Chapter 12 - Environmentally Sensitive Areas

Stormwater discharges to areas with features identified as environmentally sensitive may be subject to additional requirements, or may need to utilize or restrict certain stormwater management practices. The following type of areas are considered to be "environmentally sensitive":

- Floodplains – Areas identified within a 100-year recurrence interval flood plain.
- Steep Slopes – Areas with a slope of 33 percent or greater.
- Stream Buffers – Setbacks and vegetative buffers established adjacent to the Roanoke River as required by the County of Roanoke zoning ordinance or designated conservation area buffer zones at each bank of streams, ponds, lakes, wetlands, and stormwater BMPs.
- Critical Erosion Areas – Areas with potential serious erosion problems as defined in the VA E&SC Handbook. These fall into two sub categories.
    - The erosion hazard is critical if the slope length exceeds the following criteria:

0-7% slope	> 300 feet
7-15% slope	> 150 feet
>15% slope	> 75 feet

    - Areas may be critical if the soils are highly erodible, as classified using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (formerly Soil Conservation Service) methods, either Land Capability Classification IIIe, IVe, IV, VII, or VIII or with an erodibility index factor greater than 8.
- Karst Geology – Areas where the underlying geologic conditions include caves and crevices which allow stormwater to infiltrate and quickly migrate and transport potential pollutants.
- Hot Spots – Areas where a high potential for stormwater pollution may occur due to current or former activity on the site.
- Jurisdictional Streams and/or Water – Waters regulated by U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act. A jurisdictional determination (JD) is required that identifies and separates the Corps regulated areas from non-regulated areas. Disturbance in regulated areas requires a permit form USACE. JDs are typically good for 5 years after the determination has been made by

the USACE. Third party reports by qualified professionals will be accepted for jurisdictional stream delineation.

- Wetlands- Wetlands regulated by U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act. A jurisdictional determination (JD) is required that identifies and delineates wetlands. Disturbance in wetlands requires a permit form USACE. JDs are typically good for 5 years after the determination has been made by the USACE. Third party reports by qualified professionals will be accepted for wetland delineation.

12.1 References

The following publications may be useful in providing guidance when performing construction, establishing development limits, and developing appropriate strategies and design features to address the special concerns related to environmentally sensitive areas:

- VDOT Drainage Manual
- VA E&SC Handbook
- VA SWM Handbook
- Virginia Department of Conservation and Recreation, Technical Bulletin No. 2, Hydrologic Modeling and Design in Karst
- International Building Code
- The Development of the Land Capability Classification (reprinted from Readings in the History of the Soil Conservation Service), Douglas Helms, Soil Conservation Service, 1992
- Clean Water Act Section 404
- River & Harbors Act of 1899 Section 10
- FEMA Flood Map Service Center
- Flood Insurance Rate Map (FIRM)

12.2 Floodplains

The purpose of floodplain management is to regulate the use of the floodplains in order to protect life and property, prevent sedimentation and pollution of water resources, and to prevent or protect against the general degradation of the environment.

Floodplains and their regulatory requirements are generally based on the stream flows generated by a 100-year frequency storm and existing land development conditions. However, storms and future land development can generate flows of greater magnitude and flooding above and beyond these limits. For this reason, additional vertical and horizontal setbacks from the floodplain limits are strongly encouraged to account for future development within the upstream drainage area and to serve as a factor of safety for larger flood events.

Floodplains include:

- Areas identified within a 100-year recurrence interval floodplain as identified by the Federal Emergency Management Agency (FEMA). These areas have been identified as the Floodplain Overlay District by the County of Roanoke Zoning Ordinance.

- Areas identified within a 100-year interval floodplain as identified by an applicant floodplain study.

Management of floodplains in Roanoke County shall be in accordance with the requirements published in the County of Roanoke Zoning Ordinance.

Under no conditions, shall the land disturbance activity adversely affect the capacity of channels, floodways, ditches, or any drainage facility or system.

