Chapter 5—Physical Features

INTRODUCTION

The elements of the environment form the foundation for the quality of life that residents often seek when choosing a place to live and work. A quality of life founded on clean and accessible waterways, scenic views, woodlands, and outdoor recreation is particularly important in today's society. It is important to manage natural resources so that they continue to provide social, economic, and environmental benefits to people over time while supporting other important natural functions. This chapter identifies physical features of the City including climate data, topography, geology, soil associations, hydrology, forested lands, and flood protection mitigation measures.

RELATIONSHIP TO OTHER PLAN ELEMENTS

Land Use

Natural resources affect how land can be used and how the use of land affects the natural resources. Land use, transportation and utility initiatives, policies and impacts need to be integrated with environmental policies.

Economy

Natural resources and environmental quality can be key elements of an economic development program. Natural resources can support local manufacturing in addition to tourism and recreation.

Community Services and Infrastructure

Recycling and reuse programs decrease the waste stream to the landfill/transfer station.

Transportation

Transportation corridors can serve a recreational purpose. Additionally, corridors can be enhanced by preserving viewsheds and buffers.

PHYSICAL FEATURES

Table 5-1 - Climate, City of Staunton	
General Climate	Temperate Continental - moderate summers and winters
Average Temperature	January = 32.6 F (Avg. High 41.8° F / Avg. Low 23.4°) July = 73.6 F (Avg. High 84.0° F / Avg. Low 63.3° F) Annual = 53.6° F (Avg. High 64.0° F / Avg. Low 43.1° F)
Average Precipitation	Annual = 39.1 Inches
Concerns	Flooding can be caused by tropical storm systems that move inland or from a rapid snowmelt.

Table 5-2 — Average Temperature & Precipitation, City of Staunton

	Temperature (Degrees Fahrenheit)			Precipitation (Inches)*
Month	**Normal High**	**Normal Low**	**Average**	**Average**
January	41.8	23.4	32.6	2.67
February	45.5	25.6	35.6	2.55
March	53.6	32.8	43.2	3.25
April	64.0	41.7	52.9	3.15
May	72.3	50.6	61.5	3.74
June	80.5	59.4	70.0	3.61
July	84.0	63.3	73.6	3.90
August	82.8	61.8	72.3	3.63
September	76.2	54.2	65.2	3.79
October	66.0	42.3	54.2	2.98
November	55.6	34.9	45.2	3.09
December	44.8	26.7	35.8	2.74
Winter	*44.0*	*25.2*	*34.6*	*7.96*
Spring	*63.3*	*41.7*	*52.5*	*10.14*
Summer	*82.5*	*61.5*	*72.0*	*11.14*
Autumn	*65.9*	*43.8*	*54.9*	*9.86*
Annual	**64.0**	**43.1**	**53.6**	**39.10**

