CHAPTER 1

ANALYSIS OF PHYSICAL AND ENVIRONMENTAL CONDITIONS AFFECTING DEVELOPMENT

Introduction and Overview, City of Hopewell

The City of Hopewell is one of Virginia's oldest inhabited areas. Captain Christopher Newport discovered what is now City Point on May 13, 1607. Were it not for the impatience of the early settlers who went ashore at Jamestown Island before Captain Newport returned, the first permanent English settlement may have been where Hopewell is today. In 1613, Governor Dale established a fortified settlement called "Bermuda Cittie", which was later changed to "Charles City Point" and then shortened to "City Point", by which it is currently known. City Point served as an important port for trade with England during the Colonial Period until the Revolution. During the Civil War, City Point was a major military port for federal troops, equipment, and communications.

Hopewell's beginnings as a town came after the Dupont Company built a large plant in Hopewell to supply gun-cotton to the British and French armies during World War I. In 1917, the plant doubled in size and at its peak it employed more than 30,000 workers. The City of Hopewell sprang up around the Dupont Plant. The first sale of lots occurred in April 1915 at the corner of Broadway and Main. Much of this hastily-built city was burned in December of that same year. In the following year, 1916, Hopewell was incorporated by the General Assembly. Following the War, disaster struck Hopewell as Dupont closed their plant, throwing 30,000 people out of work.

The 1920 Census reported that Hopewell had only about 1,500 persons and about the same number at City Point. But by 1930 growth was again occurring and since that time Hopewell has hosted the development of some of America's foremost industries. The Hercules Company took over part of the Dupont gun-cotton plant to make cellulose, and remains as one of the major industries of Hopewell. The first rayon fibers made in America were manufactured in Hopewell by the Artificial Silk Company of America, today known as Hoechst/Celanese. Allied Chemicals started manufacturing ammonia in 1928 as the Atmospheric Nitrogen Corporation of

Syracuse, New York, and has since expanded to make synthetic fibers, chemicals, and perform research. Hopewell's population grew to 23,397 by 1970 but since then has shown little growth. According to the 2000 census, Hopewell's population is 22,354, a decrease of 2.3 percent. Much of the increase in population reported between 1920 and 1970 came from adding additional territory to the City's boundaries. (Figure 1.1). The original charter incorporated an area of 1.18 square miles. Subsequent additions included: 3.3 square miles in 1923; 3.39 square miles in 1952 and 3.01 square miles in 1969. The current City occupies 11.3 square miles.

GROWTH OF HOPEWELL THROUGH ANNEXATIONS 1916-2000

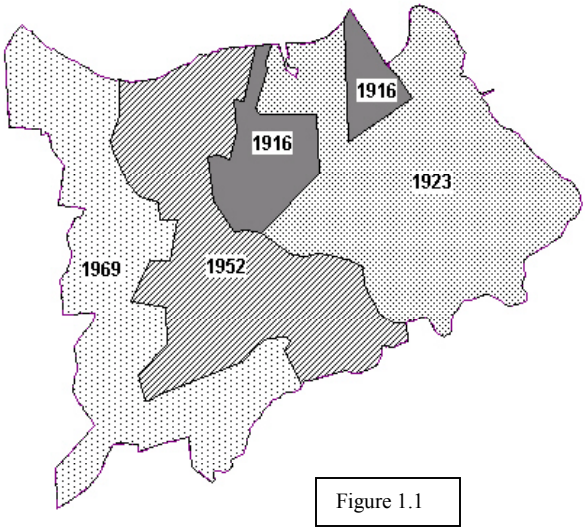
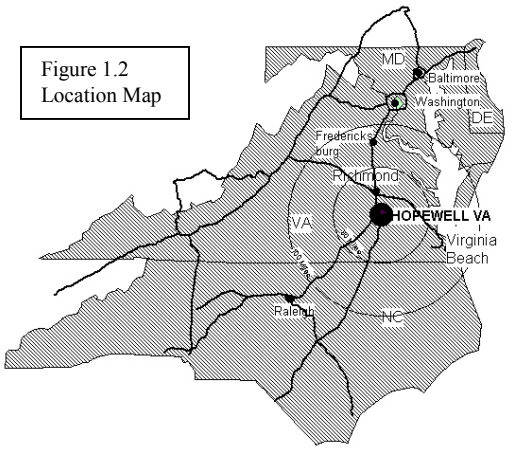


Figure 1.1

Hopewell is located approximately 25 miles south of Richmond at the confluence of the James River and Appomattox River. The City is part of the Tri-Cites Area of Petersburg, Hopewell, and Colonial Heights. It is bordered by Prince George County on the south and the Appomattox River on the north. Interstate 295 traverses the City on the west and connects it to the North/South (I-95) and East/West (I-64) Interstate routes. Figure 1.2 illustrates Hopewell's geographic position relative to the Mid-Atlantic States and major highways serving Virginia. Hopewell is also situated within the area of jurisdiction of the Chesapeake Bay Local Assistance Board. All of the Hopewell area drains directly or indirectly into the Chesapeake Bay via one of the four major rivers of Virginia, James, York, Rappahannock or Potomac. One of the prime requirements of the regulations adopted by the Chesapeake Bay Local Assistance Board (CBLAB) is that local governments within the Board's jurisdiction include in their

Figure 1.2
Location Map



Comprehensive Plan a Water Quality Protection Plan based on a detailed analysis of physical and environmental conditions.

This chapter provides that physical analysis for the City of Hopewell. It examines conditions, both natural and man-made, that may play a significant role in limiting the future development of the City. For the purpose of this analysis, physical conditions expected to place major limitations on the City's potential for development are grouped under the following three categories:

A. Physical Constraints to Development

B. Protection of Potable Water Supply

C. Analysis of Shoreline Conditions

The major purpose of this analysis is to provide the data that will provide the structural framework for designing a Land Use Plan, the basic component of Hopewell's Comprehensive plan. This analysis, therefore, will define those areas of the City that are likely to impose constraints on development such as steep slopes, highly-erodible soils, areas subject to flooding, historic features and other sensitive environmental areas. This data will also be used to ensure the City's Comprehensive Plan includes a Water Quality Protection Plan in compliance with the Chesapeake Bay Preservation Act.

A. PHYSICAL CONSTRAINTS TO DEVELOPMENT

1. Physiography and Topography

Hopewell lies in the easternmost of Virginia's physiographic provinces, the Coastal Plain. The Coastal Plain province was formed from sediments, which accumulated over hundreds of millions of years because of erosive water actions on the higher lands to the west. It is, in fact, a bed of silt, clay, sand, gravel, and other materials carried down from those elevations, deposited and accumulated to form what citizens of the region refer to as "Tidewater Virginia". Hopewell lies at the western edge of the province near the "fall line". This is where the Coastal Plain province gives way to the Piedmont province and where the rivers experience a rise in elevation, thus, the name "fall line". The Coastal Plain province, which juts out into the Atlantic Ocean as the Continental Shelf and reaches a depth of –600 feet below sea level, reaches a height of 200 feet above sea level at the fall line. The topography in Hopewell begins at about eight feet above sea level along the waterfronts of the James and Appomattox Rivers and reaches a height of just more than 80 feet above sea level further inland. The highest points in Hopewell occur along Park Avenue between Summit Street and Walnut Street. The steepest slopes in the City are found along the rivers and creeks. Figure 1.3 shows the general topography of the City of Hopewell at increments of 10, 30, 50 and 70 feet above sea level. Also shown is the layer between the water level of the James and Appomattox Rivers and the 10-foot elevation.

To correctly interpret the areas indicated by these elevations, they should be thought of as representing a range of elevations between the level shown and the next highest number. For example the eight-foot area represents land that is between the water level and 10 feet above sea level; accordingly, the 10-foot area represents land with elevations between 10 and 30 feet above sea level; and so on. The water level of the James and Appomattox Rivers provides an elevation that is approximately eight feet above sea level. Figure 1.3 shows the topography of the City of Hopewell.

Steep slopes are another limiting factor in development. One can see from examining the street patterns on this map how the more severe slopes reflect the pattern of severe slopes along these waterways. Steep slopes are a serious limiting factor to development in that they make

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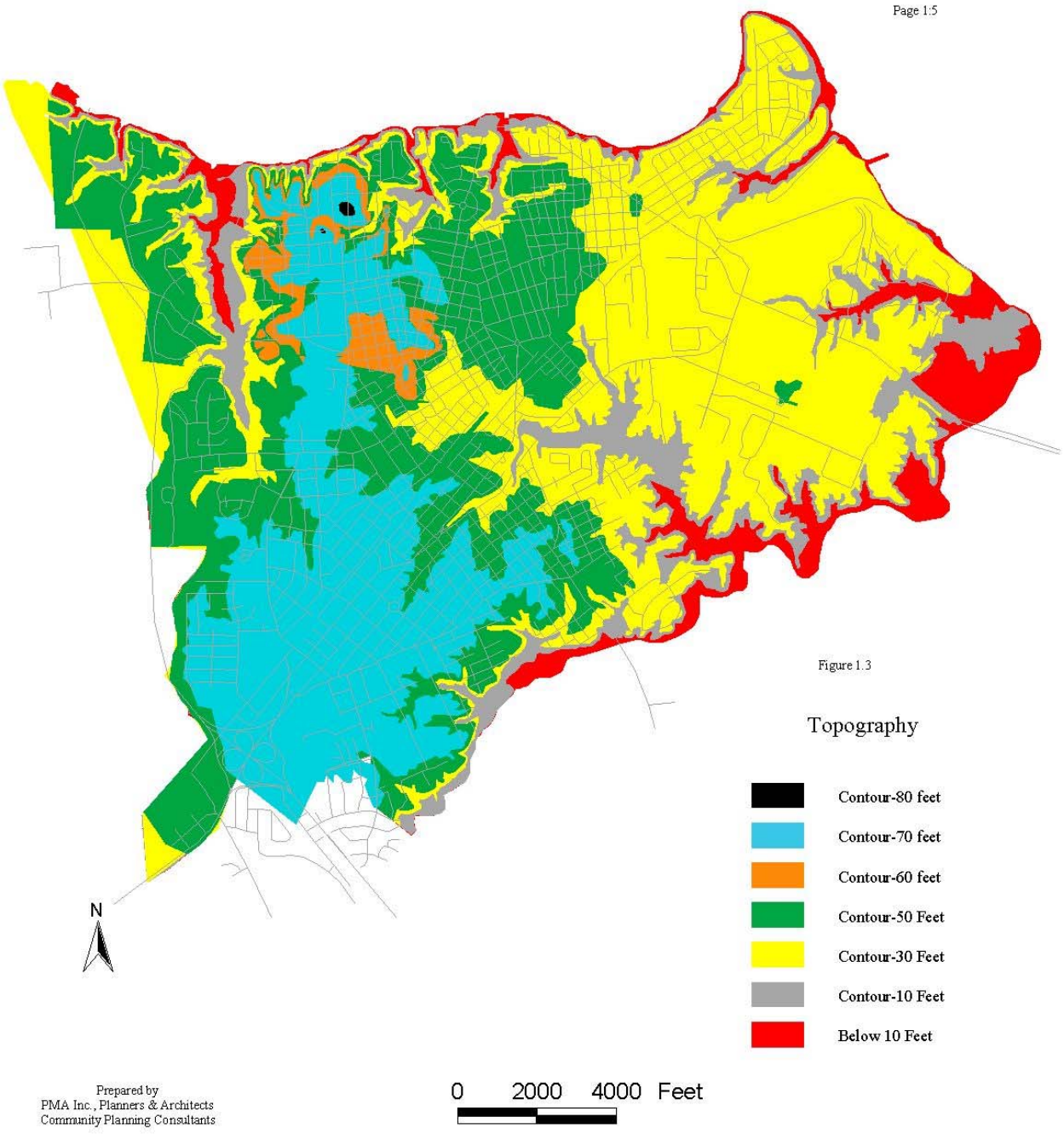

development more difficult as well as more costly. Special engineering and careful environmental analysis have to be undertaken for these areas to be developed. Consequently, these are the last areas to be developed within a community, if they are ever developed. A slope greater than 15% is generally sufficient to raise concerns about the possible development of the site and slopes of this magnitude and greater are found along some of the stream and river banks in Hopewell. Figure 1.4 shows the pattern of steep slopes in the City.

