

Environmental Guidelines

For the
Protection and
Enhancement
of the City's
Natural Resources



ADOPTED
Mayor and Council
of the City of Rockville

JULY 1999

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Introduction

Citizens and the development community have expressed support for the protection and enhancement of the city's natural resources. The effort by the development industry toward mitigating development impacts on natural resources is recognized as a critical contribution to the protection of these resources. However, despite these efforts, increased development pressure has resulted in continuing degradation of the city's natural resources.

In the City of Rockville, protecting and improving the water quality and ecological health of the city's streams and wetlands is a major planning goal. This goal is particularly important because the city is part of the Chesapeake Bay Watershed. Preservation and cleanup of the Bay are a major priority of the City and State of Maryland. Protecting and enhancing the urban forest and the City's award-winning park system are also of major importance to Rockville citizens.

Decreased native vegetative cover, increased stormwater flows and flooding, accelerated land surface and stream channel erosion, and increased sediment deposition constitute some of the major interrelated negative effects on the environment that can occur during and after development. Erosion and sedimentation exist at natural background levels in the absence of human activities. However, excess erosion and sedimentation create problems for streams and their watersheds as human activities modify the natural landscape. Of special concern is the disturbance of steep slopes, especially those in close proximity to streams or drainage courses, and the disturbance of natural stream channels, floodplains, and wetlands. The alteration of these areas exacerbates watershed erosion/sedimentation and contributes to degraded water quality and the many problems associated with excessive flow of water during and after storm events.

The negative effects of unmitigated development noted above are directly related to increases in land surface imperviousness and decreases in forest cover. Increases in imperviousness can have significant effects on the city's stream systems through the reduction of the natural ground absorption (infiltration) of stormwater and significant increases in levels of overland flow. These alterations to natural infiltration and overland flow processes result in increases in the velocity, volume, and peak discharge of stormwater entering our streams. The lag-time between the onset of rain events and peak stormwater discharge is decreased as storm flow is concentrated and rapidly transported to streams via impervious surfaces and storm drains. The effects of these alterations on streams can include enlargement of the channel cross-section, increased water

temperature, and impairment of water quality and stream habitat. In addition, the decrease in infiltration of stormwater results in decreased groundwater recharge and decreased stream base flow levels that, in turn, can increase stream temperature and reduce available in-stream habitats.

Significant impacts to riparian (see Glossary) habitats, including wetlands, result from the extreme variation in water levels caused by increased peak discharges and velocities.

Impervious surfaces

also transport sediment and other pollutants, such as heavy metals, petroleum products, and salts associated with roadways, to city streams. Increased sediment and pollutant loads impair water quality, stream habitats, and aquatic life.

The City addresses these environmental concerns through legislation regulating specific environmental elements such as stormwater management (SWM), sediment control, floodplain, and forest conservation, and through its regional SWM program, which is designated to protect and restore streams and water quality through the comprehensive management of existing and new stormwater runoff.

The City also utilizes its development review process to address environmental concerns and apply environmental standards generally accepted in surrounding jurisdictions. However, practical experience and the City's strong commitment to environmental protection require that the development review process, as a mechanism of addressing environmental issues, be strengthened by compiling guidelines that address the City's specific environmental concerns, ensuring a more comprehensive program for watershed and other natural resource protection, and establishing a consistent level of environmental protection through adherence to performance standards.

These guidelines for development are based on the following goals and principles of parkland and comprehensive watershed management and protection:

- Recognition of the adverse impacts created by development and the incorporation of mitigation techniques to address them.
- Protection of stream valleys, wetlands, and floodplains.
- Minimization of increases in watershed imperviousness.
- Improvement of the degraded nature of many of the city's existing streams through various stream channel improvement techniques.
- Protection of the ecological significance and functions of headwater areas.

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- Recognition of the need for long-term baseline stream monitoring to understand and protect the city's stream systems and to facilitate the monitoring of development impacts.
 - Protection of both upland and riparian forest resources.
 - Consideration of cumulative impacts.
 - Recognition of greenways, contiguous forest and open space corridors as important avenues for the movement of wildlife, and the consideration of wildlife problems that are created as a result of urbanization.
 - Recognition of the need to identify all natural resources on a development site.
 - Documentation of important cultural, historic, and archeological resources, and identification of views and vistas for preservation and enhancement.
 - Ensurance that citizens will continue to enjoy their City parks by promoting compatible adjacent land uses.
 - Creation of buffer zones between City parks and adjacent land uses as necessary and appropriate.

These Guidelines attempt to address the problems and opportunities encountered in parkland and watershed development and to identify management strategies designed to minimize adverse impacts. Among these management strategies are:

- Limiting impervious surfaces by maintaining wetlands, floodplains, ponds, seeps, springs, etc., in their natural condition and promoting environmentally-sensitive design of buildings, parking facilities, roadways, etc.
- Establishing protected slope areas that address slope gradient, soil erodibility, and proximity to stream channels.
- Using stream buffers.
- Establishing and preserving healthy forest and tree cover for the purpose of maintaining water quality, preserving wildlife habitat, preventing erosion, mitigating air pollution, controlling stream temperature, and enhancing community amenities in an urban environment.

-
- Controlling erosion and sediment in conjunction with land disturbing activities.
 - Providing SWM devices, storm drainage systems, and other structural facilities in a manner that respects the integrity and does not impair the natural equilibrium of stream systems.
 - Incorporating effective Best Management Practices (BMPs) into land disturbance activities.
 - Using vegetative buffers between parks and adjacent land uses.

The City of Rockville's Environmental Guidelines are based on Montgomery County's Guidelines and the City of Gaithersburg's Environmental Standards; however, there are two major differences, as follows:

- Park Buffers — The City requires buffers for all new construction adjacent to City-owned parkland. (See Table 3 on page 27.)
- Stream Buffers — Buffers for each side of all streams must be 125, 150, or 175 feet. (See Table 1 on page 14.)

Purpose

The purpose of these Guidelines is to establish a comprehensive and cohesive method to protect the city's existing natural resources during and after the development process. These Guidelines serve this purpose by providing for the identification of existing natural resources and presenting various environmental management strategies and criteria to govern development within the City of Rockville.

These Guidelines are intended to ensure that throughout the development process, adequate consideration is given to the environmental principles and strategies identified herein, as well as the following environmental management objectives:

- Maintenance of biologically viable and diverse streams and wetlands.
- Protection and restoration of stream water quality.
- Reduction in flood potential.
- Protection of water supply reservoirs against sedimentation and eutrophication.
- Conservation of forest and trees.
- Protection of steep slopes.
- Preservation/protection of wildlife habitat, wildlife corridors, and exemplary communities, such as rare, threatened, and endangered species.
- Protection against development hazards on areas prone to flooding, soil instability, etc.
- Provision of visual amenities and areas for recreation and outdoor education activities.
- Promotion of compatibility between parks and adjacent land uses.
- Protection of the Chesapeake Bay.

These Guidelines are intended to aid in the implementation of existing Federal, State, and local laws and regulations regulating sediment control, SWM, dam breach/danger reach, floodplains, wetlands, and forest conservation. These Guidelines are designed to help coordinate reviews of environmental site development issues that have impact on, and are impacted by, land use decisions, and to promote interdepartmental and interagency cooperation in the review of development proposals at the earliest possible planning stage.

These Guidelines recognize that environmental and other community interests may sometimes conflict. In such cases, these Guidelines allow the balancing of benefits and detriments to the environment with other community concerns to determine how the standards and requirements contained herein shall be applied. One example is the implementation of the City's regional SWM program, which seeks to improve water quality and/or slow downstream erosion by capturing untreated stormwater runoff from large drainage areas through carefully located public SWM facilities. Typically, regional facilities are located within stream valley buffers to maximize their effectiveness. When such location is necessary, the precise placement and design of the facility shall seek to minimize the impact on other natural resources.

Administration

These Guidelines will be applied during the earliest formal review in the land development process and shall be administered by City staff and development approval authorities, such as the Board of Appeals, the Planning Commission, and, in limited circumstances, the Mayor and Council, in conjunction with their review and approval of permit applications and development plans. These Guidelines allow for flexibility to best achieve environmental and other planning objectives on a site-by-site basis.

These environmental guidelines are intended to set forth certain City policies and planning objectives, and to identify, for developers and citizens alike, environmental development standards and guides. They are intended, however, to be administered in concert with other planning goals. Examples of other factors that shall be taken into consideration are: infrastructure requirements; open space objectives for public parks and forest conservation; and prior commitments to landowners, neighborhoods and individual citizens, among others. Particular flexibility may be necessary where the Guidelines are applied to small lots and/or re-development proposals. When flexibility in a particular application of the Environmental Guidelines is requested, the developer will be expected to include a mitigating or offsetting component within the overall development proposal. In other words, give and take will be expected.

Although these Guidelines identify specific acceptable strategies and techniques to protect natural resources and environmentally-sensitive areas from the adverse effects of construction activities and development, they are not intended to preclude innovation and consideration of technological advances in the development field. Developers are encouraged to propose proven alternative techniques and strategies that enhance development and environmental compatibility and achieve the same purposes and goals identified in these Guidelines.

Deviations from these Guidelines may be allowed when it can be satisfactorily demonstrated that strict compliance would unreasonably impact development of the site or undermine other environmental or planning considerations, provided that it can be demonstrated that safety, City road standards, storm drainage, SWM, erosion and sediment control, forest conservation, stream protection, park buffers, engineering, design, and planning issues can be satisfactorily addressed. Deviations from these Guidelines may be allowed where strict compliance would conflict with infrastructure or other development components specifically authorized by an approved Concept

Plan Application or Exploratory Application. Where feasible, mitigation techniques and strategies, as approved by the City, shall be used to minimize the impact of any deviation from these Guidelines.

These Guidelines shall not be applied to any development or portion of a development that is covered by an approved Use Permit or an approved Detailed Application, unless modifications to the Use Permit or Detailed Application are proposed by the applicant. For pending development proposals that have not received Use Permit approval or Detailed Application approval, these Guidelines may be applied in a flexible manner to minimize substantial modification to portions of the development proposal that have previously been approved.

FOR MORE INFORMATION

To obtain information/guidance on the following guidelines, please contact the City of Rockville offices listed below.

| <u>Guideline</u> | <u>Office</u> | <u>Telephone Number</u> |
|--|--|--------------------------------|
| Danger Reach/Dam Break Analysis | Civil Engineer | 240-314-8500 |
| Forest and Tree Preservation Ordinance | Assistant City Forester | 240-314-8700 |
| General Information | Community Planning and Development Services | 240-314-8200 |
| Park Buffers | Assistant City Forester | 240-314-8700 |
| Stream Quality | Environmental Specialist | 240-314-8200 |
| Stormwater Management | Civil Engineer | 240-314-8500 |
| Wetlands | Environmental Specialist | 240-314-8200 |

Natural Resources Inventory

The purpose of the Natural Resources Inventory (NRI) is to provide environmental information early in the concept phase of the development process in order to allow for more environmentally sensitive design. The NRI must be submitted before any specific development proposal is reviewed by staff. The NRI must be approved by staff before any application is made for a development-related permit or approval. A NRI shall accompany any petition for annexation.

The developer shall gather environmental information by conducting a NRI of the development site. The NRI is a complete analysis of existing natural, cultural, historic, and archeological resources and must contain specific information covering the development site and the first 100 feet of adjoining land or the width of the adjacent lot, whichever is less. (See Figure 1.) Information pertaining to streams and drainage courses on or within 200 feet of the property must also be provided. The applicant shall make a good faith effort to get permission from adjacent property owners to perform a site inspection.

The NRI shall include the following information, as detailed below:

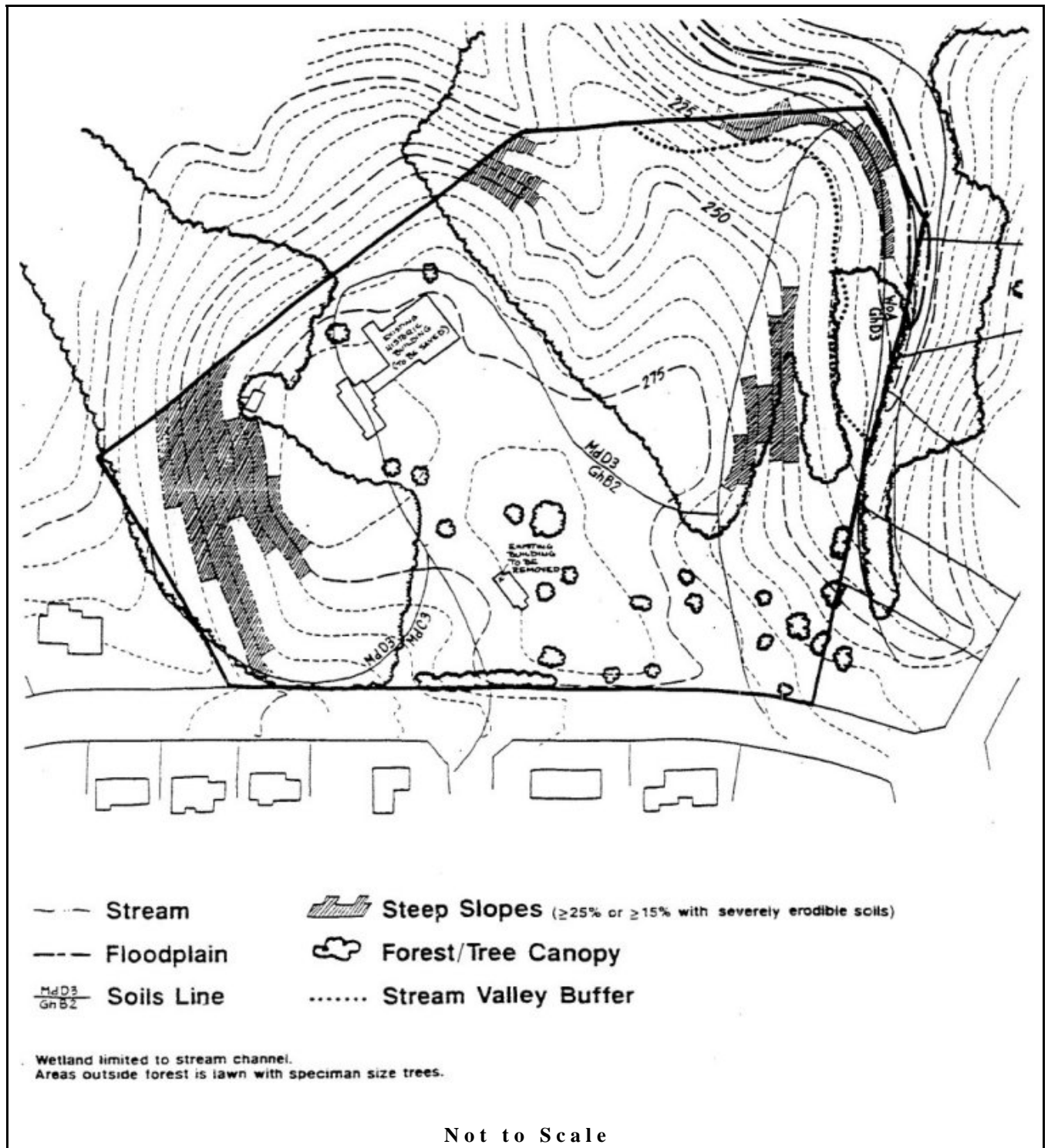
- A. Forest and Trees - Forest Stand Delineation (FSD)
- B. Forest Preserves and Greenways
- C. Streams and Floodplains
- D. Stream Buffers
- E. Wetlands
- F. Stream Quality
- G. Danger Reach/Dam Break Analysis
- H. Topography
- I. Unsafe and Unsuitable Lands (Soils)
- J. Threatened and Endangered Species and Species in Need of Conservation
- K. Existing Wildlife
- L. Cultural, Historic, and Archeological Resources
- M. Noise and Light Pollution
- N. Significant Views and Vistas
- O. Park Buffers
- P. Public Utilities, Property Lines, Existing Buildings, and/or Transportation Rights-of-Way

All NRI/FSD maps will be in a scale of one inch equals 50 feet. For sites with an overall area of greater than 30 acres, the NRI/FSD will also include a cover sheet showing the complete site on a scale of one inch equals 200 feet.