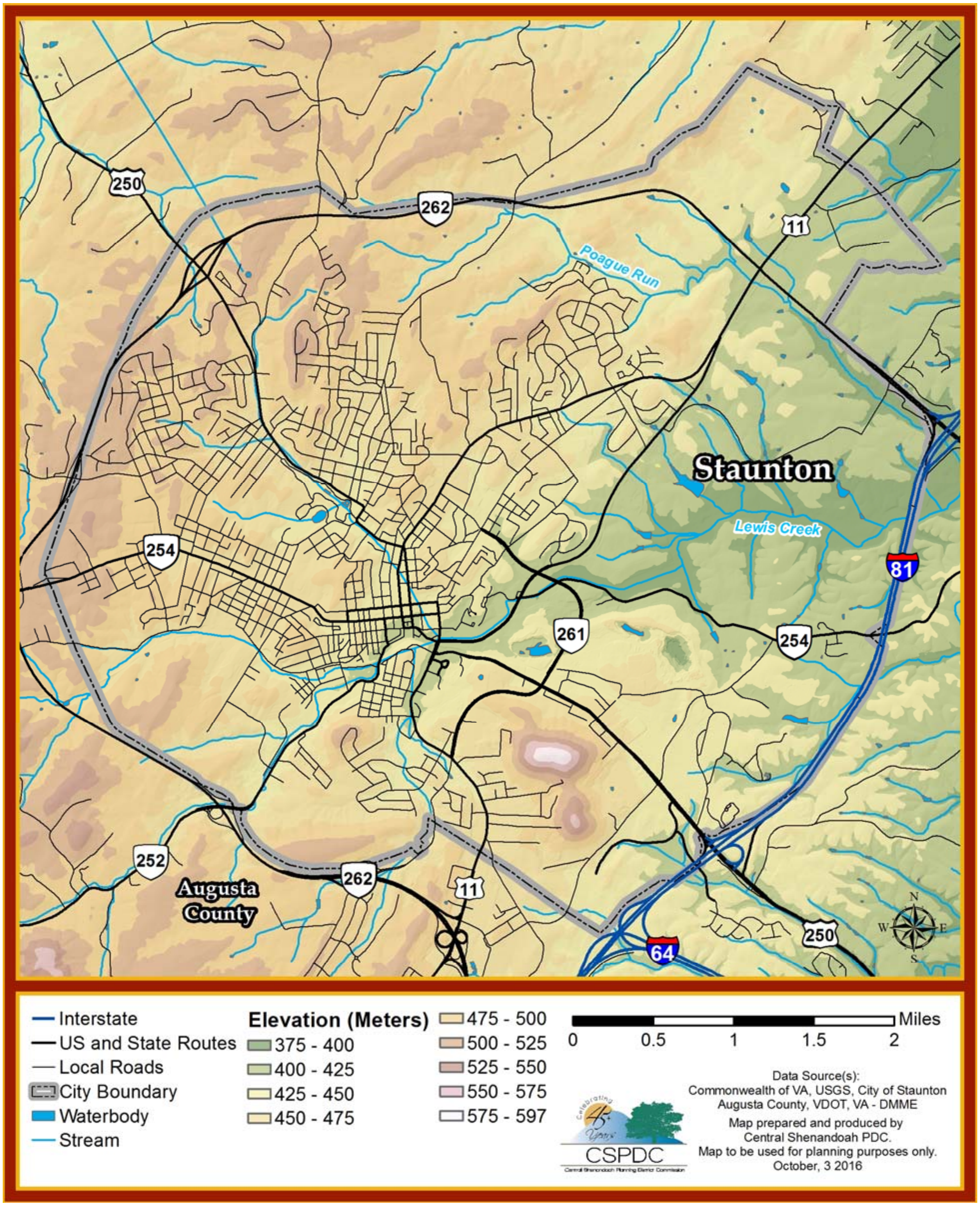
* Data from Staunton Water Treatment Plant Site: 1981-2010

Source: National Climatic Data Center

Table 5-3 - Topography, City of Staunton	
Overall Topography	Steep hills amidst a rolling valley floor.
Most Distinctive Topographical Features	Twin hills of Betsy Bell and Mary Gray
Highest Elevations	1,946 feet (Betsy Bell) 1,821 feet (Mary Gray)
Lowest Elevations	1,300 to 1,400 feet (northeast section of the City along Lewis Creek)
Typical Slopes	5% to 12%
Southern Portion of City:	Large areas of slopes greater than 20%
Northeastern Portion of the City:	Slopes ranging from less than 12% to under 5%

Table 5-4 - Slope Categories and Development Limitations	
0 to 7 Percent Slope: Flat to Moderately Sloping	No slope limitations on development or cultivation. However, some of these areas are subject to flooding and poor drainage.
7 to 15 Percent Slope: Rolling Land	Few limitations for residential, commercial, and industrial activities not requiring large amounts of level ground. Development of larger tracts is more limited due to grading costs. No limitations on pasture, forest, forage crops, and orchard uses.
15 to 25 Percent Slope: Hilly Land	Suitable for residential development if site planning takes topography into account. Construction of water and sewer facilities can be quite costly and economically infeasible. No slope limitations on pasture, forest, forage crop, and orchard uses.
25 Percent Slope and Over	Usually considered unsuitable for intensive development and cultivation. When combined with conservation practices; land may be used for outdoor recreation, wildlife management, watershed protection, and forest purposes.