2. Existing Development

Existing development plays a powerful role in determining future land use. For one thing it is an established pattern that changes very little with the result that most new development will come in one of three ways: (a) extensions of existing development on vacant land; (b) infill within the existing pattern on random vacant lots; and (c) replacement of existing use with new development.

Figure 1.5 is a land use map depicting the current development of the City of Hopewell. Residential development occupies most of the City and consists mainly of single-family detached houses, although there are several concentrations of apartments, townhomes, and condominiums. Large tracts of residential housing were developed in the early 1900s as housing for workers at the nearby industrial plants. Only two major subdivisions were added within the last decade: Lincoln Square (42 lots); and Cobblestone (111 lots). Lots along Jamestown Drive have been established and dwellings have been placed on most lots. Other residential buildings have been established as infill throughout existing residential areas.

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Industrial development is concentrated in the northeast section of the City between the James River and Baileys Creek. This is an area served by an extensive transportation network: road, rail, and port. Also in this area are some of the largest tracts of undeveloped land in the City, although most of these are owned by existing industries.

3. Undeveloped Land.

The availability of land is another factor that can limit growth. Land is needed to spur residential growth, provide jobs and recreational opportunities for those residents, and to provide goods and

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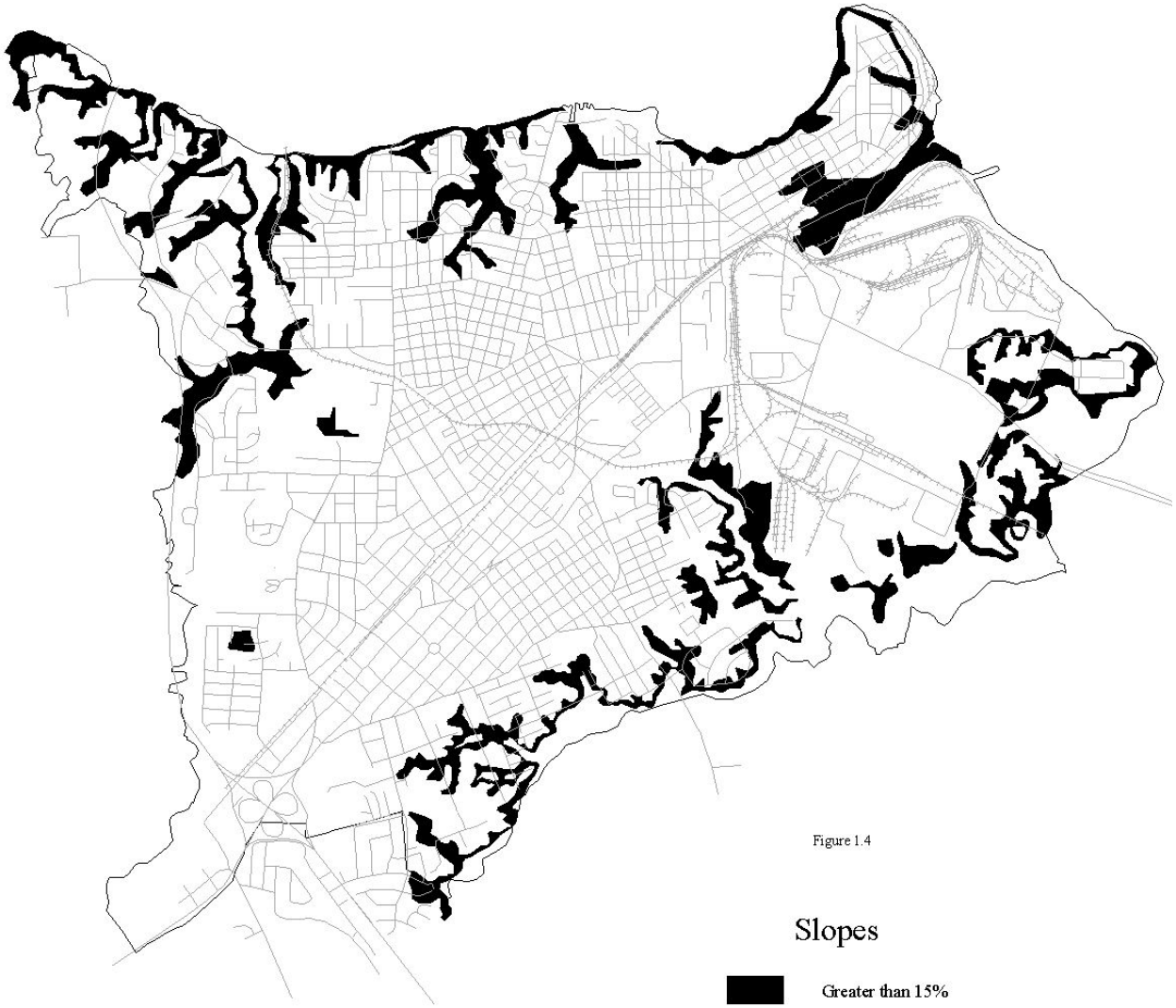

Figure 1.4

Slopes

Greater than 15%

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0 2000 4000 Feet

Source: Soil Survey of Prince George County, Virginia.
Soil Conservation Service, USDA. 1980.

services to both the residential and business community. The amount of remaining vacant land in Hopewell has diminished to a level where it is insufficient to support the long-term future growth of the City along traditional patterns where new growth is accommodated predominantly on prime undeveloped land. Compounding this problem are other factors associated with the remaining vacant land. A significant portion of this land is within the Chesapeake Bay Resource Protection Area (RPA). Other portions are plagued by steep slopes, are too rough to develop, or are non-tidal wetlands and considered undevelopable. Some land within the Resource Management Area (RMA) may be developable, although few large sites exist under single ownership. Much of the developable vacant land consists of relatively small sites, or groups of sites under multiple ownership, which may be difficult to develop efficiently. Based on the shortage of developable vacant land, an emphasis should be placed on using the remaining vacant land efficiently and effectively, and where appropriate, on redeveloping existing land to accommodate new growth.

According to the analysis in the 1991 Comprehensive Plan, the vacant land in Hopewell consists of approximately 1500 acres of which portions include prime acreage, acreage in the Chesapeake Bay Preservation Area, and areas with rough terrain. Approximately three-quarters of the vacant land consisted of developable acreage although a portion of this land fell within the RMA which would be under the limitations of the overlay district. However, not all of this land may be feasible to develop due to access problems, existing ownerships, and other practical considerations. The remaining vacant land falls within the Resource Protection Area or consists of rough terrain and is considered undevelopable for planning purposes.

a. Vacant Residential Land:

Much of the remaining vacant residential land in the City consists of single lots scattered throughout the City. The larger remaining vacant parcels have development constraints that may be great enough to preclude them from ever being fully developed. The 1990 Comprehensive plan listed three parcels that had potential for further development.

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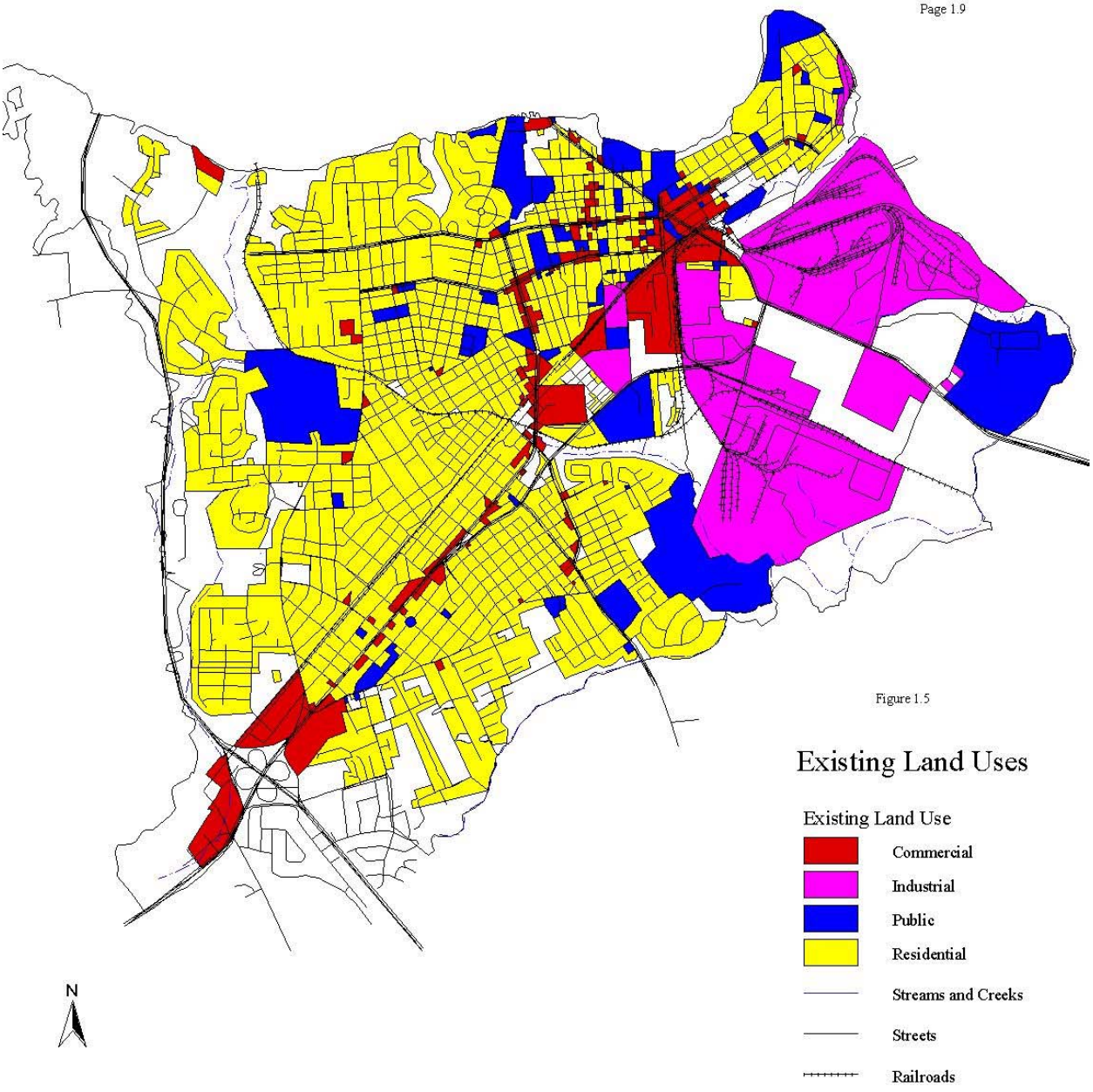

Figure 1.5

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b. Residential Development Potential of Vacant Land:

It is unlikely that all of the remaining vacant residential land can be fully developed given that much of it may be difficult to assemble and/or access efficiently to maximize its potential. The available vacant residential land has a limited capacity to absorb future growth in housing

c. Vacant Commercial Land:

Most of the vacant Commercial land is in the B-3 zone around the new I-295 interchange. There are several moderately-sized sites in this area, which could have significant commercial potential.

d. Vacant Industrial Land:

Most of the vacant industrial land occurs in the M-2 zone and consists of large parcels under ownership by adjacent industries. Most of this land is prime acreage and will support additional development although most of this land is reserved for future development by the companies that own the property.