Note: The City, at its discretion, may determine that other significant site conditions exist that should be included on the NRI.

Figure 1

Natural Resources Inventory



A. FOREST AND TREES - FOREST STAND DELINEATION

A FSD, in accordance with the requirements of Chapter 10.5 of the *Rockville City Code*, entitled “*Forest and Tree Preservation Ordinance*,” shall be shown on the NRI map.

Natural forest and tree cover from recent aerial photos shall be shown on the NRI map as a circumferential line around all forest and tree stands, which includes the outer perimeter of the branches of the individual trees. Aerial photographs are available at City Hall. More recent aerial photographs (no older than five years) may be required and will be the responsibility of the developer.

A detailed delineation of forest and trees within these boundaries must also be provided. The requirements and methodology for this delineation are contained in the *State Forest Conservation Manual* and the *City Tree Manual*, adopted as part of Chapter 10.5 of the *Rockville City Code*, entitled “*Forest and Tree Preservation Ordinance*” (FTPO).

B. FOREST PRESERVES AND GREENWAYS

Greenways are a network of linear open space/green space with vegetative cover that may include parkland, stream valleys, rights-of-way, forested cover, or grasslands. The purpose of a greenway is to provide a connective corridor of natural resources through an urban area.

The Mayor and Council have established forest preserves which are included within designated City parks, open parcels of land, and wooded areas for the promotion of environmental and wildlife preservation and education. (See Appendix A.) These designated forest preserves must be identified on the NRI map.

C. STREAMS AND FLOODPLAINS

All streams, ponds, and/or drainage courses located on or within 200 feet of the subject property must be shown, including the off-site drainage areas for all streams entering the subject property. City of Rockville topographic maps at a scale of one inch equals 200 feet and the applicant’s field topography, as confirmed by field observations, will be used to determine whether or not streams and/or drainage courses are present. Streams shall be classified as either intermittent or perennial (see Glossary) and shall show the current Maryland Department of Environment (MDE) use classification. Ephemeral streams (see Glossary) will be required to be shown on the NRI when they are associated with wetlands, steep slopes, and highly erodible soils.

Floodplains for drainage areas of more than 30 acres must be shown on the NRI by topographic delineation (with a 25-foot Building Restriction Line [BRL]). The Department of Public Works (DPW) may, on a case-by-case basis, require a drainage study that includes

delineation of flowpath and floodplain for drainage areas less than 30 acres. City topographic maps at a scale of one inch equals 200 feet may be used to determine the drainage areas. The most recent and accurate 100-year ultimate floodplain delineation approved by the City of Rockville shall be shown on the NRI maps.

Floodplain information may be obtained from the following sources: previously approved engineers' studies, City of Rockville watershed studies, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, and Flood Boundary Map. For streams that have no previously approved floodplain delineation, the applicant shall submit a 100-year ultimate floodplain study with the NRI/FSD submittal. (See Appendix B.) Floodplains based on the unapproved study or on FEMA information are considered approximate and are subject to modification. Federal Emergency Management Agency-based floodplains must be updated at the engineering permitting stage with a current ultimate floodplain study submitted by the applicant. All floodplain studies must be approved by DPW. Developers are encouraged to check with DPW prior to preparing the NRI.

Cross Reference: Floodplain Ordinance, Chapter 10 of the *Rockville City Code*

D. STREAM BUFFERS

Stream buffers shall be shown on the NRI, in accordance with Table 1, for all streams, including wetlands, seeps and springs, and the 100-year floodplain.

Table 1

| Minimum Stream Buffer Widths* In Feet from the Stream Bank | |
|--|--------------------|
| Percent of Slope | All Streams |
| 0 to <15 | 125 |
| 15 to <25 | 150 |
| 25 and Greater | 175 |
| * Stream buffer widths may be greater if floodplains, wetlands, or steep slopes extend beyond the buffer line. | |

The percent slope range for use with this table will be determined by taking representative 200-foot cross sections on both sides of the stream, drawn perpendicular to the direction of flow, and measuring the gradient of slope in the steepest 100-foot horizontal run. The stream buffer shall be measured from the top of the bank and shall include steep slopes as defined below in the Section on Topography, 100-year floodplains, wetlands, and seeps and springs. This procedure is illustrated in Figure 2. For hypothetical examples of stream buffer delineation, see Figure 3.

Mitigation options for buffers are found on Page 33, C.2. (Buffer Mitigation Options).

Note: See Appendix C for additional information on quality urban stream buffers.

Figure 2
Stream Buffer Determination Using Steep Slopes

| Cross Section Number | Maximum Slope (steepest 100 feet) | Percent Slope Range | Recommended Stream Buffer Width (measured from the top of the bank in feet) |
|------------------------------------|-----------------------------------|---------------------|---|
| Right Bank (looking downstream) | | | |
| 1 | 7% | 0-15 | 125 |
| 2 | 7% | 0-15 | 125 |
| 3 | 26% | >25 | 175 |
| Left Bank (looking downstream) | | | |
| 4 | 35% | >25 | 175 |
| 5 | 27% | >25 | 175 |
| 6 | 15% | 15-25 | 150 |

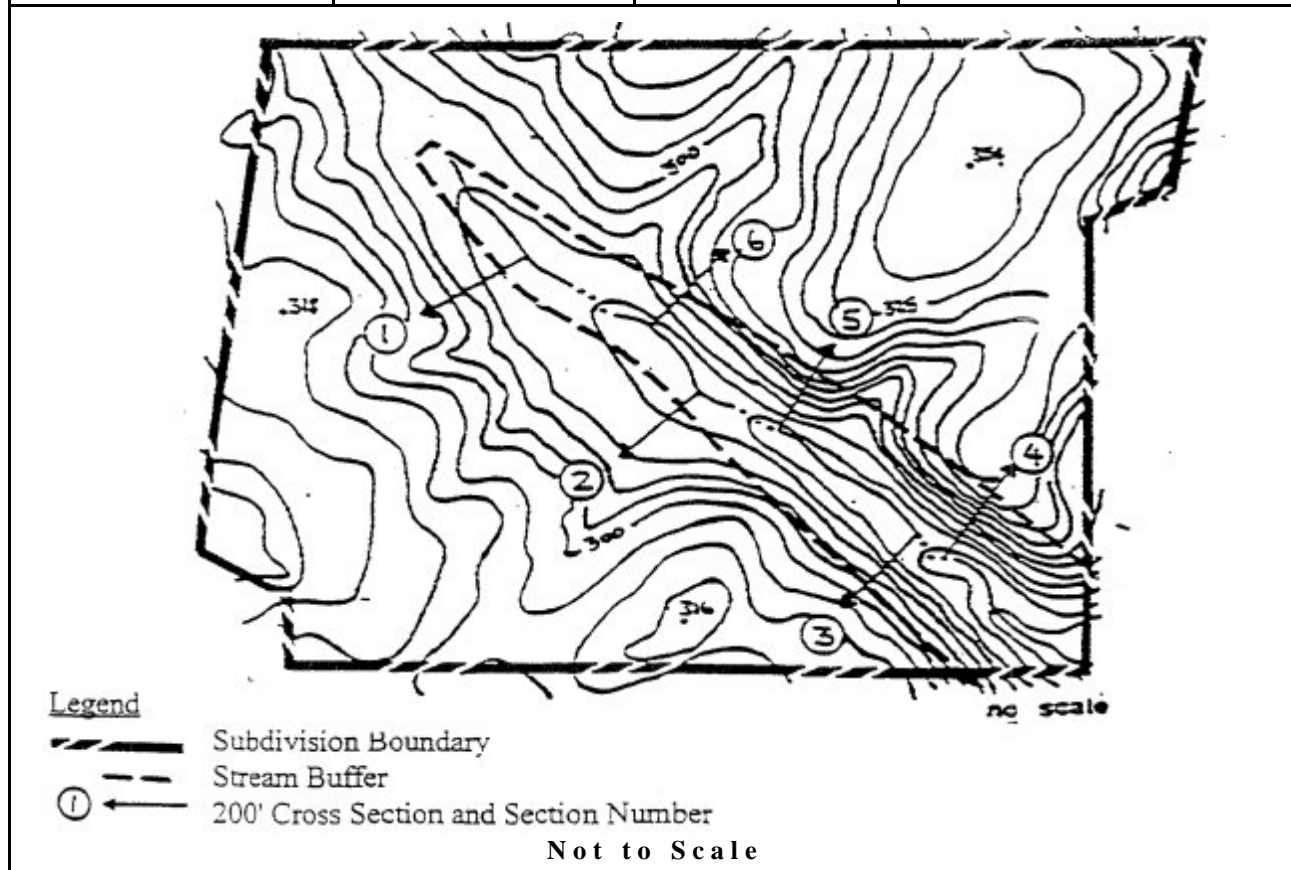
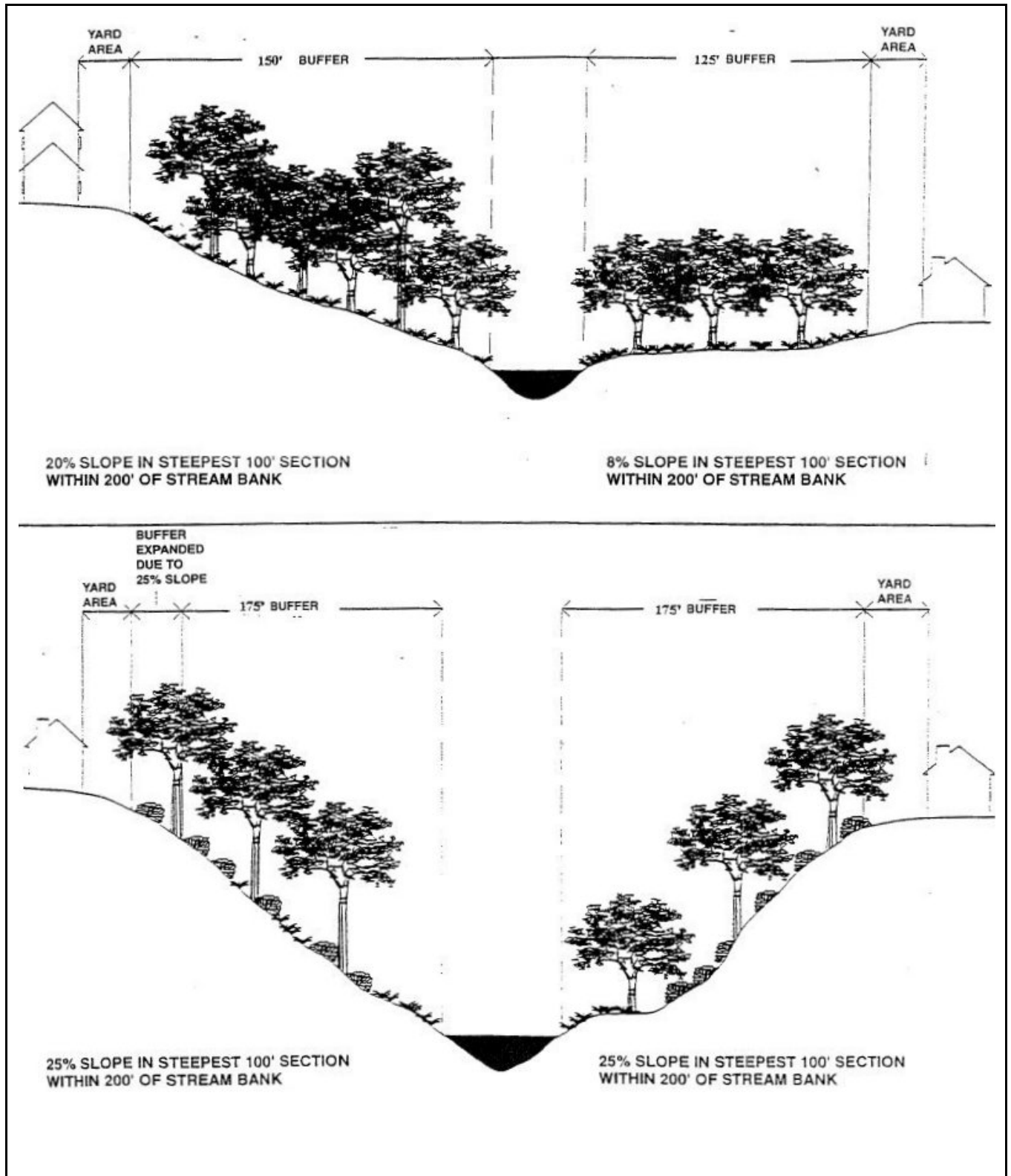


Figure 3
Hypothetical Subdivisions with Stream Buffer



E. WETLANDS

All wetlands, as defined herein (see Glossary), including non-jurisdictional wetlands such as prior converted cropland, must be shown on the NRI map as a wetland. The City recommends protection of wetlands that do not fall under the jurisdiction of the U.S. Army Corps of Engineers (U.S. ACOE) or MDE due to their potential natural resource value and/or their potential functional value through restoration. These sites can assist in offsetting the unavoidable impacts associated with development elsewhere in the city and the county. A wetland assessment, including data sheets, performed by a qualified individual (as required by U.S. ACOE), must be submitted with the NRI. The results of the assessment should be either a line denoting the edge of wetlands on the NRI map, or a note stating that no wetlands exist on the site. The name and address of the individual who conducted the wetland assessment must be shown on the map.

Wetland buffers will be incorporated into the stream buffer, as described in the Stream Buffer section. A minimum 25-foot buffer shall be around all wetlands, with expansion up to 100 feet where adjacent areas contain steep slopes or highly erodible soils. A larger, 40-foot minimum buffer is required for wetlands on first and second order streams. (See Figure 4 for stream order determination.)

Table 2 shows the recommended wetland buffer widths. (See Figure 5 for illustration of wetland and stream buffers.)

