Lepus Americanus	Snowshoe Hare		E
mammal	Corynorhinus (= Plecotus) townsendii	Virginia big-eared Bat	FE	E
mammal	Lontra canadensis	Northern River Otter		SC
mammal	Microtus chrotorrhinus	Rock Vole	FSC	E
mammal	Myotis grisescens	Gray Bat	FE	E

Figure 4-1:
Threatened and Endangered Species (Sec.90 B.1)



4.5 Anadromous, Trout and Other Significant Fisheries (Section 90 B.2)

Based on the Virginia Department of Game and Inland Fisheries VDGIF) records, there are no anadromous fish use streams within the planning area.

Trout streams within the planning area are identified in Figure 4-2. These are classified by the VDGIF as coldwater, or trout, streams. The Fisheries Division of VDGIF has identified all of the reaches in this region as wild (Class I-IV) or stockable (Class V and VI) trout streams or as tributaries to wild trout streams. These classifications give the streams special management considerations and protection. Please note that many of the streams are on private property and are not necessarily public fishing waters.

Dams within the planning area are identified on Figure 4-2 as well.

No hatcheries were identified as being located within the planning region by the VDGIF.

4.6 Scenic Rivers and Recreational Destinations (Section 90 B.3)

The Scenic Rivers Act of 1970 was passed to protect and preserve specific rivers or river segments of significant natural beauty. The Department of Conservation and Recreation, Division of Planning and Recreation Resources works with citizens and localities to evaluate the potential of rivers to be placed on the Scenic Rivers List.

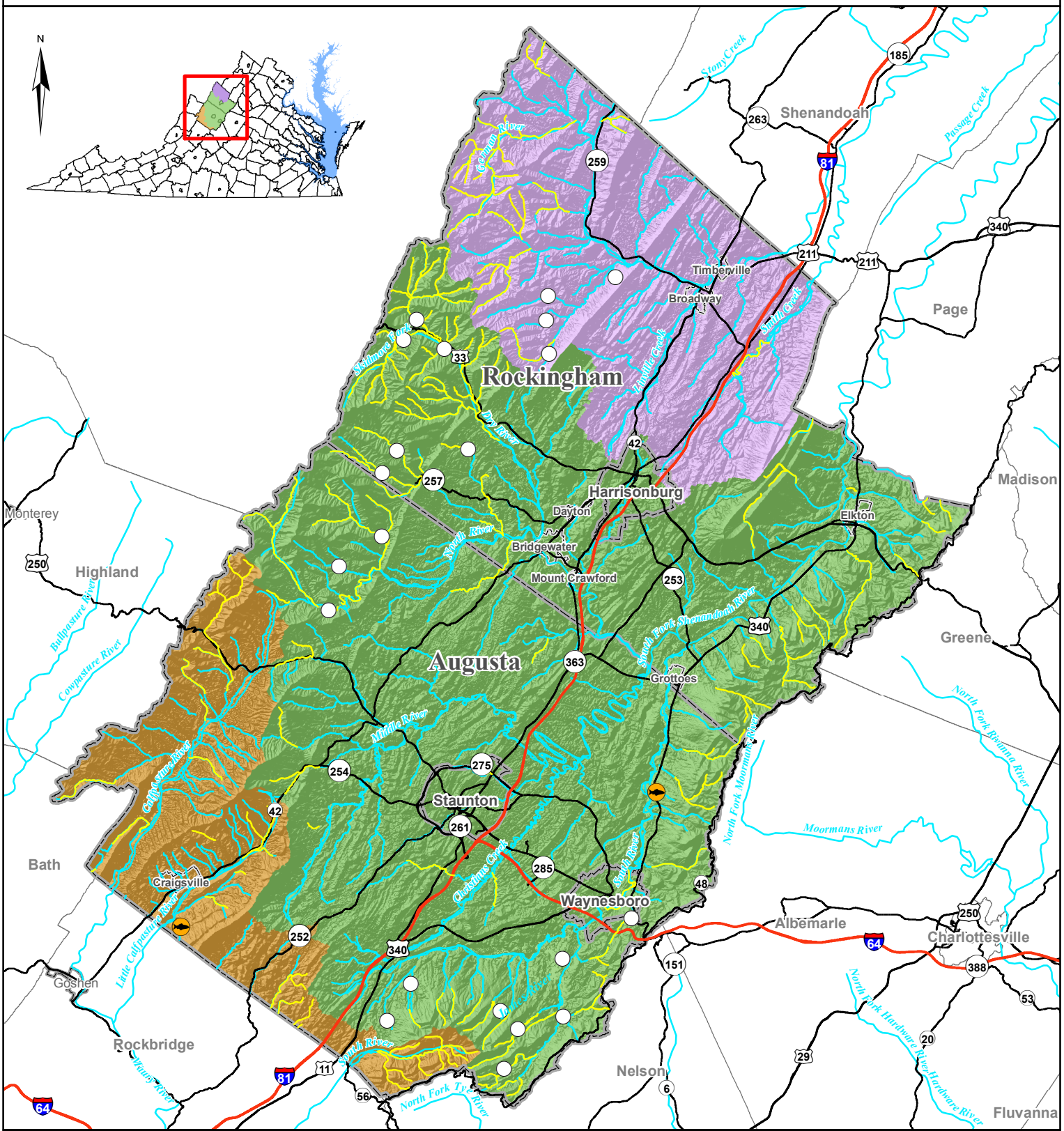
Those rivers with Scenic River status within the planning area are identified in Figure 4-3. As identified in Figure 4-3, there is one river within the planning area that is legislatively designated as a scenic river; the St. Marys River from it's headwater's in Augusta County to the boundary with the George Washington National Forest. Two additional rivers within the planning area are designated as having potential for scenic rivers listing. These include the Calfpasture River in Augusta County, from Route 250 to Marble Valley, and the South Fork Shenandoah River in Rockingham County from Port Republic to Goods Mill.

4.7 Historic and Archaeological Resources (Section 90 B.4)

The Virginia Department of Historic Resources (VDHR) was contacted to collect data on archaeological and architectural resources within the planning area. The architectural and archaeological information was collected from survey information from expert individuals in the field. The data was tracked and reviewed by DHR staff and field staff for quality assurance. The locations of these resources are presented in Figure 4-4. Specific locations of archaeological sites are not given, so as to protect the location of these resources.

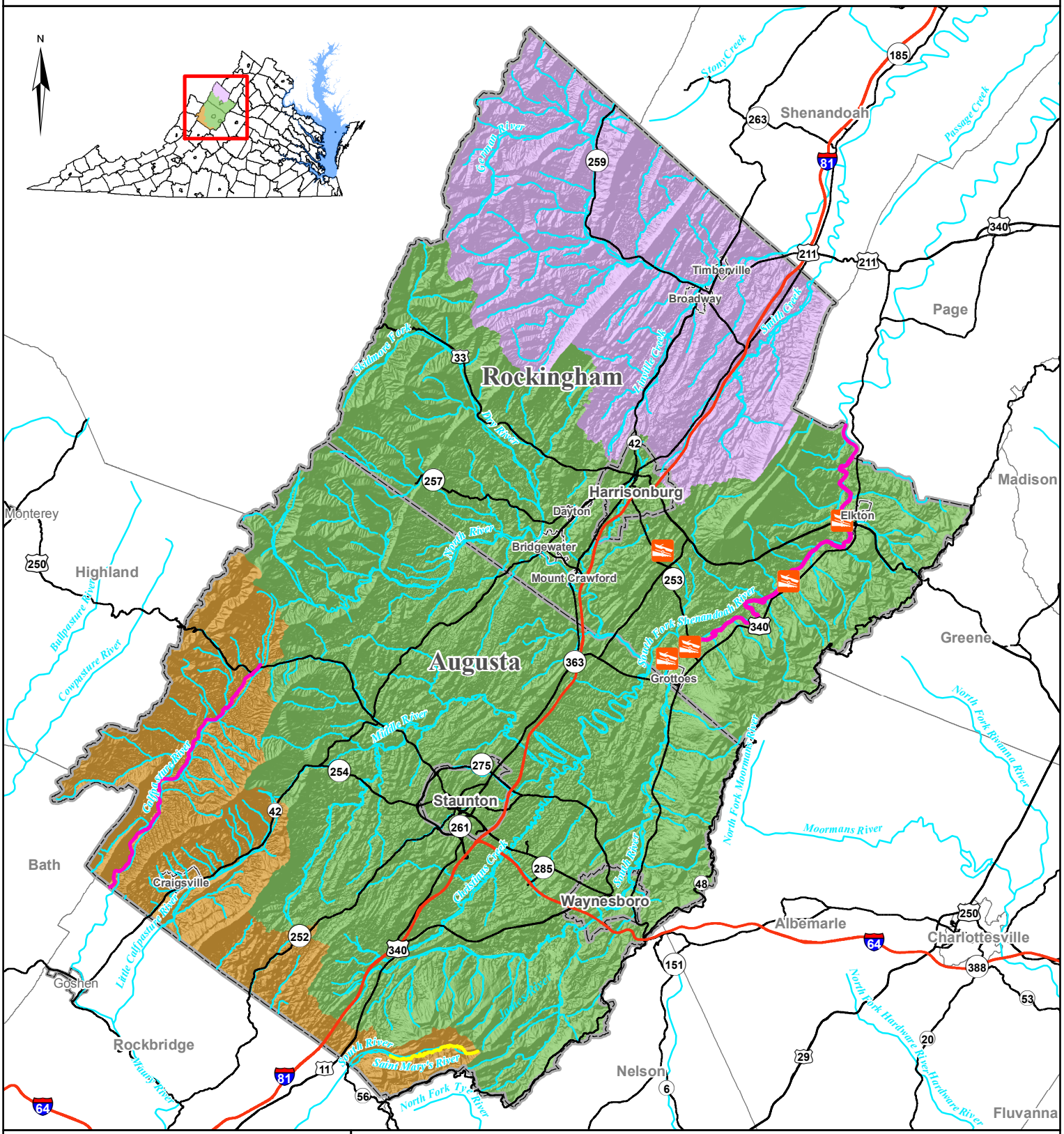
There are numerous historic and archaeological resources within the planning area. Specific information concerning those resources within a certain area can be obtained from VDHR.

Figure 4-2:
Fisheries and Hatcheries (Sec.90 B.2)



This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only. Source: VA Dept. of Game and Inland Fisheries and VA Dept. of Conservation and Recreation. February, 2009

Figure 4-3:
Scenic Rivers and Rec. Facilities (Sec.90 B.3)



0 5 10 Miles

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only. Source: VA Dept. of Game and Inland Fisheries and VA Dept. of Conservation and Recreation. February, 2009

Boating Access Sites

VA Scenic River Status

Existing

Proposed

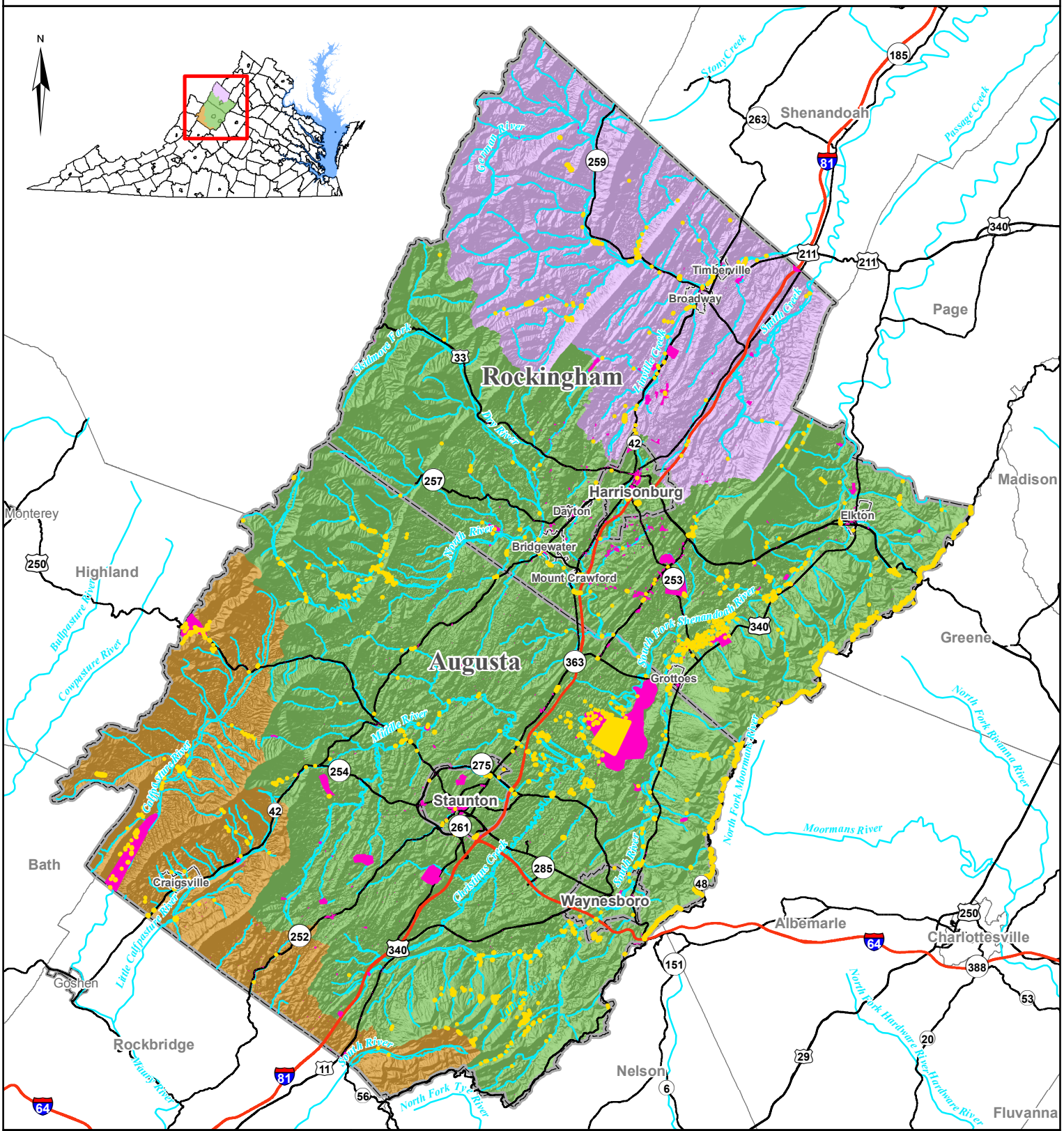
Sub-Basin

North Fork Shenandoah, VA (Potomac River Watershed)

South Fork Shenandoah, VA (Potomac River Watershed)

Maury, VA (James River Watershed)

Figure 4-4:
Historic Resources (Sec.90 B.4)



0 5 10 Miles

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: VA Dept. of Historic Resources
February, 2009

Archeological (buffered to protect location)

Architectural

Sub-Basin

North Fork Shenandoah, VA (Potomac River Watershed)

South Fork Shenandoah, VA (Potomac River Watershed)

Maury, VA (James River Watershed)

4.8 Geologic Formations (Section 90 B.5)

Geologic formations within the planning area were obtained from the U.S. Geological Survey and are presented in Figure 4-5.

4.9 Wetlands (Section 90 B.6)

The approximate locations of wetland areas within the planning area are identified in Figure 4-6. This figure delineates the areal extent of wetlands and surface waters. Aerial imagery is used as the primary data source to detect wetlands. The wetland maps were developed by the U.S. Fish and Wildlife Service (USFWS) and the USGS. The data set used to create Figure 4-6 represents the extent of wetlands and deepwater habitats that can be determined with the use of remotely sensed data.

4.10 Riparian Buffers and Conservation Easements (Section 90 B.7)

Figure 4-7 identifies easement areas and riparian buffers within the planning region. Several sources were referred to for this data: The Virginia Department of Conservation and Recreation (VDCR), The Nature Conservancy (TNC), Virginia Outdoors Foundation (VOF), and the Valley Conservation Council (VCC). Information obtained from each of these resources is described below.

The Department of Conservation and Recreation has developed a statewide "Conservation Lands" database. This database includes mapped boundaries and certain characteristics of public and certain private lands in Virginia that have potential significance for serving a variety of conservation, recreation, and open-space roles. Areas defined in the data base are included in 4-7.

The Nature Conservancy provides information on areas of conservation significance. These areas include parts of both the terrestrial and aquatic portfolios. TNC's portfolio areas depict a minimum set of locations that, if adequately protected, will capture the range of rare and representative native plants, animals, natural communities and ecological systems characteristic of a given eco-region. TNC seeks to cooperate with landowners and other partners to implement a spectrum of strategies to conserve the living resources found within the portfolio areas.

The VOF holds open space easements within the State. It is their mission to encourage the preservation of open space lands. Easement areas currently held by the VOF are identified in Figure 4-7.

The VCC “promotes land use that sustains the farms, forests, open spaces, and cultural heritage of the Shenandoah Valley region of Virginia.” Riparian easements held by the VCC are included in Figure 4-7.

Figure 4-5:
Geologic Formations (Sec.90 B.5)