The lowest floor elevation of any new residential structure, as defined in the County of Roanoke Zoning Ordinance Section 30-28, shall be at least 2 feet above the base flood elevation. The lowest floor elevation of any new non-residential structure shall be at least 1 foot above the base flood elevation unless the structure is floodproofed. The elevation of the lowest floor shall be certified by a Registered Surveyor or Professional Engineer on an Elevation Certificate after the lowest floor is installed.

Grading and cut and fill operations within the 100-year flood plain are discouraged and must be approved by the County of Roanoke. Activity within the floodplain must also be coordinated with other regulatory requirements and agencies. These may include erosion and sediment control, stream buffer protection, FEMA, VMRC, U.S. Army Corps of Engineers, Virginia DEQ, and others.

Construction of stormwater management impoundment structures within a floodplain shall be avoided to the extent possible. Where this is unavoidable, all stormwater management facility construction shall be in compliance with all applicable regulations under the National Flood Insurance Program, 44 CFR Part 59, and in accordance with the County of Roanoke Zoning Ordinance.

The County does not have the authority to alter or modify the flood limits and/or elevations established by FEMA. Should an applicant flood study indicate any alteration in FEMA's limits and/or elevations, then the applicant must contact FEMA and obtain a map revision.

12.2.1 Applicant Flood Study Requirements

A flood study, prepared by a Professional Engineer, must be prepared and submitted, by the applicant, for all areas where the drainage area is 100 acres or greater, and there are no detailed flood profiles or elevations from a FEMA Flood Insurance Study.

There are two levels of studies. A detail study is required, if any development is proposed within the floodplain. Development includes grading and road crossings. A limited detail study is acceptable, if no development is proposed within the floodplain and the purpose of the study is to avoid the floodplain.

A detail study involves a rigorous detailed hydrologic and hydraulic study of a flooding source reach. The typical riverine detail study includes the following minimum steps:

- Field survey of stream and floodplain cross-sections
- Field survey of all hydraulic structure crossings.
- Collection of historical high water mark elevations and model calibration/verification, if data is available.
- Detailed hydrologic & hydraulic modeling/computations
- Establishment of the FEMA regulatory Floodway
- Other tasks meeting all FEMA Guidelines and Specifications for Flood Hazard Mapping Partners

A limited detail study may be performed when development is to occur adjacent to, but not in the existing floodplain. In most limited detail modeling, local regional regression equations along with a HEC-RAS hydraulic model will be developed. The major difference between the HEC-RAS models for the limited detail study and the detail study will be the amount of field survey information collected in the field and used to create the model and the amount of time spent on calibration to historical flood elevations. The limited detail models typically include no field survey data, and floodways are typically not computed. The

methods for limited detail study are further outlined in the FEMA Guidelines and Specifications for Flood Hazard Mapping Partners

In addition, the following information and items are required when an applicant flood study is submitted to Roanoke County for review:

- The flood study shall be based on the **ultimate land use conditions** as published in the most recent Comprehensive Plan for upstream areas. Structure locations shall be based on the ultimate build out data.

- The flood study shall be prepared by a registered Professional Engineer licensed to practice engineering in Virginia, sealed, signed, and dated.
- Assuming that sedimentation or scour may occur during the storm event is not acceptable.

- The flood study shall compare pre- and post-development conditions to verify that the proposed development will not increase the 100 year flood elevation more than 1 foot at any point.

- The flood study shall consider backwater conditions, local obstructions and, where required by the County of Roanoke Department of Community Development, the partial or complete failure of any enclosed drainage system. Consideration must be given to the overflow path, to ensure that no structures will flood in the event of system failure.

- The flood study shall analyze the 100-year flood path for all new development.

- A digital version of the 100-year flood limits and cross sections must be provided to the County. The study and supporting data will become public information. The site plan digital file shall be in ACAD format and tied to the correct State Plane Coordinate.

- Cross sections from the study must be indicated on the site plans submitted as a part of the development review package.