4. Chesapeake Bay Protected Areas

The Chesapeake Bay Preservation Act was adopted by the Commonwealth of Virginia to improve the quality of water that enters the Chesapeake Bay. Section 10.1-2109 of the Act required each local government to designate preservation areas, which, if improperly developed, could negatively impact the water quality of the Bay and its tributaries. Total area for the Chesapeake Bay protected areas is approximately 2,300 acres. Figure 1.6 delineates the Chesapeake Bay protected areas.

a. Resource Protection Areas (RPA)

RPAs are lands that absorb wind and wave energy, stabilize soils, and filter sediment and nutrients that run off the land. They should include all lands that have an inherent water quality benefit. The only permitted uses in these areas are redevelopment of existing uses, water dependent uses such as piers, public utilities, railways and roadways, water wells, passive recreation uses, and historic preservation or archeological uses. The City's

Zoning Ordinance defines Resource Protection Areas as including the following:

1. Tidal wetlands
2. Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams
3. Tidal shores
4. A 100-foot vegetated buffer area located adjacent to one of the above types of areas and along both sides of any tributary stream

b. Resource Management Areas (RMA)

RMAs are lands, which, if improperly developed, have the potential for diminishing the functionality of RPAs. Any use that is permitted under the City's zoning ordinance is permitted in the RMA, provided all development meets performance criteria set forth in the Chesapeake Bay Act Regulations. According to the City's current Zoning Ordinance, the Resource Management Area is composed of concentrations of one or more of the following land categories:

1. 100-year floodplains
2. Streamside steep slopes
3. Nontidal wetlands not included in the Resource Protection Area

c. Intensely Developed Areas (IDA)

IDAs are areas of existing development and infill sites where little of the natural environment remains and which meet the following criteria:

1. Development has severely altered the natural state of the area such that it has more than 50 percent impervious surface
2. Public sewer and water has been constructed and currently serves the area
3. Housing density is equal to or exceeds four dwellings per acre.

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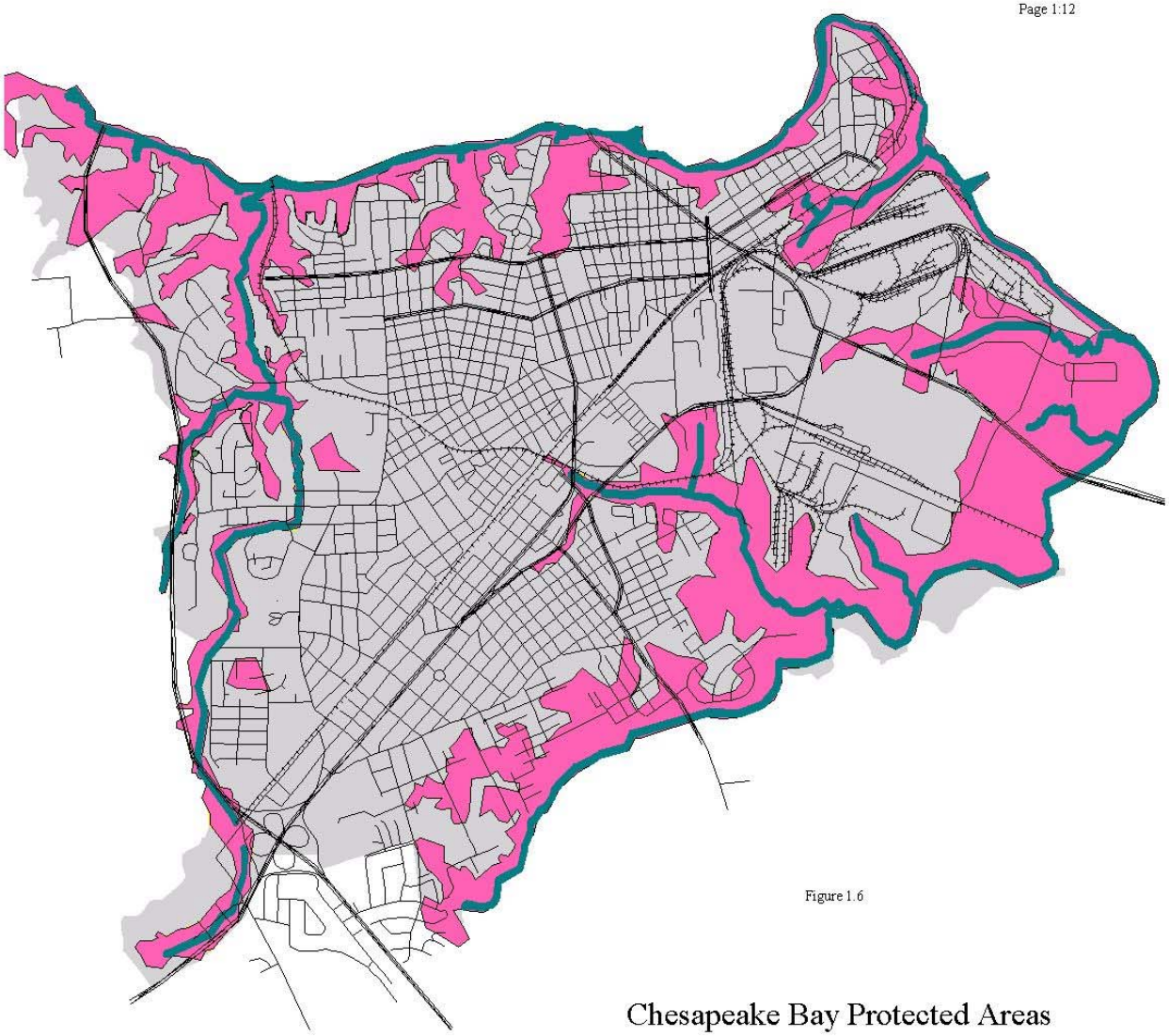

Figure 1.6

Chesapeake Bay Protected Areas

Resource Protection Area

Resource Management Area

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0 3000 6000 Feet

City Council action is required in order to establish an IDA. The Local Assistance Manual provided by CBLAD recommends that Intensely Developed Areas have a minimum size of 20 acres, and further provides that "Intensely Developed Areas shall serve as redevelopment areas in which development is concentrated as of the local program adoption date."[1] No IDAs have been established to date within the City of Hopewell.

Hopewell first established an overlay zoning district in its zoning ordinance in 1991 and at that time, as part of the first-year program of implementing the Chesapeake Bay Program, established the Resource Protection Area boundaries by adopting a model ordinance provided by CBLAD. Although the criteria for Resource Management Areas were defined in the ordinance (see language above) boundaries of the RMAs were not expressed in a map. Instead, the City took the approach that as individual properties were developed, each property owner would be responsible for providing technical services necessary to define the exact boundaries of both the RMA and RPA at a specific site. Figure 1.6 delineates graphically the areas that should be defined as the RMA as could best be determined from the soil data. Areas delineated include non-tidal wetlands, 100-year flood plains, steep stream banks and highly-erodible soil (although little of the latter was found in Hopewell).

5. Flood-prone Areas

Floodplains are low-lying areas adjacent to rivers, streams, creeks, and other bodies of water that are subject to periodic flooding when precipitation causes the volume of water to exceed the capacity of the waterway. Figure 1.7 shows the 100-year floodplain for the City of Hopewell. There are a multitude of factors, such as topography, geographic orientation of the shoreline, depth and duration of the flooding, and rate of water rise, which affect damage caused by floods. The amount of flood damage is also affected by the extent of development within a floodplain since development can interfere with the natural functions of floodplains.

[1] Section 3.4, CBLAD Regulations.

Congress established the National Flood Insurance Program in 1968. This program enables property owners to purchase federally-backed flood insurance within communities, which implement floodplain management measures to reduce flood risks to new development. Regulations of the National Flood Insurance Program specify requirements that must be included in local ordinances if a community wishes to participate in the program. Requirements of the program include regulation of buildings and other developments in floodplain areas. Hopewell's Zoning Ordinance includes floodplain regulations in Article XV. The Federal Emergency Management Agency (FEMA) establishes flood risk data for insurance rating and floodplain management in addition to conducting Flood Insurance Studies and Maps for localities. The Flood Insurance Rate maps define flood hazard areas, or areas subject to inundation at 100-year and 500-year intervals. A 100-year flood zone has a one percent (1%) chance of being inundated in any given one-year period, whereas the 500-year flood zone has a two-tenths of one percent (0.2%) chance of being flooded in the same one-year period.

6. Wetlands

Figure 1.8 shows the location of wetlands in the City of Hopewell. Concentrated along the southern border of the City, wetlands make up about 730 acres of the land area of Hopewell. The wetlands in the city closely parallel Cabin Creek, Cattail Creek and Baileys Creek. The value of wetlands includes aesthetics; flood, erosion, and pollution control; habitat; productivity; and recreation. They serve as a natural water filter for wastes and sediments, a barrier and an absorber of floodwaters, a buffer and a stabilizer of the shoreline from coastal erosion, a recharge area for ground water, and an important breeding and nesting ground for many species of fish, bird, and plant life. Wetlands also serve as valuable sites for recreation, open space, and education. There are two classifications for wetlands, tidal and nontidal. Tidal wetlands are vegetated marshes, non-vegetated beaches, sandflats, and mudflats, which are subject to regular tidal influences by salt or brackish water. Nearly all wetlands in the City are classified as non-tidal. The only tidal wetlands are a few sandflats along the James River that are subject to tidal pressures.