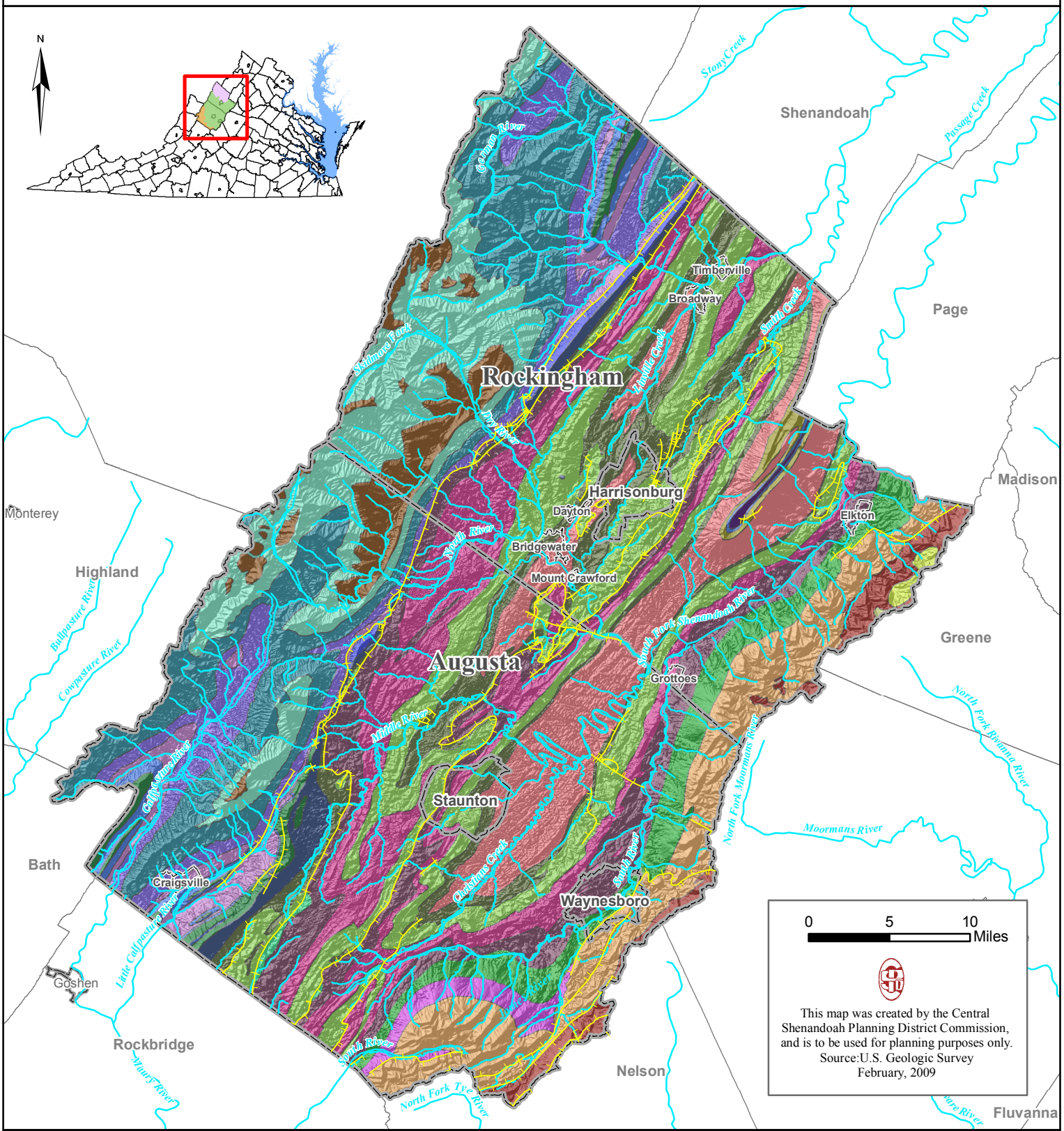
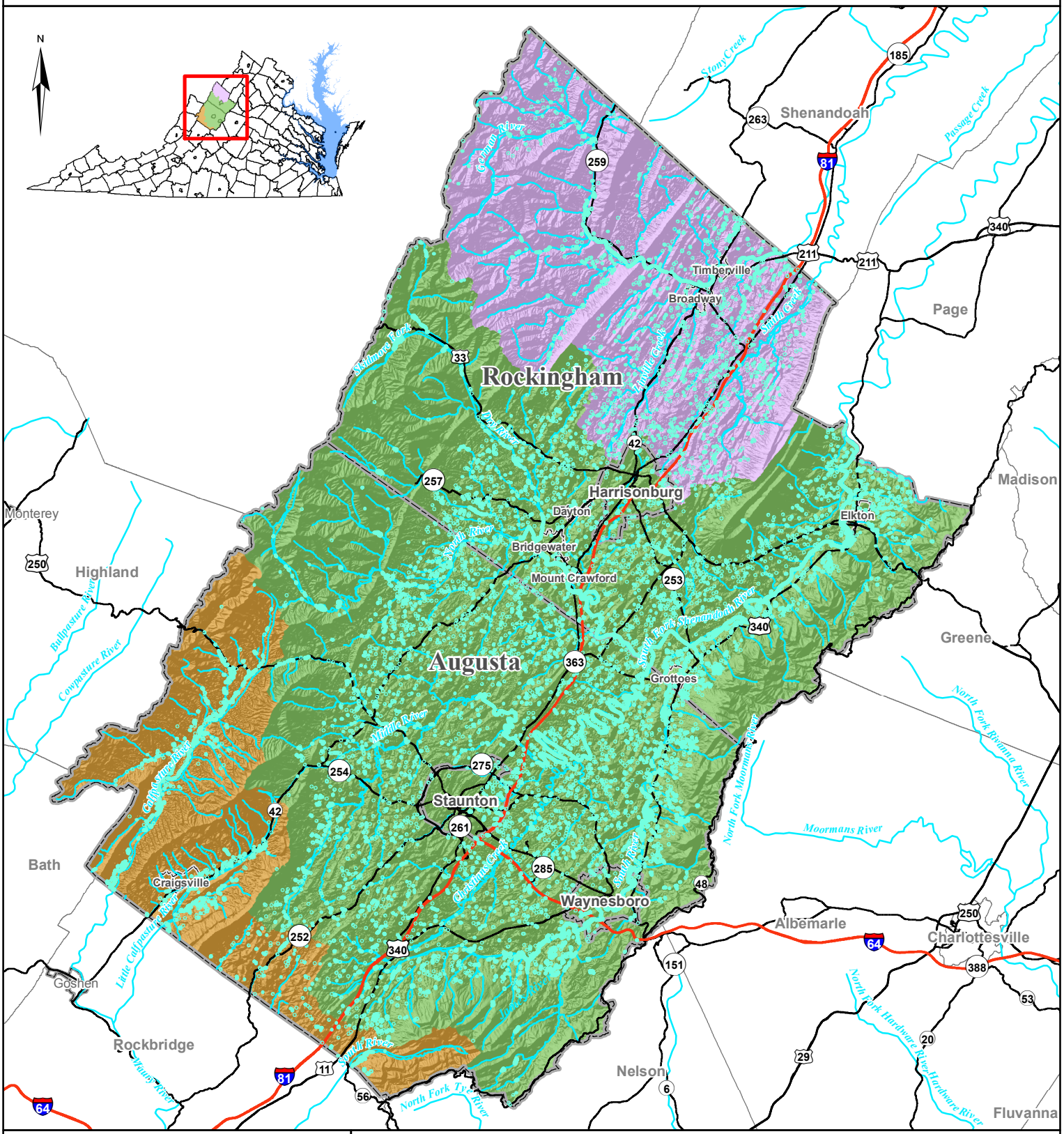


Figure 4-6:
Wetlands (Sec.90 B.6)



0 5 10 Miles

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: US Geological Survey
February, 2009

Wetland

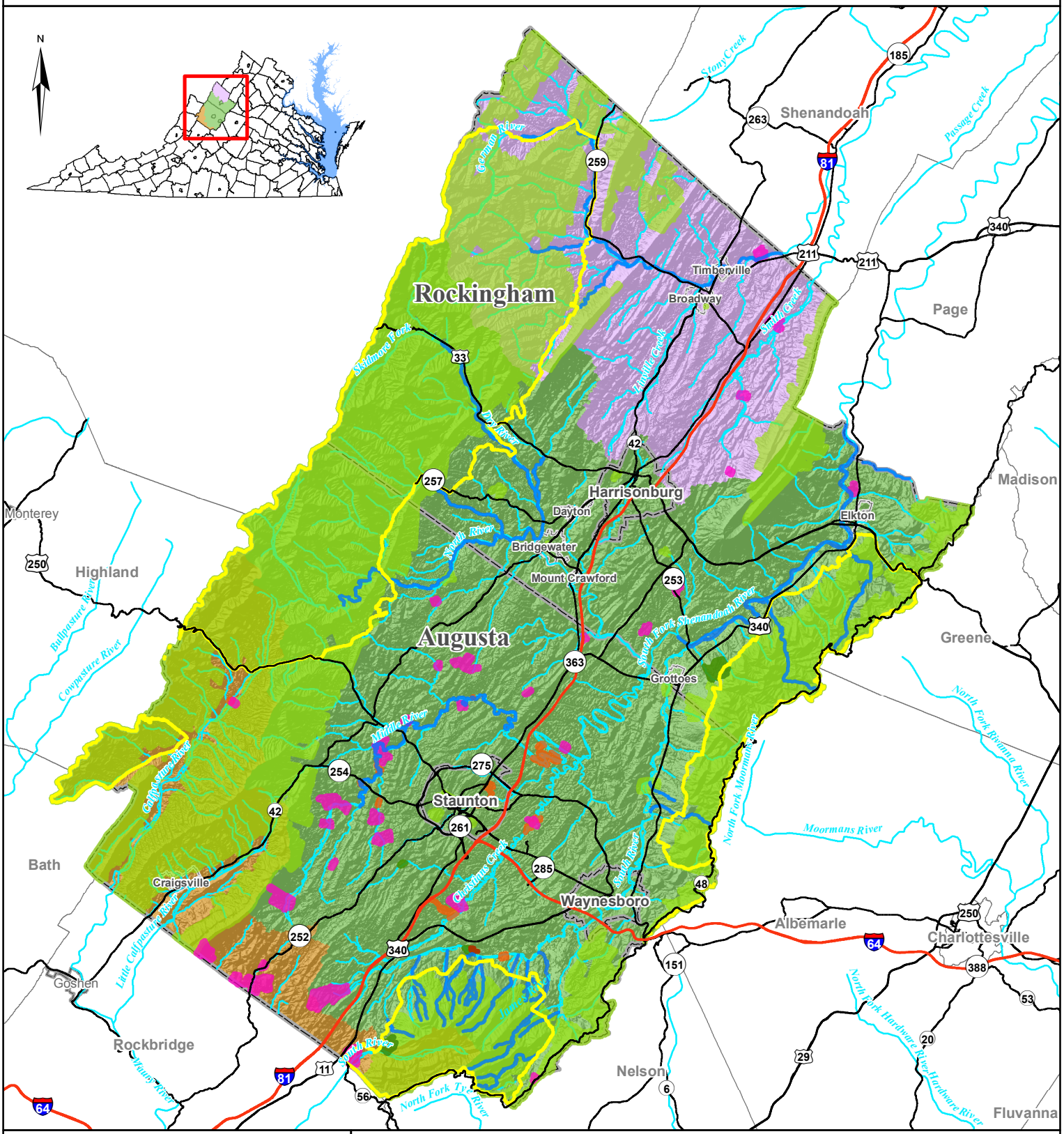
Sub-Basin

North Fork Shenandoah, VA (Potomac River Watershed)

South Fork Shenandoah, VA (Potomac River Watershed)

Maury, VA (James River Watershed)

Figure 4-7:
Easements and Riparian Buffers (Sec.90 B.7)



0 5 10 Miles

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: VA Dept. of Conservation and Recreation, Virginia Outdoors Foundation, Valley Conservation Council, and The Nature Conservancy.
February, 2009

- TNC Terrestrial Portfolio
- TNC Aquatic Portfolio
- TNC Preserves
- VOF Open Space Easements
- DCR State Natural Preserves
- VCC Service Area Riperian Easements
- DCR Conservation Lands

Sub-Basin

- North Fork Shenandoah, VA (Potomac River Watershed)
- South Fork Shenandoah, VA (Potomac River Watershed)
- Maury, VA (James River Watershed)

4.11 Land Use and Land Cover (Section 90 B.8)

Land use and Landcover by type within the planning area is depicted in Figure 4-8. Major land use and landcover within the study area include deciduous forest, evergreen forest and mixed forest. Additionally, in the valley the land cover is overwhelmingly hay or pasture with development areas interspersed throughout.

Figure 4-9 identifies impervious areas within the planning region. It is estimated that a total of 9 % of the planning area is impervious.

4.12 Impaired Streams (Section 90 B.9)

The Virginia Department of Environmental Quality (DEQ) released the Final 2008 305(b)/303(d) Water Quality Assessment Integrated Report (Integrated Report) on December 22, 2008. This report identifies impaired streams and reservoirs within Virginia. Impaired rivers, streams, and reservoirs are identified in Figure 4-10 and 4-11, by typeof impairment, and source of impairment, respectively.

4.13 Point Source Discharges (Section 90 B.10)

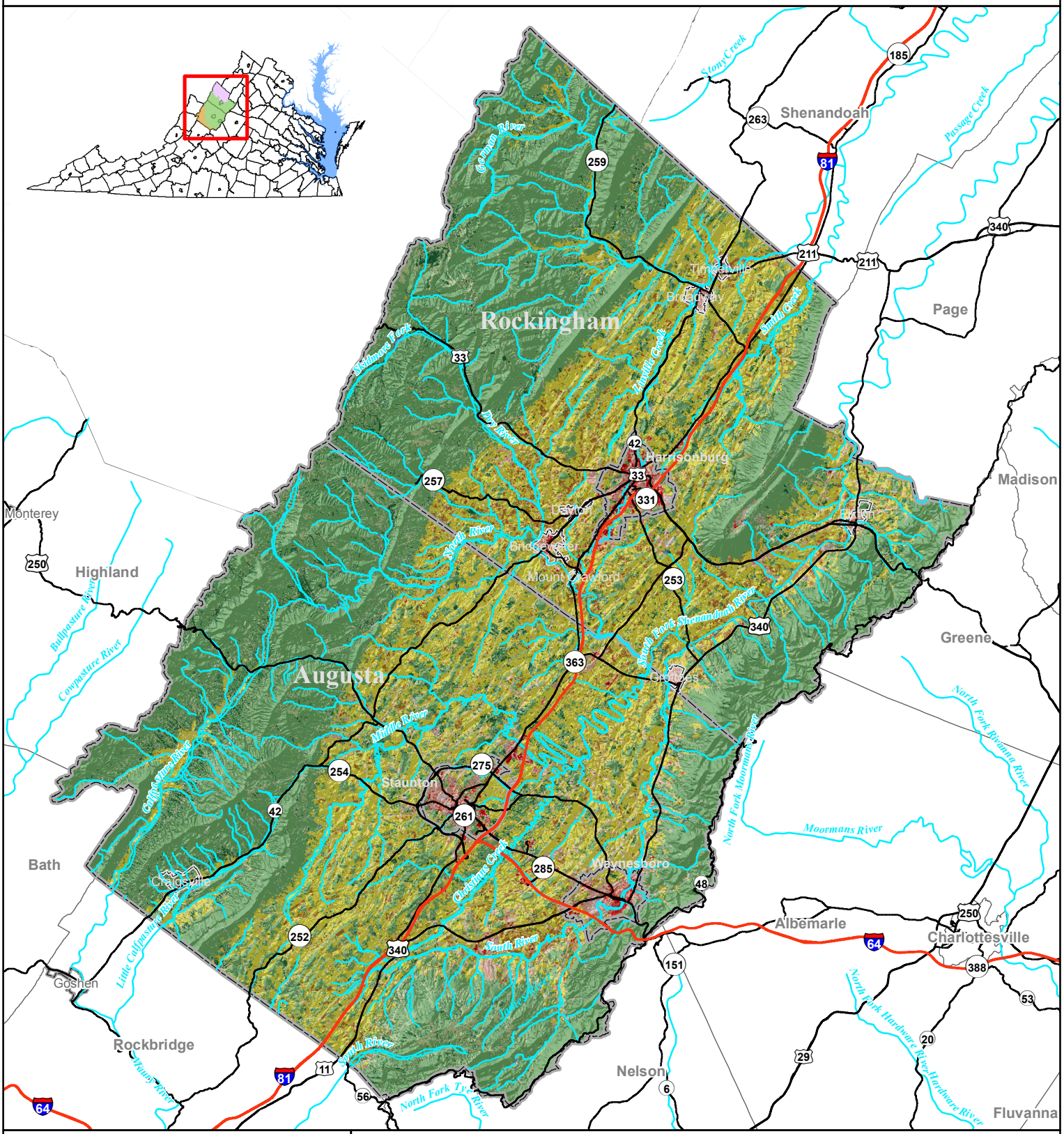
The locations of facilities which are listed by VDEQ as significant point source dischargers are identified in Figure 4-12.

4.14 Potential Threats to Water Quantity and Quality (Section 90 B.11)

Information regarding potential threats to water quality was collected from the VDEQ. Based on this data, landfills and trash collection sites within the planning area were identified and are depicted in Figure 4-13.

Other potential threats that are not depicted in Figure 4-13 include but are not limited to, septic system failures, abandoned gas stations or petroleum tanks, abandoned mines and development.

Figure 4-8:
Landcover (Sec.90 B.8)

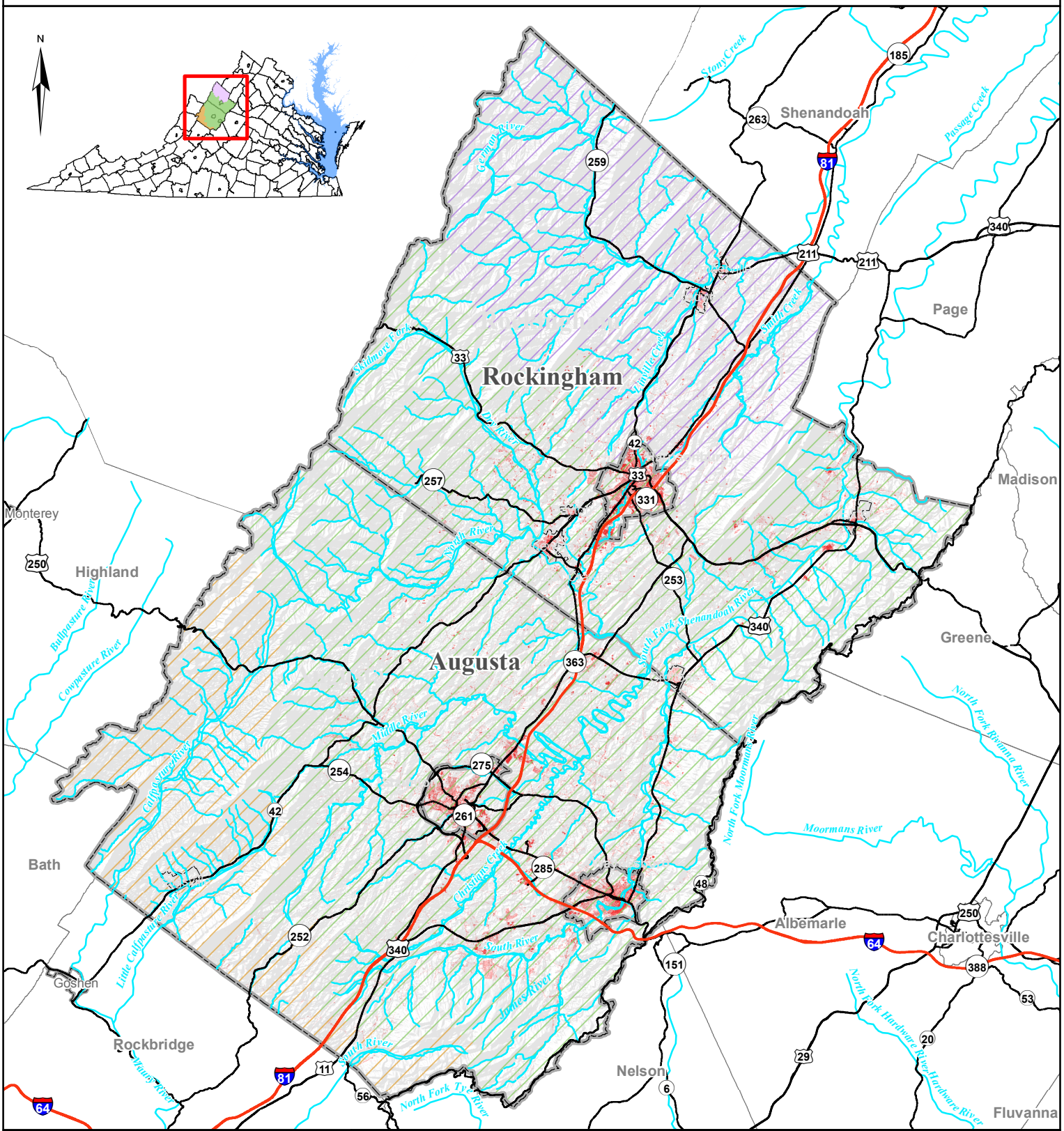


This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: US Geological Survey.
February, 2009

Landcover

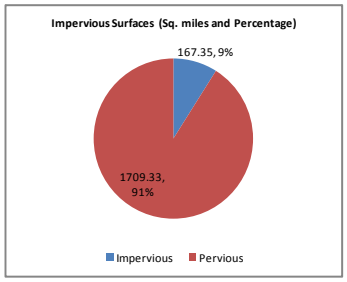
- No Data
- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Perennial Snow/Ice
- Shrub/Scrub
- Woody Wetlands

Figure 4-9:
Impervious Surfaces (Sec.90 B.8)



0 5 10 Miles

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: US Geological Survey.
February, 2009



Impervious Surfaces - LANDSAT 7 Imagery

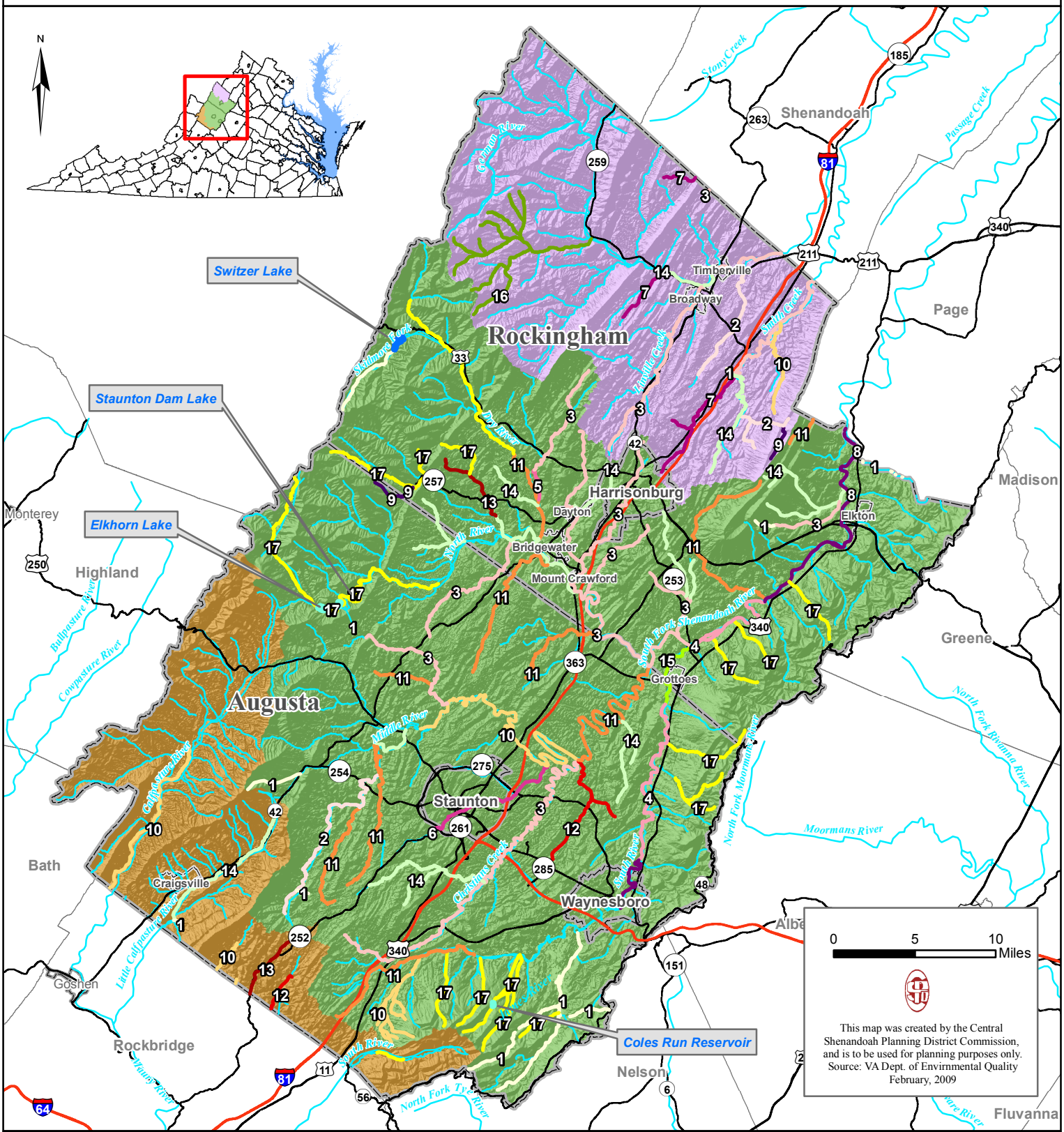
Watershed

North Fork Shenandoah. Virginia.