Map 5-1 - Elevation, City of Staunton



Map 5-2 - Slope, City of Staunton

Table 5-5 - Description of Geologic Formations, City of Staunton				
Name	**Description**	**Thickness (feet)**	**Geologic Period**	**Potential Geologic Hazard**
Alluvium	Sand and Clay	50-160	Quaternary	None
Martinsburg Formation	Shale, calcareous, silty; some greenish sandstone, fossiliferous near Little Mountain North.	2000+	Ordovician	Low bearing capacity
Edinburg Formation	Dense, black, argillaceous limestone; black shale and dark-gray, nodular-weathering limestone.	1200		Sinkhole collapse, ground water pollution
Lincolnshire Formation	Medium-grained, dark-gray, cherty limestone.	75-225		Sinkhole collapse, ground water pollution
New Market Limestone	Dove-gray, compact, high-calcium limestone.	0-200		Sinkhole collapse, ground water pollution
Beekmantown Formation	Thick-bedded, light-gray, fine-grained dolomite; some medium-gray limestone; abundant chert.	1800-2000		Sinkhole collapse, ground water pollution
Chepultepec Formation	Dark-gray to black limestone; some thin beds of dolomite; modular black chert.	300-400		Sinkhole collapse, ground water pollution
Conococheague Formation	Laminated gray limestone, thick-bedded dolomite, and thin sandstone beds.	2200-2500	Cambrian	Sinkhole collapse, ground water pollution
Elbrook Formation	Thin-to-thick-bedded limestone and dolomite; shaly dolomite.	2000+		Sinkhole collapse, ground water pollution

Source: Geology of the Staunton, Churchville, Greenville, and Stuarts Draft Quadrangles, Virginia; Virginia Division of Mineral Resources Publications, Charlottesville, Virginia (1967)