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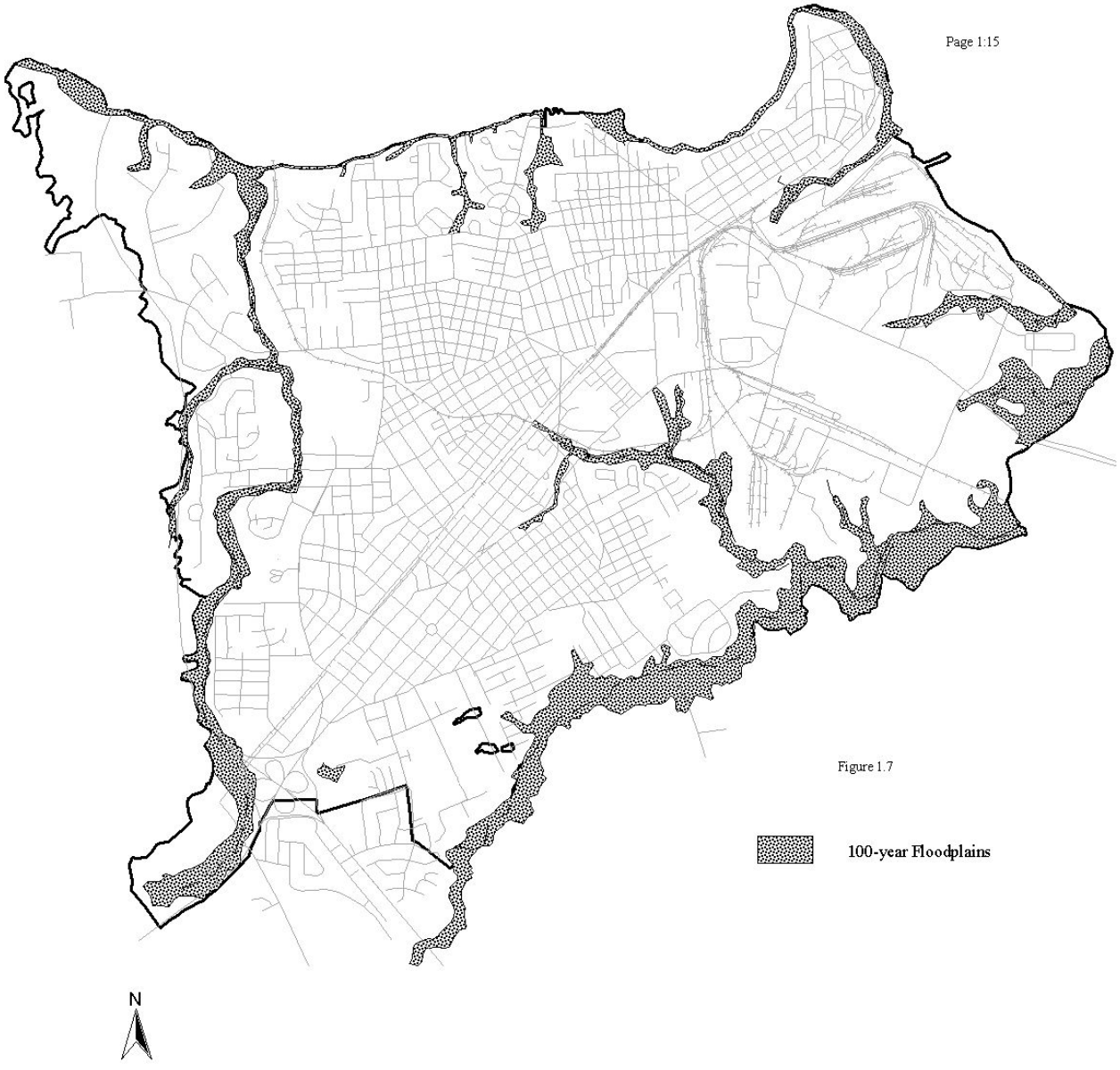

Nontidal wetlands, which may be adjacent to tidal marshes as well as further inland, are beyond tidal influences, and are either continually or seasonally saturated by freshwater. Due to seasonal and yearly variations, these types of wetlands are not as easily recognized, since there may not be any surface evidence of the presence of water during certain times of the year.

For years, wetlands were considered undesirable wastelands and breeding grounds for disease-carrying mosquitoes. Consequently, many millions of acres were filled, drained, and otherwise altered for conversion to agricultural lands or development sites. It has been estimated that between the mid 1950s and the late 1970s approximately 11 million acres of wetlands were lost nationwide. During this period, Virginia lost approximately 57,000 acres of freshwater vegetated wetlands to agricultural conversion; channelization; forestry, pond, lake, and reservoir construction; and other development. Not until the early 1970s did the science community begin to realize the significant function of wetlands. Because of that research, a number of federal, state, and local regulations evolved to manage and protect both tidal and non-tidal wetlands.

Federal Regulations: Sections 401 and 404 of the Clean Water Act are the primary federal regulations which affect development on wetlands. Before a wetland can be filled or disturbed, a wetlands permit must be obtained from the U.S. Army Corps of Engineers.

State Regulations: The Commonwealth of Virginia began to regulate wetlands in the early 1970s, with the passage of the Virginia Wetlands Act of 1972. The purpose of this act was to ensure that wetlands of primary ecological significance would not be altered or unreasonably disturbed. The following areas were exempted from this act: agricultural, silvicultural, and horticultural activities; cultivation and harvest of shellfish and worms for bait; maintenance and repair of roads and railways; outdoor recreational activities that do not disturb wetlands; construction and maintenance of noncommercial piers, boathouses, and fences constructed so as to preserve tidal flow; construction of navigational aids; maintenance of man-made drainage ditches; governmental activities; and activities undertaken pursuant to emergency decrees.

Local Regulations: The Virginia Wetlands Act gave local governments authorization to establish local wetlands boards to exercise jurisdiction and review and issue permits for development on local wetlands.

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Properly managed and maintained, wetlands become an asset to the surrounding land. Wetlands can provide an economic benefit as well as being vital in the natural ecosystem. They provide access to hunting and fishing, bird watching, boating, and other outdoor activities. These types of activities provide many economic benefits to the local economy.

The habitat that wetlands provide is crucial. Any disruption in the food cycle or life cycle can do harm to the local fauna and wildlife. This can cause the disappearance from the locality of species that provide a reason for outdoor enthusiasts to return. Loss of these species translates into loss of economic benefits to the surrounding community. Wetlands also perform cheaper, more effective, and more attractive, flood and pollution control. Wetland plant species and vegetation filter out chemicals and trap sediment before it reaches the rivers and bay. They also slow the force of runoff and store water once received. It is in the economic interests of the community to protect its wetlands.

7. Soils

According to the most recent soil survey of Prince George County, which includes Hopewell[2], land within the City of Hopewell is made up of 37 different types of soil. All of these soils are contained in one general soil unit, the Slagle-Emporia-Bonneau general soil unit. The S-E-B is generally composed of deep, moderately well drained to well-drained soils that have a loamy subsoil. The soil unit is named for the most common soils although other soils make up more than 30% of this general unit. There are also large sections of the soil in the City that were not described or delineated. More than 80% of these areas are covered in asphalt or impervious covers. It was not possible to determine the type or composition of the soils underlying these impervious covers without extensive testing. Therefore, before new uses and structures are established, each site should be tested to determine what type of soil is found there and what are that soil's respective properties.

a. Drainage:

One important aspect of the soil is how well it drains. Soil drainage affects many things about a site. Poorly drained soils need to have extra drainage installed so that water does

[2] Soil Conservation Service, USDA. *Soil Survey of Prince George County, Virginia.* (National Cooperative Soil Survey: Washington), 1980.

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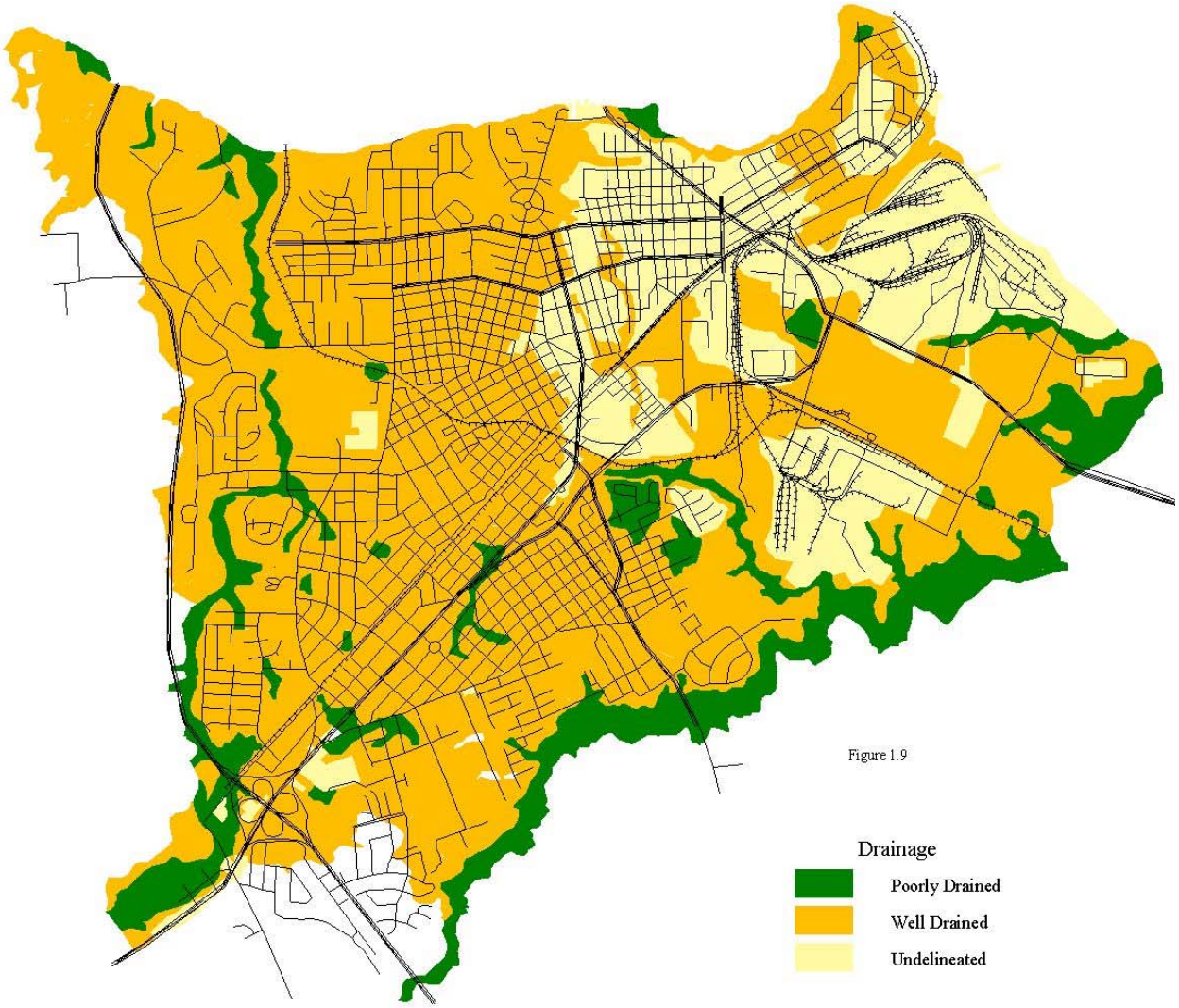

Figure 1.9

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Source: Soil Survey of Prince George County, Virginia. Soil Conservation Service, USDA. 1980.

not puddle around built structures and damage the foundations. Poorly drained soils also can exacerbate pollution. Pollutants that would normally be drained off from the soil are more likely to remain in the soil or descend into the underground aquifers creating a pollution hazard. Most of the poorly-drained soils follow the creeks and streams of the city and may be undevelopable. They parallel the RPA and most are within the floodplain. Figure 1.9 delineates the drainage qualities of the soil in the City of Hopewell.

b. Shrink-swell Qualities of the Soil

Shrink-swell refers to the capability of soils to expand or contract as moisture is gained or lost. The interaction between minerals in clay with water is the primary reason for volumetric change and, accordingly, the amount of shrink-swell in a particular soil is related to the type and amount of clay minerals found in the soil. The size of the load on the soil and the magnitude of change in soil moisture content influence the amount of swelling of soils in place. Figure 1.10 shows the shrink-swell qualities of the soils in Hopewell and classifies them as high, moderate, low or undelineated. Please see the section on Soils for an explanation of the undelineated section of the map.