South Fork Shenandoah. Virginia.

Maury, Virginia

Figure 4-10:
Impaired Rivers/Streams and Reservoirs by Type (Sec.90 B.9)



Impaired Rivers and Streams

(ID Number) Type of Impairment - Total length in miles by Impairment Type

- (1) Benthic-Macroinvertebrate Bioassessments - 49.8
- (2) Benthic-Macroinvertebrate Bioassessments, Escherichia coli - 30.2
- (3) Benthic-Macroinvertebrate Bioassessments, Escherichia coli, Fecal Coliform - 156.1
- (4) Benthic-Macroinvertebrate Bioassessments, Escherichia coli, Fecal Coliform, Mercury in Fish Tissue - 23.4
- (5) Benthic-Macroinvertebrate Bioassessments, Escherichia coli, Fecal Coliform, Nitrogen, Nitrate - 2.2
- (6) Benthic-Macroinvertebrate Bioassessments, Escherichia coli, PCB in Fish Tissue - 9.7
- (7) Benthic-Macroinvertebrate Bioassessments, Fecal Coliform - 21.5
- (8) Benthic-Macroinvertebrate Bioassessments, Fecal Coliform, Mercury in Fish Tissue - 38.9
- (9) Benthic-Macroinvertebrate Bioassessments, pH - 5.5
- (10) Escherichia coli - 83.2
- (11) Escherichia coli, Fecal Coliform - 101.1
- (12) Escherichia coli, Temperature, water - 15.2
- (13) Escherichia coli, Temperature, water, Fecal Coliform - 13.4
- (14) Fecal Coliform - 95.1
- (15) Fecal Coliform, Mercury in Fish Tissue, PCB in Fish Tissue - 5.3
- 16) Fecal Coliform, pH - 34.8
- (17) pH - 104.6

Impaired Reservoirs

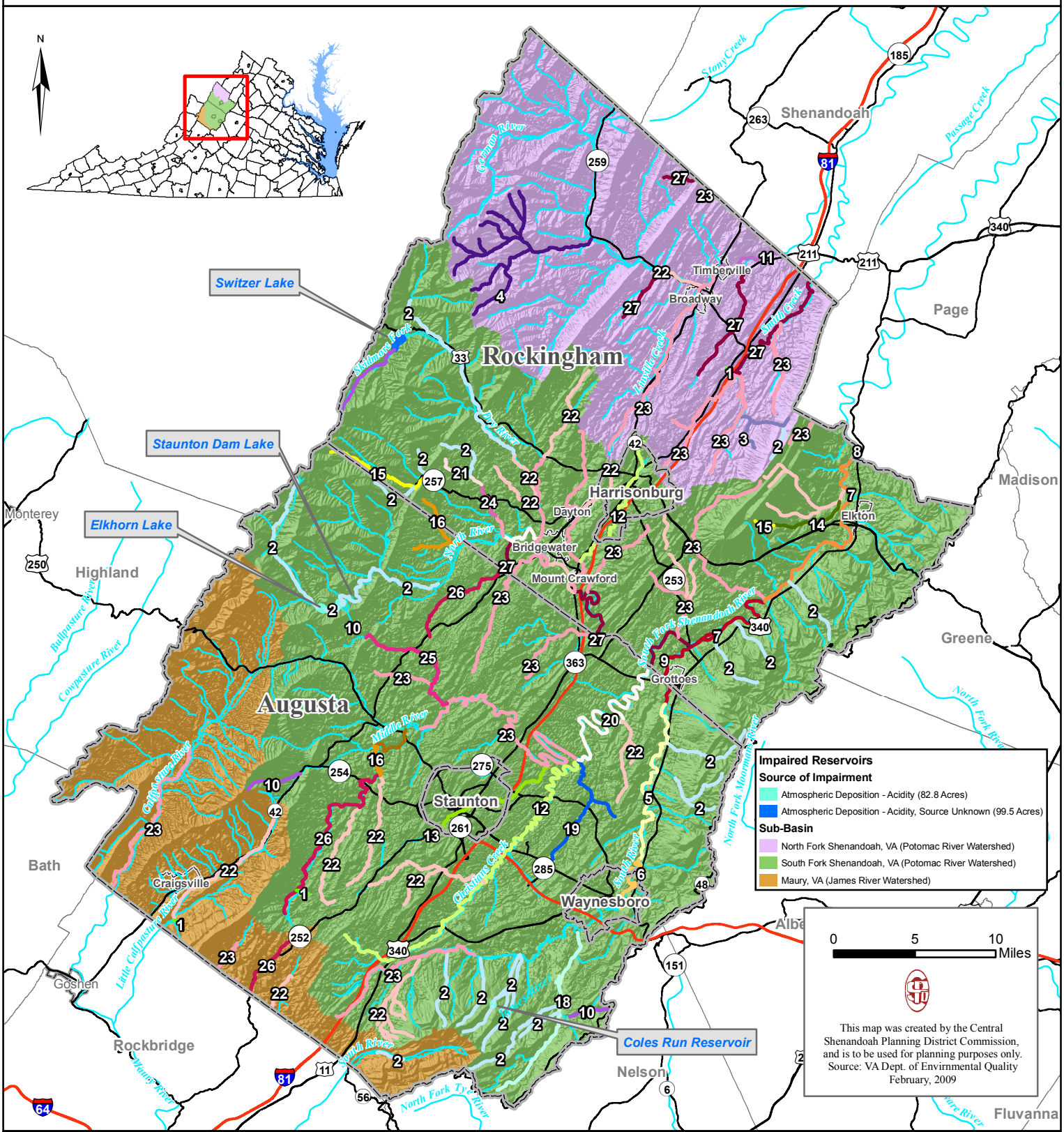
Type of Impairment - Total Acreage of Impairment

- Temperature, water, pH - 9.5 Acres
- pH - 82.8 Acres

Sub-Basin

- North Fork Shenandoah, VA (Potomac River Watershed)
- South Fork Shenandoah, VA (Potomac River Watershed)
- Maury, VA (James River Watershed)

Figure 4-11:
Impaired Rivers/Streams and Reservoirs by Source (Sec.90 B.9)

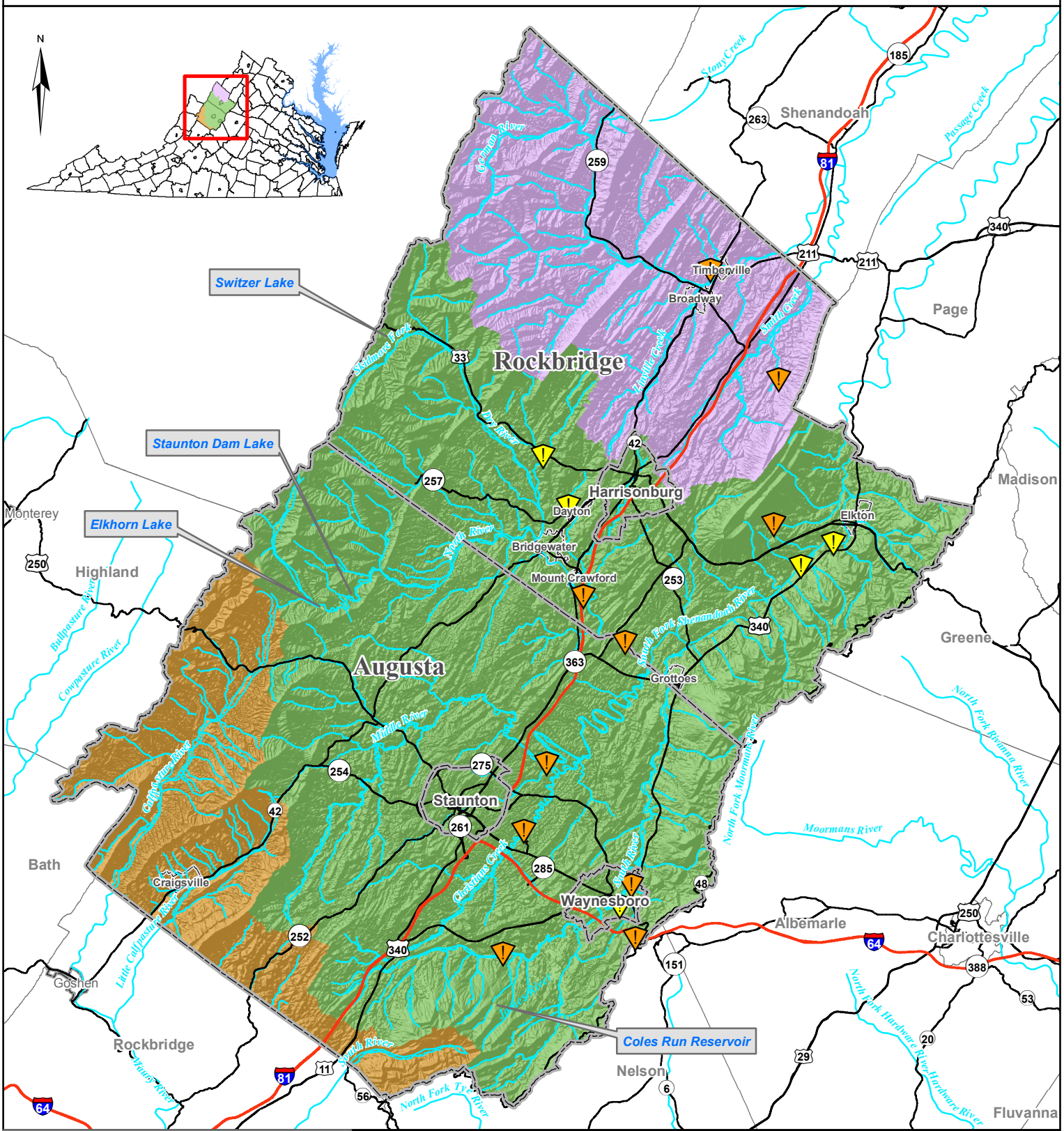


Impaired Rivers and Streams

Source of Impairment

- (1) Aquaculture (Permitted) - 2.3
- (2) Atmospheric Deposition - Acidity - 111.6
- (3) Atmospheric Deposition - Acidity, Wildlife Other than Waterfowl - 6.0
- (4) Atmospheric Deposition - Acidity, Wildlife Other than Waterfowl, Non-Point Source - 34.8
- (5) Contaminated Sediments, Municipal (Urbanized High Density Area), Wildlife Other than Waterfowl, Non-Point Source - 13.9
- (6) Contaminated Sediments, Municipal (Urbanized High Density Area), Wildlife Other than Waterfowl, Non-Point Source, Agriculture - 5.4
- (7) Contaminated Sediments, Source Unknown - 15.2
- (8) Contaminated Sediments, Source Unknown, Non-Point Source, Agriculture - 18.3
- (9) Contaminated Sediments, Wildlife Other than Waterfowl, Source Unknown, Non-Point Source, Agriculture - 14.8
- (10) Drought-related Impacts - 12.0
- (11) Industrial Point Source Discharge, Municipal (Urbanized High Density Area), Wildlife Other than Waterfowl, Non-Point Source, Agriculture - 11.8
- (12) Municipal (Urbanized High Density Area), Wildlife Other than Waterfowl, Non-Point Source - 42.3
- (13) Municipal (Urbanized High Density Area), Wildlife Other than Waterfowl, Non-Point Source, Inappropriate Waste Disposal - 9.7
- (14) Municipal Point Source Discharges, Wildlife Other than Waterfowl, Non-Point Source, Agriculture - 4.9
- (15) Natural Conditions - Water Quality Standards Use Attainability Analyses Needed - 8.3
- (16) Non-Point Source - 10.4
- (17) Non-Point Source, Agriculture - 3.3
- (18) Source Unknown - 25.8
- (19) Source Unknown, Non-Point Source - 10.1
- (20) Wildlife Other than Waterfowl - 21.0
- (21) Wildlife Other than Waterfowl, Natural Conditions - Water Quality Standards Use Attainability Analyses Needed - 3.2
- (22) Wildlife Other than Waterfowl, Non-Point Source - 115.4
- (23) Wildlife Other than Waterfowl, Non-Point Source, Agriculture - 196.8
- (24) Wildlife Other than Waterfowl, Non-Point Source, Natural Conditions - Water Quality Standards Use Attainability Analyses Needed - 2.5
- (25) Wildlife Other than Waterfowl, Source Unknown - 9.5
- (26) Wildlife Other than Waterfowl, Source Unknown, Non-Point Source - 31.2
- (27) Wildlife Other than Waterfowl, Source Unknown, Non-Point Source, Agriculture - 49.5

Figure 4-12:
Point Source Discharges (Sec.90 B.10)



Significant Dischargers

VPDES Sites

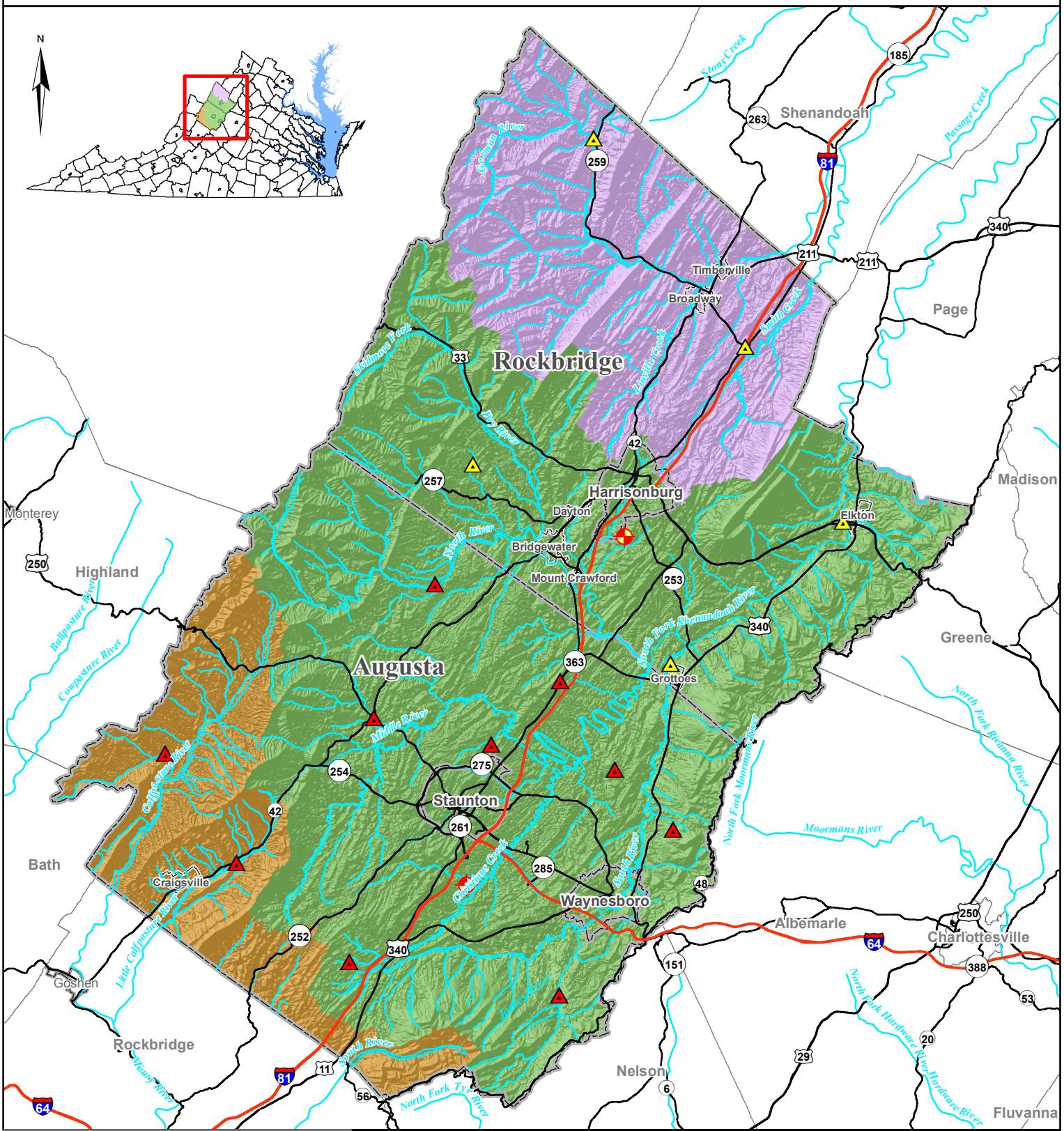
- Industrial
- Municipal

Sub-Basin

- North Fork Shenandoah, VA (Potomac River Watershed)
- South Fork Shenandoah, VA (Potomac River Watershed)
- Maury, VA (James River Watershed)

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: VA Dept. of Envirnmental Quality
February, 2009

Figure 4-13:
Potential Threats to Water Quality (Sec.90 B.11)



Augusta County Solid Waste Sites

- Landfill
- Trash Collection Site

Rockingham County Solid Waste Sites

- Landfill
- Trash Collection Site

Sub-Basin

- North Fork Shenandoah, VA (Potomac River Watershed)
- South Fork Shenandoah, VA (Potomac River Watershed)
- Maury, VA (James River Watershed)

This map was created by the Central Shenandoah Planning District Commission, and is to be used for planning purposes only.
Source: VA Dept. of Envirnmental Quality
February, 2009

5.0 PROJECTED WATER DEMANDS (Section 100)

5.1 Augusta County

Population and demand projections for Augusta County were developed and presented as part of the Water System Master Plan, prepared for the Augusta County Service Authority by W&A Associates (2010).

Chapter 4 of this report, which describes in detail the methodology for developing projections, is included as Appendix C. Population and demand projections are presented below.

5.1.1 Population Projections

Population projections for Augusta County are presented in Table 5-1

Table 5-1
Augusta County Population Growth Projection

Year	Population	Annual Growth Rate (%)
1990	54,600	--
2000	65,600	1.85
2005	69,700	1.19
2010	74,000	1.23
2015	78,500	1.19
2020	82,900	1.10
2025	87,300	1.04
2030	91,700	0.99

Source: WR&A, ACSA Draft Water System Master Plan, 2010

The ACSA water system serves areas within the County. It is assumed that existing patterns of water usage and the ratio of commercial to residential use will continue into the future.

5.1.2 Demand Projections

Demand projections for Augusta County are presented in Table 5-2.

