

# ARTICLE 21 STORMWATER MANAGEMENT

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## **21.01 Plan Approval Required**

**21.01.01** Subject to the requirements of Article 4, a drainage plan is required to be submitted with all applications except that single family and two-family residences are not required to furnish a certification in accordance with Subsection 4.18.

**21.01.02** Pursuant to the application requirements in Article 4, plans and information shall be submitted that demonstrate compliance with this Article and Appendix A in regards to stormwater management.

## **21.02 Diligence in Construction of Drainage Structures**

**21.02.01** Stormwater management facilities shall be constructed in accordance with approved plans and maintained in proper working condition.

**21.02.02** The landowner is responsible for ensuring that the construction of drainage structures and stormwater management measures are completed in accordance with the approved plan and specifications.

**21.02.03** In response to a complaint, or as a random check on compliance with the requirements of the Ordinance, the Town may perform a physical inspection of the construction of drainage structures and stormwater management measures, or monitor long term maintenance procedures. Inspections performed by the Town during construction will not relieve the landowner or applicant of their responsibility to install and maintain drainage facilities in accordance with the approved plan.

**21.02.04** In accordance with Section 4.18, a written certification shall be submitted prior to issuance of the certificate of occupancy.

(Ord. PL04727-050721, 07-01-2021)

## **21.03 Drainage & Stormwater Management Performance Standards**

**21.03.01** All drainage structures and stormwater management measures shall be designed, constructed and maintained so that adjacent properties are not unreasonably burdened with surface waters as a result of development activities. Specifically:

**A.** Offsite areas which drain to or across a site proposed for development must be accommodated in the stormwater plans for the development.

1. The stormwater management system must be capable of conveying the existing offsite flows through or around the development such that the volume and rate of flow from the adjacent property is not altered.

2. If offsite flows are carried in the site system, any detention ponds shall be sized to accommodate this flow.
  - B. Stormwater drainage facilities shall be designed to limit the discharge from the site to the rate that existed prior to development of the site.
    1. For projects that are redeveloping a developed site, the discharge will be limited to that which occurs before any new development.
  - C. The type and location of the discharge will be as occurred before the current development unless the discharge is to a manmade conveyance system.
    1. If the discharge is in a manmade conveyance the Town of Boone will be furnished an easement to the point that the pre-development flows are duplicated.
- 21.03.02** All site improvements shall be provided with a drainage system that is adequate to prevent the undue retention of surface water on the development site. Surface water shall not be regarded as unduly retained if:
- A. The retention results from a technique, practice or device deliberately installed as part of an approved sedimentation or stormwater runoff control plan, or
  - B. The retention is not substantially different in location or degree than that experienced on the development site prior to site improvements, unless such retention presents a danger to health or safety.
- 21.03.03** These competing goals for retention and discharge can be accomplished by designing, constructing and maintaining all stormwater management installations to the extent practicable to:
- A. Avoid increases in surface runoff volume and velocity by including measures which promote the infiltration of stormwater,
  - B. Maximize the time of concentration of stormwater runoff, and
  - C. Promote the filtration and precipitation of pollutants from stormwater runoff in order to protect the water quality of the receiving watercourse.
- 21.03.04** The drainage system of a development site shall coordinate with and connect to the drainage systems or drainage ways on surrounding properties or streets where they exist.
- 21.03.05** All site improvements shall conform to the natural contours of the land, and without disturbance, utilize the preexisting natural and preexisting man-made drainage ways.
- 21.03.06** Lot boundaries within subdivisions shall be made to coincide with natural and preexisting man-made drainage ways to avoid creation of lots that can only be built upon by altering such drainage ways.
- 21.03.07** Stormwater shall not be diverted from one natural drainage basin into another.
- 21.03.08** Stormwater shall not be channeled or directed into sanitary sewers.

**21.03.09** Design Storm:

- A. The minimum design capacity for all storm drainage facilities and cross drainage facilities in public streets shall be the twenty-five (25) year discharge.
- B. The design of drainage facilities in flood hazard areas shall be consistent with the requirements of Article 30.
- C. The computation of stormwater runoff shall follow established engineering best practices. Acceptable methods of computation include, but are not limited to, those outlined in the Soil Conservation Service National Engineering Field Manual, the Rational Method, and published U.S. Geological Survey techniques for estimating stream flow. Runoff coefficients shall be based on full development of the watershed to the extent of the current zoning.
- D. Stormwater detention shall be provided to ensure that the rate of discharge does not exceed the pre-development rate of discharge. In order to demonstrate this, pre and post development hydrographs will be submitted that demonstrate no increase in flow leaving the site during the twenty-five (25) year twenty-four (24) hour storm. Inflow-outflow calculations shall also be submitted for any stormwater detention ponds.

**21.03.10** Stormwater pipe for either culverts or closed systems shall be constructed of either reinforced concrete, corrugated steel, or aluminized pipe in conformance with North Carolina Department of Transportation (NCDOT) Standard Specifications or high-density polyethylene corrugated pipe with smooth interior which meets the product specification of ASHTO M294.