Map 5-3 - Geologic Formations, City of Staunton

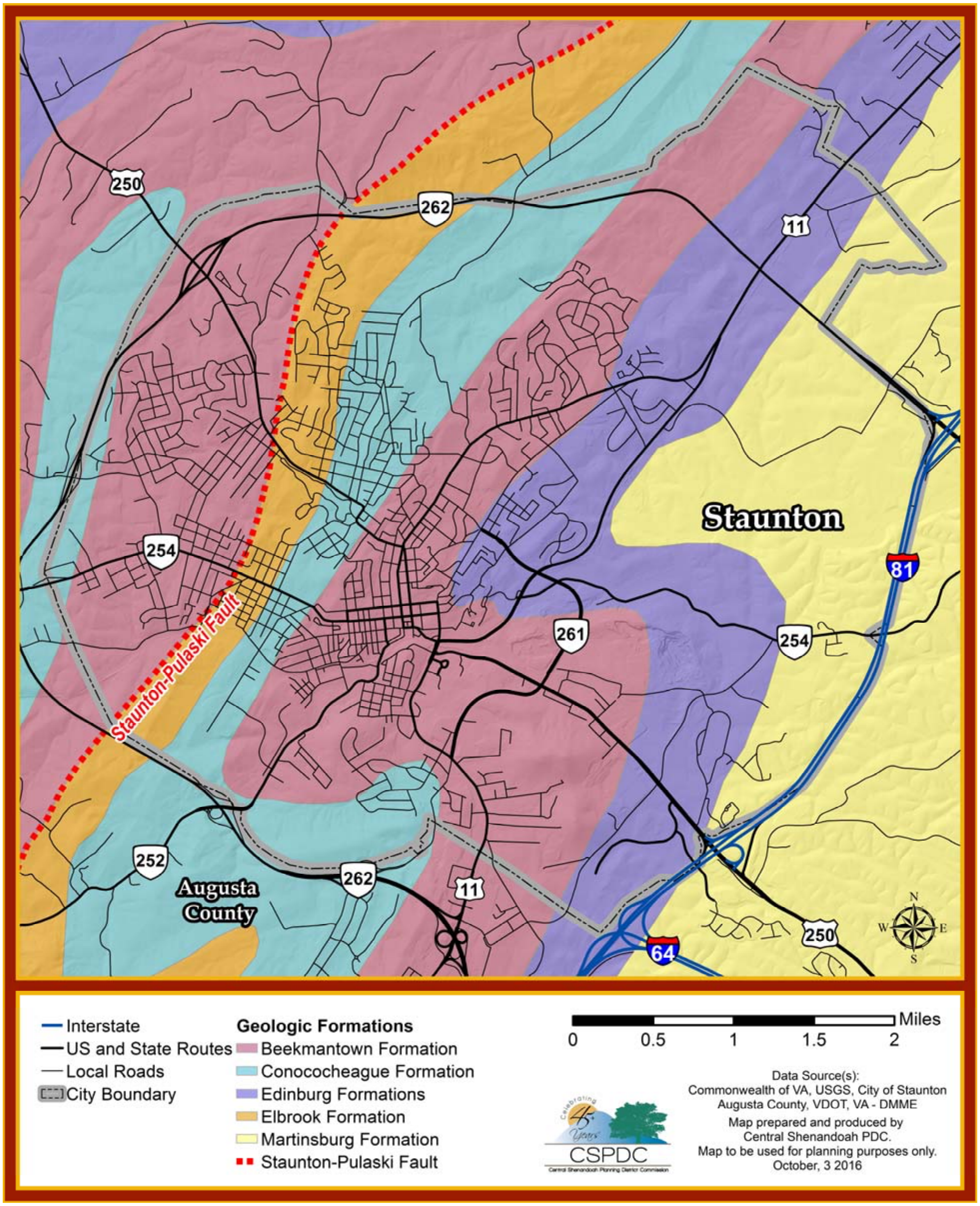
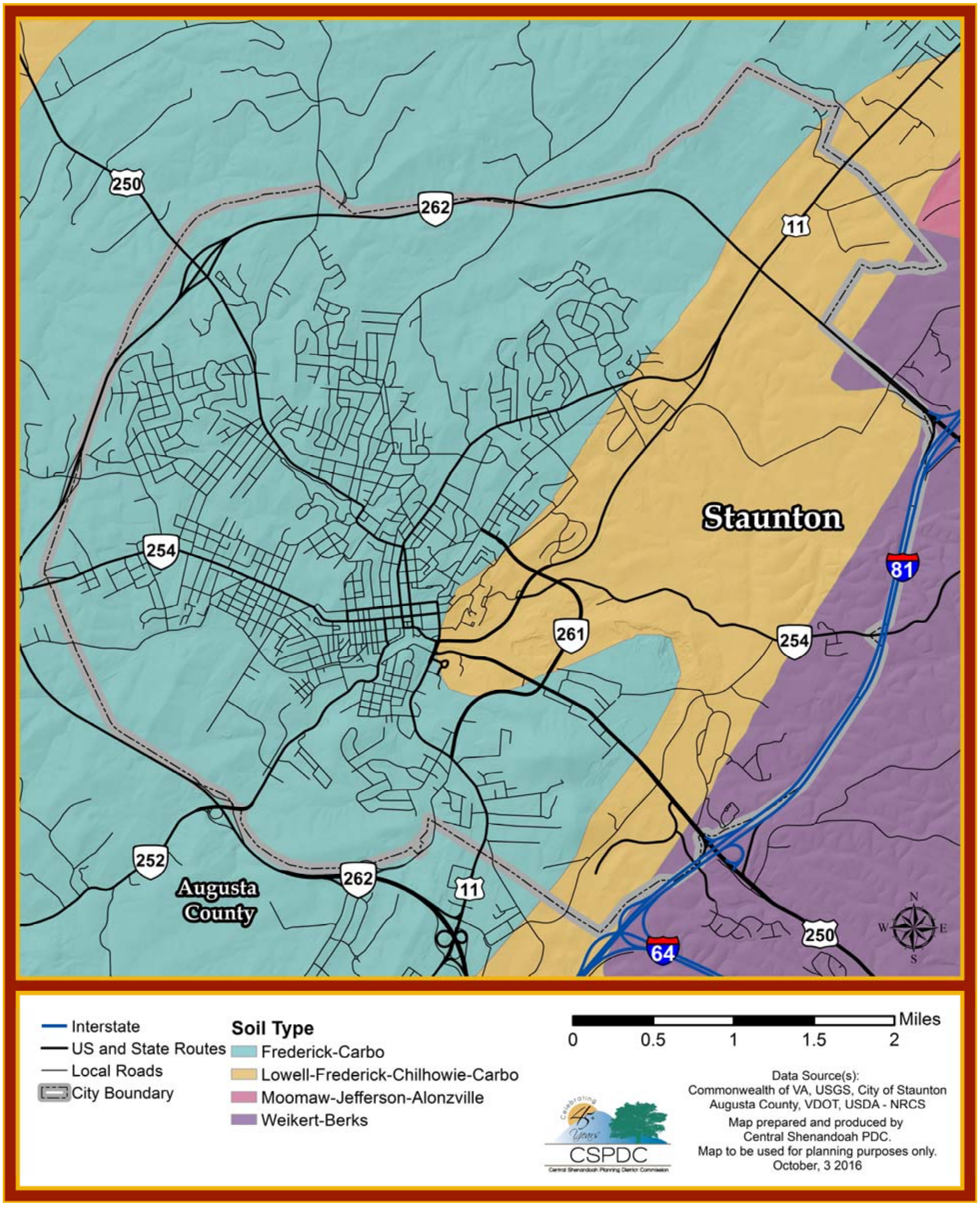