Table 5-2
ACSA Water System Demands

Water System	Water System Demand (gpd)			
	2007	2017	2027	2037
Augusta Springs w/ Estaline Valley	34,000	50,000	66,000	97,000
Blackburn	74,000	95,000	115,000	156,000
Rt. 250 West	14,000	15,000	16,000	18,000
Chuchville	122,000	137,000	152,000	182,000
Deerfield	11,000	13,000	16,000	20,000
Dooms	163,000	237,000	311,000	459,000
Harriston	35,000	41,000	47,000	59,000
Middlebrook	6,000	7,000	7,000	9,000
Mount Sidney	172,000	188,000	204,000	236,000
South River	3,291,000	4,073,000	4,854,000	6,417,000
Verona w/ Mt.Sidney	773,000	855,000	937,000	1,101,000
Weyers Cave	254,000	426,000	597,000	940,000
TOTAL	**4,777,000**	**5,949,000**	**7,204,248**	**9,458,000**

Source: WR&A, ACSA Draft Water System Master Plan, 2010

Based on information provided by the ACSA and presented in Section 3.1, the current demand is disaggregated into the categories presented in Table 5-3.

Table 5-3
Current Demand Disaggregation – ACSA

Disaggregated Category	Percentage of Total Usage (%)
Residential	45
Commercial	28
Industrial	0
Military	0
Production Processes	3
Other	0
Lost and Unaccounted	23
Sale to Other Communities	1
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands by demand sector, for the ACSA service area from 2007-2047 are presented in Table 5-4.

Table 5-4
Disaggregated Water Demand Projections - ACSA

	Year			
User Category	**2007**	**2017**	**2027**	**2037**
Residential	2.15	2.68	3.24	4.26
Commercial	1.34	1.67	2.02	2.65
Industrial *	0	0	0	0
Lost and Unaccounted-for Water	1.10	1.37	1.66	2.18
Sales to Other Communities	0.05	0.06	0.07	0.09
Total	**4.77**	**5.95**	**7.20**	**9.46**

Note: The Water System Master Plan (WR&A, 2010) provides projections for the years 2007 through 2037. These projections are presented here and disaggregated using data provided by ACSA.

5.2 Town of Bridgewater

5.2.1 Population Projections

Current and projected population estimates for the Town of Bridgewater are presented in 5-5.

Table 5-5
Current and Projected Population Estimates – Town of Bridgewater

Year	Population	Population change	Percent Change
2000	5,203	--	--
2007	5,379	176	3.4
2015	6,850	1471	27.4
2020	8,637	1,787	26.1
2030	10,194	1,557	18.0
2040	11,303	1,109	10.9
2050	12,411	1,108	9.8
2000-2050 Population change		**7,208**	**138.5**

Source: Year 2000 – U.S. Census Data
Year 2007 – Weldon Cooper Center Estimate
Years 2015-2050 – Town of Bridgewater staff estimates

The total population of the Town of Bridgewater is predicted to increase through the planning period from 5,203 in the Year 2000 (U.S. Census estimate) to 10,194 in 2030. In addition, the Town has projected further growth through the Year 2050. Based on the projections presented in Table 5-3 the average annual growth rate for the period 2000 through 2050 is 0.02 percent. The Town predicts the greatest growth in population to occur by the Year 2020. After that time, the growth rate is predicted to decrease.

5.2.2 Demand Projections

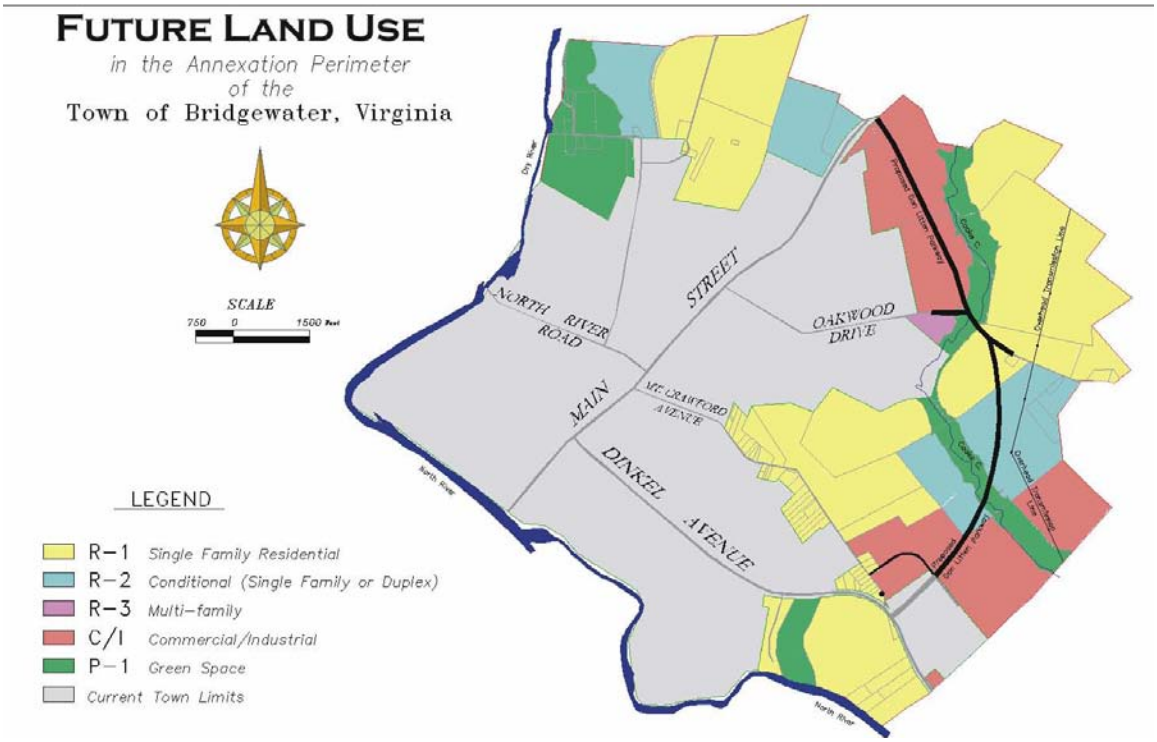
The Town of Bridgewater developed water demand projections based on existing and projected land use within the Town, assuming a water usage rate per acre of land. There are four land use designations used in projecting demand. These designations for the Town are presented in Table 5-6.

Table 5-6
Land Use Designations for the Town of Bridgewater

Land Use	Acres
Town Perimeter	1,549
Annexation Perimeter	1,486
Potential Annexation (2030-2040)	330
Potential Annexation (2040-2050)	330

There are currently 1,549 acres of land within the boundaries of the Town of Bridgewater. The Town itself has reached buildout. The Annexation Perimeter is that land which is designated and approved for future annexation from Rockingham County. A total of 1,486 acres are currently located within the Annexation Perimeter. An additional 660 acres are identified as potentially being within that perimeter in the future. The current Annexation Perimeter is depicted in Figure 5-1.

Figure 5-1
Town of Bridgewater – Future Land Use Annexation Perimeter



Source: Town of Bridgewater, Year 2008 Comprehensive Plan.

Average water usage each month is presented in Table 5-7.

Table 5-7
Average Monthly Water Usage – Town of Bridgewater

Month	Average Water Usage (mgd)	Month	Average Water Usage (mgd)
January	22.4	July	26.7
February	20.7	August	26.6
March	23.6	September	25.4
April	23.2	October	26.6
May	252	November	22.4
June	25.0	December	21.1
Annual Average Water Useage (mgd)		**24.075**	

Average daily water usage is calculated from the average monthly water usage for the Town (24.075 mgd) divided by the average number of days in a month (30.5). Using this methodology, existing average daily water usage in the Town perimeter is 0.79 mgd. To estimate a usage per acre value, the existing average daily water usage is then divided by

the number of acres in the Town (1,549) to result in an average daily usage per acre factor of 0.00051 mgd.

Buildout has already occurred within the current Town limits. To project into the future, assumptions were made regarding buildout of the annexation perimeter, to estimate the total number of acres developed in the future. These data are presented in Table 5-8.

Table 5-8
Assumptions for Buildout in the Annexation Perimeter

Year	Acres within Town[a]	Buildout % in Annexation Perimeter	Acreage in Annexation Perimeter	Acreage
2000	1549	0	--	1549
2010	1549	0	--	1549
2015	1549	33	495	2044
2020	1549	67	990	2539
2030	1549	100	1486	3035
2040	1549	100	1486+330[b]	3365
2050	1549	100	1498+330[b]	3695

[a] The Town has currently met its buildout potential.
[b] The potential exists for additional annexation perimeter expansion during these periods.

Using these assumptions, and the average daily usage per acre factor of 0.00051 mgd, projected demands for the Town of Bridgewater are presented in Table 5-7.

Table 5-9
Projected Water Demand – Town of Bridgewater

Year	Acreage	Average Daily Usage	Water Demand (mgd)
2000	1549	0.00051	0.79
2010	1549	0.00051	0.79
2015	2044	0.00051	1.04
2020	2539	0.00051	1.29
2030	3035	0.00051	1.55
2040	3365	0.00051	1.72
2050	3695	0.00051	1.88

Based on information provided by the Town of Bridgewater, the current demand is disaggregated into the categories presented in Table 5-10.

Table 5-10
Current Demand Disaggregation – Town of Bridgewater

User Category	% of Total Demand
Residential	34.99
Commercial	23
Industrial *	32
Lost and Unaccounted-for Water	10
Sales to Other Communities	0.01
Total	**100**

* Productions Processes are included in the value presented for Industrial

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Bridgewater from 2006-2040 are presented in Table 5-11.

Table 5-11
Disaggregated Water Demand Projections – Town of Bridgewater

	Year				
Demand Sector	**2006**	**2010**	**2020**	**2030**	**2040**
Residential	0.28	0.28	0.45	0.54	0.60
Commercial	0.18	0.18	0.30	0.36	0.40
Industrial *	0.25	0.25	0.41	0.50	0.55
Lost and Unaccounted-for Water	0.08	0.08	0.13	0.16	0.17
Sales to Other Communities	0.0001	0.0001	0.0001	0.0002	0.0002
Total	**0.79**	**0.79**	**1.29**	**1.55**	**1.72**

5.3 Town of Broadway

Future population for the Town of Broadway has been studied extensively as part of the Town's review of the Comprehensive Plan.

5.3.1 Population Projections

The Town of Broadway has grown rapidly in the last decade. Reasons for this include, expanding the town boundary through two annexations and a housing boom. When looking at the short-term growth trend, projects are skewed. Because of this, a 3.0 percent growth rate has been established as the desired rate of growth for the planning

period (Town of Broadway Comprehensive Plan, 2011). Assuming a 3.0% annual growth rate, population projections are presented in Table 5-12.

Table 5-12
Current and Projected Population Estimates – Town of Broadway

Year	Population
2000	2,192
2010	3,691
2020	4,960
2030	6,666
2040	8,959

Note: Assumes a 3 % annual rate of growth.

Broadway population is projected to increase by over 300 percent over the planning period (2000-2040).

5.3.2 Demand Projections

Assuming a 3.0% annual growth rate, demand projections are presented in Table 5-13.

Table 5-13
Projected Water Demand – Town of Broadway

Year	Water Demand (mgd)
2010	0.37
2020	0.50
2030	0.67
2040	0.90

Note: Assumes a 3 % annual rate of growth

Total demand is projected to increase 140 percent over the period (2010-2040). Based on information provided by the Town of Broadway, the current demand is disaggregated into the categories presented in Table 5-14.

Table 5-14
Current Demand Disaggregation – Town of Broadway

User Category	% of Total Demand
Residential	70
Commercial	7
Industrial *	10
Lost and Unaccounted-for Water	13
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Broadway are presented in Table 5-15.

Table 5-15
Disaggregated Water Demand Projections – Town of Broadway

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.26	0.35	0.47	0.63
Commercial	0.03	0.04	0.05	0.06
Industrial *	0.04	0.05	0.07	0.09
Lost and Unaccounted-for Water	0.05	0.07	0.09	0.12
Sales to Other Communities	0	0	0	0
Total	**0.37**	**0.50**	**0.67**	**0.90**

5.4 Town of Craigsville

A Water Supply Upgrade Preliminary Engineering Report (PER) for the Town of Craigsville has been prepared by Engineering Concepts, Inc. (October 17, 2007). This report included a discussion of population and water demand projections for the Town. The sections of that report related to population and water demand projections are paraphrased herein and referenced to when used.

For the purposes of the PER, a twenty-year planning period was used to evaluate water demand: from 2007-2027. For purposes of this Water Supply Plan, the planning period is 2000-2040. Therefore additional analysis is presented beyond that done in the PER to estimate population and demands for interim years and through 2040.

5.4.1 Population Projections

The population of the Town of Craigsville, based on the 2000 Census, was 979. The 2007 estimated population of the Town (Weldon Cooper Center, 2007) is 1,025. This represents a 4.7% increase over the 2000 Census data, which translates to an average annual increase of 0.77%.

A growth rate for the State of 34.1% between 2006 and 2030 is predicted in the Central Shenandoah Valley Region Demographic Forecasts 2006 (CSPDC, 2006) which is

equivalent to an average annual increase of 1.145% (Engineering Concepts, Inc., 2007). This is a higher growth rate than what has been observed in the Town in recent years. Discussions with Town staff indicated that there is potential for growth greater than what has occurred previously. Therefore, to be conservative, the 1.145% average annual increase in population was applied through the year 2027. This results in a population in the town of 1,302 in that year (Engineering Concepts, Inc., 2007).

The Virginia Department of Corrections (DOC) operates a unit near the Town that receives water from the town system. The DOC was contacted regarding the Craigsville facility, and there are no current plans to expand the facility (Engineering Concepts, Inc., 2007).

A constant growth rate in population was assumed to estimate the population for the interim years that were not included in the PER, as well as the year 2040. Population projections for the Town of Craigsville are presented in Table 5-16

Table 5-16
Current and Projected Population Estimates – Town of Craigsville

Year	Population *
2000	979
2007	1,063
2010	1,099
2020	1,218
2027	1,302
2030	1,338
2040	1,458

Source: Year 2000 – U.S. Census Data
Year 2007 – Weldon Cooper Center Estimate
Year 2027 – Engineering Concepts, Inc., 2007
* Population estimates for Years 2010, 2020, 2030, and 2040 interpolated from Engineering Concepts, assuming constant rate of growth of 1.18% per year over the entire planning period.

Craigsville population is projected to increase by 49 % over the planning period (2000-2040).

5.4.2 Demand Projections

A review of the production and consumption of water by the Town over the 5 year period from 2002-2007 was performed as part of the PER. Based on this analysis, total water demand was disaggregated into different categories. These categories are presented in Table 5-17

Table 5-17
Water Consumption by User Category – Town of Craigsville

Water Use Category	Percent of Total Demand
Town of Craigsville	17
ACSA-Estaline Valley	1
DOC Facility	34
Unaccounted-for Water	16
Misc.	32
Total	**100**

The ACSA-Estaline Valley consumption represents the percentage of the total Craigsville demand that is provided through agreement from the Augusta County Service Authority. The maximum purchase allowed is 50,000 gpd, and no growth is assumed into the future. Miscellaneous consumption represents unmetered connections, internal uses, estimated tank overflow, and other non-metered consumption.

As defined in Section 3.4 of this report, average daily usage in Craigsville in 2006 was 0.355 mgd. Based on existing agreements and the population projections presented in Section 5.4.1, total projected demand in 2027 is estimated to be 414,000 gpd (Engineering Concepts, Inc., 2007). Total projected water demand is presented in Table 5-18

Table 5-18
Total Projected Water Demand – Town of Craigsville

Year	Population	Water Demand (mgd)
2000	979	0.355
2007	1,063	0.361
2010	1,099	0.377
2020	1,218	0.399
2027	1,302	0.414
2030	1,338	0.421
2040	1,458	0.442

Source: Year 2000 – 2002 water demand from Section 3.4 is used to estimate 2000 demand
Year 2007, and 2027 – Engineering Concepts, Inc, 2007
Years 2010, 2020, 2030, 2040 – estimated assuming the constant growth rate for the planning period.

To provide a disaggregation of the total demand into demand categories, based on discussion with Town staff, it is assumed that 90% of the total usage is residential, and 10% is commercial. No industrial demand is assumed for the future in Craigsville. Based on these assumptions, total demand is disaggregated in Table 5-19.

Table 5-19
Disaggregated Total Water Demand – Town of Craigsville

Year	Residential Demand (mgd)	Commercial Demand (mgd)	Total Demand (mgd)
2000	0.320	0.036	0.355
2007	0.333	0.037	0.370
2010	0.339	0.038	0.377
2020	0.359	0.040	0.399
2027	0.373	0.041	0.414
2030	0.379	0.042	0.421
2040	0.398	0.044	0.442

5.5 Town of Dayton

5.5.1 Population Projections

It is assumed that the population of the Town of Dayton will increas throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the Town of Dayton are presented in Table 5-20.

Table 5-20
Current and Projected Population Estimates – Town of Dayton

Year	Population
2000	1344
2010	1530
2020	1755
2030	2013
2040	2308

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Dayton population is projected to increase by 71 percent over the planning period (2000-2040).

5.5.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-21. It is expected and planned that over the planning period, demands will be reduced by up to 5

percent as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-21.

Table 5-21
Projected Water Demand – Town of Dayton

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	0.1008	1	0.0998
2010	0.1148	2	0.1125
2020	0.1316	3	0.1277
2030	0.1510	4	0.1449
2040	0.1731	5	0.1644

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 65 percent over the planning period (2000-2040). Based on information provided by the Town of Dayton, the current demand is disaggregated into the categories presented in Table 5-22.

Table 5-22
Current Demand Disaggregation – Town of Dayton

User Category	% of Total Demand
Residential	13
Commercial	2
Industrial *	80
Production Processes	1
Lost and Unaccounted-for Water	4
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Dayton are presented in Table 5-23.

Table 5-23
Disaggregated Water Demand Projections – Town of Dayton

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.0146	0.0166	0.0188	0.0214
Commercial	0.0023	0.0026	0.0029	0.0033
Industrial *	0.0900	0.1022	0.1159	0.1315
Production Processes	0.0011	0.0013	0.0014	0.0016
Lost and Unaccounted-for Water	0.0045	0.0051	0.0058	0.0066
Sales to Other Communities	0	0	0	0
Total	**0.1125**	**0.1277**	**0.1449**	**0.1644**

5.6 Town of Elkton

5.6.1 Population Projections

It is assumed that the population of the Town of Elkton will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the Town of Elkton are presented in Table 5-24.

Table 5-24
Current and Projected Population Estimates – Town of Elkton

Year	Population
2000	2,042
2010	2,726
2020	3,790
2030	5,269
2040	7,326

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Elkton population is projected to increase by more than 250 percent over the planning period (2000-2040).

5.6.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-25. It is expected and planned that over the planning period, demands will be reduced by up to 5 percent as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-25.

Table 5-25
Projected Water Demand – Town of Elkton

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	0.1532	1	0.1516
2010	0.2045	2	0.2004
2020	0.2843	3	0.2757
2030	0.3952	4	0.3794
2040	0.5495	5	0.5220

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 240 percent over the planning period (2000-2040). Based on information provided by the Town of Elkton, the current demand is disaggregated into the categories presented in Table 5-26.

Table 5-26
Current Demand Disaggregation – Town of Elkton

User Category	% of Total Demand
Residential	84
Commercial	3
Industrial *	0
Production Processes	0
Lost and Unaccounted-for Water	13
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Dayton are presented in Table 5-27.

Table 5-27
Disaggregated Water Demand Projections – Town of Elkton

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.1683	0.2316	0.3187	0.4385
Commercial	0.0060	0.0083	0.0114	0.0157
Industrial *	0	0	0	0
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.0261	0.0358	0.0493	0.0679
Sales to Other Communities	0	0	0	0
Total	**0.2004**	**0.2757**	**0.3794**	**0.5220**

5.7 Town of Grottoes

5.7.1 Population Projections

It is assumed that the population of the Town of Grottoes will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the Town of Grottoes are presented in Table 5-28.

Table 5-28
Current and Projected Population Estimates – Town of Grottoes

Year	Population
2000	2,114
2010	2,668
2020	3,455
2030	4,475
2040	5,796

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Grottoes population is projected to increase 175 percent over the planning period (2000-2040).

5.7.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-29. It is expected and planned that over the planning period, demands will be reduced by up to 5 percent as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-29.

Table 5-29
Projected Water Demand – Town of Grottoes

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	0.1586	1	0.1570
2010	0.2001	2	0.1961
2020	0.2591	3	0.2514
2030	0.3356	4	0.3222
2040	0.4347	5	0.4130

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 163 percent over the planning period (2000-2040). Based on information provided by the Town of Grottoes, the current demand is disaggregated into the categories presented in Table 5-30.