12.2.2 Floodplain Delineation

The limits of floodplain floodways shall be staked and flagged in the field prior to any land disturbance activities and they shall remain undisturbed during construction. After the completion of construction, the limits of floodplain floodways shall be checked to verify that no unauthorized filling has taken place in the floodway.

Place floodplain limits and floodways on the final plats submitted for each property. All subdivision plats and site plans located within the floodplain in whole or in part shall include base flood elevation data.

12.3 Steep Slopes

Special precautions and guidelines are required for development in areas having steep slopes, defined as thirty-three and one third percent (33.3%) or greater. These precautions and guidelines address the increased potential for soil erosion, sedimentation, water pollution and septic disposal problems associated with the development of areas with significant topographical relief. Unrestricted development of steep slopes may result in:

- Rapid and/or large-scale movement of soil and rock;
- Rapid and excessive stormwater run-off;
- Deposition of eroded material leading to siltation of natural and man-made bodies of water;
- Loss of aesthetic resource; and
- Greater travel distance of septic effluent in the event of septic system failure.

12.3.1 Development Restrictions

Land-disturbing activities on steep slopes are regulated by Chapter 8.1 of the County Code, "Erosion and Sediment Control and Steep Slope Development Ordinance of the County of Roanoke, Virginia."

If the grade of a site is greater than 33.3%, refer to the International Building Code for steep slope development requirements.

12.3.2 Design Standards

No land disturbance of steep slopes may occur without a geotechnical study that concludes that the land disturbance will result in a stable finished slope. For the requirements of a geotechnical study, see County of Roanoke Erosion and Sediment Control and Steep Slope Ordinance.

Land disturbance of steep slopes require the preparation and submittal to the County of as-built plans showing that the finished geometry is in substantial conformity with the approved site plan.

Site grading and measures required to control stormwater runoff shall collect and carry storm drainage away from the steep slope to the extent possible. If concentrated runoff is to be discharged in areas of steep slopes, adequate protection must be installed to prevent channel erosion and energy dissipation shall be used at the base of the steep slope to prevent erosion where the flow transitions to a shallower slope. The use of a closed conduit storm drain should be considered in accordance with Chapter 7.

12.4 Stream Buffers

Stream buffers are established to provide a naturally vegetated strip of land adjacent to a stream. This buffer protects the stream from encroachment by development, preserves the water, recreational, and environmental resources, protects the floodplain and floodway, retards runoff, and helps improve the water quality of stream by preventing erosion and filtering non-point source pollution from runoff.

The establishment of stream buffers as a water quality measure is encouraged by the County of Roanoke. Requirements for stream buffers shall be in accordance with Section 30-75 of the County of Roanoke Zoning Ordinance- Roanoke River Conservation and Overlay District. Additionally, the development must meet the required stream setbacks as outlined in Section 30-75-5.

12.5 Critical Erosion Areas

Critical erosion areas, if cleared of vegetation and exposed to the elements of nature, may experience significant erosion and sedimentation problems, including a significant loss of topsoil. These soils tend to be located on hillsides and areas with steep slopes, and adjacent to river valleys and tributaries.

Critical erosion areas include:

- The erosion hazard is critical if the slope length exceeds the following criteria:

0-7% slope	> 300 feet
7-15% slope	> 150 feet
>15% slope	> 75 feet

Critical erosion areas shall be indicated on the Erosion and Sediment Control Plan. To the extent feasible, disturbance of critical erosion areas shall be avoided or minimized. Where critical erosion areas are disturbed, their protection and stabilization shall specifically be addressed by the Erosion and Sediment Control Plan and the Stormwater Management Plan.

12.6 Karst Geology

Developers and Designers are cautioned that construction in karst geology requires special care and study; and that they are responsible to ensure that all appropriate investigations are performed by licensed geotechnical engineers or geologists to ensure long-term soil stability for proposed buildings and site improvements.

Although proper study of site conditions is the responsibility of the Developer and Designer, Roanoke County may, at its discretion, require a geotechnical investigation, prepared by a licensed geotechnical engineer or geologist, on a case by case basis.