F. STREAM QUALITY AND ASSESSMENT

The City has three watersheds located within its boundaries: Cabin John, Rock Creek, and Watts Branch (the watershed map in Appendix D shows the approximate boundaries of the three watersheds). The NRI must identify the stream and show any watershed improvements proposed by the City for the site. The City may require the developer to prepare a stream assessment using a City-approved technique. Contact DPW for current stream quality information. Monitoring of SWM BMPs is not intended to be an enforcement tool for previous development. Rather, it is intended to evaluate effectiveness to improve future SWM techniques.

The City's goal is to use the information obtained from stream monitoring as a tool to evaluate how development and its mitigating factors, such as BMPs, affect the stream. The assessment technique will evaluate the existing condition, construction impacts, and the value and effectiveness of SWM BMPs.

The information acquired by the City will be used to assess the following:

1. Existing Condition

The results of the stream assessment will determine the parameters of the stream prior to construction and development.

2. Construction Impacts

During construction, if it is determined that the sediment control measures are not removing the sediment and mitigating construction impacts effectively, the City will require additional sediment control measures, as provided in the City's sediment Control Ordinance and Regulations.

3. Value and Effectiveness of BMPs

The stream assessment will continue after development to provide information on the conditions, once the BMPs have been installed. The results of this information will allow the City to evaluate the type of BMP and its potential use in the future more effectively. If it is determined that the BMP is not providing the anticipated control, the developer will not be required to remove nor replace the existing BMP.

Evaluating streams is not an exact science because of the many external forces that can affect the streams. The City has drafted these Environmental Guidelines to allow for the flexibility in determining a stream assessment technique that may change as new methods of testing and evaluation are developed.

All partial and complete fish barriers shall be identified on the NRI. Partial barriers are any obstruction which would likely prohibit or impede normal upstream-downstream fish movements during certain times of the year (e.g., low summer base flow conditions which could create unacceptably shallow depths of low flow through a box culvert). Complete barriers are obstructions that totally prevent the normal movement of fish at all times of the year (e.g., a perched culvert, which creates a vertical drop).

Figure 4

Stream Order Determination

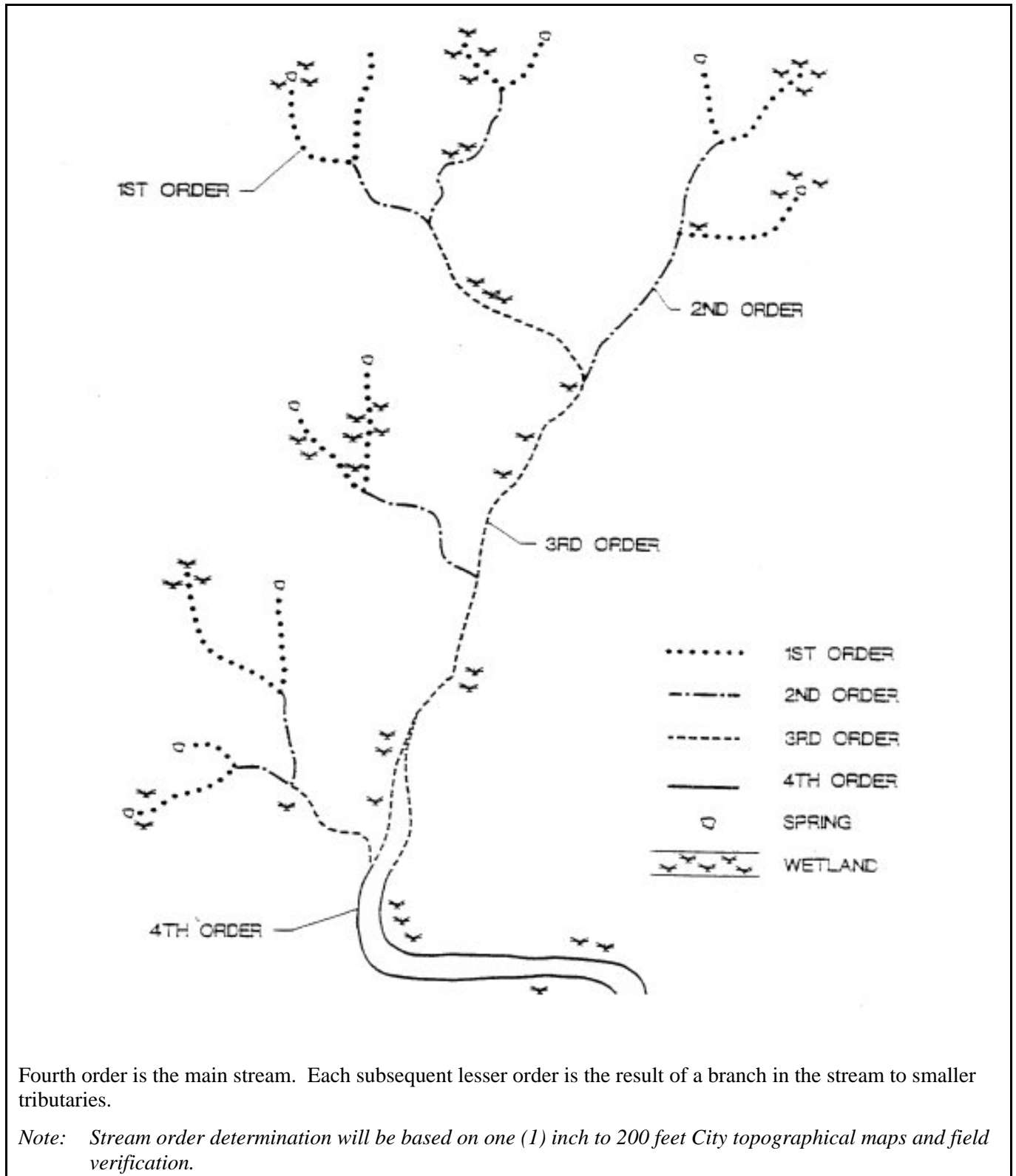
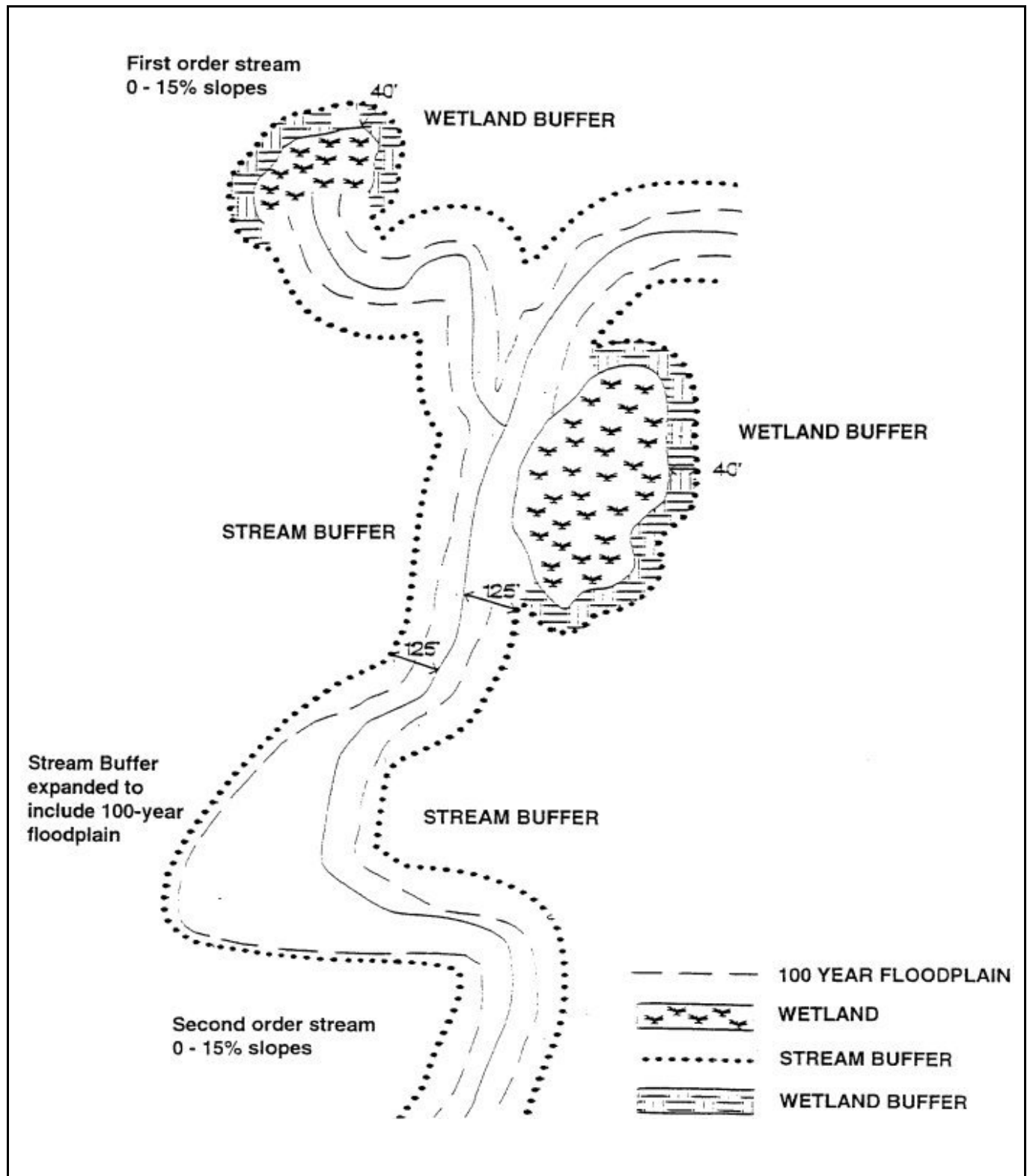


Table 2

| Buffers for Wetlands, Springs and Seeps | | | |
|--|--------------------------------------|---|-----------------------|
| Stream Order * | Wetlands with Steep Slopes ** | Wetlands with Erodible Soils *** | Other Wetlands |
| | | | |
| All Streams - First & Second Order Streams | 40-100' | 40-100' | 40' |
| All Streams - Third & Higher Order Streams | 25-100' | 25-100' | 25' |
| <p>* See definition of stream order in Figure 4.</p> <p>** Buffer for wetlands adjacent to steep slopes will be expanded to include the steep slopes up to 100-foot maximum. Steep slopes are defined as 25 percent or greater on the steepest 50 feet within the 100 feet adjacent to the wetland.</p> <p>*** Buffer for wetlands adjacent to erodible soils will be expanded to include the erodible soils up to 100-foot maximum. Erodible soils are those soils classified as having a severe hazard of erosion in the soil profile descriptions of the most recent <i>Soil Survey of Montgomery County</i> (July 1995), published by the Natural Resources Conservation Service (NRCS), formerly Soil Conservation Service. (See Appendix E.)</p> | | | |

Figure 5

Illustration of Stream Buffers with Wetlands and Floodplain



G. DANGER REACH/DAM BREAK ANALYSIS

In order to have information necessary to protect proposed developments against dam failures from existing dams, the NRI shall include a dam breach analysis for all existing dams located within one mile upstream of the proposed development. (In some cases, the City may require a dam breach analysis of existing downstream dams if it is believed that its impact will affect upstream properties.) The analysis must show the danger reach (area inundated by the dam break flood), footprints of existing structures, and spot danger reach water surface evaluations. The Maryland-National Capital Park and Planning Commission (M-NCPPC) has maps showing the danger reaches for Lake Needwood and Lake Frank.

For proposed ponds, danger reach/dam break information, as described in this section, must be submitted with the SWM concept plan.

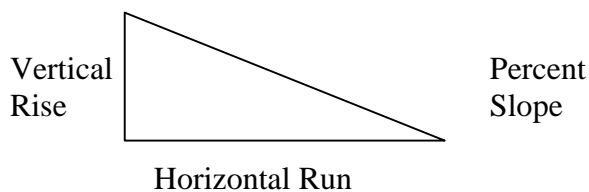
This information will be subject to verification by DPW, which may consult with the Montgomery Soil Conservation District regarding the technical aspects of the analysis. Additional information that also may be required by DPW includes, but is not limited to:

- Information on the dam itself, including storage volume and the hazard classification.
- Dam break analysis using HEC-1, DAMBRK, TR-66, or other appropriate models.
- Flowpath/channel to carry such a flood (including any proposed easements).

H. TOPOGRAPHY

All slopes greater than 15 percent must be shown on the NRI map. A slope that has a gradient equal to or greater than 25 percent will be considered steep and must be highlighted on the inventory map.

“Percent slope” is defined as vertical rise in feet divided by horizontal run in the steepest 100-foot segment multiplied by 100 percent.



$$\text{Percent Slope} = \frac{\text{vertical rise}}{\text{horizontal run is the steepest 100-foot segment}} \times 100\%$$

Slopes are classified as being either (1) near a stream or hydraulically adjacent, or (2) hydraulically remote. The terms "near stream" and "hydraulically adjacent" generally refer to the area lying within 200 feet of a stream's bank, which is considered to be the most environmentally-sensitive or critical portion of the stream valley. If the stream buffer, as determined by the steepest 100-foot section within the hydraulically adjacent area (Table 1), encompasses the toe of a steep slope, the buffer will be expanded beyond the width in Table 1 to include the entire slope. A hydraulically-remote area lies outside the stream buffer. For hypothetical examples of stream buffer delineation, see Figure 3.

I. UNSAFE AND UNSUITABLE LANDS (Soils)

Environmentally-sensitive site design depends on knowledge of the nature and degree of constraints and opportunities offered by a given site. Identification of unsafe or unsuitable land is an integral part of this analysis, both from the standpoint of providing safe and habitable buildings and for providing protection and conservation of natural resources such as streams, wetlands, floodplains, forests, and trees. The primary reasons for classifying land as unsafe or unsuitable for development are problems with soils/geology, topographic constraints, and surface and subsurface water hazards.

Therefore, soil boundaries must be identified on the NRI map. In addition, development limitations must be provided either in a separate report or as a note on the plan drawing. Severely limited areas must be highlighted on the plan drawing. Soils with severe limitations for development are those that have one or more of the following characteristics, as identified in the most recent version of the *Soil Survey of Montgomery County, Maryland*, prepared by the United States Department of Agriculture NRCS:

- Seasonal high water table
- Subject to flood hazard
- Poor drainage
- Wetland/hydric soil conditions
- High shrink/swell potential
- Shallow depth to bedrock
- Excessive slopes
- High susceptibility to erosion

One of the most common of these characteristics is highly erodible soils. Highly erodible soils are those listed in the highly erodible lands report and can be referenced in the most recent *Soil Survey of Montgomery County, Maryland*. (See Appendix E for a complete list of highly erodible soil types.)

Where deemed appropriate by City staff, a geotechnical report prepared by a professional engineer/geologist may be required. If the NRI identifies a highly erodible soil or soils with severe building limitations and development is proposed on the soil, a geotechnical report will be required at the time the preliminary development plan is submitted. The report shall provide more detail of soil and geologic characteristics in order to determine whether soils can support the proposed development using suitable engineering measures. These engineering measures would remediate the poor soil conditions.