Table 5-30
Current Demand Disaggregation – Town of Grottoes

User Category	% of Total Demand
Residential	84
Commercial	3
Industrial *	0
Production Processes	0
Lost and Unaccounted-for Water	13
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Grottoes are presented in Table 5-31.

Table 5-31
Disaggregated Water Demand Projections – Town of Grottoes

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.1647	0.2112	0.2706	0.3469
Commercial	0.0059	0.0075	0.0097	0.0124
Industrial *	0	0	0	0
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.0255	0.0327	0.0419	0.0537
Sales to Other Communities	0	0	0	0
Total	**0.1961**	**0.2514**	**0.3222**	**0.4130**

5.8 City of Harrisonburg

It is assumed that the population of the City of Harrisonburg will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the City of Harrisonburg are presented in Table 5-32.

Table 5-32
Current and Projected Population Estimates – City of Harrisonburg

Year	Population
2000	40,468
2010	48,914
2020	60,154
2030	73,977
2040	90,977

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Harrisonburg population is projected to increase 175 percent over the planning period (2000-2040).

5.8.2 Demand Projections

Based on development trends, the City of Harrisonburg projects that water demands will grow at a rate of 2.5% annually through the planning period, accounting for demand reductions due to conservation. Based on this assumption, the resulting demand reductions are incorporated into the demand presented in Table 5-33.

Table 5-33
Projected Water Demand – City of Harrisonburg

Year	Projected Water Demand
2006	6.60
2010	6.29
2020	7.93
2030	9.57
2040	11.04

Note: Assumes an annual average growth rate in demands of 2.5 percent over the planning period.

Based on information provided by the City of Harrisonburg, the current demand is disaggregated into the categories presented in Table 5-34.

Table 5-34
Current Demand Disaggregation – City of Harrisonburg

User Category	% of Total Demand
Residential	16
Commercial	15
Industrial *	7
Production Processes	33
Lost and Unaccounted-for Water	27
Sales to Other Communities	2
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the City of Harrisonburg are presented in Table 5-35.

Table 5-35
Disaggregated Water Demand Projections – City of Harrisonburg

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	1.01	1.27	1.53	1.77
Commercial	0.94	1.19	1.44	1.66
Industrial	0.44	0.56	0.67	0.77
Production Processes	2.08	2.62	3.16	3.64
Lost and Unaccounted-for Water	1.70	2.14	2.58	2.98
Sales to Other Communities	0.13	0.16	0.19	0.22
Total	**6.29**	**7.93**	**9.57**	**11.04**

5.9 Rockingham County (including Mt. Crawford)

It is assumed that the population of the Rockingham County will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for Rockingham County are presented in Table 5-36.

Table 5-36
Current and Projected Population Estimates – Rockingham County

Year	Population
2000	67,714
2010	76,314
2020	86,579
2030	98,225
2040	111,437

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Rockingham County population is projected to increase 65 percent over the planning period (2000-2040).

5.9.2 Demand Projections

Demand projections for Rockingham County were completed in 2006 by Draper Aden Associates. The findings of the study are documented in the *Rockingham County Three Springs Water System Analysis* (Draper Aden Associates, 2006) and summarized herein.

From 1994 to 2003 water demand grew at an average pace of about 0.065 mgd per year. Since 2003, the rate of growth in water demand in the County has increased significantly to 0.283 mgd per year. This increase is primarily a result of growing industrial demand. Though this recent increase in demand is not anticipated to be maintained in the future, Rockingham County does not anticipate growth to return to its previous levels.

Future water demands were derived from analysis of the comprehensive plan, zoning ordinance, historical water usage, known development conditions, and discussions with the Economic Development and Public Works staff. Regions of growth were categorized into land uses and estimated demands per acre were calculated. Once the amount of anticipated water usage per acre was established, the acreage of the anticipated growth areas was obtained from the Comprehensive Plan. Anticipated future use was established by reasonably assumed development rates within each land use type (Draper Aden Associates, 2006). Based on this detailed analysis, demand projections for Rockingham County are presented in Table 5-37.

Table 5-37
Projected Water Demand –Rockingham County

Year	Projected Water Demand
2006	2.01
2010	2.98
2020	4.97
2030	6.80
2040	9.53

Based on information provided by Rockingham County, the current demand is disaggregated into the categories presented in Table 5-38.

Table 5-38
Current Demand Disaggregation – Rockingham County

User Category	% of Total Demand
Residential	27
Commercial	51
Industrial	0
Production Processes	1
Lost and Unaccounted-for Water	20
Sales to Other Communities	1
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for Rockingham County are presented in Table 5-39.

Table 5-39
Disaggregated Water Demand Projections – Rockingham County

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.8046	1.3419	1.8360	2.5731
Commercial	1.5198	2.5347	3.4680	4.8603
Industrial	0	0	0	0
Production Processes	0.0298	0.0497	0.0680	0.0953
Lost and Unaccounted-for Water	0.5960	0.9940	1.3600	1.9060
Sales to Other Communities	0.0298	0.0497	0.0680	0.0953
Total	**2.980**	**4.970**	**6.80**	**9.53**

5.10 City of Staunton

In the FY 2007 contractual agreement developed between DEQ and the CSPDC, a component was included that made provision for completing Section 100 work for the City of Staunton. Being that the City of Staunton is the only locality in the planning area required to complete this task, it is highly recommended that these figures and estimated projections be examined more closely with the regional group.

5.10.1 Population Projections

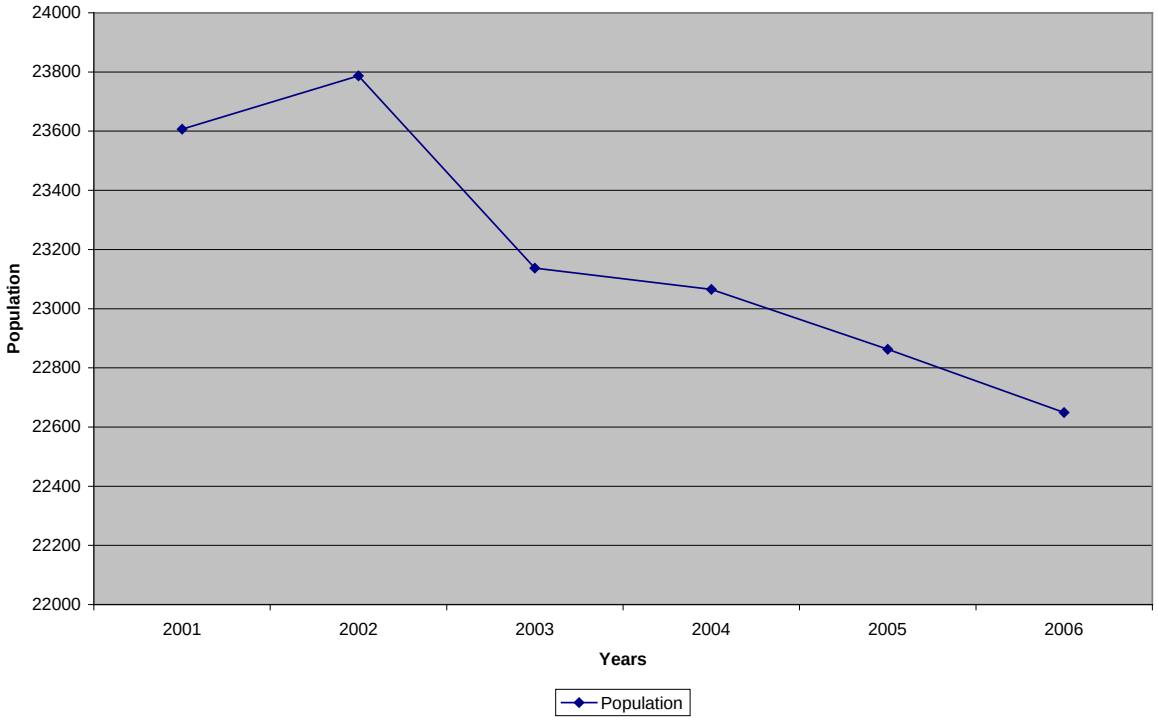
According to the regulations, Section 100 is expected to include projections of future water demand. Population in aggregate or disaggregated formulations should be estimated according to information from the U.S. Census Bureau, the Weldon Cooper Center, the Virginia Employment Commission, or other accepted source of population information. Demand projection methodologies should be consistent with those outlined in the American Water Works Association or American Society of Civil Engineers manuals. Sources of information and methodologies used in projecting future water demand shall be documented.

For this section, Woods & Poole Population Projection data was examined along with Census Bureau data, however, after studying these different data sets, the Virginia Employment Commission (VEC) data was used to determine population projections. This data set projects population to 2030, falling short of the required 30 to 50 planning timeframe required in the regulations. In order to meet the intent of the requirement, population projections were made based on historical data by from VEC. This was accomplished by utilizing a word growth forecasting method in Excel.

According to population projections developed by VEC, growth trends in Staunton appear to be relatively flat, if not on the decline. While this may be the case, additional growth in the areas of Augusta County that surround the City along with the City of Waynesboro's continued growth may very well lead to creation of a Small Metropolitan Statistical Area (SMSA) as a result of the 2010 decennial census. This designation is made when a confined geographical area's population density reaches or exceeds 50,000 persons. With this designation, comes much economic development activity as major retailers begin to move into the market realizing that a substantial market base is locating/growing in the area. This event would most likely shift recent historic growth trends in the City of Staunton. Figure 5-40 depicts the City's population between 2001 and 2006.

Figure 5-2

Staunton Population Trends 2001-2006



Projected water use based on population is presented in Table 5-40.

Table 5-40
City of Staunton Projected Water Use Based Upon Population, 2001-2050

Year	Population	Annual Water Use (MGD)
2001	23,607	6.427238356
2002	23,787	5.145540274
2003	23,137	5.089317808
2004	23,065	4.069041096
2005	22,863	8.068865753
2006	22,649	7.821317808
2010	22,704	5.990857705
2020	22,230	5.865784302
2030	22,235	5.867103642
2040	21,538.64	5.683355886
2050	21,112.84	5.571000956

Based on historical water consumption data from 2001-2006, an index was developed for each year based on population relative to water consumption, and is presented in Table 5-41.

Table 5-41
City of Staunton Water Consumption Index

Year	Population	Water Consumption (mgd)	Index (Population vs. Water Consumption)
2001	23,607	6.427238356	**0.000272**
2002	23,787	5.145540274	**0.000216**
2003	23,137	5.089317808	**0.00022**
2004	23,065	4.069041096	**0.000176**
2005	22,863	8.068865753	**0.000353**
2006	22,649	7.821317808	**0.000345**

In order to "smooth" out the indices, an average was taken by adding each year's index and then dividing by the number of years. The index developed is 0.000246. This number is then applied to forecasted population projections for the City of Staunton. In order to determine if this number was statistically significant or not, the index was applied "back-casting" the years of consumption history that was available (see Tables 5-42 and 5-43).

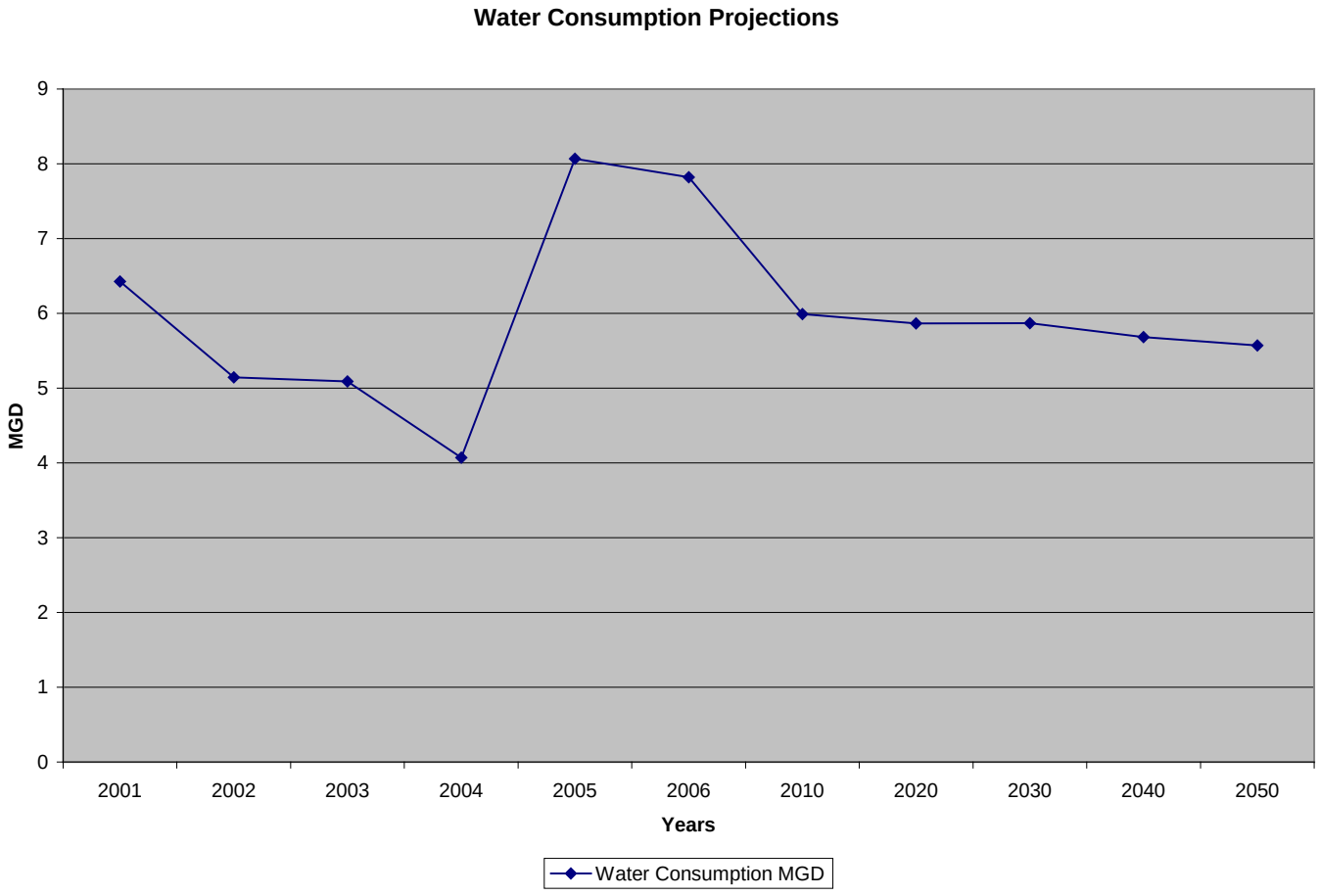
Table 5-42
Back-Projected Water Consumption, 2001-2006

Year	Population	Water Consumption (mgd)	Refined Index	Backprojected Water Consumption (MGD)
2001	23,607	6.427238356	0.000264	6.22913
2002	23,787	5.145540274	0.00246	6.276627
2003	23,137	5.089317808	0.000264	6.105113
2004	23,065	4.069041096	0.000264	6.086114
2005	22,863	8.068865753	0.000264	6.032813
2006	22,649	7.821317808	0.000264	5.976345

Table 5-43
Back-Projected Water Consumption vs. Actual Water Consumption, 2001-2006

Year	Population	Water Consumption (MGD)	Refined Index	Backprojected Water Consumption (MGD)	Difference
2001	23,607	6.427238356	0.000264	6.22913	-0.198108
2002	23,787	5.145540274	0.000246	6.276627	+1.131086
2003	23,137	5.089317808	0.000264	6.105113	+1.015795
2004	23,065	4.069041096	0.000264	6.086114	+2.017072
2005	22,863	8.068865753	0.000264	6.032813	-2.036052
2006	22,649	7.821317808	0.000264	5.976345	-1.844972

Figure 5-3



*This index does not take into account drought conditions or other factors that may have contributed to greater or lesser water consumption during the study period. Also other

factors such as growth in Augusta County, and the sale of water to Augusta County has not been factored into this projection.

Based on information provided by the City of Staunton, the current demand is disaggregated into the categories presented in Table 5-44.

Table 5-44
Current Demand Disaggregation – City of Staunton

User Category	% of Total Demand
Residential	62
Commercial	20
Industrial *	5
Production Processes	0
Lost and Unaccounted-for Water	13
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the City of Staunton are presented in Table 5-45.

Table 5-45
Disaggregated Water Demand Projections – City of Staunton

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	3.71	3.64	3.64	3.47
Commercial	1.20	1.17	1.17	1.12
Industrial *	0.30	0.29	0.29	0.28
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.78	0.76	0.76	0.73
Sales to Other Communities	0	0	0	0
Total	**5.99**	**5.87**	**5.87**	**5.6**

5.11 Town of Timberville

Future population and water demand for the Town of Timberville were also estimated in the "Plains Mill Feasibility Study" (Peed & Bortz, 2005). Projections were made based on current development patterns and assumed land usage, both in expected annexation areas and in undeveloped areas inside the current corporate limits. Expansion outside of the currently planned annexation areas is not anticipated in the foreseeable future. The Feasibility study assumes full development of the annexation areas and land within the Town limits by 2055. The annual water demand growth rate is 2.0%.

5.11.1 Population Projections

Assuming a 2.0% annual growth rate, population projections for the Town of Timberville are presented in Table 5-46.

Table 5-46
Current and Projected Population Estimates – Town of Timberville

Year	Population
2000	1,705
2005	1,850
2010	2,044
2015	2,250
2020	2,486
2025	2,736
2030	3,023
2035	3,327
2040	3,676
2045	4,047
2050	4,472
2055	4,921

Source: Year 2000 – U.S. Census Data
Years 2005, 2015, 2025, 2035, 2045 and 2055 – Peed&Bortz, 2005
Years 2010, 2020, 2030, 2040, 2050 – interpolated from Peed&Bortz data assuming constant rate of growth over the planning period

Timberville population is projected to increase by 115 % over the planning period (2000-2040).

5.11.2 Demand Projections

Assuming a 2.0% annual growth rate, demand projections are presented in Table 5-4.

Table 5-47
Projected Water Demand – Town of Timberville

Year	Water Demand (mgd)
2000	0.20
2005	0.22
2010	0.24
2015	0.26
2020	0.29
2025	0.32
2030	0.36
2035	0.39
2040	0.43
2045	0.47
2050	0.53
2055	0.58

Source: Year 2000 – 2002 water demand from Section 3.11 is used to estimate 2000 demand
Years 2005, 2015, 2025, 2035 and 2045 – Peed&Bortz, 2005
Years 2010, 2020, 2030, 2040, 2050 – interpolated from Peed&Bortz data assuming constant rate of growth over the planning period.

Total demand is projected to increase 115% over the planning period (2000-2040).

Based on information provided by the Town of Timberville, the current demand is disaggregated into the categories presented in Table 5-48.

Table 5-48
Current Demand Disaggregation – Town of Timberville

User Category	% of Total Demand
Residential	70
Commercial	5
Industrial	0
Production Processes	0
Lost and Unaccounted-for Water	25
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Timberville are presented in Table 5-49.

Table 5-49
Disaggregated Water Demand Projections – Town of Timberville

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.1680	0.2030	0.2520	0.3010
Commercial	0.012	0.0145	0.0180	0.0215
Industrial	0	0	0	0
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.0600	0.0725	0.0900	0.1075
Sales to Other Communities	0	0	0	0
Total	**0.24**	**0.29**	**0.36**	**0.43**

5.12 City of Waynesboro

5.12.1 Population Projections

It is assumed that the population of the City of Waynesboro will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the City of Waynesboro are presented in Table 5-50.

Table 5-50
Current and Projected Population Estimates – City of Waynesboro

Year	Population
2000	19,250
2010	21,006
2020	22,658
2030	24,440
2040	26,363

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Waynesboro population is projected to increase 37 percent over the planning period (2000-2040).

5.12.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-51. It is expected and planned that over the planning period, demands will be reduced by up to 5 percent as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-51.

Table 5-51
Projected Water Demand – City of Waynesboro

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	1.464	1	1.4494
2010	1.575	2	1.5439
2020	1.699	3	1.6484
2030	1.833	4	1.7597
2040	1.977	5	1.8784

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 30 percent over the planning period (2000-2040). Based on information provided by the City of Waynesboro, the current demand is disaggregated into the categories presented in Table 5-52.