Karst is an underlying geology which is common in Roanoke County where the underlying rock is predominantly soluble limestone or dolomite creating caves, crevices, and other cavities in the rock. Stormwater may infiltrate to the karst geologic rock and quickly drain through the open cavities. In addition to providing a quick transport mechanism for potential stormwater pollutants, this may create quick erosion of the limestone, potentially causing sinkholes or other surface sloughing. Identification of karst geology shall be based on local geology and soils maps, aerial photography, and site visits by a person familiar with karst geology.

Karst areas present problems with conventional hydrologic stormwater models, creating poor representation of runoff rates as most models do not have allowances for losses through sinkholes, crevices, or caves.

See DCR Technical Bulletin #2, Hydrologic Modeling and Design in Karst for additional information on identification, and modeling requirements for areas in karst geology. Recommended practices include:

- Design the site to take maximum advantage of topography.
- Minimize site disturbance, cuts, fills, and drainage alterations.
- Minimize the impervious surface.
- Stormwater conveyance structures shall be designed to dissipate overland flow over the largest areas possible. Avoid concentration of flows and ponding.
- Stormwater management facilities located in karst areas shall be installed with a liner. Only BMP structures approved for karst areas by the VA BMP Clearinghouse will be allowed for installation.

12.7 Stormwater Hot Spots

Stormwater discharges from land uses or activities with higher potential pollutant loadings, known as “hotspots”, may require a greater level of stormwater treatment or the

use of specific structural BMPs and pollution prevention practices. Greater concentrations of sediment, hydrocarbons, traces metals, pesticides, and other toxics than are found in typical stormwater runoff may qualify a site for designation as a hot spot.

The following land uses and activities may be stormwater hotspots:

1. Vehicle salvage yards and recycling facilities;
2. Vehicle fueling stations;
3. Vehicle service and maintenance facilities;
4. Vehicle and equipment cleaning facilities;
5. Fleet storage areas (bus, truck, etc);
6. Industrial sites (for SIC codes contact VA DEQ);
7. Marinas (service and maintenance areas);
8. Outdoor liquid container storage;
9. Outdoor loading and unloading facilities;
10. Public works storage areas;
11. Facilities that generate or store hazardous materials;
12. Commercial container nursery;
13. Golf courses;
14. Chemical storage; and
15. Dry cleaning operations.

12.7.1 Design Restrictions

Stormwater BMP practices having an infiltration component located in stormwater hotspot areas shall be provided with adequate pretreatment or storage areas to preclude pollutants from the infiltration area.

The property owner must conform with all applicable laws and regulations relevant to any chemicals or hazardous materials used on these sites. Industrial

operations shall be conducted to minimize exposure of chemical storage containers to stormwater, and contain any runoff as required by law where this can not be avoided.

These sites must also meet DEQ VSMP and DEQ VPDES permit requirements, where applicable.

12.7.2 Golf Course Development

Golf courses, while maintaining impervious area and natural buffers allow for the introduction of nutrients into stormwater through fertilizers and chemicals into stormwater through the use of pesticides and herbicides.

Design of golf courses, public or private, should meet the following performance standards:

1. Managed turf should be reduced by including areas of rough devoted to native plants, natural environments, and wildlife habitat enhancement;

2. An Integrated Pest Management and nutrient management plan should be prepared and followed;

3. Native or naturalized landscaping should be used to the extent possible;

4. Natural vegetation and trees along streams should be retained to the extend possible;

5. Stream crossings should be minimized;

6. Irrigation, drainage and retention systems should be designed to provide for efficient use of water and the protection of water quality;

7. Water reuse strategies should be employed when feasible;

8. Adherence to the “Environmental Principles of Golf Courses in the United States” published by the Center for Resource Management is encouraged.

9. A Nutrient Management Plan should be developed by a certified Nutrient Management Planner consistent with DCR’s Nutrient Management Training and Certification Regulations.