J. THREATENED AND ENDANGERED SPECIES AND SPECIES IN NEED OF CONSERVATION

The habitat location of flora and fauna that are designated as rare, threatened, endangered, in need of conservation, and watch list species, as determined and designated by the Maryland Natural Heritage Program, Department of Natural Resources (DNR), must be documented. To determine if a property contains any significant species, send a vicinity map with a letter requesting identification of significant species to the DNR Natural Heritage Program. The current 1999 address is: DNR National Heritage Program, Tawes State Office Building, 580 Taylor Avenue, E-1, Annapolis, Maryland 21401. The DNR will check its database for known occurrences of significant species and will send a response letter that can be submitted with the NRI map.

The City's staff will work with DNR to identify appropriate buffering measures that help protect known populations of such species and/or their sensitive habitat areas.

The City's Recreation and Parks Department, M-NCPPC Department of Parks, and DNR should be consulted when parkland is adjacent to a site, to determine the location of any special habitat areas within parks that may require special buffering and/or protection measures.

K. EXISTING WILDLIFE

A general description of existing wildlife, seen or known to exist on the subject site, is required as a note on the inventory map. Existing and potential wildlife management problems, such as displacement, residential interactions, road crossings, and wildlife corridors related to the proposed development must be addressed in the notes. Wildlife passage, corridor and habitat areas on large parcels shall be identified by a wildlife biologist.

L. CULTURAL, HISTORIC, AND ARCHEOLOGICAL RESOURCES

All cultural, historic and archeological resources found on the site or identified on the City's cultural resource inventory, as updated, must be identified on the NRI map. The sites of

historical and cultural resources, as designated by the Maryland Historical Trust (MHT), the City's Historic District Commission (HDC), and the Cultural Arts Commission must be documented.

The existence of significant cultural, historic, or archeological resources on a site should be determined at a pre-submission meeting with City Preservation staff. As a general guide, any structure older than 50 years of age or possessing architectural significance, or a site associated with a person or event of importance to local, state, or national history or development, should be examined to determine significance. Examples include: dwellings, outbuildings, trees, cemeteries, neolithic and archaic Indian sites, monuments, markers, boundary posts, toll roads, fords, mills, slave quarters, wells, graves, etc.

All cultural, historic, and archeological resources identified as potentially significant in the pre-submission meeting or identified in the City's Adopted "Historic Resources Management Plan" must be identified on the NRI map. Sites should be documented on standard Historic Sites Inventory Forms provided by MHT and commonly referred to as a "MHT Form" for evaluation by HDC, Cultural Arts Commission, and MHT.

M. NOISE AND LIGHT POLLUTION

Existing and adjacent sources of noise and/or light pollution that may affect the subject site must be identified on the NRI map. These sources may include, but are not limited to the following:

- Highways
- Industrial and commercial development
- Gun clubs
- Transportation facilities
- Mass transitways
- Recreational facilities

N. SIGNIFICANT VIEWS AND VISTAS

The NRI shall identify views and vistas, such as geological features (forest, rolling hill, etc.), parkland, and views associated with sites of historical, educational, cultural, recreational, or scenic significance. Restrictions may be applied to development proposals that alter views and vistas, which are determined to be significant. Final decision authority on such determination will rest with the City's Planning Commission.

O. PUBLIC UTILITIES, PROPERTY LINES, EXISTING BUILDINGS, AND/OR TRANSPORTATION RIGHTS-OF-WAY

The NRI shall delineate existing or master planned utility rights-of-way and dedicated, or to be dedicated, transportation rights-of-way for transit, roadways, bikeways, and walkways. In addition, all property lines, utility lines, and existing buildings and structures will be included in the NRI.

P. PARK BUFFERS

Park buffers (see Glossary), shown in Table 3, are required from adjacent proposed development. Park buffers are measured from the property line. The maximum buffer on private property is 100 feet, but may be reduced to 20 feet for small properties, or where the intent is achieved by virtue of setbacks within the park, or by features that provide the intended separation, or where the park is designed to be integrated into proposed development. Wider buffers are required, up to the 100-foot maximum, where it is necessary to maximize separation between active park areas, such as ballfields and new development.

Table 3
City Park Buffers

| Buffer Area (feet) | Park Area Adjacent to Proposed Development |
|-------------------------------|--|
| 20' | Undeveloped or Proposed Active Recreation Areas in Parks |
| 100' | Existing Active Recreation Areas in Parks |

Buffers for Undeveloped (Passive Parks)

When non-residential development occurs adjacent to a public park that is undeveloped or passive, a park buffer or no-build zone, 20 feet in width, shall be established. Construction of buildings, parking lots, and other impervious surfaces shall not be allowed in the park buffer. Exceptions may be made for necessary road crossings, public utilities, and hiker/biker trails.

Where park buffers are established, setbacks required by the zoning ordinance will remain in effect, and will be measured from the property line. The no-build restrictions in the park buffer area will be enforced in addition to the restrictions created by the setback requirements. If the required setback is contained within the park buffer, no additional setback is required.

Buffers for Existing Active Recreation Areas in Parks

A minimum 20-foot, no-build buffer zone next to active parks also shall be required. The 100-foot buffer area requirement is intended primarily to create a safety zone between adjacent development (all types of land uses) and active park areas, such as ballfields, golf courses, etc.

Construction of buildings, parking lots, sheds, residential appurtenances such as swing sets, and/or impervious surfaces shall not be allowed in the (active) park buffer. Where the City develops an active recreation area in a public park adjacent to existing development, it shall take responsibility for establishing the required minimum buffer area or safety zone. The 100-foot buffer is not necessarily measured from the park boundary, but from the edge of the active area within the park.

Park buffers may be required to be forested, landscaped with shrubs and grass, or contain berms or fences, appropriate for the specific location. The buffers, with appropriate conservation easements, may be included in the common open space for a subdivision or may be deeded to the City. Once a buffer is established, the setbacks for adjacent properties are based on the zoning ordinance standards for the zone. If the required setback is contained within the park buffer, no additional setback is required.

A street adjacent to a park/recreation area may be considered in a buffer calculation if a natural separation does not exist or cannot be created.

Guidelines for Development

The following guidelines will be applied to protect sensitive environmental features on development sites, as identified by the NRI.

A. FOREST AND TREE CONSERVATION

The requirements for forest and tree conservation are contained in Chapter 10.5 of the *Rockville City Code*. A FSD must be included in the NRI. A Forest Conservation Plan (FCP) is required as part of any development plan. Criteria for determining priority areas and details for submission of FCPs are included in the most recent version of the City and State technical manuals.

B. FOREST PRESERVES AND GREENWAYS

These areas must be shown on the NRI. They will be reviewed by the Recreation and Parks Department staff. Expanded buffers, easement requirements, or reduced clearing and grading allowances may be required adjacent to these areas. Planning and development should consider opportunities for greenways. (See definition on Page 12.) The Mayor and Council have, by resolution, designated eight forest preserves within the City of Rockville. (See Appendix A.)

C. STREAM VALLEY PROTECTION

The following guidelines address stream buffers (including hydraulically-adjacent slopes, hydraulically-remote slopes, and approved clearing and grading within these areas or that affect these areas). They are designed to provide greater protection, through use of stream buffers, for the more environmentally-sensitive areas.

1. Guidelines for Stream Buffers

- a. Streams, ponds, natural surface springs, and seeps shall be maintained in a natural condition so that the existing hydraulic regimen and water quality standards can be maintained.
- b. Except as provided below, no buildings, structures, impervious surfaces, or activities requiring clearing or grading will be permitted in stream buffers.

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- c. Sediment and erosion control facilities are allowed as a temporary use in unforested areas of the stream buffer when DPW finds that performance of the overall site sediment control system will be improved measurably by placement of a facility at that location. At a minimum, grading must be at least 25 feet from the stream bank, outside wetlands and their buffer, and outside forest and associated critical root zone areas, except as authorized by an approved FCP.
 - d. Private SWM facilities are generally discouraged within stream buffers, since, as a general rule, location of this permanent use within the buffer does not allow maximized accomplishment of all environmental management objectives for the stream buffer. However, maximum long-term effectiveness of SWM facilities are also an important objective of an overall stream protection strategy, and must be considered together with the buffer objectives in making decisions. As a general rule, minimized buffer intrusions are allowed for construction of suitable SWM facilities or nonerosive storm drain outfalls, and unavoidable and consolidated sanitary sewer connections.

A private SWM facility may be allowed within the stream buffer area on a case-by-case basis. The following factors will be considered in evaluating which private facilities or other private BMPs may be appropriate in the buffer:

- (1) Documented and measurable improvement in the effectiveness of the SWM control system.
- (2) Minimized encroachment into the buffer.
- (3) Avoidance of existing sensitive areas (forests, wetlands and their buffers, floodplain, steep slopes, and habitat for rare, threatened, and endangered species with their associated protection buffers).
- (4) Consistency of the SWM facility or BMP design with the preferred use of the buffer (e.g., preservation of existing forest and natural vegetation within part or all of the floodplain, naturally contoured and vegetated infiltration areas or filter strips, etc.) The use of ponds or wetland BMPs should be restricted to the following:¹

¹ Refers to (a) through (e). From Site Planning for Urban Stream Protection (page 118), Tom Schueler, Center for Watershed Protection, December 1995

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- (a) a maximum contributing area of 100 acres, and/or
 - (b) the first 500 feet of perennial stream channel, and/or
 - (c) clearing of the stream side buffer zone only for the outflow channel (if the pond is discharging from the middle zone into the stream), and/or
 - (d) off-line locations within the middle or outer zone of the buffer, and/or
 - (e) use ponds only to manage stormwater quantity within the buffer.
- (5) Excessive grading caused by an uphill SWM location and/or the reduction of numerous smaller, less-efficient structures outside the buffer.
 - (6) Existence of severely degraded conditions within the buffer area that could not be improved if the SWM facility is outside the buffer area.
 - (7) Presence of man-made structures (e.g., farm ponds) in the buffer area under pre-development conditions that can be converted to SWM use without excessive stream disturbance.
 - (8) Ability to provide full or partial mitigation for the loss of buffer function from the disturbance and permanent absence of forested areas. (See Buffer Mitigation on page 33, C.2.)

City staff will evaluate SWM alternatives that provide effective SWM in a manner closest to the preferred use of the buffer as a stable forested area. When a SWM facility is allowed in the buffer, an area that is of comparable or greater environmental benefit than that used for the SWM facility, and not otherwise protected, may be required as a replacement buffer.

- e. Clearing and grading for other purposes within the stream buffer (such as paving for bikeways or other recreation amenities) may be allowed on a case-by-case basis, so long as the encroachment is not inconsistent with a comprehensive approach to protecting areas that are critical to preserving or enhancing streams, wetlands, and their ecosystems. The developer shall provide rationale for stream buffer encroachment, addressing, at a minimum, the factors below:

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- (1) Reasonable alternatives for avoidance of the buffer are not available.
 - (2) Encroachment into the buffer has been minimized.
 - (3) Existing sensitive areas have been avoided (forest, wetlands and their buffers, floodplain, steep slopes, and habitat for rare, threatened, and endangered species and their associated protection buffers).
 - (4) The proposed use is consistent with the preferred use of the buffer (e.g., pervious areas, such as tieouts to existing grades, slope stabilizing BMPs, etc.).
 - (5) The plan design provides compensation for the loss of buffer function. (See Buffer Mitigation on page 33, C.2.)
- f. Road and utility crossings will be permitted in the stream buffer when it is satisfactorily demonstrated that such location is the best available option considering all of the circumstances, and provided that every effort is made to locate road alignment and/or utilities to create the least disturbance to existing vegetation, grade, and wetlands. Fish passage barriers will not be permitted.
- Where feasible, utility easements must be set back a minimum of 50 feet from all stream banks or outside wetlands and their buffers, whichever provides more protection. In-stream placement of sediment control devices, stream crossings, and channel modifications must be avoided whenever possible. Multiple utility, bikeway, and trail rights-of-way within the buffer should be consolidated to minimize buffer disturbance. Reduced or overlapping right-of-way and utility easements should be used where feasible.
- g. Deposition or stockpiling of any material such as excavated rock, topsoil, stumps and shrubs, grass clippings, and building material within the designated stream buffer is strongly discouraged. Activities such as composting or topsoil stockpiling that are necessary to restore an area within a utility easement or temporary sediment control area, may be approved on a case-by-case basis when no other reasonable alternative is available.
- h. Stream buffers shall be delineated on all new record plats to ensure that the public and subsequent property owners are informed of their existence.

2. Buffer Mitigation Options

When an encroachment on a standard stream buffer is proposed by a developer, the City shall consider options for mitigating or offsetting the encroachment. Such options include:

- a. Buffer Averaging - Establishing additional stream buffer in another location within the development to offset the proposed reduction or encroachment. The offsetting buffer area must be environmentally comparable.
- b. Enhanced Forest Retention or Reforestation - Establishing additional tree-save area or reforestation area beyond the City's legal requirements for forest conservation, not necessarily within a stream buffer, to offset the proposed reduction or encroachment.
- c. Enhanced Retention of General Open Space - Establishing additional public open space for park use to offset the proposed reduction or encroachment.
- d. Bioengineering Practices - Enhancing the watershed protection system with additional bioengineering as an offsetting environmental improvement.
- e. Stream Channel Restoration - Provision of stream channel improvements as an offsetting environmental improvement.
- f. Installation of Additional SWM BMPs - Provision of additional SWM BMPs as an offsetting environmental improvement.

3. Guidelines for Steep Slopes Outside the Stream Buffers (Hydraulically Remote)

To the extent possible, hydraulically remote steep slope areas should be incorporated into the site's open space and/or remain undisturbed. However, development of these areas may be approved on a case-by-case basis, where the developer can demonstrate that safety, City road standards, storm drainage/SWM, erosion and sediment control, engineering, tree preservation, soil stabilization, design, and planning issues are satisfactorily addressed.

4. Guidelines for Approved Clearing and Grading in Stream Buffers and Hydraulically Remote Slopes

- a. All approved clearing and grading activities in stream buffers and hydraulically remote slopes must adhere to the most recent Maryland State standards and specifications for such activity. Furthermore, it is strongly recommended that phased clearing and

grading be used whenever feasible. In watershed areas, phased clearing and grading may be required for sediment control permit approval by DPW. Close coordination shall be maintained with DPW and the Washington Suburban Sanitary Commission (WSSC) to reduce potential additional disturbance from water and sewer line construction. All disturbed areas should be revegetated as soon as possible, as required by the *Maryland Standards and Specifications for Sediment and Erosion Control*. Emphasis should be placed on reforestation of disturbed areas. In many instances, disturbed areas may need replenishment of topsoil before successful reforestation or revegetation can be implemented. Areas without suitable existing vegetated buffers (e.g., cultivation) should be stabilized or seeded prior to grading activity.

- b. Stormwater management concept plans that address water quantity and quality must be approved by DPW during the preliminary design phase. These plans should incorporate effective BMPs and respect natural stream channels, existing aquatic life, and stream habitat.
- c. The location, design, and construction of new development and transportation facilities will be carefully reviewed to avoid introduction of toxic materials into stream systems.
- d. In instances where a Master Plan or Citywide program identifies a need for water quality or other monitoring, City staff may recommend stream monitoring to evaluate impacts of development proposals on the environment. In instances where stream monitoring is a condition of development approval, the monitoring will be conducted by the developer, with the guidance and oversight of City staff to assure efficient, consistent, and comprehensive stream monitoring efforts. Recommended monitoring protocols will follow the sampling procedures developed by the County Biological Monitoring Work Group, as presented in the *Montgomery County Water Quality Monitoring Program Stream Monitoring Protocols*, which is available from Montgomery County Department of Environmental Protection (MCDEP).