Table 5-52
Current Demand Disaggregation – City of Waynesboro

User Category	% of Total Demand
Residential	68
Commercial	11
Industrial *	5
Production Processes	3
Lost and Unaccounted-for Water	13
Sales to Other Communities	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the City of Waynesboro are presented in Table 5-53

Table 5-53
Disaggregated Water Demand Projections – City of Waynesboro

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	1.0499	1.1209	1.1966	1.2773
Commercial	0.1698	0.1813	0.1936	0.2066
Industrial	0.0772	0.0824	0.0880	0.0939
Production Processes	0.0463	0.0495	0.0528	0.0564
Lost and Unaccounted-for Water	0.2007	0.2143	0.2288	0.2442
Sales to Other Communities	0	0	0	0
Total	**1.5439**	**1.6484**	**1.7597**	**1.8784**

6.0 Water Demand Management (Section 110)

The following section addresses the water demand management and conservation measures for the Upper Shenandoah River Basin Water Supply planning area, as specified in the Water Supply Regulations 9 VAC 25-780-110. According to the regulations the water supply plan will describe practices for more efficient use of water within the planning area.

The types of measures described below include the adoption and enforcement of the Virginia Uniform Statewide Building Code that address low flow toilets and appliances and landscaping and irrigation restrictions. The plan also includes information that describes water conservation and water reduction measures utilized within the planning area. These include technical, educational and financial programs.

The water supply plan also includes and describes practices that address unaccounted water loss in the maintenance and operation of each water system. The types of programs described include leak detection and repair policies as well as the project that replace outdated and inefficient water distribution lines.

Finally, the Water Supply Plan describes current conservation practice, techniques and technologies utilized by each of the local governments, public service authorities and regional conservation entities.

Each locality completed the Water Demand Management Information form. This information was used to catalog and describe the water efficiency, water conservation and water loss reduction practice used within the planning area as detailed below.

6.1 Water Use Efficiency

6.1.1 Adoption of the Virginia Uniform Building Code

The following chart describes the localities that have adopted the Virginia Uniform Building Code and the responsible party for enforcement of the Code:

Table 6-1 – Adoption of the Virginia Uniform Building Code by Locality

Locality	Year Adopted	Enforcement	Comments
Augusta County	1988 sections 604.4 and table 604.4 of the 2003 International Plumbing Code	Augusta County	
Town of Bridgewater	1991	Rockingham County	Bridgewater does not have a building inspections dept. all activities of this nature are handled by Rockingham County
Town of Broadway	2003		Rockingham performs inspections
Town of Craigsville	1999 Ordinance # 604.4 Table of 2003 International Plumbing Code		Inspections performed by county building Official in accordance with state build and county codes
Town of Dayton	Have not adopted		
Town of Elkton	1991	Rockingham County	Rockingham County's Community Development Dept. has building inspectors who check to insure flow rates meet the building code requirements
Town of Grottoes	1988 Ordinance # 63:1	Rockingham County	Building codes are monitored and inspected by Rockingham County
City of Harrisonburg	1993 Ordinance # 11-1-1		Through building/plumbing inspections of new construction
Town of Mt. Crawford	1991	Rockingham County	Rockingham County's Community Development Dept. has building inspectors who check to insure flow rates meet the building code requirements
Rockingham County	1991	Rockingham County	Rockingham County's Community Development Dept. has building inspectors who check to insure flow rates meet the building code requirements

City of Staunton	1997 Ordinance amending sections 9-2, 9-14, and 9-16 of chapter 9 of the code for the City of Staunton		City of Staunton building official implements the codes through the process of permitting and inspection to insure compliance
Town of Timberville			Rockingham County performs all building inspections for Timberville
City of Waynesboro	1988	Augusta County	

6.1.2 Other Local Water Use Ordinance or Plans

None of the localities have adopted ordinances and/or developed and implemented other plans and programs that address low-water use and water efficient landscaping. However, as part of the adoption of the Upper Shenandoah River Basin Water Supply Plan, each locality will adopt the Drought Response Plan and the related ordinance that enacts the Drought plan. Please see appendix of the plan for more information.

6.1.3 Homeowner's Associations

There is no data available to support that any homeowner's association groups have adopted landscaping plans or other plans to increase water efficiency or reduce water use. However, as part of the adoption of the Upper Shenandoah River Basin Water Supply Plan, each locality will adopt the Drought Response Plan and the related ordinance that enacts the Drought Plan. As a result homeowners' association groups will be required to comply with the ordinance. Please see appendix of the plan for more information.

6.1.4 Wasteful Water Use

The City of Harrisonburg has adopted ordinance 7-2-16 that states it shall be unlawful to allow water to run in a wasteful manor. Service may be discontinued for violation of this section. Rockingham County has their own water and sewer rules and regulations that allows use to disconnect service for "willful or indifferent waste of water due to any cause". Once the county sees a leak on a customer's line, they'll inform them of the situation. If they do not repair the leak within a certain amount of days, the county will notify them that they'll be cutting off t heir meter unless the leak is repaired. The Town of Timberville adopted ordinance 6-1.15. The ordinance reads that "no person shall open any pipe, fire plug, hydrant, cock or another part of the Town water system so as to waste water". None of the other localities have adopted ordinance declaring wasteful water use and/or running of water unlawful. However, as part of the adoption of the Upper Shenandoah River Basin Water Supply Plan, each locality will adopt the Drought Response Plan and the related ordinance that enacts the Drought Plan.

6.1.5 Irrigation Efficiency

Augusta County has implemented practices of irrigation efficiency by disallowing sewer credits giving during irrigation months. None of the other localities in the Upper Shenandoah River Basin Water Supply Planning area implement practices to increase irrigation efficiency such as requiring irrigators to invest in irrigation meters, water recycling or withholding sewer credits during irrigation months.

6.1.6 Municipal/Private Water Suppliers

The Town of Dayton has efficiency measures by way of monitoring, meter calibrations, using untreated water for backwashing filters, and leak detection. The Town of Grottoes has also implemented water use efficiency measures. During water supply emergencies, residents are asked to reduce wasteful water use practices (i.e. lawn care watering, car washing, etc.). The City of Staunton has also implemented these measures through the installation and use of low flow fixtures, water accounting practices, and distribution maintenance. No other data available to support water use efficiency measures taken by municipal and/or private water suppliers with the exception of localities with metered water connections.

6.1.7 WaterSense Partners

The WaterSense program sponsored by the EPA partners with manufacturers, retailer and distributors, utilities, state and local governments, non-governmental organizations, trade associations, irrigation professionals and other conservation groups and organizations to promote the use of water-efficient products and the need for smart water use. EPA's website: www.epa.gov/watersense/partners/index.htm lists organizations that have agreed to partner with EPA to promote water conservation. None of the community water systems in the Upper Shenandoah River Basin Watershed planning area are listed on the EPA's list of WaterSense Partners.

EPA's WaterSense website lists professional landscape and irrigation companies that have been certified through the WaterSense program. There are 58 listed on EPA's website. Of these 19 provide services statewide and five (5) provide services in the area in and around the Upper Shenandoah River Basin planning region.

6.1.8 Other Efficient Water Use Practices

The Town of Craigsville has implemented additional efficient water use practices such as identifying water leaks and losses and repairing them as soon as possible. The City of Harrisonburg has also implemented additional practices. They have an on-call staff available immediate to respond to main breaks and a leak survey program to lacate main leaks and schedule repairs. Other than the plans, measures, and practices mentioned above; there are no other measures taken by the localities for more efficient use of water in the planning area. As stated previously the adoption of the Upper Shenandoah River Basin Water Supply Plan and the Drought Response Plan along with the enacting ordinance; numerous water efficiency practices and measures will be implemented.

6.2 Water Conservation

The following sections outlines and describes the efforts made by the localities and community water systems to reduce water consumption on a long-term basis.

6.2.1 Augusta County

Augusta County has adopted water conservation practices through their water suppliers such as reducing the frequency of filter back wash. Also, the ACSA has installed low-flow toilets in all new buildings, both private and government. Water suppliers in Augusta County have also offered "yard taps" to monitor and reduce outdoor water use by installing separate irrigation meters so that customers are only billed water. The ACSA offers water saving tips on the web under their Education web-page. It is an outreach program that includes education about leak detection and water conservation. Programs include education to elementary schools and booths at the County Fair and Sweet Dreams.

6.2.2 Town of Bridgewater

The Town of Bridgewater has installed low-flow fixtures in all new construction. As worn fixtures are replaced, they are updated with new low-flow parts, in both private and government buildings. Bridgewater has also implemented education programs. The *Bridgewater Current*, a monthly publication produced by the Town of Bridgewater, periodically provides information on water conservation or ways for homeowners to check for water leaks in their home. Lastly, the Town of Bridgewater has implemented a declining block rate payment structure to encourage water conservation.

6.2.3 Town of Broadway

The Town of Broadway has made improvements to their water conservation by operating WTP to use as little water as possible. They have also installed low-flow toilets, sinks and urinals in their new construction buildings. Lastly, Broadway has implemented an inclining block rate payment structure to encourage water conservation.

6.2.4 Town of Craigsville

In the Town of Craigsville, the Augusta County Correctional Center had a water conservation study done and made upgrades on showers, faucets, urinals, and toilets. They introduced shorter shower times in the facility, down to 6 minutes and if a toilet is flushed twice in a 5 minute period, they lock out for 1 hour.

6.2.5 Town of Dayton

The Town of Dayton has water suppliers who have adjusted their operating procedures to improve water conservation with their Cargil Starting plant wide water conservation. The town has also installed new low-flow water fixtures so that they meet all new International plumbing

code requirements. Dayton has installed these fixtures in all new construction buildings and in their government buildings, new municipal buildings, parks, buildings and shops.

6.2.6 Town of Elkton

The Town of Elkton has required that all new municipal buildings and new construction and renovations be installed with low-flow fixtures. The county has also offered the locality "yard taps". For anyone who wants to install an irrigation system without also being billed for sewer, these irrigation taps are made available.

6.2.7 Town of Grottoes

The Town of the Grottoes has made no other water conservation measures to reduce water use long-term within their locality and/or planning area

6.2.8 City of Harrisonburg

The City of Harrisonburg's water suppliers have also adjusted some of their operating procedures to improve water conservation. WTP does not backlash anymore than it necessary. Backlashed waters re-used for irrigation at city golf course; this method is referred to as the release and re-captures method. Harrisonburg has also installed low-flow fixtures in municipal renovations and in new construction and renovations. Harrisonburg also distributed flyers with information on water conservation throughout their city, and during voluntary conservation declaration city encourages conservation in accordance with AWWA practices.

6.2.9 Town of Mount Crawford

The Town of Mount Crawford has required that all new municipal buildings and new construction and renovations be installed with low-flow fixtures. The county has also offered the locality "yard taps". For anyone who wants to install an irrigation system without also being billed for sewer, these irrigation taps are made available.

6.2.10 Rockingham County

Rockingham County has required that all new municipal buildings and new construction and renovations be installed with low-flow fixtures. The county has also offered the locality "yard taps". For anyone who wants to install an irrigation system without also being billed for sewer, these irrigation taps are made available.

6.2.11 City of Staunton

In 2004, the City of Staunton completed upgrading their water plant by incorporating a new airscour system. The new filter design improved effluent quality and backwash efficiency. The increased filter run times saves over 28 million gallons per year. The Public Works Dept. of Staunton has replaced all conventional plumbing fixtures with new low-flow faucets and has begun to install no-flow urinals. Also, some fixtures have been purchased but have not been

installed in City Hall and the Police Dept. The City of Staunton has also offered "yard taps" to their citizens. For an additional expense, a customer has an option to have a second meter installed for the sole purpose of irrigation and not be subject to prorated sewerage fees. This allows the customer to monitor their irrigation volumes more easily. Staunton encourages tours and interaction with the public to inform them of issues concerning water. Staunton may be putting together a water conservation presentation to present to school children.

6.2.12 Town of Timberville

The Town of Timberville has made just one water conservation measure to reduce water use long-term within their locality and/or planning area, by establishing an inclining block rate payment structure to encourage water conservation.

6.2.13 City of Waynesboro

The City of Waynesboro has adopted water conservation practices through their water suppliers such as reducing the frequency of filter back wash. Also, the ACSA has installed low-flow toilets in all new buildings, both private and government. Water suppliers in Augusta County have also offered "yard taps" to monitor and reduce outdoor water use by installing separate irrigation meters so that customers are only billed water. The ACSA offers water saving tips on the web under their Education web-page. It is an outreach program that includes education about leak detection and water conservation. Programs include education to elementary schools and booths at the County Fair and Sweet Dreams.

6.3 Water Loss Reduction

This section describes the measures and practices taken to address water loss in the maintenance of water systems to reduce unaccounted for water loss within the locality and/or planning area.

6.3.1 Metering Usage

One of the best ways is to identify and monitor water loss is through a metered water system. Table 6-2 depicts the communities in the planning that area that have a system for meters, meter inventory, testing, maintenance and replacement:

Table 6-2 – Summary of Water Conservation Measures by Locality

Locality/ Community Water System	Metered System	Service Meters Source Meters	Meter Reading Frequency	Comments
Augusta County	Yes	Source and Service Meters	Bimonthly	Service meters read bimonthly, and source meters are read daily. ACSA has a meter maintenance program for accountability which includes a meter replacement program and is calibrated yearly.

Town of Bridgewater	Yes	Source and Service Meters	Monthly	Town has 2 water supplies: North River and a deep well. Both are metered and read on a daily basis. Service meters are read monthly and repaired or replaced as needed.
Town of Broadway	Yes	Source and Service Meters	Bimonthly	Source meters are calibrated every year, and the town is currently installing new meters in all our service areas.
Town of Craigsville	Yes	Source and Service Meters	Monthly	Residential services meters are stocked and have been tested by the ACSA.
Town of Dayton	Yes	Source and Service Meters	Monthly	Source meters are read daily, while services meters are read monthly
Town of Elkton	N/A	N/A	N/A	N/A
Town of the Grottoes	Yes	Source and Service Meters	Bimonthly	Source meters are read Monday through Friday and service meters are read bimonthly. Meter maintenance and replacement needs are determined and corrected at the time of meter readings.
City of Harrisonburg	N/A	N/A	N/A	N/A
Town of Mt. Crawford	N/A	N/A	N/A	N/A
Rockingham County	Yes	Service	Monthly	Rockingham is working on a maintenance program through their utilities crew. Testing is done when a complaint is received or a large reduction in usage is noticed.
City of Staunton	Yes	Service and Source Meters	Monthly and Bimonthly	The meter readings are read and accounted for by experienced individuals. They can and do recognize unusual readings or flows through meters…i.e. Stopped meters or unusually large readings.
Town of Timberville	Yes	Service Meters	Quarterly	Currently on an entire system change out program. Approximately half of the meters have been replaced by this point.
City of Waynesboro	N/A	N/A	N/A	N/A

* Cities and towns with "N/A" have no record of Water Loss Reduction in their DEQ form.

6.3.2 Ordinance or Policy to Require Customer to Repair Leaks

The following localities have a policy or an ordinance in place that requires a water user to repair leaking fixtures, appliances or plumbing:

1. Rockingham County – Rockingham County will disconnect service for willful or indifferent waste of water due to any cause. It is not an ordinance but in our rules and regulations. If the county determines that someone has a leak they will notify them of the issue. If they do not fix the problem, then Rockingham will discontinue their service.

6.3.3 Use of State Revolving Funds

The following localities have reported that they received Clean Water State Revolving Loan Funds and/or Drinking Water State Revolving Funds: These funds can be used to install water meters in its distribution system and/or to develop and implement water audit and leak detection practices. These funds can also be used to promote water conservation education through development and implementation of water conservation plans, public education program, and/or ordinances or regulation to conserve water.

- No locality within the region has reported that they received Clean Water State Revolving Loan Funds and/or Drinking Water State Revolving Funds.

6.3.4 Water Use Enforcement

Practices and polices for tracking unauthorized connection and the enforcement of unauthorized connections vary among localities. With limited staff and resources, it is difficult for localities to monitor and police unauthorized connections. Localities must depend on reports of these instances. In most cases, there are monetary and criminal sanctions enforced for the unauthorized use of water and connections.

1. Town of Bridgewater – town staff members as well as citizens are encouraged to report any unauthorized water use.
2. Town of Craigsville – if someone in the distribution area is using water and the town becomes unaware of them being a customer, they would investigate to see where they are getting their water supply from.
3. Town of Dayton – the town employees monitor meters for fire hydrants, but fire suppression in buildings are not metered.
4. Rockingham County – any time an unauthorized connection is found, information is obtained including where, when and any information about the person/business. A cop of our rules and regulations will be sent along with a letter detailing our requirements for connections. Rockingham also will ask for an estimate of how much was used and then will send out an invoice.
5. City of Staunton – each legitimate hydrant connection should have an issued meter that is measured by city employees.
6. Town of Timberville – the town performs visual inspections of any possible unauthorized connections

6.3.5 Capital Improvement Plans

The following localities/service authority have Capital Improvement Plans (CIP) which include dedicated funds to upgrade existing facility infrastructure, water mains, water lines, fire hydrants, valves, etc. to reduce water loss:

1. Augusta County – ACSA had a substandard line replacement program that focuses on replacing small (primarily 4" and smaller) pipes that are primarily old and of poor material, such as galvanized pipe. $200,000 is budgeted per year. In 2006, 2,200 feet of pipe were replaced/upgraded in the Substandard Water Line Program. Overall, this program has eliminated miles of old, substandard water lines.
2. Town of Craigsville – attitude value to reduce loss at water tank
3. Town of Dayton – have ongoing projects to improve their CIP
4. Rockingham County – Rockingham has funds for upgrading our infrastructure though they may not be for just water loss reasons. Lines may be old and need to be replaced and/or upsized. The assumption is that there are leaks in the systems which will need to be eliminated.
5. City of Staunton – Staunton regularly implement water main replacements in the most problematic areas. These planned replacements reduce the damage to adjacent property and limit expenses to the citizens of Staunton.
6. Town of Timberville – annual budget includes funds for distribution system maintenance and meter change out program.

In general, repairs and upgrades are made on an as needed basis utilizing department maintenance funds.

6.3.6 Public Education Programs

One of the most cost-effective means of water conservation and reduction of water loss is through public education. There are numerous ways that a locality can establish an effective public education program. Some examples include, enhanced billing appliance/fixture rebate and other incentives, customer water audits, and other conservation outreach efforts. Below is a list of the localities that offer public education programs or incentives to help reduce customer-side water loss:

1. Augusta County – customer service provides, at no charge, tablets for leak detection and we also provide our service with use of the meter master to detect leaks on the customer side of the meter.
2. Town of Bridgewater – in cases where there is apparent water leakage, a member of the town staff will suggest to the homeowner methods they can use to determine the source of the leak.
3. Town of Dayton – offers education programs such as onsite inspections and some literature is made available to water users.
4. Town of the Grottoes – customers who express concerns about leaks are provided with leak detection tablets.
5. City of Staunton – the customer service staff is equipped to instruct customers on how to look for leaks with provided die pills and how to check meters for flow. They provide

customers with information to properly winterize plumbing to prevent leaks and damage to property.

7.0 DROUGHT CONTINGENCY AND RESPONSE (Section 120)

In accordance with the Water Supply Planning regulations (9 VAC 25-780-120), a Regional Drought Plan has been drafted for the Upper Shenandoah Basin, and is included in Appendix E. The Plan was developed to guide communities in the Upper Shenandoah River Basin through instances when water shortages lead to drought conditions. The Plan, developed by Central Shenandoah Planning District (CSPDC) Commission staff with input from the affected localities and the Virginia Department of Environmental Quality (DEQ), will complement localities' water conservation policies and ordinances, as well as water resource plans. During the early stages of the drought planning process, a Drought Task Force was formed and membership included representatives from each locality. This Drought Task Force has been the overseeing locality body during the development of the Drought Response and Contingency Plan.

The Plan includes methods for localities, and residential, commercial, and industrial customers to help reduce demand during times of an impending or actual shortage. In addition, water supply regulation requires the structuring of a drought response and contingency plan with at least three graduated stages of response identified. The Plan is structured based on the Water Supply Planning Regulation and the Virginia State Drought Assessment and Response Plan.

Drought triggers or indicators to determine drought response levels, or stages, have been developed specifically with the individuality of each water system in mind. These indicators are designed to help alert local decision-makers of the need to consider implementing additional water reduction measures as drought conditions worsen. Response measures specified in the Plan are intended to supplement ongoing conservation programs and are designed to rapidly reduce water demand. The Plan is intended to help the Upper Shenandoah localities' staff implement these measures early to avoid the inevitable pitfalls of reactive, crisis-mode decision-making.