- A. Corrugated steel pipe shall be fully bituminous coated. In lieu of fully bituminous coated galvanized pipe, aluminized pipe without a bituminous coating may be used. Pipe which carries active stream flow shall be partially paved (paved invert) fully bituminous coated galvanized pipe. In lieu of fully bituminous coated partially paved galvanized pipe, aluminized pipe which has been half bituminous coated and partially paved may be used. Connecting bands shall conform to NCDOT Standard Specifications.
- B. Minimum pipe diameter shall be eighteen inches (18") for open ended culverts and fifteen inches (15") for closed systems and driveway culverts. Minimum pipe diameter for portions of closed systems placed outside the public right-of-way and privately maintained shall be twelve inches (12").
- C. Depth of cover shall be appropriate for the pipe material, pipe wall thickness and anticipated loading. Minimum depth of cover shall be twelve inches (12").
- D. Downsizing of culverts within pipe systems is prohibited.
- E. Storm drainage piping shall be placed in a straight alignment at uniform grade. No changes in alignment shall be allowed except at catch basins, manholes, or other junctions that provide appropriate clean out access.

- F.** Storm drainage structures, including inlet grates and frames, shall conform to NCDOT Standard Specifications.
- G.** No change in pipe material shall be allowed except at storm drainage junctions.
- H.** Existing stormwater conveyance infrastructure on or through any site being considered for development or redevelopment may remain in place and active, subject to the following criteria:
  - 1. The conveyance system meets all requirements of this Article, except Subsection 21.03.10-A and the system is certified by a design professional to be properly sized with capacity to handle the applicable design storm. The design professional shall also provide a qualitative assessment of the system to include observations of visible signs of erosion, scour, corrosion, degradation, or other structural inadequacies, along with recommendations for any suggested improvements.
  - 2. That the landowner will, at their expense, repair or replace the system or components thereof in the event that the system should fail to function at any time in the future. Any such repair or replacement shall be in accordance with all provisions of this Article.
- I.** The centerline of any culverts placed along a roadway shall be a minimum of ten feet (10') from the edge of pavement or edge of unpaved travel way.
  - 1. Due to the extreme topography or other unique features related to a specific driveway, it may not be practical to install the culvert at this location.
  - 2. Upon demonstration of adequate cause, the permit-issuing authority may allow deviations from this requirement.
  - 3. The applicant shall demonstrate that the proposed deviation will result in a culvert that adequately provides the drainage function and minimizes the chance that the ends of the culverts will be damaged.

**21.03.11** Hydraulic Design:

- A.** Design capacity headwater elevations for open ended culverts shall be below the roadway shoulder or finished site grade elevation.
- B.** Design capacity hydraulic grade line for closed pipe systems shall be at or below the inlet grate elevation.
- C.** The hydraulic design of culverts and pipe systems shall take into account the effect of tail water and allow for all energy losses within the system.
- D.** Drainage design calculations shall be submitted demonstrating compliance with these regulations.
  - 1. Minimum information required is a tabulation of the system which presents the type of each inlet, time of concentration, volume to the inlet, size of pipe, length of

pipe, pipe inverts at both the high and low end, and hydraulic grade line for each pipe section.

**21.03.12** End Treatments:

- A. Headwalls, flared end sections, or other adequate slope protection shall be provided at culvert ends.
- B. Storm drain outlets shall be protected against erosion by providing energy dissipaters and/or other adequate channel lining.

**21.03.13** Open Channels and Ditches:

- A. Design capacities for open channels and ditches shall be determined by the Manning Equation.
  - 1. The value of the roughness coefficient shall be appropriate for the material encountered and the condition of the channel.
- B. All ditch bottoms and side slopes shall be stabilized with pavement, stone, or vegetative linings adequate to withstand design velocities.
  - 1. Stone rubble linings shall be placed on filters of washed gravel and/or geotextile fabric.

**21.03.14** NCDOT Standard concrete curb or combination curb and gutter is required for the direction and control of stormwater in all parking lots. Alternate effective control measures which are consistent with Subsection 21.03.03 will be considered for approval on a case by case basis.

**21.03.15** Use of drainage swales rather than curb and gutter with storm sewers is provided for in Article 23.

**21.03.16** Building construction is prohibited from being horizontally closer than:

- A. Ten feet (10'), from the centerline of drainage culverts less than forty-eight inches (48") in diameter, or
- B. Ten feet (10') plus one half the culvert diameter, from the centerline of drainage culverts greater than forty-eight inches (48") in diameter.

This restriction shall not apply to building roof, foundation drains, or incidental yard drains which originate closer than ten feet (10') to the building and convey stormwater immediately away from the building.

**21.03.17** Culverts or pipe systems which convey stormwater to or from existing enclosed drainage facilities shall be connected to the existing facility with an enclosed junction.

- A. Connections to existing facilities in public rights-of-way shall require the execution of an encroachment agreement with the Town for Town streets or the NCDOT for state-maintained roads.

- 21.03.18** Where impoundment or detention facilities are included in the design of stormwater management installations, every effort shall be made to minimize the degree of maintenance required to ensure the continuing effectiveness of the facility.
- A.** Maintenance of stormwater impoundment or detention facilities shall be the responsibility of the landowner.
  - B.** Where impoundment or detention facilities are to be located in common areas, the applicant shall record with the Watauga County Register of Deeds an instrument setting forth provisions for the establishment of a property owners association for the purpose of assessing dues for maintenance of the facilities by purchasers of property which will be served by the facilities within the development. The applicant shall maintain these facilities until such time that the property owner's association assumes responsibility for maintenance.

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