Table 5-6 - Geology and Development Limitations	
Geologic Concerns for Development	Numerous sinkholes and caverns due to large karst region (underlying limestone and dolomite cause caves, sinkholes, creeks, and large springs). The Staunton-Pulaski Fault, one of the most significant faults in Virginia, passes through Montgomery Hall Park, Gypsy Hill Park, and the Pinehurst Area.
Karst Issues	Weight of structures may cause new fractures to form or old ones to move. Result may be a rapid collapse of the ground surface or a gradual subsidence over time. Weight of structures may cause compaction or subsidence of the rock; clay and soil mixture found in the bottom of sinkholes. Could cause foundations to crack. Taking water from the underground (e.g., by pumping wells) or changing groundwater recharge (e.g., by changing surface drainage) may remove a portion of the support from sinkholes. Result may be subsidence. Heavy rains and sudden increases in the amount of water drainage into a sinkhole could cause instability. Result could be subsidence or collapse. Development of karst regions increases the amount of water drainage into a sinkhole and could cause instability. Result could be subsidence or collapse.
Fault Issues	Impervious ground associated with development might prevent a significant amount of water from entering the fault plane, and thereby, retard the recharge to the groundwater supply. Development on a natural recharge area, such as a fault, could channel pollution into the groundwater supply. Slumping or tilting of buildings, foundation failures, or collapse could occur to development on or close to faults as a result of ground instability.

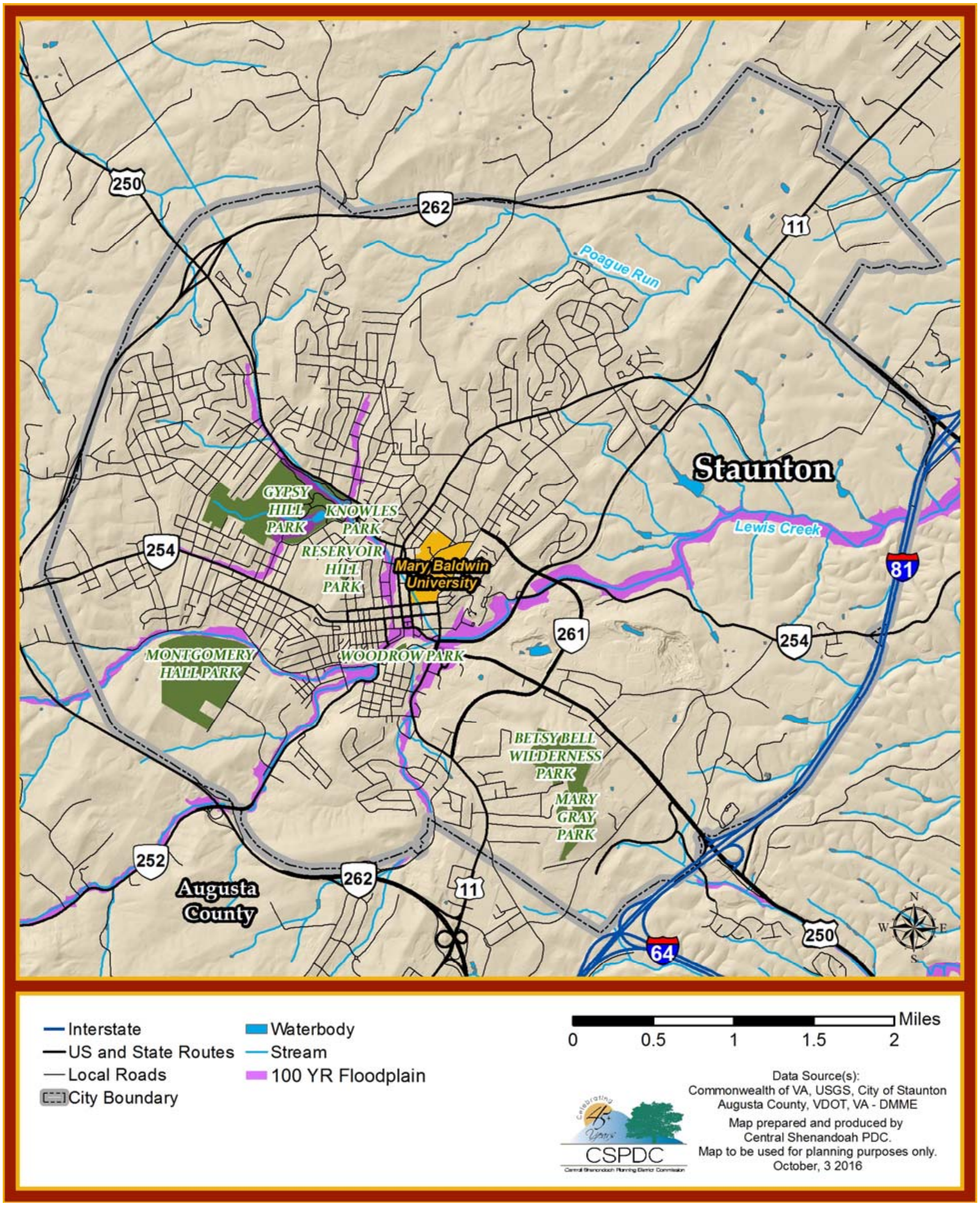
Table 5-7—Soil Associations, City of Staunton	
Frederick-Christian-Rock Outcrop	Deep, well-drained soils that have a subsoil of clay loam to clay; areas of rock outcrop; all on limestone uplands.
Frederick-Bolton-Christian	Deep to moderately deep, well-drained soils that have a subsoil of clay loam to clay or gravelly loam to gravelly clay loam; on limestone uplands.
Chilhowie-Edom	Moderately deep to deep, well-drained soils that have a dominantly clayey subsoil; on limestone uplands.
Berks-Weikert-Sequoia	Shallow to deep, well-drained soils that have a subsoil of shaly silt loam, shaly loam, or clay; on shale uplands.
Note: The general soils map is not suitable for site planning or small scale planning. The soils in any one association will vary in slope, stoniness, drainage, and other characteristics which affect development, management, and use.	