The Upper Shenandoah Drought Preparedness and Response Plan provides guidelines for determining the current drought response stage, higher or lower drought response stages, termination of all drought response stage declarations, and the response measures suggested for implementation at each stage. In general, the Plan provides both guidelines and "hard lines" to provide the Water Purveyor with sufficient information and flexibility to consider current circumstances pertinent to the declaration of specific drought response stages and implementation of specific drought response measures. Because individual locality system intakes include both local groundwater and stream intakes the approach of providing guidelines will better serve the community rather than establishing rigid criteria that may not adequately reflect water supply availability or water distribution system conditions.

The Plan includes three drought response levels ranging from drought watch to drought emergency. These drought stage triggers are among the primary "hard line" or mandatory triggers in the Plan. Once a drought watch level has been declared,

progression through drought warning and emergency stages will be declared based on threats to the localities' supplies and/or local system indicators that indicate negative impacts to the utility's groundwater supplies or stream intakes.

Drought response measures in the Plan are meant to supplement rather than replace ongoing water conservation and education programs. One or more response actions may be implemented when a drought response stage is declared. Additional actions may be implemented if needed based on continual monitoring of local system indicators. Specific conservation measures included in Upper Shenandoah drought response actions were developed based on the following general principles:

1. Emphasize the need for visible leadership from locality-maintained facilities.
2. Reduce or restrict highly visible, non-essential uses of water.
3. Avoid or minimize economic impacts to the community except under extreme conditions.
4. Work with large commercial water users to determine their own operational strategies for reducing water use well in advance of implementing advanced drought response stages.
5. Continue to proactively educate all customers on the importance of using water efficiently regardless of climatic conditions.
6. Ensure that any water restrictions do not impact community health and safety.

Tables 7-1, 7-2, and 7-3 are general guidelines for drought response and mitigation during the three drought stages in the Plan. In addition, within the Plan itself, there are compilations of indicators specific to the localities within the Upper Shenandoah Basin area for the three drought stages outlined in the Drought Response and Contingency Plan (Appendices A and B of the Drought Plan). Furthermore, there are region-wide water conservation measures to be incorporated during periods of declared drought stages (Appendices C, D, and E of the Drought Plan). These region-wide conservation measures in the Plan may be implemented on an individual locality basis when an Upper Shenandoah River Basin local government declares a drought stage. It is possible that the increased public awareness of water conservation activities during a drought stage may reduce water use up to 5% to 15%.

Table 7-1

Guidelines for Drought Response and Mitigation during a Drought Watch Stage

DROUGHT STAGE	ACTIONS		
Drought Watch	**Communities/ Localities Need to:**	**Individuals Need to:**	**Commercial Entities Need to:**
Goal of drought actions in this stage are to reduce use by up to 5%.	Implement Voluntary Conservation Measures (see Appendix C of Drought Plan) Review and/or update Regional Drought Plan Communicate conditions, increase outreach and provide conservation tips. Increase water use efficiency and/or promote use reclaimed water for public facility landscaping. Consider developing increased conservation rate charges or surcharges to respond to drought conditions.	Conduct home water audits and leak detection. Fix leaking faucets and replace faulty fixtures. Implement Voluntary Conservation Measures (see Appendix C of Drought Plan): • Convert high water using plumbing to low-flow fixtures. • Water at night or in the early morning to avoid the hottest part of the day • Make sure sprinklers are working properly to reduce overspray • Plant native or drought tolerant plants • Use a bucket when washing cars or go to a commercial car wash • Utilize water harvesting strategies. • Reuse water as much as possible such as reusing dishwater and rinse water for watering indoor and outdoor plants, where allowed by law.	Implement voluntary water reduction and follow conservation plan. Discontinue use of decorative fountains. Require commercial facilities with monthly demand exceeding a threshold limit to conduct a self-audit.

Table 7-2

Guidelines for Drought Response and Mitigation during a Drought Warning

DROUGHT STAGE	ACTIONS		
Drought Warning	**Communities/ Localities Need to:**	**Individuals Need to:**	**Commercial Entities Need to:**
Goal of drought actions in this stage are to reduce use by up to 5% - 10%.	Continue implementation of Voluntary Conservation Measures (see Appendices C & D) Begin the reduction or elimination of non-essential uses (Appendix E of Drought Plan) to reduce water usage by 5 to 10% Communicate drought level and conditions to public. Increase education on conservation followed by voluntary reductions for communities. Consider implementing a schedule for public lawn watering. Implement increased conservation rate changes or surcharges, as determined by locality.	Continue implementation of Voluntary Conservation Measures (see Appendices C & D) and follow the items below: • Reduce lawn watering to no more than two times per week between the hours of 9 p.m. and 10 a.m. • Reduce vegetable garden watering and water between the hours of 9 p.m. and 10 a.m. • Avoid sprinkler use. Use soil-soakers or drip irrigation • Do not plant new landscaping or grass	Implement water conservation plans. Implement interior retrofit for all high water use faucets and materials. Restrict washing of sidewalks, driveways, parking lots or any other paved surface except in the case of meeting health and safety standards. Prohibit operations of fountains at commercial sites.

Table 7-3

Guidelines for Drought Response and Mitigation during a Drought Emergency

DROUGHT STAGE	ACTIONS		
Drought Emergency	**Communities/ Localities Need to:**	**Individuals Need to:**	**Commercial Entities Need to:**
Goal of drought actions in this stage are to reduce use by up to 10% - 15%.	Implement mandatory non-essential water use restrictions to reduce water usage by 10-15% (see Appendix E of Drought Plan) Continue aforementioned conservation measures from watch and warning stages. Communicate conditions, increase outreach and promote conservation tips. Consider the adoption and enforcement of emergency ordinances as necessary to protect public welfare, health, and safety.	Implement mandatory non-essential water use restrictions (see Appendix E of Drought Plan), including the following: • No unrestricted lawn irrigation. • No washing of paved areas with any pressurized water source except in the case of meeting health and safety standards. • No washing of autos, trucks, types of mobile equipment except at facilities with wash water re-circulating systems. • No filling or topping off of outdoor swimming pools Continue aforementioned conservation measures from watch and warning stages. Where allowable by law, reuse water: • Reuse dishwater for plants. • Capture shower water in buckets for watering plants.	Implement mandatory non-essential water use restrictions (see Appendix E of Drought Plan). Voluntarily reduce water consumption by at least 10%. This reduction may result from the elimination of other non-essential water uses not listed in Appendix E of Drought Plan, application of water conservation practices, or reduction in essential water uses. Follow conservation measures for 'individuals' where appropriate. Discontinue the service of water to the restaurant or other food service establishment customers unless specifically requested by customer.

8.0 STATEMENT OF NEEDS AND ALTERNATIVES

In accordance with the Water Supply Planning regulations (9 VAC 25-780-130), a statement of need is required that clarifies the adequacy of existing water source to meet current and projected demands. This section addresses the adequacies of existing water supplies to meet demands through the planning period, based on the data presented in previous sections of this report.

Projected Year 2040 water demands and current permitted capacities of each locality are compared in Table 8-1

Table 8-1
Adequacy of Existing Water Supplies

Locality	Projected Year 2040 Water Demand (mgd)	VDH Permitted Capacity (mgd)	Year 2040 demand as % of Permitted Capacity
Augusta County (ACSA)	9.46	6.37	149
Bridgewater	1.72	1.5	115
Broadway	0.90	0.67	134
Craigsville	0.44	0.47	94
Dayton	0.16	2.94	5
Elkton	0.52	1.072	49
Grottoes	0.41	0.40	103
Harrisonburg	11.04	10.00	110
Rockingham	9.53	3.698	258
Staunton	5.6	12	47
Timberville	0.43	0.39	110
Waynesboro	1.88	4.82	39
Planning Region	**42.09**	**44.18**	**95**

Based solely on these data, the region as a whole, will meet its projected 2040 water demand with the existing regional supply. However, that would assume that the necessary infrastructure was in place to move water around the region as necessary to meet individual community deficits. Realistically, that is not an appropriate manner for the region to view its future supply needs.

When reviewing the data by locality, several localities show deficits in the Year 2040 compared to existing permitted sources. It should be emphasized that these 2040 demand numbers are based on numerous assumptions, as defined in Section 5. Therefore, a change in projection methodology could result in a change in the 2040 demand projection. The methodology used herein is a logical, reasonable manner in which to project demands. However, it is impossible to predict the future with certainty. The localities within this region are fully aware of this. As a result, they have been planning

for future water supplies and expansions of their systems as necessary to assure that their needs are met into the future. A brief description of locality plans is provided in the following paragraphs.

The ACSA has numerous planned improvements written into its Capital Improvement Plan. Within the next 5 years, water exploration will be occurring in the South River, Dooms, and Mt. Sidney water systems in order to provide redundancy and prepare for future needs. In addition, Coles Run Reservoir and Treatment Facility will be upgraded to meet DCR guidelines; a treatment facility for a new well will be built in Churchville, a treatment plant for Blue Hole in the South River system will built. Wells will also be developed in the three systems where water exploration will occur, dependent upon land availability and well yields and water quality.

The Town of Bridgewater currently receives water from the North River, which has an estimated yield at the intake of 13.5 mgd. The Town currently can treat up to 1.5 mgd. The Town could consider increasing its treatment capacity for the future when the need arises.

The current raw water source for the Town of Broadway is the North Fork of the Shenandoah River. To date, this source has provided adequate water for the Town; however, records indicate that during periods of low flow conditions (less than 233,200 gallons per day), the North Fork will not provide adequate water to allow operation of the plant at peak capacity. Linville Creek is an alternate and/or additional raw water source for the Town. The calculated safe yield of Linville Creek is 880,000 gpd which will more than satisfy the peak demand of the Town's water plant. In 2002, the Town entered into a long-term lease on a new spring, which should adequately serve the residents for the foreseeable future. Plains Mill Spring is one of Rockingham County's larger springs, with flows averaging 5 mgd. All preliminary engineering studies have been completed for this project.

The Town of Craigsville appears as though it will be able to meet 2040 demand with the existing system and an agreement to purchase water from Augusta County. However, they are currently studying additional well development to assure an adequate supply into the future.

The Towns of Elkton and Dayton are anticipated to be able to meet their projected future needs with existing supplies.

The analysis shows that the Town of Grottoes is close to being able to meet the projected demand with its existing supplies. To assure that future needs are met in the Town of Grottoes, a new well is currently under development. It is expected to be operational within the next two years.

The city of Harrisonburg current projects include the design of new intake and pump station on South Fork of Shenandoah River, and associated 24-inch pipeline. The water

filtration plant is being upgraded to achieve 15 MGD capacity at conventional filter rates. Numerous additional improvements are being planned to assure that water is moved through the system with the greatest efficiency. These current and future planned projects are expected to provide the needed capacity for the City to meet its projected demands.

Rockingham County is looking at potential alternatives to increase its water supply to meet future demands. The County is currently in discussion with the City of Harrisonburg regarding collaboration on the Harrisonburg project of a new intake and pump station on the South Fork of Shenandoah River and the new transmission line. In addition, the County is considering future well development as an option. Preliminary evaluations are taking place.

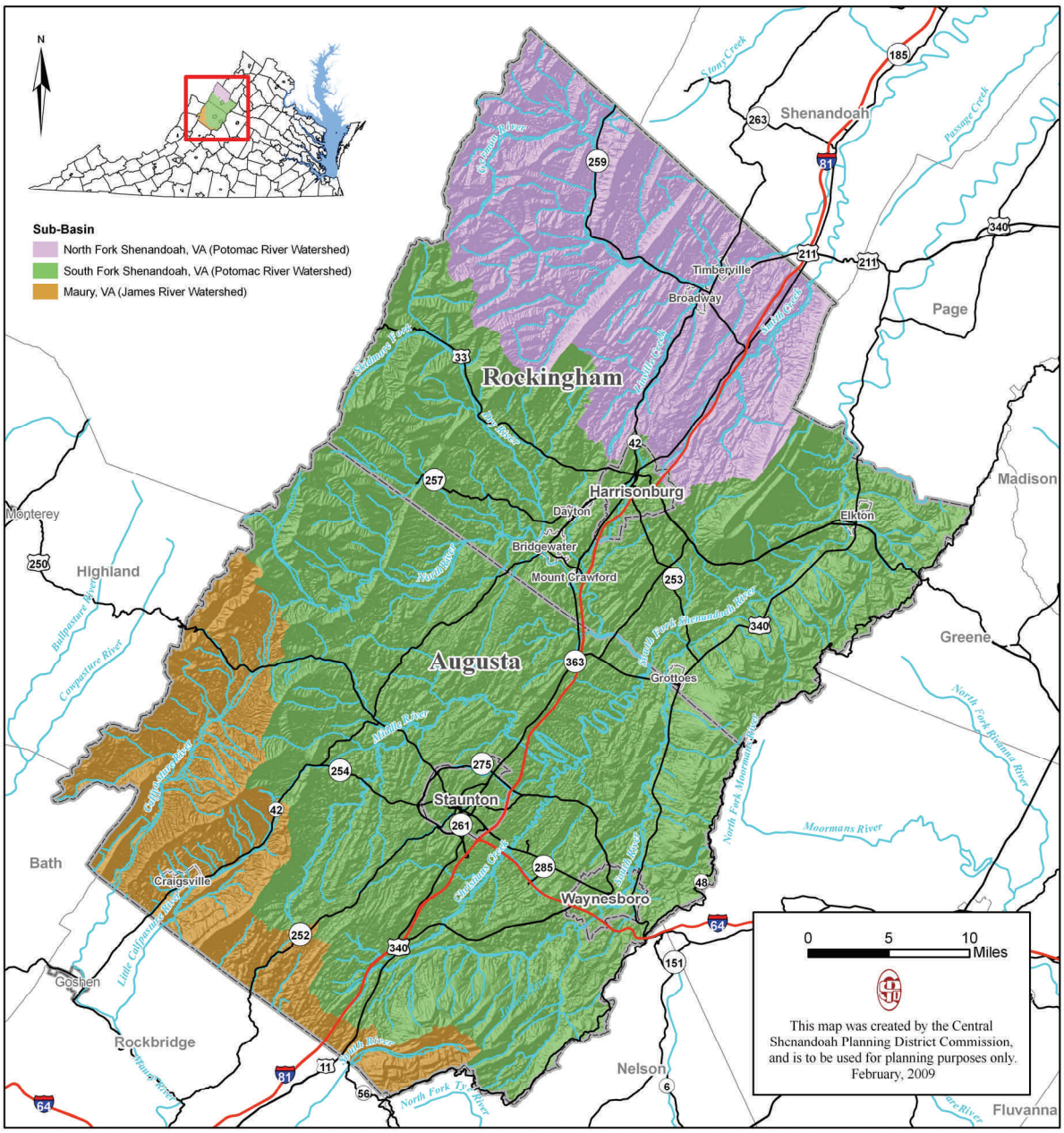
Based on this analysis, the City of Staunton has sufficient supply to meet its anticipated future needs.

It is anticipated that the Town of Timberville may need an increase in supply to meet demand far into the future. Timberville currently works with the Town of Broadway to meet its wastewater needs. One alternative for the Town in the future would be to collaborate with Broadway on the Plains Mill Spring project.

Based on this analysis, the City of Waynesboro has sufficient supply to meet its anticipated future needs.

Upper Shenandoah River Basin
Water Supply Plan

June 2011



Prepared and Submitted By:

CSPDC

Central Shenandoah Planning District Commission

This report was prepared by the Central Shenandoah Planning district Commission (CSPDC). The CSPDC was chartered on September 30, 1969 and is comprised of five counties, five cities and eleven towns. For over forty years, the CSPDC has been providing assistance to local governments and their citizens with issues including land use planning and regulation, transportation, disaster mitigation and preparedness, solid waste management, economic development, water and waste water, emergency management, housing, water resource management and human services. The Central Shenandoah Planning District Commission makes every effort to respond to the changing needs of the citizens of the Central Shenandoah Valley. Should you have any questions, please call or email us.

Executive Summary

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Water Supply Plan

Upper Shenandoah

Introduction

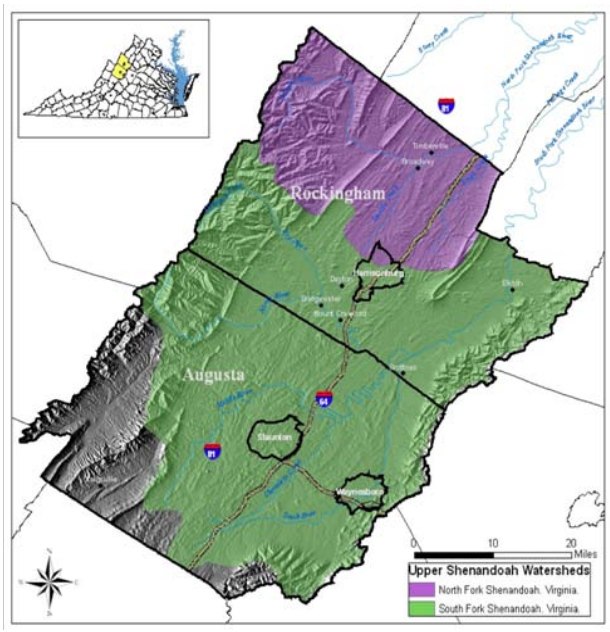
The Upper Shenandoah River Basin Water Supply Plan was developed in accordance with 9-VAC 25-780, Local and Regional Water Supply Planning. This requirement provides guidance to localities in developing a Water Supply Plan – a regulation that became mandated to all localities by the General Assembly. The final regulations became effective November 2, 2005 and made provisions for all localities electing to participate in a regional water supply planning effort to submit plans to the Virginia Department of Environmental Quality no later than November 2, 2011.

This plan is designed to:

Planning Area

"Planning area" is defined in regulation 9 VAC 25-780-100 B as the geographical area as defined by local government boundaries that is included in the local or regional water supply plan. The Upper Shenandoah River Basin WSP includes 13 localities:

- Augusta County
- Town of Bridgewater
- Town of Broadway
- Town of Craigsville
- Town of Dayton
- Town of Elkton
- Town of Grottoes
- City of Harrisonburg
- Town of Mt. Crawford
- Rockingham County
- City of Staunton
- Town of Timberville
- City of Waynesboro



Planning Process

In early 2006, sub-regional groups began forming in the Upper Shenandoah Basin communities where Augusta-Staunton-Waynesboro formed one regional entity and Rockingham-Harrisonburg formed a separate one. During the summer of 2006, grants were announced to assist localities in develop water supply planning work. The CSPDC was awarded a grant matched by local contribution to develop a water supply plan on behalf of the sub-region.

For the Upper Shenandoah Basin communities to develop the best comprehensive planning document and also to make best use of fiscal resources, they joined to form one regional group. This provided a strong regional group that coincided with the political boundaries of the Upper Shenandoah Basin communities that fall within the service area of the Central Shenandoah Planning District Commission. During the late summer/early autumn 2006, localities were invited to the regional table as they fell within the regulation to develop and maintain their individual or regional water supply plans. In 2007, the Upper Shenandoah Basin Water Supply Planning Committee was created. The planning effort was led by the Central Shenandoah Planning District Commission.

Upper Shenandoah Water Supply
Technical Advisory Committee

Name	Locality/ Organization
Timothy Fitzgerald	Augusta County
Jennifer Hoover	Augusta County Service Authority
Warren Heidt	Rockingham County
Mike Collins	City of Harrisonburg
Tom Sliwoski	City of Staunton
Nate Litteral	City of Waynesboro
Carleen Loveless	Town of Bridgewater
Ross Clem	Town of Broadway
John Temple	Town of Craigsville
Lelan Siler	Town of Dayton
Reid Wodicka	Town of Elkton
Ashley Jacobs	Town of Grottoes
-	Town of Mt. Crawford*
Austin Garber	Town of Timberville
Sara Jordan	Virginia DEQ
Tammy Stephenson	Virginia DEQ

* Town of Mt. Crawford is represented by Rockingham County

Other Water Planning Efforts

At the same time the Upper Shenandoah communities were forming a working committee or Technical Advisory Committee (TAC), there were water supply planning efforts underway on regional, sub-regional and macro-regional levels throughout the Shenandoah River Basin.