The implications of the shrink-swell qualities of soils for planning purposes revolve around the design and building of foundations for such structures as roads, buildings, and bridges. High shrink-swell soils require special engineering techniques in the design of foundations to allow for the expansion and contraction of the soil without damaging the structure that sits upon that soil. Soils with very low shrink-swell qualities may not be stable enough to support any large-sized structure. Hopewell has no soils that rate very low in shrink-swell quality.

c. Run-off Quality of Soils.

This quality describes the capability of the soil to capture precipitation and prevent it from running off into streams and other watersheds. Figure 1.11 shows the run-off potential of the soils and lists them in order from slight potential to excessive potential for run-off. Most of the soils in Hopewell have either severe or excessive run-off

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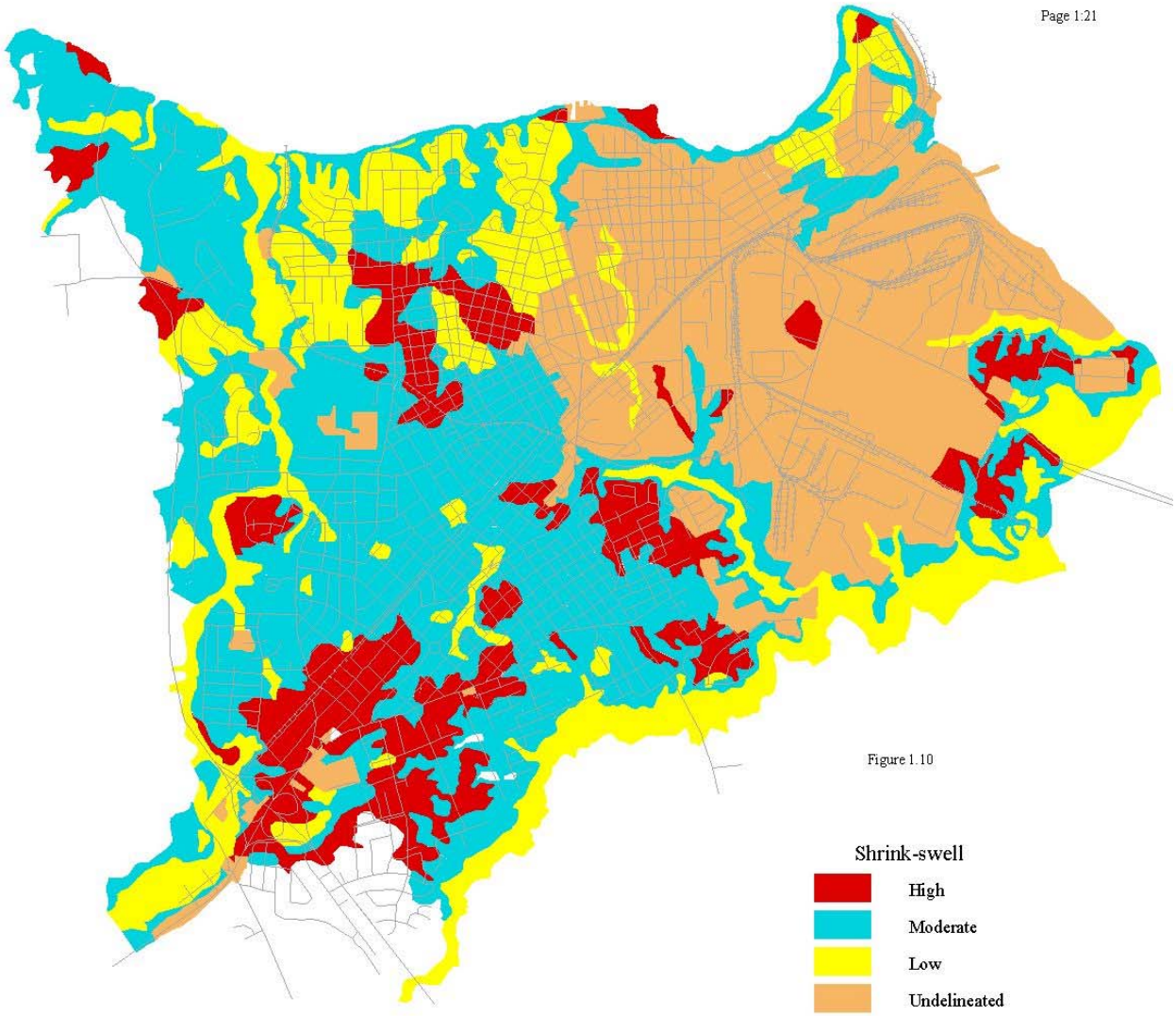

potential, due, in large part, to the built-up nature that is common to urban areas. Most of the slight to moderate run-off potential soils are in the northern section of the City.

Run-off potential is important, especially when discussing the Chesapeake Bay regulations, because one goal of the Chesapeake Bay Act is to reduce pollution from non-point sources. Non-point source pollution, such as run-off from urban areas like parking lots and streets, run-off of excess lawn fertilizers and pesticides, and erosion of soil from stream banks or improperly managed construction sites, is a big contributor to the pollution of the Chesapeake Bay and its tributaries. By careful management of those soils with slight run-off potential, it may be possible to lessen non-point source pollution by allowing these soils to capture precipitation that otherwise would run off into the waterways carrying possible water contaminants.

d. High Water Table

Another important soil quality is the depth of the seasonal high water table. The high water table, Figure 1-12, affects structure placement on a site, suitability for a basement for a dwelling, and the types of buildings that can be placed on a site. It can also affect placement of recreational areas such as swimming pools. A seasonal water table is considered high if it reaches closer than 48 inches below the ground surface. A moderate water table is between 48 and 72 inches below the surface of the earth. Most of Hopewell is considered to have a high water table. It must be remembered, however, that this is a generalized interpretation; each site is different and must be evaluated separately to determine the height of the seasonal water table.

e. Hydric Soils

A hydric soil is defined as a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper layers. Hydric soils of Virginia are defined and listed in a document published by the U.S. Department of Agriculture, Soil Conservation Service, entitled Hydric Soils of Virginia. Though there are wetlands in Hopewell, there are no hydric soils in the City.

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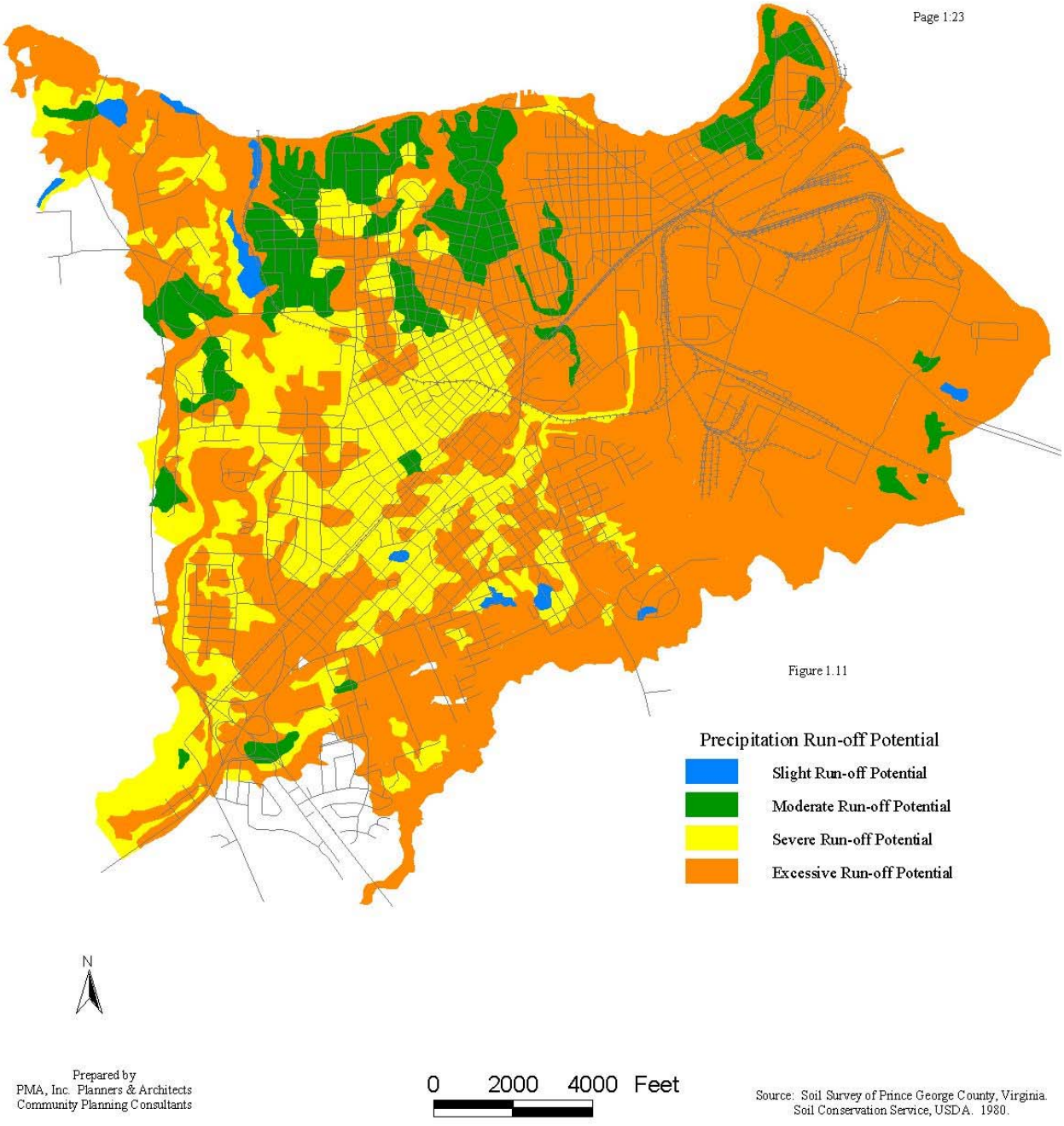

Figure 1.11

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Source: Soil Survey of Prince George County, Virginia. Soil Conservation Service, USDA. 1980.