D. WETLANDS AND FLOODPLAIN PROTECTION

1. Wetlands

It is the City's goal to protect all wetlands within the city, regardless of State and Federal exemptions. It is the goal of these Guidelines to attain no net overall loss in nontidal wetland acreage and function and to strive for a net resource gain in nontidal wetlands

over present conditions. In support of this goal, the following wetland guidelines, which are based on the Maryland Nontidal Wetlands Protection Act, will be followed during review of development plans:

- a. Wetlands, as defined in these Guidelines (see Glossary), will be subject to the restrictions and requirements set forth in the State (Code of Maryland Regulations {COMAR} 08.05.04) and Federal Nontidal Wetlands Regulations (Sections 401 & 404 of the Clean Water Act). Exemptions in the State and Federal regulations are not applicable within Rockville for these Guidelines. Protection and/or mitigation requirements will be consistent with State and Federal regulations.
- b. A minimum buffer width of 25 feet will be established around nontidal wetland areas. A larger, 40-foot buffer will be established around wetlands associated with first or second order streams. The buffer will be expanded up to 100 feet around wetlands with adjacent areas containing steep slopes or highly erodible soils, as described in Table 2. When a wetland buffer extends beyond the stream buffer that would be required according to Table 1 of these Guidelines, the stream buffer will be expanded to the wetland buffer line. (For example, see Figure 5.)
- c. Development proposals that will impact wetlands will be evaluated under the Federal and State wetland avoidance guidelines that are listed in order of preference as follows:
 - (1) Avoiding the wetland impact altogether by not taking a certain action or parts of an action.
 - (2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
 - (3) Rectifying the impacts by repairing, rehabilitating, or restoring the affected environment.
 - (4) Reducing or eliminating the impact, over time, by preservation and maintenance operations during the life of the action.
 - (5) Compensating for the impact by replacing or providing substitute resources or environments.

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- d. Wetlands and their associated buffer areas must be maintained in their natural condition, unless the proposed disturbance is unavoidable and no reasonable alternative exists, such as:
 - (1) Road crossings, water and sewer lines, and storm drain outfalls.
 - (2) Stormwater management facilities, when it can be demonstrated that upland areas are not feasible or would severely limit the performance/effectiveness of the facility. (See C.1.d. on page 30.)
 - (3) Projects for wildlife and habitat enhancement.
 - (4) Wetland enhancement projects.
 - (5) Bikeways and trails, when it can be demonstrated that a desired and satisfactory connection cannot be made otherwise.
 - e. Proposed alterations to areas designated as wetlands must be reviewed and approved by the City and, where appropriate, by MDE, DNR, and U.S. ACOE prior to commencement of any alteration activities. It is strongly recommended that conceptual approval of alterations of wetlands of extraordinary quality or environmental sensitivity be received from these agencies prior to development of a site plan. Such wetlands include:
 - (1) Nontidal wetlands with threatened or endangered species or species in need of protection.
 - (2) Nontidal wetlands of special State or City concern.

2. Floodplains

The following guidelines are based on existing State and City laws and regulations which govern development activities in floodplains:

- a. No building may be located within a horizontal distance of 25 feet BRL of the 100-year ultimate floodplain, unless DPW issues a variance or exemption as set forth in Chapter 10, Article III of the *Rockville City Code*.
- b. There may be no land-disturbing activity within the floodplain district, unless DPW issues a floodplain variance or exemption as set forth in Chapter 10, Article III of the *Rockville City Code*.

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- c. To ensure that the public and subsequent property owners are informed as to the existence of a floodplain, floodplains shall be delineated on all new record plats with reference elevations at critical locations. The metes and bounds description for the more restrictive line, the floodplain boundary or stream buffer shall be provided on the record plat. The description of the line shall reference both the stream buffer and floodplain delineation.
 - d. When the floodplain extends beyond the stream buffer that would be required, according to Table 1 herein, the stream buffer will be expanded to encompass the floodplain. (For example, see Figure 5.)

E. STREAM QUALITY ENHANCEMENT

In cases where an existing stream on the site is degraded and experiencing erosion, bank failure, undercutting of adjacent trees, or other problems related to the integrity of the stream channel, the City, on a case-by-case basis, may require the submission and approval of a plan addressing bioengineering or stream stabilization to correct stream problems.

The City of Rockville will determine when stream restoration is required under the following circumstances:

1. The City's SWM ordinance and regulations require that all stormwater runoff be safely conveyed. Therefore, in cases where the City allows uncontrolled runoff to enter a stream, the City will determine what stream restoration is needed to safely convey this runoff.
2. Stream restoration can be used as mitigation where buffer averaging or other Environmental Guideline variances have been requested by the developer.

For small development sites that have a stream section requiring stabilization or other work, the City will take into consideration, as appropriate, the relatively minor effect the development has on the overall watershed.

F. DANGER REACH/DAM BREAK ANALYSIS

In order to ensure minimal risk to public well-being and property, it is the policy of the City to prohibit any dwelling units within the area that might be inundated by the dam break flood (danger reach). In order to achieve this, the following techniques are employed where appropriate:

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1. Use of zoning options that require adequate open space for protection of the danger reach.
 2. Use of cluster development provisions in the zoning ordinance.
 3. Encouragement of dedication/park acquisition/conservation easement.
 4. Application of regulatory review policies to minimize flood risk.

To inform the public and subsequent property owners of the existence of a dam and its potential to fail or breach, all danger reach areas shall be delineated on all new record plats, with reference elevations at critical locations.

G. UNSAFE AND UNSUITABLE LAND PROTECTION

1. Soils with Severe Limitations

Development shall avoid areas of the site which contain soils with severe limitations. In some cases, development may be prohibited or restricted in these areas as a condition of approval. Restrictions may include the requirement for implementation of engineered solutions, the use of BRLs, restriction of housing types (such as prohibiting basements), and relocation or deletion of lots.

2. Required Geotechnical Report

When no other options exist and development on problem soils cannot be avoided, a geotechnical report prepared by a certified geotechnical engineer will be required. This report will describe the soil's limitations and the engineering measures necessary to protect against development hazards and impacts. Development may be allowed when staff is convinced that suitable measures will mitigate the soil's constraints over the long term. Should unforeseen soil problems become evident during construction, a stop-work order may be issued until the necessary geotechnical reports are submitted to the City and suitable measures to mitigate the problems are determined and implemented. Disclosure of geotechnical reports must be made to prospective homeowners in a manner approved by the City.

H. PROTECTION OF RARE, THREATENED AND ENDANGERED SPECIES; SPECIES IN NEED OF CONSERVATION AND WATCHLIST SPECIES

When a rare, threatened or endangered species, a species in need of conservation, or a watchlist species, as designated by the Maryland DNR Forest, Wildlife and Heritage Service

(see Appendix F), or its habitat is identified at a site, development must be avoided in these areas unless an alternate plan is approved by the State and/or the City. This may include creating programs for the protection of the identified species or habitat. The developer should consult with the Maryland DNR on any such alternate plan.

1. Endangered species are animals or plants whose survival is in immediate jeopardy due to:
 - a. The present or threatened destruction, modification, or curtailment of their habitat or range.
 - b. Overutilization for commercial, recreational, scientific, or educational purposes.
 - c. Disease or predation.
 - d. Inadequacy of existing regulatory mechanisms.
 - e. Other natural or man-made factors affecting their continued existence.
2. Threatened species are animals or plants that are present in small numbers and likely to become endangered within the foreseeable future.
3. Rare species are animals or plants imperiled because of rarity (typically six to 20 estimated occurrences or few remaining individuals or acres in the area), or because some factors make them vulnerable to becoming extinct.

I. EXISTING WILDLIFE

Where development is expected to impact wildlife or its habitats on a site, wildlife management recommendations shall be incorporated into the site development proposal as a wildlife management report or plan. These management recommendations should address:

1. Human-wildlife interactions.
2. Edge to Area Ratio proposed by the development plan (see Glossary).
3. Wildlife passage, corridor and habitat impacts shall be minimized with preservation and protection as the goal. Large parcel areas shall be reviewed by a wildlife biologist and least impact recommendations shall be incorporated.
4. Linkage of isolated wildlife habitat areas.

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5. Landscape design and natural resource management practices. These should address wildlife problems and provide habitat enhancement, if appropriate.
 6. Compliance with the City's wildlife management policies.

J. PRESERVATION OF CULTURAL, HISTORIC, AND ARCHEOLOGICAL RESOURCES

The existence of (or potential existence of) cultural, historic, or archeological resources on a site, as determined in the pre-submission meeting with staff, should be referred to the HDC and the MHT for a recommendation as to their cultural and historic significance to the area.

The final determination of the site's legal designation as a historic district is made by the Mayor and Council through the Local Map Amendment process, which includes a public hearing. Examples include dwellings, outbuildings, trees, cemeteries, neolithic and archaic Indian sites, monuments, markers, boundary posts, toll roads, fords, mills, slave quarters, wells, graves, etc.

K. NOISE ABATEMENT

There are two basic noise-related conditions that are of concern in the development review process. The first is a noise condition emanating from an individual source or from a proposed use on a single parcel. This condition is currently controlled by the Montgomery County Noise Control Ordinance, which applies within the city. Noise emanating from a proposed use under review must adhere to the noise level restrictions of the Noise Control Ordinance in effect at the time of development review.

The second is a noise-existing condition emanating from public or quasi-public facilities such as highways, arterial roads, and railroads. The impact from those sources of noise pollution remains largely uncontrolled at present, in spite of their widespread impacts. The purpose of this section is to address this type of noise by requiring compliance with the current

M-NCPPC Staff Guidelines for the consideration of Transportation Noise Impacts in Land Use Planning and Development, prepared by the Environmental Planning Division, Montgomery County Planning Board.

L. LIGHT ABATEMENT

Site and construction design shall require compliance with the technical standards of the Building Official and Code Administrators (BOCA) National Energy Code edition, as adopted by the Mayor and Council, in effect at the time of construction permit issuance. Forested lighting buffers are strongly encouraged for adjoining properties with differing land uses. Nuisance spill lighting from residential or commercial properties will not be permitted.

M. PRESERVATION OF SIGNIFICANT VIEWS AND VISTAS

Significant views and vistas shown on the NRI should be preserved, enhanced, and utilized through various planning principles. Street design, layout, and alignment should be used to capitalize on a significant view or vista from one site to another.

The use of prominent public or private buildings, sited on high elevation points or strategically located so as to create a focal point or a public space for the enjoyment of prominent views or vistas, is recommended. The placement of buildings so as not to block or disrupt established views and vistas also should be considered.

N. SITE IMPERVIOUSNESS CONSIDERATIONS

Minimizing imperviousness is one of the best methods for assuring protection of water resources. Evidence clearly indicates a relationship between the overall level of watershed imperviousness and the water quality and health of the aquatic community within the receiving stream.

Development on a site should be designed to reduce impervious surfaces wherever possible. In addition, utilities should consider all options for minimizing impervious surfaces.

Where higher levels of imperviousness are necessary and unavoidable, measures should be employed to increase infiltration and reduce adverse effects of imperviousness. See the City of Rockville's SWM Ordinance and Regulations to calculate the impervious area.

O. PUBLIC UTILITIES, PROPERTY LINES, EXISTING BUILDINGS, AND/OR TRANSPORTATION RIGHTS-OF-WAY

All utilities must be considered in the planning process, stream buffer locations, enhancement, and reforestation areas.

P. PARK BUFFERS

Park buffers shall be implemented as indicated in Table 3.

Implementation

The City may require development agreements (including hold-harmless agreements), easements, and other measures deemed necessary to ensure compliance with conditions of development approval. Such measures shall be in addition to, and not a substitute for, developer's obligation to meet all applicable, City, County, State, and Federal environmental standards required as part of the normal regulatory and permitting process.

A. DEVELOPMENT AGREEMENTS

When required by the City, the developer and the owner (if different from the developer) of the property shall enter into one or more binding agreements with the City to ensure that development satisfies the conditions for development approval. The terms and form of any such agreement must be approved by City staff and the City Attorney. The agreement shall be recorded by the developer, among the land records of Montgomery County, at the developer's expense.

Where applicable, appropriate language referencing the development agreement and the obligations to be undertaken thereunder shall be included in the Homeowners' Association (HOA) documentation and in agreements between the owners of ownership lots delineated on an ownership plat approved by the Planning Commission. The City may require other references or disclosure of the development agreement as it deems appropriate. All documents referencing or disclosing the development agreement are subject to review by the City Attorney.

During construction, and until the facility and/or other property improvements subject to the agreement are completed and approved by the City, the responsibility for compliance with the agreement will remain with the developer. The developer shall convey such property/facility to a HOA or ownership lot owners with warranties as to its fitness for the intended usage. When appropriate, the HOA or ownership lot owners shall assume responsibility under the agreement. However, unless otherwise expressly approved by the City, notwithstanding the conveyance of the property or any improvements to a HOA, the developer shall remain responsible for the two-year warranty period applicable to trees planted pursuant to an approved FCP.

B. CONSERVATION EASEMENTS

Conservation easements shall generally be required for:

1. Stream and nontidal wetlands.
2. Forest conservation areas as required by the City's FTPO (Chapter 10.5 of the *Rockville City Code*).
3. Park buffers.

Conservation easements on the subject property may also be required to protect trees along the property boundaries of adjacent land for compatibility reasons. Other appropriate long-term protection measures may be determined on a case-by-case basis. Developers are encouraged to suggest methods, other than conservation easements, for long term-protection of natural areas. The City discourages conservation easements on single family residential lots. All easements shall be delineated on new record plats so that the public and subsequent property owners are informed of the existence of such easements.

GLOSSARY

Terms and Abbreviations

Afforestation — The creation on a tract that is not presently in forest cover, of a biological community dominated by trees and other woody plants, at a density of at least 100 trees per acre with at least 50 percent of the trees having the capability of growing to a diameter, at 4.5 feet above the ground (diameter at breast height), of 2 inches or more within seven years.

Best Management Practices (BMPs) — A structural or non-structural device designed to temporarily store or treat urban stormwater runoff in order to mitigate flooding, reduce pollution, and provide other amenities.

BRL — Building Restriction Line

City — City of Rockville

Concept Plan Application — Initial application required for a Comprehensive Planned Development under Article XII of the Rockville Zoning Ordinance (Chapter 25 of the *Rockville City Code*).

Conservation Plan — A restriction on the land and the natural features on this land. This easement is shown on the record plat and its terms and conditions are recorded in the County's land records. Most commonly, the agreement prohibits removal of healthy, mature trees and shrubs and changes to the scenic character of the land without written permission from the City of Rockville, Recreation and Parks Department.