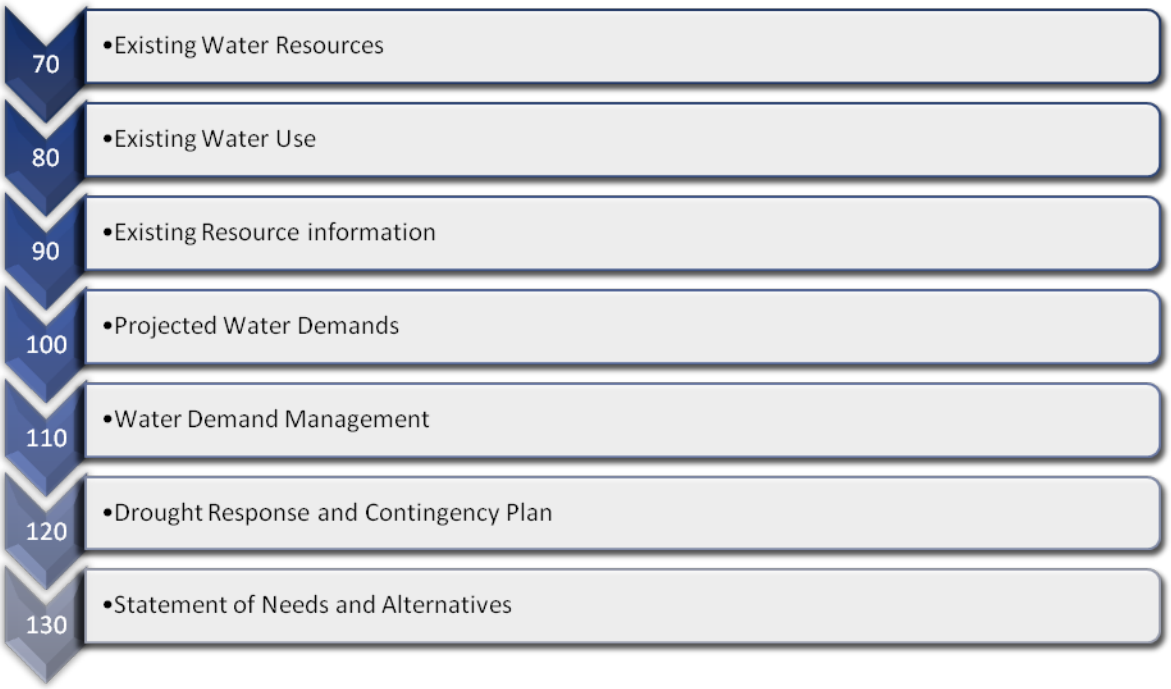
The USGS began working on a 6-year Minimum In-stream Flow (MIF) study of the South Fork of the Shenandoah River. The majority of the planning area for this plan falls within the watershed boundary of the South Fork Shenandoah River. The MIF study was completed in September 2010 and will be helpful in future updates/review of the water supply planning effort.

Also on-going at a macro-regional level is the Shenandoah Basin Water Strategic Plan that is managed by the Northern Shenandoah Valley Regional Commission (NSVRC). There is great benefit to regional discussions regarding water resources throughout the basin as both the northern Valley and central Valley will be competing for water resources out of the same river particularly in an era of rapid growth for many localities within the planning area.

The Central Shenandoah Planning District Commission helped in the coordination of these planning efforts by acting as a liaison between localities and regulatory agencies. Additionally, the CSPDC helped to organize educational outreach efforts by hosting workshops and facilitating work group sessions.

WSP Structure

As outlined by regulation 9 VAC 25-780, this plan contains the elements listed below. This information was collected from existing, readily available information and additional detailed studies. Combined, these elements allow for a comprehensive analysis and planning of the water resources in the Upper Shenandoah River Basin.



Section 70 – Existing Water Resources

Section 70 requests localities within the planning area to submit information regarding their existing water sources, including groundwater, surface water reservoirs and stream intakes. For purposes of this plan, a community water system is one that is owned, operated, and/or maintained by a local government.

Municipal Community Water Systems

Owner	Water System	Source
Augusta County	250 West Water	Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/ North River Dam Interconnected System)
	Middlebrook	Groundwater – 1 well
	Augusta Springs	Groundwater – 1 well, 1 spring
	Blackburn	Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/ North River Dam interconnected System)
	Churchville	Groundwater – 5 wells
	Deerfield	Groundwater – 1 well, 1 spring
	Dooms	Groundwater – Vesper View well; Additional source water available from Waynesboro interconnection
	Estaline Valley	Purchased – Town of Craigsville (4 wells, 2 springs)
	Harriston (Harriston East Subdivision)	Groundwater – 2 wells
	South River	Coles Run Reservoir, 6 groundwater wells
	Verona	Quicks Spring, Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/ North River Dam interconnected System)
	Weyer's Cave: Dice's Spring	Dice's Spring
Town of Bridgewater	Town of Bridgewater – Countryside Estates	North River
Town of Broadway	Town of Broadway	North Fork Shenandoah River, Linville Creek
Town of Craigsville	Town of Craigsville	Groundwater – 4 wells, 2 springs
Town of Dayton	Town of Dayton	Groundwater – 2 wells, Silver Lake Spring
Town of Elkton	Town of Elkton	Groundwater – 2 wells
Town of Grottoes	Town of Grottoes	Groundwater – 3 wells
City of Harrisonburg	City of Harrisonburg	Rawley Springs, Switzer Dam (Dry River intake) and North River
Rockingham County	Rosedale	Purchased – City of Harrisonburg
	Harmany Hills	Purchased – City of Harrisonburg
	Mount Crawford	Owned by Town – water service provided and maintained by Rockingham County
	RR Donnelly/Smith Creek	Purchased – City of Harrisonburg
	Lilly Subdivision	Groundwater – 2 wells
City of Staunton	City of Staunton	Middle River, Gardner Spring and Elkhorn Lake/ North River Dam (Interconnected System)
Town of Timberville	Town of Timberville	Groundwater – 2 wells, 1 spring
City of Waynesboro	City of Waynesboro	Groundwater – 3 wells

In addition to the municipal systems listed above the planning area has 19 private community water systems using groundwater. Of these, 11 are located in Rockingham County while the remaining 8 are located in Augusta County. Many of these private systems provide water to subdivisions or mobile home parks. There are no private systems using surface water and only one community water system using a stream intake.

This plan also identifies large self-supplied users, both agriculture and non-agriculture. There are 17 total non-agricultural large self supplied users. Of the 9 large self-supplied groundwater users 5 are located in Rockingham County, 2 in Waynesboro, 1 in Staunton and 1 in Augusta County. Of the 8 large self-supplied surface water users, 4 are located in Rockingham County, 3 in Augusta County and 1 in Waynesboro. There are 19 agriculture large self supplied users.

There is no groundwater or surface water purchased from outside the geographic boundaries of the planning area. There are no existing contracts or known current planning efforts to purchase water from outside the geographic boundaries of the planning area.

Section 80 – Existing Water Use

Section 80 of the regulation requires a description of existing water use. These data are compiled from several sources: VDH permit compliance reports, VDEQ water withdrawal reports, and the individual localities and water purveyors. Years 2002 and 2003 were chosen to indicate differences in usage and source water availability during a drought year followed directly by a wet water year. The Year 2006 was chosen to represent the most current data for all systems. The TAC also determined that the community systems would provide historic disaggregated water consumption by use for year 2006.

2006 Average Daily Withdrawal (MGD)

Locality	Average
ACSA	4.009
Bridgewater	0.83
Broadway	0.433
Craigsville	0.355
Dayton	1.635
Elkton	0.353
Grottoes	0.245
Harrisonburg	6.479
Rockingham*	2.007
Staunton	3.91
Timberville	0.221
Waynesboro	3.256

*Includes Mount Crawford

Section 90 – Existing Resource Information

Section 90 of the regulation requests a description of existing resource conditions to include geologic, hydrologic, and meteorological conditions in the planning area. In addition, a description of existing environmental conditions must be included that pertains to, or may possibly affect in-stream uses, and water supply sources currently serving the area.

Geology

The study area is part of the Valley and Ridge Physiographic Province, which is characterized by gently rolling and hilly valleys, as well as gradual mountain slopes. Elevations range from a high of 4,463 feet above sea level at Elliott's Knob to a low of 900 feet above sea level near the Rockingham and Page County boarder.

Hydrology

The study area has a high quality of hydrological resources. A narrow belt along the western toe of the Blue Ridge Mountains has a particularly high potential for groundwater because of favorable geologic and recharge conditions. High capacity wells have been developed successfully throughout the planning area. Surface springs in the area result from significant sources of groundwater.

The entire study area is situated in the Shenandoah River drainage basin. The major waterways are the North and South Forks of the Shenandoah River in Rockingham County. These two rivers are part of the Potomac River Basin which flows to the Chesapeake Bay. The North and South Rivers pass through portions of Rockingham and Augusta County and the Middle River flows through the north central portion of Augusta County.

Meteorology and Climate

The climate of the study area is classified as modified continental with mild winters and warm summers. The mountains and elevation are major factors controlling the climate. Annual normal temperatures average 53 degrees and annual precipitation averages 35 inches.

Scenic Rivers and Recreational Destinations

The Scenic Rivers Act of 1970 was passed to protect and preserve specific rivers or river segments of significant natural beauty. There is one river within the planning area that is legislatively designated as a scenic river; the St. Marys River from it's headwater's in Augusta County to the boundary with the George Washington National Forest. Two additional rivers within the planning area are designated as having potential for scenic rivers listing. These include the Calfpasture River in Augusta County, from Route 250 to Marble Valley, and the South Fork Shenandoah River in Rockingham County from Port Republic to Goods Mill.

Additional information can be found regarding the following topics in Section 90:

- Anadromous, Trout & Other Significant Hatcheries
- Historic and Archaeological Resources
- Geologic Formations
- Riparian Buffers & Conservation Easements
- Land Use and Land Cover
- Impaired Streams
- Point Source Discharges
- Potential Threats

Section 100 – Projected Water Demands

Section 100 of the regulation requests a description of projected water demands to include population estimates and projections, estimated water demand within the planning are for 30 to 50 years, and estimated future water use.

Population Projections

Locality	2010	2020	2030	2040
Augusta County*	74,000	82,900	91,700	
Bridgewater		8,637	10,194	11,303
Broadway	3,691	4,960	6,666	8,959
Craigsville	1,099	1,218	1,338	1,458
Dayton	1530	1755	2013	2308
Elkton	2726	3790	5269	7326
Grottoes	2668	3455	4475	5796
City of Harrisonburg	48,914	60,154	73,977	90,977
Mt. Crawford**				
Rockingham County	76,314	86,579	98,225	111,437
City of Staunton	22,704	22,230	22,235	21,538
Timberville	2,044	2,486	3,023	3,676
City of Waynesboro	21,006	22,658	24,440	26,363

*Projections only available for 2017, 2027, 2037
** Included in Rockingham County Projections

Projected Water Demand (MGD)

Locality	2010	2020	2030	2040
Augusta County*	4.78	5.95	7.20	9.46
Bridgewater	.79	1.29	1.55	1.72
Broadway	.37	.50	.67	.90
Craigsville	.377	.399	.421	.442
Dayton	.1125	.1277	.1449	.1644
Elkton	.2004	.2757	.3794	.5220
Grottoes	.1961	.2514	.3222	.4130
City of Harrisonburg	6.29	7.93	9.57	11.04
Mt. Crawford**				
Rockingham County	2.98	4.97	6.80	9.53
City of Staunton	5.99	5.86	5.86	5.68
Timberville	.24	.36	.36	.43
City of Waynesboro	1.5439	1.6484	1.7597	1.8784

*Projections only available for 2017, 2027, 2047
**Included in Rockingham County Projections

Section 110 – Water Demand Management

Section 110 of the regulation requests a description of water demand management to include information describing efficient water use practices, water conservation measures and practices to address water loss. Data was collected from Demand Management Forms submitted by the localities.

Additional information can be found regarding the following topics in Section 110:

- Adoption of Virginia Uniform Building Code
- Local Water Use Ordinances or Plans
- Homeowners' Association
- Wasteful Water Use
- Irrigation Efficiency
- Municipal/ Private Water Suppliers
- Efficient Water Use Practices
- Water Conservation
- Water Loss Reduction
- Capital Improvement Plans
- Public Education

Section 120 – Drought Response and Contingency Plan

In accordance with the Water Supply Planning regulations (9 VAC 25-780-120), a Regional Drought Plan has been developed for the Upper Shenandoah Basin to guide communities in the planning area through instances when water shortages lead to drought conditions.

The Plan includes three drought response levels ranging from drought watch to drought emergency. These drought stage triggers are among the primary "hard line" or mandatory triggers in the Plan. Once a drought watch level has been declared, progression through drought warning and emergency stages will be declared based on threats to the localities' supplies and/or local system indicators that indicate negative impacts to the utility's groundwater supplies or stream intakes.

These region-wide conservation measures in the Plan may be implemented on an individual locality basis when an Upper Shenandoah River Basin local government declares a drought stage. It is possible that the increased public awareness of water conservation activities during a drought stage may reduce water use up to 5% to 15%.

Guidelines for Drought Response and Mitigation during a Drought Watch Stage		
Communities/ Localities Need to:	**Individuals Need to:**	**Commercial Entities Need to:**
Implement Voluntary Conservation Measures (see Appendix C of Drought Plan) Review and/or update Regional Drought Plan. Communicate conditions, increase outreach and provide conservation tips. Increase water use efficiency and/or promote use reclaimed water for public facility landscaping. Consider developing increased conservation rate charges or surcharges to respond to drought conditions.	Conduct home water audits and leak detection. Fix leaking faucets and replace faulty fixtures. Implement Voluntary Conservation Measures (see Appendix C of Drought Plan): • Convert high water using plumbing to low-flow fixtures. • Water at night or in the early morning to avoid the hottest part of the day. • Make sure sprinklers are working properly to reduce overspray. • Plant native or drought tolerant plants. • Use a bucket when washing cars or go to a commercial car wash. • Utilize water harvesting strategies. • Reuse water as much as possible such as reusing dishwater and rinse water for watering indoor and outdoor plants, where allowed by law.	Implement voluntary water reduction and follow conservation plan. Discontinue use of decorative fountains. Require commercial facilities with monthly demand exceeding a threshold limit to conduct a self-audit.

Guidelines for Drought Response and Mitigation during a Drought Warning Stage		
Communities/ Localities Need to:	**Individuals Need to:**	**Commercial Entities Need to:**
Continue implementation of Voluntary Conservation Measures (see Appendices C & D) Begin the reduction or elimination of non-essential uses (Appendix E of Drought Plan) to reduce water usage by 5 to 10%. Communicate drought level and conditions to public. Increase education on conservation followed by voluntary reductions for communities. Consider implementing a schedule for public lawn watering. Implement increased conservation rate changes or surcharges, as determined by locality.	Continue implementation of Voluntary Conservation Measures (see Appendices C & D) and follow the items below: • Reduce lawn watering to no more than two times per week between the hours of 9 p.m. and 10 a.m. • Reduce vegetable garden watering and water between the hours of 9 p.m. and 10 a.m. • Avoid sprinkler use. Use soil-soakers or drip irrigation. • Do not plant new landscaping or grass.	Implement water conservation plans. Implement interior retrofit for all high water use faucets and materials. Restrict washing of sidewalks, driveways, parking lots or any other paved surface except in the case of meeting health and safety standards. Prohibit operations of fountains at commercial sites.

Guidelines for Drought Response and Mitigation during a Drought Emergency Stage		
Communities/ Localities Need to:	**Individuals Need to:**	**Commercial Entities Need to:**
Implement mandatory non-essential water use restrictions to reduce water usage by 10-15% (see Appendix E of Drought Plan) Continue aforementioned conservation measures from watch and warning stages. Communicate conditions, increase outreach and promote conservation tips. Consider the adoption and enforcement of emergency ordinances as necessary to protect public welfare, health, and safety.	Implement mandatory non-essential water use restrictions (see Appendix E of Drought Plan), including the following: • No unrestricted lawn irrigation. • No washing of paved areas with any pressurized water source except in the case of meeting health and safety standards. • No washing of autos, trucks, types of mobile equipment except at facilities with wash water re-circulating systems. • No filling or topping off of outdoor swimming pools. Continue aforementioned conservation measures from watch and warning stages. Where allowable by law, reuse water: • Reuse dishwater for plants. • Capture shower water in buckets for watering plants.	Implement mandatory non-essential water use restrictions (see Appendix E of Drought Plan). Voluntarily reduce water consumption by at least 10%. This reduction may result from the elimination of other non-essential water uses not listed in Appendix E of Drought Plan, application of water conservation practices, or reduction in essential water uses. Follow conservation measures for 'individuals' where appropriate. Discontinue the service of water to the restaurant or other food service establishment customers unless specifically requested by customer.

Section 130 – Statement of Needs and Alternatives

Section 130 of the regulation requests a description of adequacy of existing supplies to meet current and projected demands. If deficits are expected a general discussion of potential alternatives is to be included.

Projected Year 2040 water demands and current permitted capacities of each locality were compared to determine adequacy of existing supplies. Based solely on that analysis, the region as a whole, will meet its projected 204 water demand with the existing regional supply. However, that would assume that the necessary infrastructure was in place to move water around the region as necessary to meet individual community deficits. Realistically, that is not the case.

When reviewing the data by locality, several localities show deficits in the Year 2040 compared to existing permitted sources. It is impossible to predict the future with certainty. The localities within this region are fully aware of this. As a result, each of the localities is actively engaged in planning for future water supplies and expansions of their systems as necessary to assure that their needs are met into the future.

Existing and planned future water supplies are anticipated to meet the projected demands of all localities within the region.

Additional Documentation

Each locality is responsible for adopting a Resolution in support of the Upper Shenandoah River Basin Water Supply Plan. A Model resolution is presented below.

RESOLUTION
Adoption of the Upper Shenandoah River Basin
Water Supply Plan

WHEREAS, the Virginia General Assembly has mandated the development of local and regional water supply programs throughout the Commonwealth and the State Water Control Board has developed regulations 9 VAC 25-780, Local and Regional Water Supply Planning, to implement this planning process; and

WHEREAS, based upon these regulations, county, cities, and towns are required to complete a water supply program that fulfills the regulations by deadlines based on population.

WHEREAS, local governments may elect to join one or more other local governments to develop a regional water supply program for which a deadline of November 2, 2011 has been established.

WHEREAS, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources;
- A description of existing water use;
- A description of existing water resource conditions;
- An assessment of projected water demand;
- A description of water management actions;
- A statement of need;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies;
- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;

- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

WHEREAS, it is reasonable and prudent for the following local governments to coordinate and collaborate in the development of a regional water supply program:

- Augusta County
- Rockingham County
- City of Harrisonburg
- City of Staunton
- City of Waynesboro
- Town of Bridgewater
- Town of Broadway
- Town of Craigsville
- Town of Dayton
- Town of Elkton
- Town of Grottoes
- Town of Mt. Crawford
- Town of Timberville

WHEREAS, *[JURISDICTION]* is part of the Upper Shenandoah River Basin Regional Water Supply Plan which includes the 13 localities listed above;

WHEREAS, the Upper Shenandoah River Basin Regional Water Supply Plan was developed in accordance with Virginia Regulation 9 VAC 25-780-70 through 9 VAC 25-780-130; and

WHEREAS, on *[DATE], [JURISDICTION]* held a public hearing to accept public comment on the Upper Shenandoah River Basin Regional Water Supply Plan and all written comments submitted have received a written response as required; and

NOW, THEREFORE BE IT RESOLVED that the *[GOVERNING BODY]* of the *[JURISDICTION]* hereby adopts the Upper Shenandoah River Basin Regional Water Supply Plan as it pertains to *[JURISDICTION]*. Approval and adoption of this regional plan indicates support for and general agreement with the regional planning approach, but does not indicate approval or disapproval of conclusions and recommendations presented in the plan as they pertain to other localities. *[JURISDICTION]* reserves the right to comment on specific water supply alternatives in the future even though such alternatives may be recommended in this adopted plan. *[JURISDICTION]* will not be limited to specific water supply alternatives in this adopted plan and reserves the right to recommend additional alternatives for consideration in the future.

BE IT FURTHER RESOLVED that the *[GOVERNING BODY]* of the *[JURISDICTION]* intends that the Upper Shenandoah River Basin Regional Water Supply Plan shall be revised to reflect changes in relevant data at least once every five years and shall be revised and resubmitted to the Virginia Department of Environmental Quality every ten years in accordance with the regulation and sound planning practice.

PASSED, APPROVED AND ADOPTED by the *[GOVERNING BODY]* of the *[JURISDICTION]* at a meeting held on *[DATE].*