Table 5-8 - Hydrology, City of Staunton	
Watersheds	Majority of the City is in the Lewis Creek Watershed, which lies in the Middle River Basin, which lies in the upper portion of the Shenandoah River Valley, which is a portion of the Potomac River Basin. Remainder of the City has 6 tributaries which empty into Bell Creek or Christian's Creek. (3 tributaries are in the northern portion of the City, while 3 tributaries are in the eastern portion of the City.)
Lewis Creek Drainage Area	Approximately 28 square miles, including 17 miles of floodway.
Flood Concerns	Greatest susceptibility to floods is along a 3-mile span of Lewis Creek encompassing the Central Business District. Large areas of parking lots, streets, and other impervious surfaces causes a high percentage of rainfall to be funneled rapidly into inadequate drainage structures. Primary issue: capacity.

Map 5-4 - Soil Associations, City of Staunton



Map 5-5 - Hydrology, City of Staunton



Map 5-6 - Forested Land, City of Staunton

Table 5-9—Flood Protection / Mitigation Measures Taken by the City	
Hydraulic Structures	Lake Tams - A retention pond at Gypsy Hill Park to deal with flooding on West Beverley.
Streambank Restoration	Along the intermittent stream through Gypsy Hill Park.
Floodplain Management	Staunton has a FEMA-designated "Floodplain District" in its zoning code.
National Flood Insurance Program (NFIP)	Staunton participates in and is a member in good standing with the NFIP, allowing property owners to purchase flood insurance through the NFIP. The NFIP aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners and encouraging communities to adopt and enforce floodplain management regulations.
Integrated Flood Observing and Warning System (IFLOWS)	Staunton participates in IFLOWS, which was developed by the National Weather Service.
Stormwater Management	Staunton has a stormwater management ordinance as part of the City Code.
Mitigation Planning	Staunton City Council adopted a series of 26 recommendations on June 13, 2002 as part of the Central Shenandoah Valley Regional Flood Mitigation Plan. Measures include flood prevention, property protection, natural resource protection, emergency services, structural projects, and public education. Staunton is included in the Central Shenandoah Valley Hazard Mitigation Plan which addresses hazards such as Flooding, Drought, Hurricane, Severe Winter Storm, Land Subsidence and Karst, Tornado, Wildfire, Landslide, and Terrorism. The mitigation plan is designed to reduce the impact of natural disasters in the region.