Cultural, Historic, and Archeological Resources — Sites, structures, and districts of historical, archeological or architectural significance, together with their appurtenances and environmental settings, as defined in Section 8.01 (a), Article 66B of the *Annotated Code of Maryland*, revised 1995.

Danger Reach — An area subject to unusual and rapid accumulation or runoff of surface water as a result of an upstream dam failure.

Detailed Application — Detailed development application required for special development procedures under Article XII of the Rockville Zoning Ordinance (Chapter 25 of the *Rockville City Code*).

Development Plan — A detailed drawing, prepared by a registered land surveyor, professional engineer or architect, showing the existing and proposed physical layout of a property in terms of dimensions; e.g., building structures, roadways and streets, easements, rights-of-way, drive aisles, vehicular parking areas, sidewalks, bike trails, site entrances/exits, location and placement of utilities, stormwater management facility, topography, and natural features of the site should be shown. Such plans shall also denote and illustrate adjacent site users and improvements located within 50 to 100 feet of the subject property.

Diameter at Breast Height (dbh) — The diameter of a tree as measured at a height of 4.5 feet from the ground.

DNR — State of Maryland Department of Natural Resources

DPW — City of Rockville Department of Public Works

Drainage Course — A natural or man-made drainage network having a defined channel that appears on either City 200-foot scale topographical coverage, a developer's field topographic, or is located in the field.

Edge to Area Ratio — Ratio of the total forest edge to the total forest area.

Ephemeral Stream — A channel at the upstream terminus of an intermittent stream that has flow only in direct response to precipitation.

Erodibility Coefficient (k factor) — Value assigned to soil types by the USDA Natural Resources Conservation Service that identifies the susceptibility to erosion based on topography and various soil characteristics.

Exploratory Application — Initial application required for a Planned Residential Unit Development and Residential Townhouse Development under Article XII of the Rockville Zoning Ordinance (Chapter 25 of the *Rockville City Code*).

Floodplain — A relatively flat or low land area adjoining a river, stream, pond, SWM structure, or water course subject to periodic, partial, or complete inundation; or an area subject to unusual and rapid accumulation or runoff of surface water as a result of an upstream dam failure.

100-Year Flood — A flood that has a one percent statistical probability of being equaled or exceeded in a given year (or that would occur on the average of once in every 100 years). Unless otherwise stated, this calculation is based on the contributing watershed being completely developed.

100-Year Floodplain — The area along a river, stream, pond, SWM structure, or watercourse that would be inundated by a 100-year flood, based on ultimate development of the watershed under existing zoning.

Flowpath — The area of land required to discharge the waters of the 100-year flood.

Forest — A biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or greater. Forest includes:

- (1) Areas that have at least 100 trees per acre with at least 50 percent of those trees having a 2-inch or greater dbh.
- (2) Forest areas that have been cut, but not cleared. Forest does not include orchards.

Forest Conservation — The retention of existing forest or the creation of new forest at the levels prescribed by the development plan approval.

Forest Conservation Plan (FCP) — Outlines the strategies and specific plans proposed for retaining, protecting, and reforesting and/or afforesting areas on a site.

Forest Stand Delineation (FSD) — A detailed summary of existing forest and trees on a site, prepared by identifying forest stands based on methodology detailed in the City's Forest Conservation Manual and the State of Maryland Technical Manual. The information gathered in the forest stand delineation is overlaid with the natural resources inventory and becomes the basis for determining priority areas for forest and tree retention.

Forest and Tree Preservation Ordinance (FTPO) — Establishes procedures, standards, and requirements that protect trees and forests during and after development activity and minimizes tree loss due to development activity.

Geotechnical Report — A report prepared by a professional engineer or geologist discussing the existing soils on a site with respect to structural safety and providing more detail of soil and geologic characteristics in order to determine that soils can support development using suitable engineering measures.

HDC — City of Rockville Historic District Commission

HOA — Homeowners' Association

Highly Erodible Soils — Those soils identified in Appendix B of this document.

Hydraulically Adjacent Slopes — Slopes lying within 200 feet (from bank) of a stream/drainage course that drain directly to the stream/drainage course or its associated floodplain. When the stream buffer encompasses the toe of a steep slope within the 200-foot section, adjacency will apply to the entire slope even if the 200-foot cutoff is in the middle of the slope.

Hydraulically Remote Slopes — Slopes lying beyond the area designated as the stream valley buffer of a stream/drainage course, or slopes lying beyond 200 feet (from bank) of a stream/drainage course if the stream buffer is less than 200 feet, that may or may not drain directly to the stream/drainage course or its associated floodplain.

Intermittent Stream — Surface waters, contained within a defined channel or bed, that flow at least once per year, unrelated to a recent rainfall event. An intermittent stream, for purposes of these guidelines, includes one or more of the following characteristics:

- (1) hydric soils or wetlands within or adjacent to channel;
- (2) hydraulically sorted sediments;
- (3) removal of vegetative litter; or
- (4) loosely rooted vegetation by the action of moving water.

MCDEP — Montgomery County Department of Environmental Protection

MDE — Maryland Department of the Environment

MHT — Maryland Historical Trust

M-NCPPC — Maryland-National Capital Park and Planning Commission

Native — Refers to a plant or animal species whose geographic range during pre-colonial times included the Piedmont of Maryland. Information on native plants can be found in *Woody Plants of Maryland* (Brown and Brown, 1972) and *Herbaceous Plants of Maryland* (Brown and Brown, 1984), as well as other sources.

Natural Resources Inventory (NRI) — A complete analysis of existing natural features, forest, and tree cover on site. The NRI must cover the development site and first 100 feet of adjoining land around the perimeter or the width of adjoining lots, whichever is less. Natural features include topography; steep slopes; perennial, intermittent, and ephemeral streams, and major drainage courses; 100-year floodplain, wetlands, soils and geologic conditions; critical habitats; aerial extent of forest and tree cover; cultural features and historic sites; and necessary buffers.

NRCS — (United States Department of Agriculture) Natural Resources Conservation Service

Park Buffer — An area of separation (open space, forest or landscaping) that preserves the integrity of a park/recreation area by preventing physical or aesthetic encroachment from adjoining land uses.

Percent Slope — $[(\text{Vertical Rise in feet}) / (\text{Horizontal Run in feet in the steepest 100-foot segment})] \times 100 \text{ percent}$. Vertical rise in feet divided by horizontal run in feet is the steepest 100-foot segment, multiplied by 100 percent.

Perennial Stream — A stream that has a flow of water all year.

Pond — A small pool of water, often artificially formed.

Riparian Forest — Forest area directly adjacent to or on the edge of a stream and its tributaries, river, lake, or pond.

Reforestation — The creation of a biological community dominated by trees and other woody plants containing at least 100 trees per acre, with at least 50 percent of those trees having the potential of attaining a two-inch or greater dbh within seven years.

Seeps and Springs — Continuous or ephemeral groundwater flow exiting from slopes or ground surfaces under artesian pressure or gravity flow.

Shrub — A woody plant, usually with multiple stems, each of which has a dbh of less than three inches. Shrubs are generally less than 20 feet tall at maturity.

Significant Tree — Any tree 12-inch dbh or greater, located outside of a forest, or a 24-inch dbh or greater tree located inside the forest.

Specimen Tree — A tree that is a particularly impressive or an unusual example of a species due to its size, shape, age, or other trait that epitomizes the character of the species.

Steep Slope — A slope in which the percent slope equals or exceeds 25 percent.

Stream — See ephemeral stream (page 45), intermittent stream (page 47), and perennial stream (page 48).

Stream Buffer — A strip of natural vegetation contiguous with and parallel to the bank of a perennial or intermittent stream that may be designed to:

- (1) Protect hydraulically adjacent slope areas.
- (2) Maintain or improve the water temperature regimen/water quality of the stream(s).
- (3) Protect natural wetlands.
- (4) Provide groundwater storage/recharge for a stream.
- (5) Complement on-site erosion/sediment control measures by serving as a backup natural filter/trap.

SWM — Stormwater Management

Tree — A large, woody plant having one or several self-supporting stems or trunks and numerous branches that reach a height of at least 20 feet at maturity.

U.S. ACOE — U. S. Army Corps of Engineers

Use Permit — Permit required by the Rockville Zoning Ordinance (Chapter 25 of the *Rockville City Code*) before a building or other structure can be constructed or used.

Water Uses — A distinct designated water use applied to each surface water of the state by the Maryland Department of the Environment. The designated water uses and their specific standards are described in detail in Appendix C.

Wetland — An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

WSSC — Washington Suburban Sanitary Commission

APPENDIX A

Forest Edges, Forest Preserves, and Greenways

A. FOREST EDGES

Forest structure within Rockville is highly fragmented and linear. Hence, any circular or block stands with maximized area versus edge is inherently more valuable for preservation through ecological time. Forest edges next to fields are good for some wildlife, but bad for others. Similarly, edges can have drying winds that reduce the quality of forest growth, alien plant intrusion, and other conditions at the edges.

B. FOREST PRESERVES

Forest preserves provide for the care and protection of the trees, wildlife, streams, soils, vegetation, and other natural features. They have been designated to acknowledge that the forest areas are one of the most significant natural resources within the city. The Mayor and Council adopted a resolution to designate the following forest preserves within existing City parks:

1. **Anderson Park - 12.9 Acres**
Princeton Place, adjacent to Montgomery College property.
2. **Cabin John Stream Valley - 5.4 Acres**
Cabin John Parkway, dead end to Wootton Parkway.
3. **Dawson Farm Tributary Stream Valley and Conservation Area - 4.6 Acres**
Rear of Carter Road between West Edmonston Drive and Levertown Road.
4. **Dogwood Park - 16.5 Acres**
Monroe Street, east to Cabin John Parkway, along the stream to Wootton Parkway.
5. **Hungerford/Stoneridge SWM Forest - 1.8 Acres**
Former community pool site at the dead end of Cabin John Parkway.

-
- 6. Montrose Woods Park Stream Valley - 6.1 Acres**
Dead-end of Rollins Avenue, along Old Farm Creek, to the rear of St. Elizabeth Church property and Tildenwood Lane.
 - 7. Northeast Park - 6.7 Acres**
Between Gude Drive and Wesley Road and First Street.
 - 8. Rockmead Forest - 23 Acres**
Watts Branch Parkway, southwest to the rear of Infield Court North and adjoining Fallsmead Elementary School property.
 - 9. Shapiro Tract at Rockville Civic Center Park - 105 Acres**
Rear of the Rockville Civic Center along Croydon Creek stream valley, east to Rock Creek and north to Route 28.
 - 10. Upper Watts Branch - 56.2 Acres**
Nelson Street, north to Gude Drive.
 - 11. Welsh Park Forest - 8 Acres**
Norris Street, east to Forest Avenue.
 - 12. Woottons Mill Park Stream Valley - 60 Acres**
Watts Branch Parkway, south to Wootton Parkway.

C. GREENWAYS

The purpose of a greenway is to provide a connective corridor of natural resources through an urban area. The greenway through the city should include stream valleys, parks, street trees, public and private open space, rights-of-way, SWM areas, and forests. Other greenway areas include golf courses, trails, and residential backyards.

Greenways have the potential to organize and structure the pattern of development by defining boundaries, land use hierarchy, and providing buffers.

APPENDIX B

Requirements for Floodplain Delineation

The floodplain includes all areas subject to inundation by the waters of the ultimate 100-year flood and an associated 25-foot BRL. The 100-year ultimate floodplain is defined as the area which would be inundated by floodwaters that have a one percent chance of being equaled or exceeded in a given year. For computation purposes, the 100-year ultimate floodplain can be further defined as the area flooded by a rainfall event which produces 7.2 inches of rainfall (over 24 hours) and assumes that the upstream contributory drainage basin is fully developed per the City's Master Plan or zoning maps. This includes all waterways for drainage areas as small as required to produce the identified inundation limits. The City of Rockville has determined this drainage area to be 30 acres or greater.

The hydrology will be determined for ultimate development within the watershed, using TR-55, TR-20, or the Rational Method (in special cases only, determined on a case-by-case basis). Documentation shall be required in the computation of water surface elevations. For backwater profiles, acceptable programs are HEC-2 and HEC-RAS.

Floodplain delineations must be based on field run cross sections using WSSC datum. Surveyed cross sections should be spaced no greater than 200 feet apart and are to be provided at a minimum at the following locations:

- at bridges (four cross sections required),
- where stream slope changes abruptly,
- at major bends in the stream,
- where major stream channel contractions or expansions occur, and
- where significant differences are noted in the Manning's roughness coefficient.

Note: Additional cross sectional information may be required on a case-by-case basis by the DPW.

APPENDIX C

Purpose and Function of Quality Urban Stream Buffers

(Revised - 7/99)

This report provides information and analysis of the basis for the guidelines pertaining to stream buffers. For Use I streams (see Appendix D), Rockville Guidelines for the Protection and Enhancement of the City's Natural Resources (EGs) recommend buffer widths as detailed in the chart below. These buffer widths are 25 feet wider than those currently recommended in the M-NCPPC's Guidelines for Environmental Management of Development in Montgomery County and the City of Gaithersburg's Environmental Standards.

Table 1

| Minimum Stream Buffer Widths* In Feet from the Stream Bank | |
|--|--------------------|
| Percent of Slope | All Streams |
| 0 to <15 | 125 |
| 15 to <25 | 150 |
| 25 and Greater | 175 |
| * Stream buffer widths may be greater if floodplains, wetlands, or steep slopes extend beyond the buffer line. | |

The following issues are addressed in this appendix:

- What are the purposes of stream buffers?
- What is planted in stream buffers?
- What is the research foundation for the City’s stream buffer guidelines?
- How will flexibility be practiced in the application of this guideline?

The Executive Council of the Chesapeake Bay Program has defined a Riparian Forest Buffer as: “an area of trees, usually accompanied by shrubs and other vegetation, that is adjacent to a body of water and which is managed to maintain the integrity of stream channels and shorelines, to reduce the impact of upland sources of pollution by trapping, filtering and converting sediments, nutrients, and other chemicals and to supply food, cover and thermal protection to fish and other wildlife.”

Stream buffers serve these and many other purposes that enhance both the natural and the human environment. Riparian vegetation can have a great influence on bank stability, biological diversity, water temperature, and serve as attractive amenities to neighborhoods and commercial developments as well.

Quality stream buffers provide stabilization or improvements to:

- **Water Quality and Hydrology**

In urban settings, where stream buffers are often reduced to 125 feet or less, stream buffers function best *in conjunction with* SWM, bio-filters, BMPs, etc.

- **Wildlife and Fish Habitat**

Stream buffers maintain open space corridors through developed urban areas, providing habitat for wildlife. Forest cover shades the stream, helping to maintain cooler water temperatures, thereby enhancing the habitat for aquatic life.

- **Aesthetics and Outdoor Recreation**

Forested buffers preserve precious open space as development occurs, enhance the look and feel of developed areas, and provide people with space to recreate.