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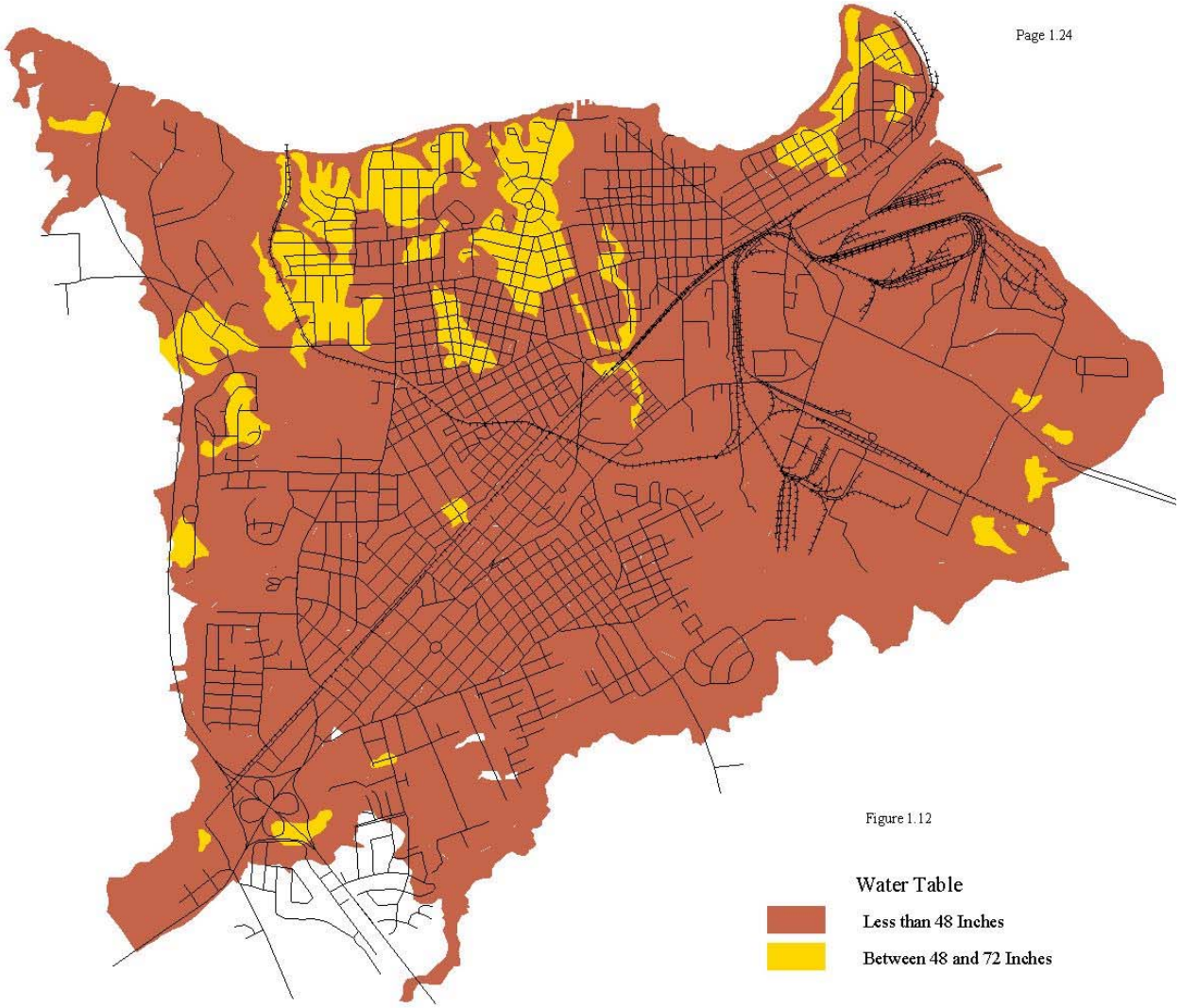

8. Historic Resources

Historic resources play an important role in the community. Their purpose is two-fold; they help the local economy by drawing tourists and they help educate succeeding generations in the history of the locality in which they reside. The most significant historic feature of Hopewell is City Point. It has been previously noted that this area was first known as "Bermuda Cittie" and later called "Charles City Point" and eventually shortened to its present name.

This community missed being the first permanent English Settlement by some 24 hours. It seems that when the three ships anchored off Hog Island early in May 1607 the instructions from the London Company were opened. They were to establish the first settlement at least 50 miles from the ocean because of fear of Spanish raiders. Captain Christopher Newport, the mariner in charge of the voyage from England, set out with a small party in a shallop to explore up the river. When he reached the mouth of the Appomattox River he saw a small Indian village, perched on the bluff where Appomattox Manor now stands. Newport and his men landed and distributed gifts to the queen and were so royally entertained that they stayed for three days. Captain Newport wrote later that he considered this the ideal place for the new settlement but when he returned down the James, he found the other settlers had already moved up the river and anchored at Jamestown, which became the first permanent English settlement.

In 1613, Governor Dale (Sir Thomas Dale) established a fortified settlement on the bluff where Appomattox Manor now stands and called it "Bermuda Cittie" (later Charles City Point and City Point). The first free school in America was established at City Point in 1621. The very next year, 1622, the community was wiped out when the Indians staged the "Great Massacre." City Point gained further historical significance in 1864 when Union General Ulysses S. Grant established his headquarters there during the Union siege of Petersburg.

The City Point unit of the Petersburg National Battlefield is located at City Point and encompasses Grant's headquarters in the park. Appomattox Manor, built ca. 1763, is located at the tip of City Point and is included in the Petersburg National Military Park. Other historical

landmarks in old City Point include St. John's Episcopal Church built ca. 1840; the Porter House, ca. 1810; and City Point House, ca. 1730.

There are other places of historical interest in Hopewell besides City Point. Weston Manor, built ca. 1780, is located on the banks of the Appomattox River and now serves as a museum and cultural center for the City. Crescent Hills subdivision has one of the largest concentrations of Sears-Roebuck houses in the nation. Built in the late 1920s and early 1930s, these houses have not been substantially altered which may make them eligible for the National Register. The Beacon Theater, which has been undergoing a restoration, and the James E. Mallonee School are also historically significant structures in Hopewell. There are two historic cemeteries in Hopewell; Appomattox Cemetery and City Point National Cemetery, the latter of which has both Union and Confederate soldiers buried within its confines. Figure 1.13 shows the locations of these historic sites as well as others that may have historical significance.

Since Hopewell has been occupied for almost 400 years, there may be other sites of historical and cultural significance in the City. A complete survey of the older sections of the City by the Virginia Department of Historic Resources (VDHR) may result in many other sites being qualified for addition to the Register. Current preservation issues in Hopewell include the preservation and restoration of the "Downtown" area and adaptive reuse of older buildings that may have historical significance.

COMPREHENSIVE PLAN
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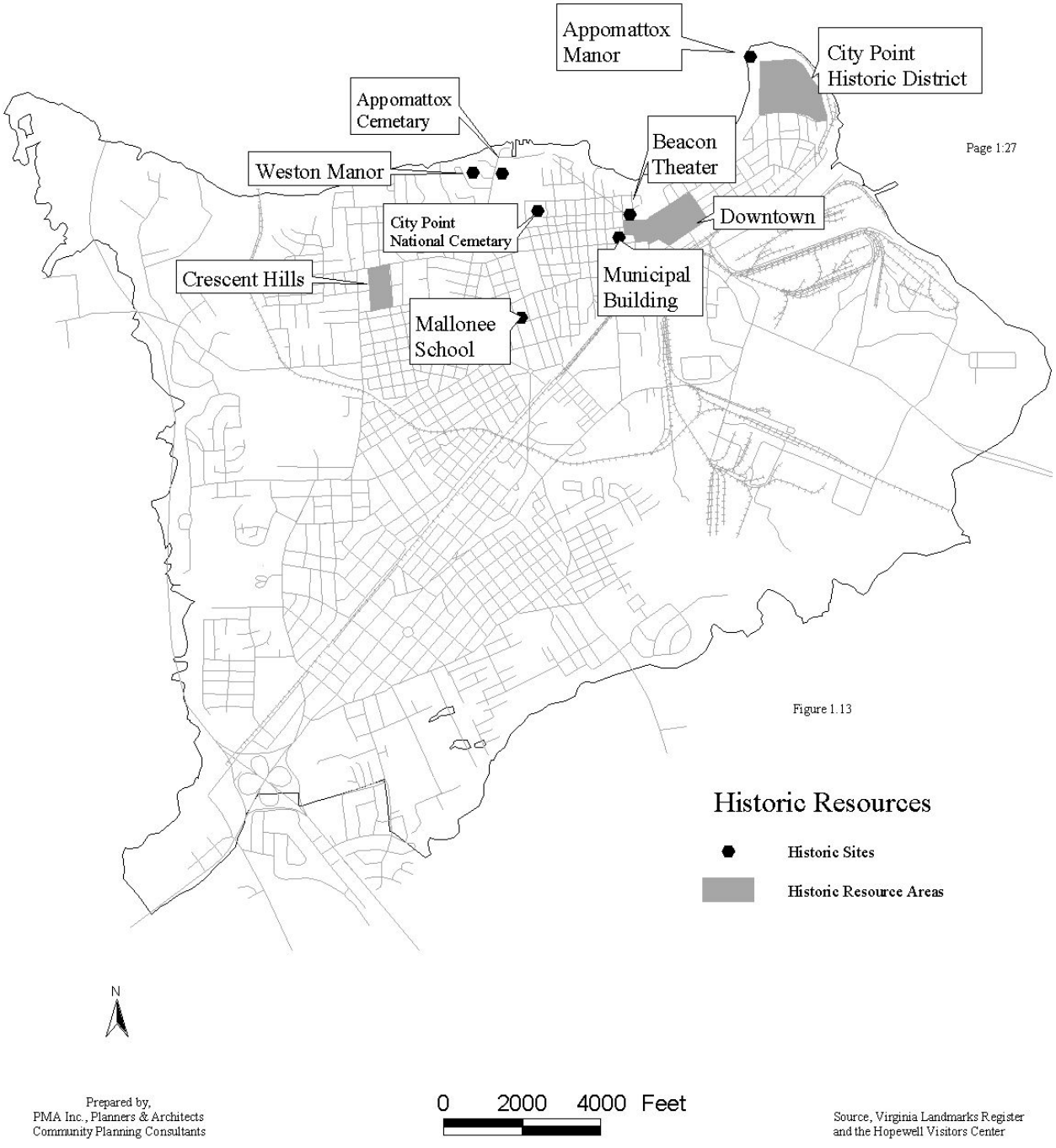


B. ANALYSIS OF CONDITIONS RELATED TO POTABLE WATER SUPPLY

Water resources are often described in the context of a hydrologic cycle. This is the cyclical movement of water within the environment from atmosphere, to land, to sea, to atmosphere again. Precipitation, infiltration, evaporation, and transpiration are the principle mechanisms, which move water from one location to another. Precipitation in the form of rain, snow, or hail can be intercepted by vegetation, infiltrate into the ground, or run off as surface waters. Plants, which intercept precipitation, absorb moisture and transpire water back into the air. Infiltrated water is stored underground in storage areas between layers of rock or sediment, known as aquifers. Water not infiltrated eventually runs into depression areas, such as puddles, streams, lakes, rivers, and oceans. As exposed surface waters evaporate into the atmosphere, the hydrologic cycle continues. Water for drinking purposes is obtained directly from rivers and streams, impoundments of surface water (dams and reservoirs) and/or from underground aquifers.

1. Water Supply for Hopewell

In Hopewell, drinking water is obtained from the Appomattox River from a pumping station at the confluence of the Appomattox and James Rivers. The Appomattox River is one of the longest and least developed rivers in Virginia. The Virginia-American Water Company in Hopewell supplies water to Hopewell, Fort Lee and the suburban areas in Prince George County. The company withdraws its water from the Appomattox River near the confluence with the James River. The treatment plant has a current capacity of 33 million gallons per day (mgd). The average total water production is 21 mgd. Eighty-five percent of the water processed is consumed by the industries of Hopewell. There are currently over 8,500 connections to the system.

2. Conditions Affecting Water Quality

Sources of Pollution. Potential contamination of ground and surface water includes two sources of pollution: point and non-point. Non-point source pollution contributes about

three-fifths of the nitrogen that reaches the Chesapeake Bay, and more than half of the phosphorus. To reduce runoff from fields, increased efforts have been made in the Bay watershed to install Best Management Practice plans (BMPs). To maximize nutrient control, resource specialists suggest that the BMP concept be replaced with "best management systems" (BMS's). BMS's are a combination of conservation practices or management measures which, when used in concert, can achieve greater nutrient reductions. A BMS, for example, may combine conservation tillage practices with grass waterways, strip-cropping, diversions, stream-side buffers, and a nutrient management plan.

Nutrients from lawns, roadways and other developed areas are flushed into waterways by rain. Urban areas contribute about 14 percent of the phosphorus and 11 percent of the nitrogen. In recent years, some progress has been made toward installing runoff control devices on new developments, but "retrofitting" controls on already-developed areas are particularly costly to maintain.

Approximately 25 percent of the nitrogen entering the Bay and its tributaries, and about 33 percent of the phosphorus originates from point source pollution. These are mainly municipal wastewater treatment plants. Historically, these plants were designed to remove pathogens from sewage to protect public health. Increasingly, however, these plants have been upgraded to help better remove nutrients. This upgrading has been particularly successful for phosphorus -- greatly aided by the phosphate detergent bans that went into effect in the mid to late 1980s.

Nitrogen removal from wastewater treatment plants has lagged behind phosphorus removal. New techniques are being developed to better remove nitrogen from wastewater. Some, such as biological nitrogen removal, promote natural denitrification processes in waste, increasing nitrogen removal from the normal 10 percent to 20 percent to 60 percent to 85 percent. Other techniques, such as the addition of certain chemicals, have also proven effective in nitrogen removal. However, nitrogen removal can be expensive, requiring millions of dollars of upgrades at treatment plants. Some technologies such as biological nitrogen removal can require extensive facility expansions, making them impractical for plants with land constraints. Point sources of

pollution also include landfills, heavy industrial sites, underground storage tanks, and other commercial facilities that have the potential to generate pollution. Because they are known, they are readily regulated and monitored. Virginia's Groundwater Protection Steering Committee has assigned top priority to the following sources of groundwater contamination: underground storage tanks, landfills, lagoons and holding ponds, septic systems and waste treatment facilities, pesticides and fertilizers, and hazardous wastes.

Underground Storage Tanks: Contamination of groundwater from underground storage tanks has increased steadily in recent years. Reports indicate that there are thousands of such tanks in use in the State, as well as a substantial amount of unused and abandoned tanks. Recent Environmental Protection Agency studies indicate that as many as 35 percent of all underground tanks eventually leak. Many contain petroleum products or other substances which have the potential to contaminate groundwater should leakage occur. Groundwater pollution by petroleum products stored in underground tanks is a very serious problem that is relatively common and often occurs in the vicinity of gasoline service stations. The gasoline additive MBTE has been determined to be a significant source of groundwater pollution not only in Virginia but also nationwide. In Virginia, the Underground Storage Tank Program requires newly installed underground storage tanks to meet design, construction, and monitoring standards to prevent leaks and overflows and have corrective action plans with a detailed mitigation strategy in the event of a spill. The Department of Environmental Quality (DEQ) operates a program that investigates reported cases of groundwater contamination resulting from leaking underground tanks. The table on the following page shows reported UST leaks in Hopewell since 1987.

Landfills: Various types of substances found in landfills have the potential to contaminate groundwater. Contaminants such as chemicals, fertilizers, paint, and other materials may move through the ground and pollute the water table and deeper aquifers. The Virginia Department of Waste Management's regulations contain landfill design requirements and standards to prevent groundwater contamination.

Table 1.1. Underground Steel Tank Leaks, Hopewell, 1987-2000

Year	Type of Facility	Address*
2000	Residence	S Mesa Dr.
2000	Residence	River Rd.
2000	Mr. Bills	702 City Point Rd.
2000	Champs Market	925 City Point Rd.
2000	Starkes Grocery	17607 James River Dr.
1999	West End Service Center	110 S 15th Ave.
1999	Hopewell Wastewater Treatment Plant	231 Hummel Ross Rd.
1999	Breez-In Store 9	10101 James River Dr.
1999	Enochs JW Inc.	416 E Randolph Rd.
1999	Trico Gas/Hydrojet Car Wash	925 City Point Rd.
1998	Bartlett & Gates Fuel Oil Former	1102 Plant St.
1998	Public Works Department	103 S Hopewell St.
1998	Residence	Garfield St.
1997	Residence	S 23rd St.
1997	Firestone Store #0279/002577	Cavalier Square Shopping Center
1997	Residence	N. 12th Ave.
1996	Residence	E. Cawson St.
1995	John Randolph Hospital	411 W Randolph Rd.
1995	Cintas Corp.	218 S. 14th Ave.
1995	Breez in #2	930 Cousins Ave.
1994	Hopewell Plant	Route 10
1994	Regional Enterprises	410 Water St.
1994	ICI Americas Inc.	1 Discovery Dr.
1994	Termite & Pest Control	508 S 17th Ave.
1994	First Baptist Church	2nd & Randolph St.
1994	Firestone Fibers & Textiles Co.	105 Winston Churchill Blvd.
1992	John Randolph Hospital	411 W Randolph Rd.
1992	Aqualon	1111 Hercules Rd.
1992	Virginia-American Water Co.	Route 10 and Industrial Dr.
1991	Shirley Plantation Sand & Gravel	Route 156
1991	Seiberts Hopewell Amoco	805 S. 15th Ave.
1991	Damrons Chevron	3934 Oaklawn Blvd.
1991	B F Industries of S. Atlantic Inc.	112 Winston Churchill Blvd.
1991	Broadway Convenience Plus	1001 W. Broadway St.
1991	AMR	400 S 15th St.
1991	Seiberts Hopewell Amoco	805 S 15th Ave.
1990	Getty Mart Hopewell	Mesa & Sussex
1990	Residence	Brown Ave.
1989	Stone Container Hopewell	910 Industrial St.
1989	Virginia-American Water Co.	Route 10 and Industrial Dr.
1987	VDOT Right of Way, Former Citgo	4003 Oaklawn Blvd.

* To protect identities, residences have just the street named.

Table 1.2 Possible Septic Systems, City of Hopewell July 2001

Street	Number of Tanks
Arlington Road	3
Atwater Road	6
Belmont Avenue	2
Bland Avenue	1
Broaddus Drive	1
Cabin Creek Drive	1
Cedar Level Road	3
Courthouse Road	1
Davis Lane	2
Davison Avenue	2
Dinwiddie Avenue	3
E. Poythress Street	1
Eppes Street	1
Fisher Avenue	1
George Street	1
Gilbert Street	3
Jackson Farm Road	3
Libby Avenue	5
Luray Street	1
Mercer Lane	1
Myrtle Street	1
N. 21st Avenue	2
N. Colonial Drive	1
North Avenue	2
Oxford Road	1
Park Avenue	2
Randolph Road	1
River Road	3
Riverside Avenue	1
Sherwood Lane	3
Spring Road	1
Stewart Avenue	1
Vinton Street	1
W. Broadway	2
Walnut Street	1
Woodside Court	3
Total	**66**

Lagoons and Holding Ponds: Lagoons and holding ponds often contain liquid waste produced by coal-fired power plants, rendering plants, fertilizer operations, sewage treatment facilities, and other commercial activities which produce wastes that filtrate into the ground and contaminate the groundwater.

Septic Systems and Wastewater Treatment Plants: Septic systems are considered a major threat to groundwater resources and are the leading contributor to the total volume of waste discharged directly into the ground. Consequences of failing septic systems in a highly-concentrated area can be far more serious than individual failures. Hopewell has few, if any, active septic systems. Less than one percent of households in the City rely on septic systems for waste treatment. Table 1.2 illustrates the general location of these tanks.

The Virginia Department of Health is the agency responsible for regulating household septic systems and mass drain fields in the Commonwealth. The Department's primary concern has been protection of public health from surface ponding of sewage caused by soils that do not percolate, and contamination of private wells from adjacent septic systems. The DEQ is responsible for the approval of commercial and industrial septic systems.

While these systems are governed by the general requirements of a No-Discharge Program, no separate criteria or program exists for permitting these facilities.

Wastewater treatment plants are another source of potential water pollution. Storms and heavy usage can cause the system to overflow and fail which could send untreated raw sewage flooding into rivers and creeks. The Virginia Department of Environmental Quality is charged with supplying permits and inspecting wastewater treatment facilities in the state.

The Hopewell Regional Wastewater Treatment Facility (HRWTF) is a 50 million gallons a day (MGD) secondary treatment plant, currently treating an average flow of 30 MGD. About 85% of the total plant flow and 90% of the organic loading is generated by six local industries. It also treats wastewater from the Fort Lee army base.

Superfund Sites: Superfund sites are abandoned industrial or commercial sites that have been determined by the Environmental Protection Agency (EPA) to contain hazardous wastes that endanger the health of the citizens of the area. In 1980, a fund was set up to enable the EPA to clean up these sites when those companies or individuals responsible for the contamination cannot be found or cannot pay for the clean-up work. The money for the fund comes primarily from taxes levied on the chemical and petroleum industries.

The City of Hopewell has one such site, the 42-acre "Exeter Superfund Site", which is the former Bridgestone-Firestone Nylon Plant facility. In 1992, the EPA discovered electrical transformers containing polychlorinated biphenyls (PCBs), insulation containing asbestos, and more than 200 drums containing hazardous materials. In November 1992, the EPA initiated action to stabilize, remove, and dispose of the PCBs, drums of hazardous substances, and the asbestos. Clean up on-site was financed by the Superfund and was completed in November 1993.

To recover the costs of the clean up, in 1997 the EPA filed a civil action against Bridgestone-Firestone Inc., Perry Realty Investments, Perry Machinery Corporation, and Exeter Properties, Inc., the owners of the property. They recovered nearly $1 million of the $1.7 million total cost and placed a judgment lien against the site to recover the rest of the clean up cost. In August of 1998, Hopewell advised the federal government that the property had outstanding taxes, penalties, and interest exceeding $600,000.

As a result of an action against the owners of the property to recover the unpaid taxes, a judge accepted an offer from a local developer to purchase the property. That company will combine the superfund site with an adjacent parcel and use it for development by occupancy by a major retail chain. The developer will also convey a portion of the site to the City for their own use. In order to prevent the EPA from suing the City and the new owner to recover the rest of the costs of the clean up, the City has agreed to pay the EPA $50,000 and conduct a removal of asbestos from the site. That is expected to cost between $1 and $1.5 million.