A. Stream Buffer Width

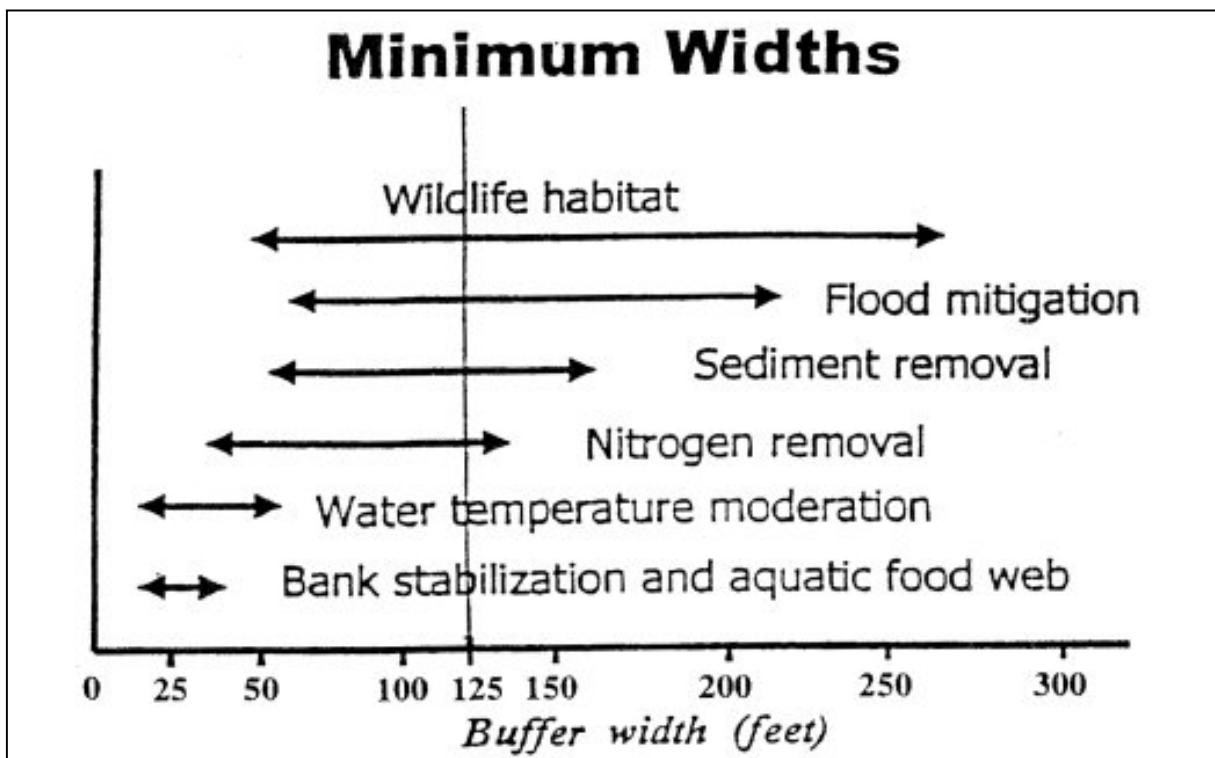
Determining appropriate widths for stream buffers involves looking at four criteria:

1. Site and watershed characteristics
2. Intensity of adjacent land use

3. Water quality and habitat functions
4. Potential value of the natural resource

Much of the available research and information on riparian stream buffers addresses various specific functions of buffers. A great majority of this focus is on removal of sediment, nutrient uptake, and stormwater attenuation. This research indicates that 50-75 feet is an effective width for the removal of pollutants only under sheet flow drainage conditions, which is the condition in a naturally forested area. In developed areas, much of the flow from adjacent impervious areas enters the stream buffer from point sources (pipes, outflows, street dead ends, etc.); hence the need for BMPs to augment the function of the buffers. However, focusing only on sediment removal, etc. does not address the more complex issues and benefits of quality stream buffers.

While current research may not indicate that adding 25 feet of width to stream buffers provides substantial increased removal of sediments and pollutants, there is no question that the extra width provides quantitative improvements to a wide variety of other important management objectives. This combination of objectives is consistent with the purposes of the Environmental Guidelines. The chart below, reprinted from the USDA Chesapeake Bay Riparian Handbook, "A Guide for Establishing and Maintaining Riparian Forest Buffers," illustrates the point.



The attached chart, taken from the Center for Watershed Protection's handbook, "Site Planning for Urban Stream Protection," lists 20 benefits for urban stream buffers. Taking a close look at the chart indicates that wider buffers better support various management objectives, such as:

- Reducing overall watershed imperviousness
- Improving available habitat for wildlife
- Distancing areas of impervious cover from the stream
- Providing more space for SWM ponds
- Increasing property values
- Protecting associated wetlands
- Providing corridors for conservation

Additionally, the City recognizes stream buffers as preferred reforestation/afforestation sites. Suitable sites for reforestation/afforestation within the city are extremely limited. In most development scenarios, wider buffer requirements will promote greater preservation of valuable, mature stands of trees.

Active recreational uses of open space are typically associated with playing fields. But forest buffer areas support valuable active uses, including trails that create links between communities, commuter routes and general recreation. Properly designed, paved hiker/biker trails provide access for individuals of all ages and abilities. Accessible trails can be designed in an environmentally sensitive manner. Passive uses of buffers are very broad reaching, including bird watching, photography, wildlife appreciation, reflection, and a feeling of "escape" from the daily rigors.

The State of Maryland's "Smart Growth" policies encourage the development of urban areas by concentrating growth near established transit areas. Smart Growth also encourages clustering to concentrate housing into a smaller area thereby creating opportunities to preserve more open space. Smart Growth supports the protection of riparian buffers recognizing the values of these areas. For Smart Growth to be effective, the existing urban resources should not be compromised but be preserved through programs that establish "Green Infrastructure."

As urban growth continues in Rockville, our natural resources are reduced both in area and quality. Particularly in Rockville's older neighborhoods and commercial areas, past development took place without addressing the impacts associated with increased impervious areas, and with little or no recognition of the value of environmental conditions

and attributes. Some areas of the City contain no open streams (the entire stream network was enclosed in storm drain pipes) or stream channels with virtually no buffers. Non-environmentally-sensitive agricultural practices reduced the effectiveness of the pervious areas by filling/draining wetlands and farming directly adjacent to streams.

Fortunately, development planning in Rockville over the past two decades has been more sensitive to the values associated with watershed preservation and protection. Much of the Watts Branch and Rock Creek watershed valleys have been incorporated into the park system and designated as permanent Forest Preserves by the Mayor and Council. Sections of the Cabin John valley in Tower Oaks are also being deeded to the City and designated as stream valley parks. Buffer widths are ample throughout these stream valleys (see attached chart, **Park Stream Buffer Widths**.) In some cases they stretch to more than 3,000 feet. These forested stream valleys are regarded by residents as invaluable assets. Many of Rockville's neighborhoods would be very different indeed without this precious open space.

Quality stream buffers balance a number of important environmental protection objectives consistent with the overall purpose of the Environmental Guidelines. In balancing these objectives, the 125-foot buffers exceed the minimum width recommended for some objectives, while providing below-average benefits in other objectives (see chart, page 55). The historical treatment of stream buffers in the development of Rockville has ranged from excellent (in sections where ample stream valley parks have been established) to insensitive (in cases where sections of streams have been filled or placed in pipes). The 125-foot buffer width standard will promote balance and consistency in future developments, and the Environmental Guidelines provide the flexibility necessary to adjust to circumstances unique to each project.

Some developers claim that wider stream buffers serve little or no purpose and that such a City requirement would be very detrimental to development plans. While acknowledging that *any buffers* will impact the configuration of a proposed development, staff believes that these impacts are reasonable and will result in improved development plans.

B. Flexibility in Application of the Stream Buffer Guidelines

During the development review process, the City is committed to exercising flexibility in its application of stream buffer guidelines. Options that provide for flexibility are addressed in the proposed guidelines (see Guidelines for Development, Stream Valley Protection, on pages 29-33.) When an encroachment on a stream buffer is proposed by a developer, the Guidelines provide specific mitigation options (page 33), including:

-
1. Buffer averaging
 2. Enhanced forest retention or reforestation
 3. Enhanced retention of general open space
 4. Bioengineering practices
 5. Stream channel restoration
 6. Installation of BMPs
 7. Enhanced SWM

Staff recognizes that particular flexibility in administering buffer guidelines will be necessary for small development sites, in-fill and redevelopment projects.

Site Planning for Urban Stream Protection

Benefits of Urban Stream Buffers

(f) = benefit amplified by or requires forest cover

| |
|--|
| 1. Reduces watershed imperviousness by 5 percent. An average buffer width of 100 feet protects up to 50 percent of watershed area from future development. |
| 2. Distances areas of impervious cover from the stream. More room is made available for placement of BMPs and septic system performance is improved. <i>(f)</i> |
| 3. Reduces small drainage problems and complaints. When properties are located too close to a stream, residents are likely to experience and complain about backyard flooding, standing water, and bank erosion. A buffer greatly reduces complaints. |
| 4. Stream “right-of-way” allows for lateral movement. Most stream channels shift or widen over time. A buffer protects both the stream and nearby properties. |
| 5. Effective flood control. Other, expensive flood controls not necessary if buffer includes the 100-year floodplain. |
| 6. Protection from stream bank erosion. Tree roots consolidate the soils of floodplain and stream banks, reducing the potential for severe bank erosion. <i>(f)</i> |
| 7. Increase property values. Home buyers perceive buffers as attractive amenities to the community. Ninety percent of buffer administrators feel buffers have a neutral or positive impact on property values. <i>(f)</i> |
| 8. Increased pollutant removal. Buffers can provide effective pollutant removal for development located within 150 feet of the buffer boundary, when designated properly. |
| 9. Foundation for present or future greenways. Linear nature of the buffer provides for connected open space, allowing pedestrians and bikes to move more efficiently through a community. <i>(f)</i> |
| 10. Provides food and habitat for wildlife. Leaf litter is the base food source for many stream ecosystems; forests also provide woody debris that creates cover and habitat structure for aquatic insects and fish. <i>(f)</i> |
| 11. Mitigates stream warming. Shading by the forest canopy prevents further stream warming in urban watersheds. <i>(f)</i> |
| 12. Protection of associated wetlands. A wide stream buffer can include riverine and palustrine wetlands that are frequently found near streams. |
| 13. Prevent disturbance to steep slopes. Removing construction activity from these sensitive areas are the best way to prevent severe rates of soil erosion. <i>(f)</i> |
| 14. Preserves important terrestrial habitat. Riparian corridors are important transition zones, rich in species. A mile of stream buffer can provide 25-40 acres of habitat areas. <i>(f)</i> |
| 15. Corridors for conservation. Unbroken stream buffers provide “highways” for migrations of plant and animal populations. <i>(f)</i> |
| 16. Essential habitat for amphibians. Amphibians require both aquatic and terrestrial habitats and are dependent on riparian environments to complete their life cycle. <i>(f)</i> |
| 17. Fewer barriers to fish migration. Chances for migrating fish are improved when stream crossings are prevented or carefully planned. |
| 18. Discourages excessive storm drain enclosures/channel hardening. Prevents increases in runoff from impervious cover and subsequent eroding or overflowing of headwater streams. |
| 19. Provides space for stormwater ponds. When properly placed, structural BMPs within the buffer can be an ideal location to remove pollutants and control flows from urban areas. |
| 20. Allowance for future restoration. Even a modest buffer provides space and access for future stream restoration, bank stabilization, or reforestation. |

Existing Park Stream Buffer Widths Primary Streams

(July 1999)

| Station | Total Buffer Width | Left | Right |
|--|--------------------|-------|-------|
| <u>Cabin John at Dogwood Park (2700 linear feet)</u> | | | |
| 0' at Cabin John Parkway/Lynfield | 1400' | 2400' | 0' |
| 500' | 75' | 75' | 0' |
| 1000' | 250' | 200' | 50' |
| 1500' | 550' | 475' | 75' |
| 2000' | 170' | 70' | 100' |
| 2500' | 475' | 75' | 400' |
| 2700' at Wootton Parkway | 300' | 75' | 225' |
| Percent of buffer length exceeding 125' (wide) on both sides = 15% | | | |
| <i>Buffer widths assume minimum slope (0-15%)</i> | | | |
| <u>Potomac Woods Park (2300 linear feet)</u> | | | |
| 0' at Stratton Culvert | 775' | 75' | 700' |
| 500' | 200' | 0' | 200' |
| 1000' | 175' | 125' | 50' |
| 1500' | 1400' | 1000' | 400' |
| 2000' | 600' | 250' | 350' |
| 2300' end City Limits | 200' | 50' | 150' |
| Percent of buffer exceeding 125' (wide) on both sides = 47% | | | |
| <i>Buffer widths assume minimum slope (0-15%)</i> | | | |

| Station | Total Buffer Width | Left | Right |
|--|--------------------|-------|-------|
| <u>Shapiro Tract Park/Civic Center (200 linear feet)</u> | | | |
| 0' at Norbeck Road | 3500' | 1300' | 2200' |
| 500' | 3700' | 1300' | 2400' |
| 1000' | 2200' | 1000' | 1200' |
| 1500' | 2600' | 900' | 1700' |
| 2000' | 1400' | 0' | 1400' |
| (At Rockville High School) | | | |
| Percent of buffer length exceeding 125' (wide) on both sides = 70% | | | |
| <i>Buffer widths assume minimum slope (0-15%)</i> | | | |
| <u>Upper Watts Branch Park (3800 linear feet)</u> | | | |
| 0' at Gude Drive | 250' | 150' | 100' |
| 500' | 500' | 70' | 430' |
| 1000' | 140' | 40' | 100' |
| 1500' | 360' | 130' | 230' |
| 2000' | 625' | 475' | 150' |
| 2500' | 380' | 220' | 160' |
| 3000' | 1030' | 330' | 700' |
| 3500' | 700' | 200' | 500' |
| 3800' at Nelson Street | 500' | 100' | 400' |
| Percent of buffer exceeding 125' (wide) on both sides = 93% | | | |
| <i>Buffer widths assume minimum slope (0-15%)</i> | | | |

| Station | Total Buffer Width | Left | Right |
|--|--------------------|------|-------|
| <u>Woodley Gardens Park (2250 linear feet)</u> | | | |
| 0' at Nelson Street | 300' | 50' | 250' |
| 500' | 350' | 200' | 300' |
| 1000' | 475' | 250' | 225' |
| 1500' | 840' | 140' | 700' |
| 2000' | 175' | 75' | 100' |
| 2250' at Nelson Street (I-270) | 420' | 400' | 20' |
| Percent of buffer length exceeding 125' (wide) on both sides = 70% | | | |
| <i>Buffer widths assume minimum slope (0-15%)</i> | | | |
| <u>Woottons Mill Park (4500 linear feet)</u> | | | |
| 0' at Watts Branch Parkway | 1400' | 600' | 800' |
| 500' | 500' | 250' | 250' |
| 1000' | 900' | 800' | 100' |
| 1500' | 600' | 350' | 250' |
| 2000' | 450' | 250' | 200' |
| 2500' | 400' | 100' | 250' |
| 3000' | 320' | 20' | 300' |
| 3500' | 500' | 300' | 200' |
| 4000' | 350' | 250' | 100' |
| 4500' at Wootton Parkway | 230' | 80' | 150' |
| Percent of buffer exceeding 125' (wide) on both sides = 90% | | | |
| <i>Buffer widths assume minimum slope (0-15%)</i> | | | |

APPENDIX D

State Designated Water Uses for Streams Within the City of Rockville and Watershed Map

Source: Code of Maryland Regulations (COMAR) 26.08.02, Anti-Degradation Policy (COMAR 26.08.02.04)

The MDE applies distinct designated water uses for the surface waters of the state, each having a specific set of standards. Below is a list of definitions of each water use in Rockville and the State and City anti-degradation.

A. USE I: WATER CONTACT RECREATION AND PROTECTION OF AQUATIC LIFE

Waters that are suitable for water contact sports, play and leisure time activities where the human body may come in direct contact with the surface water, fishing, the growth and propagation of fish (other than trout), other aquatic life and wildlife, agricultural water supply, and industrial water supply.

1. Criteria for Use I Waters

- a. Bacteriological - there may not be any source of pathogenic or harmful organisms in sufficient quantities to constitute a public health hazard. A public health hazard will be presumed when:

-
- (1) fecal coliform density exceeds a log mean of 200 per 100 milliliters based on a minimum of five samples taken over 30 days;
 - (2) 10 percent of total number of samples exceed 400 per 100 milliliters; or
 - (3) except when a sanitary survey approved by the MDE discloses no significant health hazard, (1) and (2) do not apply.
- b. Dissolved Oxygen - may not be less than 5.0 milligrams/liter at any time.
 - c. Temperature - maximum temperature outside the mixing zone may not exceed 90 degrees F (32 degrees C) or the ambient temperature of the surface waters, whichever is greater. A thermal barrier that adversely affects aquatic life may not be established.
 - d. pH - normal pH values may not be less than 6.5 or greater than 8.5.
 - e. Turbidity - may not exceed levels detrimental to aquatic life. Turbidity in the surface water resulting from any discharge may not exceed 150 units at any time or 50 units as a monthly average.
 - f. Toxic Substances - all toxic substance criteria to protect fresh water and estuarine and salt water aquatic organisms, and the wholesomeness of fish for human consumption, apply in fresh, estuarine and salt waters (see COMAR 26.08.02.03-3).

B. USE I-P: WATER CONTACT RECREATION, PROTECTION OF AQUATIC LIFE, AND PUBLIC WATER SUPPLY

Waters that are suited for all uses identified in Use I and use as a public water supply.

1. Criteria for Use I-P Waters

- a. The criteria for Use I waters (a) - (e).
- b. Toxic Substances - all toxic substances criteria for protection of fresh water aquatic organisms and to protect public water supplies and the wholesomeness of fish for human consumption apply.

C. USE II: SHELLFISH HARVESTING WATERS

None in the City of Rockville.

D. USE III: NATURAL TROUT WATERS

None in the City of Rockville

E. USE III-P: NATURAL TROUT WATERS AND PUBLIC WATER SUPPLY

None in the City of Rockville.

F. USE IV: RECREATIONAL TROUT WATERS

Waters that are capable of holding or supporting adult trout for put and take fishing and that are managed as a special fishery by periodic stocking and seasonal catching (cold or warm water).

1. Criteria for USE IV Waters

- a. Bacteriological - same as Use I waters.
- b. Dissolved Oxygen - same as Use I waters.
- c. Temperature - maximum temperature outside the mixing zone may not exceed 75 degrees F (23 degrees C) or the ambient temperature of the surface water, whichever is greater. A thermal barrier that adversely affects aquatic life may not be established.
- d. pH - same as Use I waters.
- e. Turbidity - same as Use I waters.
- f. Toxic Substances - all toxic substance criteria to protect fresh water aquatic organisms and the wholesomeness of fish for human consumption apply.

G. USE IV-P: RECREATIONAL TROUT WATERS AND PUBLIC WATER SUPPLY

Waters that include all uses identified for USE IV waters and use as a public water supply.

1. Criteria for USE IV-P Waters

- a. The criteria for Use IV waters (a) - (e).

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- b. Toxic Substances - all toxic substances criteria for protection of fresh water aquatic organisms and to protect public water supplies and the wholesomeness of fish for human consumption apply.

H. ANTI-DEGRADATION POLICY

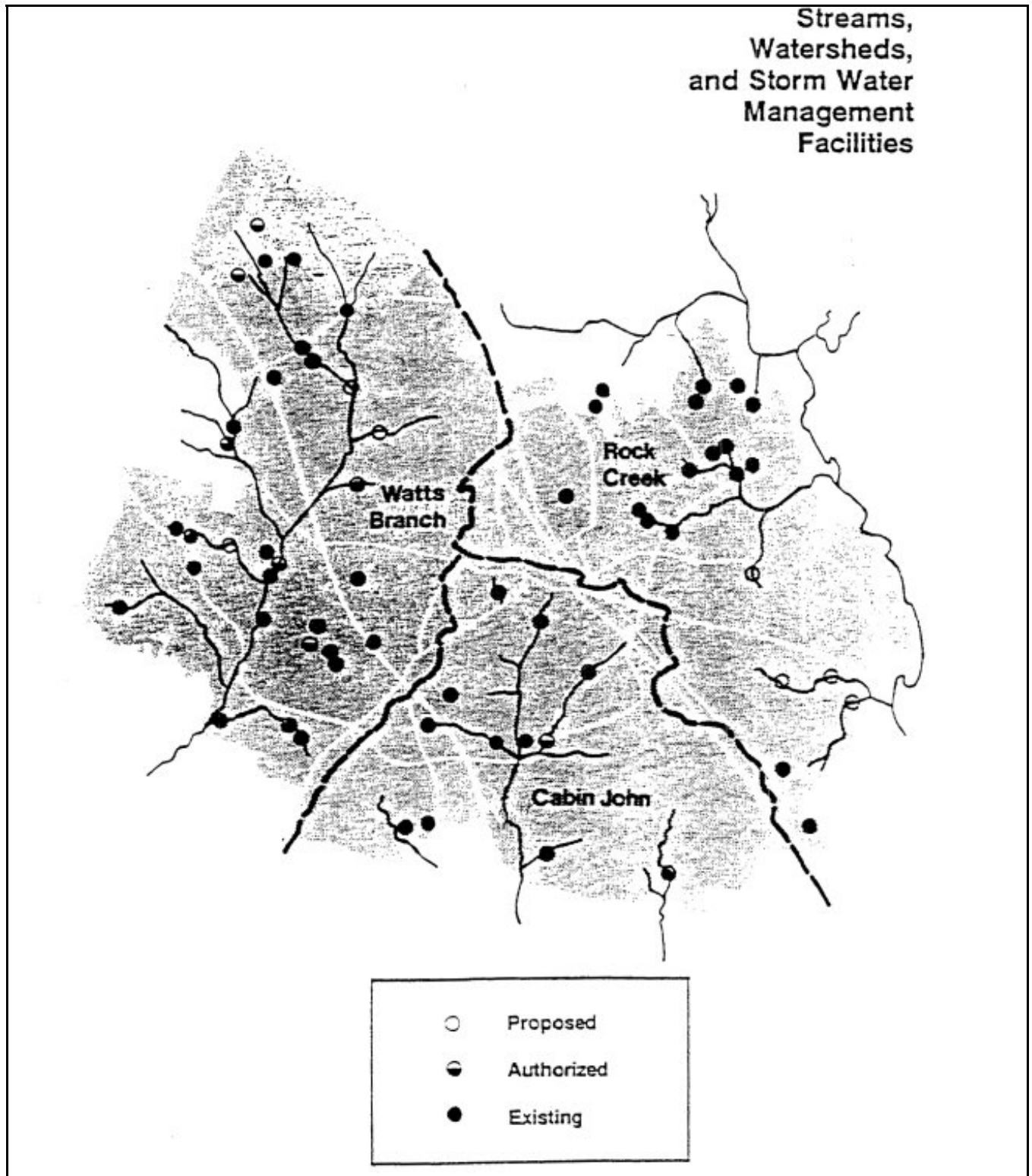
All streams within the City of Rockville are required to adhere to Maryland's anti-degradation stream regulations, as follows:

COMAR 26.08.02.04 Anti-Degradation Policy (State of Maryland)

1. Certain waters of this State possess an existing quality which is better than the water quality standards established for them. The quality of these waters shall be maintained unless:
 - a. the Department determines a change is justifiable as a result of necessary economic or social development; and
 - b. a change will not diminish uses made of, or presently possible in, these waters.
2. To accomplish the objective of maintaining existing water quality:
 - a. new and existing point sources shall achieve the highest applicability statutory and regulatory effluent requirements; and
 - b. nonpoint sources shall achieve all cost effective and reasonable best management practices for nonpoint source control.
3. The Department shall discourage the downgrading of any stream from a designated use with more stringent criteria to one with less stringent criteria. Downgrading may only be considered if:
 - a. the designated use is not attainable because of natural causes; or
 - b. the designated use is not attainable because of irretrievable man-induced conditions; or
 - c. controls more stringent than the effluent limitations and national performance standards mandated by the Federal Act, and required by the Department, would result in substantial and widespread economic and social impact.

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4. The Department shall provide public notice and opportunity for a public hearing on the proposed change before:
 - a. permitting a change in high quality waters; or
 - b. downgrading any stream use designation.
 5. Water which does not meet the standards established for it shall be improved to meet the standards.

Watershed Map



July 1998

APPENDIX E

Erodible Soils List

Source: "Highly Erodible Lands Report," Soil Survey, Montgomery County, Maryland, U.S. Department of Agriculture, NRCS.

The following soils are classified as highly erodible land by the NRCS, based upon the universal soil loss equation and the soil loss tolerance value established for each soil. These highly erodible soils should be incorporated into the property's open space and carefully managed during construction.

- 1C Gaila silt loam, 8 to 15% slopes
- 2C Glenelg silt loam, 8 to 15% slopes
- 4C Eliok silt loam, 8 to 15% slopes
- 9C Linganore-Hyattstown channery silt loams, 8 to 15% slopes
- 16C Brinklow-Blocktown channery silt loams, 8 to 15% slopes
- 16D Brinklow-Blocktown channery silt loams, 15 to 25% slopes
- 17C Occoquan loam, 8 to 15% slopes
- 18C Penn silt loam, 8 to 15% slopes, very stony
- 18E Penn silt loam, 15 to 45% slopes, very stony
- 20C Brentsville sandy loam, 8 to 15% slopes
- 21C Penn silt loam, 8 to 15% slopes
- 21D Penn silt loam, 15 to 25% slopes
- 21E Penn silt loam, 25 to 45% slopes
- 21F Nestoria-Rock Outcrop Complex, 25 to 50% slopes
- 24C Montalto silt loam, 8 to 15% slopes, very stony
- 24D Montalto silt loam, 15 to 25% slopes, very stony
- 25C Legore silt loam, 8 to 15% slopes
- 26C Montalto silt loam, 8 to 15% slopes

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- 27C Neshaminy silt loam, 8 to 15% slopes
 - 35C Chrome silt loam, 8 to 15% slopes
 - 57C Chillum silt loam, 8 to 15% slopes
 - 57D Chillum silt loam, 15 to 25% slopes
 - 58C Sassafras loam, 8 to 15% slopes
 - 61C Croom gravelly loam, 8 to 15% slopes
 - 61D Croom gravelly loam, 15 to 25% slopes
 - 61E Croom gravelly loam, 25 to 40% slopes
 - 64C Croom and Bucks soils, 8 to 15% slopes
 - 65B Wheaton silt loam, 0 to 8% slopes
 - 109D Hyattstown channery silt loam, 15 to 25% slopes, very rocky
 - 109E Hyattstown channery silt loam, 25 to 45% slopes, very rocky
 - 116D Blocktown channery silt loam, 15 to 25% slopes, very rocky
 - 116E Blocktown channery silt loam, 25 to 45% slopes, very rocky

APPENDIX F

Rare, Threatened or Endangered Plant and Animal Species Known to Occur Within the City of Rockville

Source: Maryland DNR, Forest, Wildlife and Heritage Service

The Wildlife and Heritage Division's Natural Heritage database indicates that there are several records for species of concern known to exist within the Rockville City limits. They are as follows:

| <u>Scientific Name</u> | <u>Common Name</u> | <u>State Status</u> |
|------------------------|---------------------------------|-------------------------|
| Cistothorus platensis | Sedge Wren | Threatened |
| Mustela nivalis | Least Weasel | In Need of Conservation |
| Platanthera peramoena | Purple Fringless Orchid | Threatened |
| Calystegia spithamea | Low Bindweed | Rare |
| Goodyera tessellata | Tesselated Rattlesnake Plantain | Endangered, Extirpated |

Note: In addition, some forested areas contain Forest Interior Dwelling Bird habitat. Populations of many Forest Interior Dwelling Bird Species (FIDS) are declining in Maryland and throughout the eastern United States. The conservation of this habitat is strongly encouraged by DNR.

APPENDIX G

Air Pollution

Air pollution is recognized as a serious environmental problem in the Washington metropolitan region. Air pollution is monitored and regulated by the State of Maryland and the Federal Government. Although the City of Rockville does not have specific regulations or ordinances addressing air pollution, the Environmental Guidelines Task Force recommends consideration of the following practices and policies:

- A.** The City should make every effort to comply with or exceed all State and Federal regulations and policies and to promote compliance among Rockville businesses and residents.
- B.** The City should encourage businesses to take initiatives that help to mitigate air pollution. Since motor vehicles are by far the largest source of air pollution in our region, many of these programs focus on commuting alternatives. Some examples are:
 - 1. Incentives for employees who car/van pool, such as free parking and pay incentives.
 - 2. Incentives for employees to use public transportation.
 - 3. Implementation of bicycling-related initiatives recommended in the City's Bicycle Master Plan, such as construction of the bikeway system to make bicycling a more viable alternative, incentives for employees to ride bicycles to work, incentives for public sector office buildings and large private businesses to offer bike lockers and shower/changing facilities, and making loaner bikes available for short trips around town.
 - 4. Incentives for larger businesses and public sector employers to convert fleet vehicles to electric and/or natural gas to make alternative-fuel vehicles available to employees for short trips.
 - 5. The inclusion of recharging equipment at larger businesses for employees who use electric cars.

The City should consider adopting a comprehensive initiative to promote reduction of automobile usage.

REFERENCES

City of Gaithersburg Environmental Standards, City of Gaithersburg, Planning and Code Administration, November 1995

Code of Maryland Regulations 26.08.02, Anti-Degradation Policy (COMAR 26.08.02.04)

Environmental Guidelines, Guidelines for Environmental Management of Development in Montgomery County, Maryland-National Capital Park and Planning Commission, February 1997

Highly Erodible Lands Report, Soil Survey, Montgomery County, Maryland, U.S. Department of Agriculture, NRCS

Maryland Department of Natural Resources, Forest, Wildlife and Heritage Service

Palone, R.S. and Albert Todd (editors), 1997, Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers. United States Department of Agriculture, Forest Service. NA-TP-02-97. Radnor, Pa.

Site Planning for Urban Stream Protection, Tom Schueler, Center for Watershed Protection, December 1995