Pesticides and Fertilizers: Groundwater contamination from pesticides and fertilizers is a complex problem. Although these chemicals are widely used and offer numerous benefits in farming, forestry, and lawn maintenance, their use is difficult to monitor and regulate. Contamination from pesticides and fertilizers in groundwater is dependent upon the rate of application, rate of decomposition, water solubility of the substance, nature of the soil, and depth to groundwater. Although contamination from pesticides and fertilizers generally extends over a wide area at very low concentrations, increases may build up over years of use. In Hopewell, fertilizers and pesticides applied to lawns and gardens are one of the main sources of non-point source pollution.

The problem of groundwater contamination by pesticides and fertilizers has been addressed by a number of federal and state regulations. Maximum contaminant levels for approximately a dozen pesticides were adopted by the Environmental Protection Agency under the Safe Drinking Water Act.

3. Watersheds

Though Hopewell draws its water from the Appomattox River, it is located in the James River Basin watershed. A watershed is an area of land drained by a river, stream, or system of connecting rivers and streams such that all water within the area flows through a single outlet. The James River Basin is the longest watershed in Virginia, traveling 450 miles and draining approximately 10,102 miles before emptying into the Chesapeake Bay. It actually begins in West Virginia and traverses the entire state of Virginia. Approximately one-third of the state's population lives within this region and it covers about 25% of the land mass of the State of Virginia.

Hopewell can be subdivided into five secondary watershed areas. Figure 1.14 shows the principal watersheds in the City. Table 1.1, shown opposite the map, gives a brief description of each watershed.

The hydrologic relationships among areas within the City are important factors in the persistence of non-point source and point source pollution. These watersheds are vulnerable to the same types of both point and non-point pollution as groundwater. It is important to monitor and control the amount of pollutants in the watershed to protect the cleanliness of the water and ensure that the rivers remain clean enough to be used for drinking water.

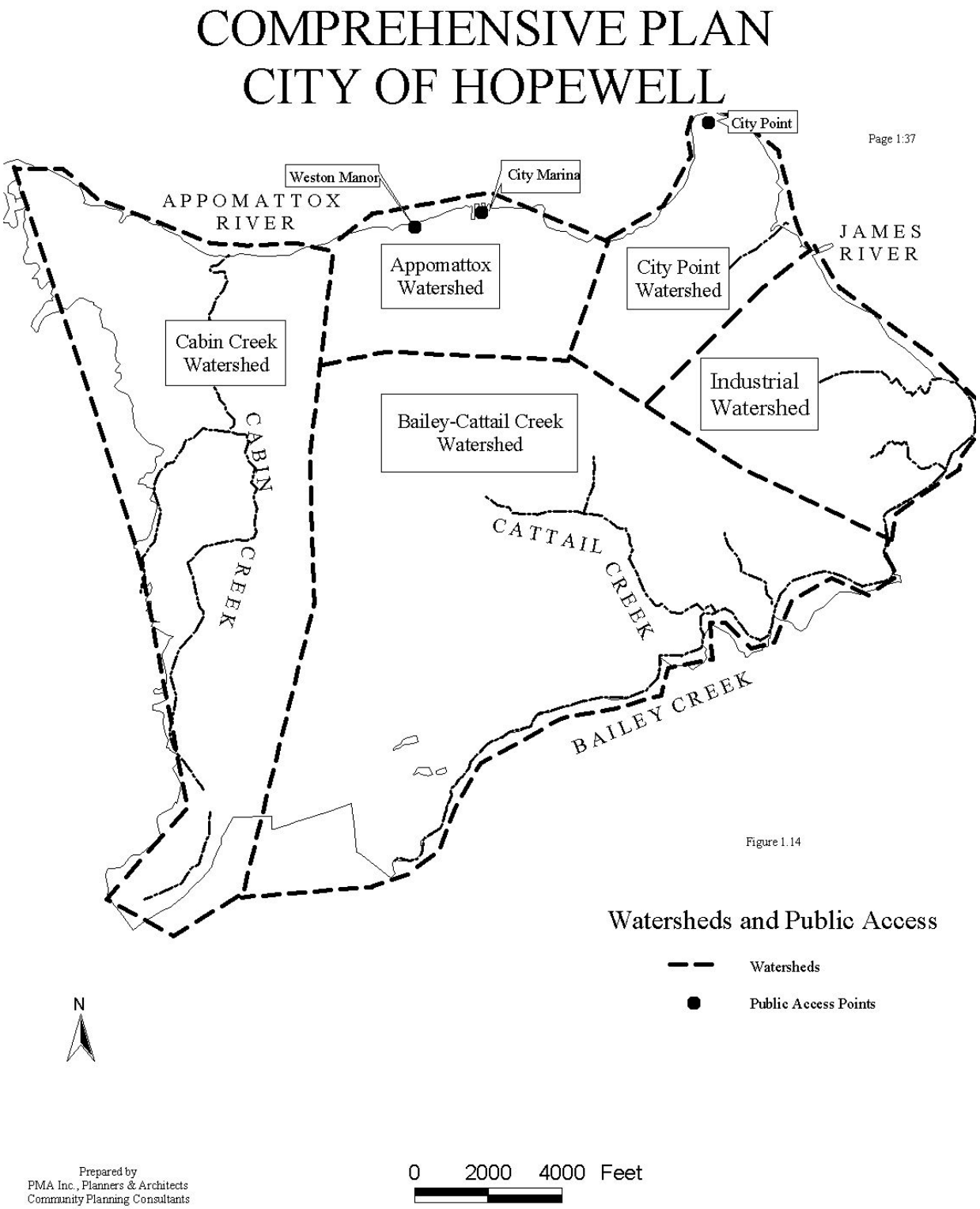
4. Water Supply Planning Issues

While there have been pollution problems with the James River and some of the streams and creeks in Hopewell, the Appomattox River remains relatively clean and pollution-free. The biggest issue for the City concerning the cleanliness of the water supply is the fact that Virginia American Water Company has their pumping facility less than 500 yards from The City Marina. This could create a hazard if there is a major spillage or leakage from the Marina into the river. Other hazards associated with this location include the proposed development of a hotel in conjunction with the Marina, run-off from streets and roads, and streambank

Table 1.3

SUMMARY OF WATERSHED CONDITIONS

Watershed Identity	Approximate Land Area	Principal Features of Watersheds
1. Cabin Creek	1,905.5 acres	The Cabin Creek watershed traverses the City north to south and includes both Cabin Creek and Bull Hill Creek. Land use is mostly residential though there is some commercial development along the southern edge. Fort Lee is directly to the west of this watershed.
2. Appomattox Watershed	597.7 acres	The Appomattox watershed drains the northern end of the City. Much of this area is residential though there is some public land uses in this region. The City Marina is also in this watershed, as is the Virginia American Pumping Station.
3. City Point Watershed	578.2 acres	This watershed includes the oldest portions of the city and drains into both the Appomattox River and the James River. There is a mixture of residential, commercial, and industrial uses in this region.
4. Industrial Watershed	813.7 acres	The Industrial watershed drains into the James River. This watershed is occupied almost entirely with industrial land uses although the Hopewell regional sewage treatment plant is located in this region.
5. Bailey-Cattail Creek Watershed	2,927.8 acres	This watershed drains into Cattail Creek and Bailey Creek. The largest watershed in the City, this region is a mixed use area encompassing residential, commercial and industrial land uses. Bailey Creek has been placed on the list of "impaired" waters by the State of Virginia due to dissolved oxygen and bacteria.


COMPREHENSIVE PLAN
CITY OF HOPEWELL
Page 1:37
City Point
Weston Manor
City Marina
APPOMATTOX RIVER
JAMES RIVER
Appomattox Watershed
City Point Watershed
Cabin Creek Watershed
Industrial Watershed
Bailey-Cattail Creek Watershed
CABIN CREEK
CATTAIL CREEK
BAILEY CREEK
Figure 1.14
Watersheds and Public Access
Watersheds
Public Access Points
N
Prepared by
PMA Inc., Planners & Architects
Community Planning Consultants
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erosion. It is imperative that the City maintain adequate pollution-control measures at the Marina in order to minimize the risk of pollution so near the pumping facility.

C: ANALYSIS OF SHORELINE SITUATION

The City of Hopewell has approximately seven miles of shoreline fronting on the Appomattox River and the James River. This section will examine the general development along the shoreline, shoreline erosion, and public access to those rivers. The information for this section came from a variety of sources. Information was provided by the Hopewell Department of Development, the James River Soil and Water Conservation District, and through field surveys conducted by PMA. Information was also culled from satellite photographic images found on the world-wide web at www.terraserver.microsoft.com and the Chesapeake Bay Public Access Plan, prepared in 1990 by the Chesapeake Bay Executive Council. For the purposes of this study, the shoreline is divided into two areas: the Appomattox River and the James River. Each will be analyzed on the three previously-mentioned points. Figure 1.14 shows the Public Access Points mentioned in this section.

1. Appomattox River

General Development: This segment extends from the Hopewell city line to the confluence of the James River at City Point. Its shoreline extends approximately four miles and includes the mouth of Cabin Creek. Development along the Appomattox River is mainly residential with few commercial sites. There are no industrial uses along this river. There are some historic sites along this waterfront, most notably Weston Manor, which is described in the section on historic resources. There is a new condominium residential development along this shoreline, Anchor Point, which includes a full-service marina. Other development in this area includes some the oldest portions of Hopewell along old City Point. Three bridges cross the Appomattox in this area: Interstate 295, Route 10, and the CSX Railroad trestle.

Shoreline Erosion: The Chesapeake Bay Area Public Access Plan did not identify any sites in this area that had shoreline erosion greater than two feet per year. There are some

slopes greater than 15% along this shoreline (see Figure 1.4), especially around City Point, that may suffer erosion during major storms.

Public Access: There are three main public access areas along the Appomattox River: the new marina at Anchor Point, City Marina off of Route 10/Randolph Road, and the area behind Weston Manor. Anchor Point Marina is a full-service marina built mainly to service the needs of the condominium owners. City Marina is a city-owned, full-service facility that charges reduced rates to city residents. There is a VDOT-approved boat-launching ramp and there are more than two-dozen boat slips for larger boats. There is also a pavilion and a stage with a large parking area and a welcome center. Weston Manor, which serves the city as a museum and cultural center, has a grassy area that extends to the Appomattox River and a pier that extends out into the River.

2. James River

General Development: This section extends from the confluence of the Appomattox and the James to the mouth of Bailey Bay at Bailey Creek. It is approximately three miles in length. This section is almost entirely industrial except for some residential land uses at the tip of City Point. The Hopewell Regional Wastewater Treatment Facility (HRWTF) is also located in this area.

Shoreline Erosion: The Chesapeake Bay Area Public Access Plan did not identify any sites in this area that had shoreline erosion greater than two feet per year. There are some slopes greater than 15% along this shoreline (see Figure 1.4), especially around City Point, that may suffer erosion during major storms.

Public Access: There is little public access along the James River in the City. Along the waterfront at City Point is a small historical walk that discusses the role the area played in the Civil War and a small boardwalk that is used for fishing. There is no place to launch a trailered boat, though there is space to launch a car top boat such as a canoe or kayak. At one time, there were docks for river-going tugboats along the industrial waterfront but those have been dismantled. With limited access to this waterfront for the general public, it can be assumed this situation is unlikely to, or should, change.