December 11, 2013

City of Durham Stormwater Development Review Comments on Partially Impervious Surfaces

SECTION 51.(e) "The Environmental Review Commission shall study State stormwater programs, including how partially impervious surfaces are treated in the calculation of built-upon area under those programs. The Environmental Review Commission shall report its findings and recommendations to the 2014 Regular Session of the 2013 General Assembly."

History of "impervious" in City of Durham

- Subject to Watershed Protection rules to protect water supplies
- Pollutant of concern was TSS
- Studies linked water quality streams to % impervious in watershed, >24% impervious ⇉ stream quality impairment
- Paving better than gravel RE: TSS (gravel can have a lot of fines)

Current interpretation of "impervious" in City of Durham:

- "*Impervious surface* means a surface that because of its composition and/or its use impedes the natural infiltration of water. It includes but is not limited to buildings, roofs, solid decks, driveways, parking areas, patios, sidewalks, and compacted gravel areas. It does not include areas that are part of permitted stormwater controls or the open surface water such as swimming pools." [Section 70-736 of Stormwater Performance Standards for Development ordinance]
- Our concern with gravel is not only with it being impermeable, but also with the soil underneath the gravel becoming compacted due to load (pedestrian or vehicle traffic)
- Areas <u>landscaped</u> with rock not considered impervious
- Site-specific consideration may be given for other situations where gravel is not load-bearing (e.g., power substation and cell tower enclosures)
- City uses TR-55 Watershed Hydrology modeling, which regards gravel roads as having a Curve Number of 91 (in HSG D soils, which is much of Durham) vs. a Curve Number of 98 for paved roads (the higher the surface's Curve Number, the more rainfall runs off of the surface)

Thoughts on gravel as partially impervious surface

- Considering gravel parking lots, roads, etc. as pervious will:
    - <u>Help new development</u> (the pollutant loading will decrease if gravel areas are categorized as something other than 100% impervious surfaces)
    - <u>Hurt re-development</u> (existing gravel surfaces would not be "grandfathered in" as existing impervious, which could trigger

the need for a high level of stormwater treatment on site for projects that proposed to convert gravel footprint to impervious footprint)
    - Because much of Durham is already developed, we are seeing a number of good redevelopment projects being proposed
- Any determination on how partially impervious surfaces should be treated in the calculation of built-upon area needs to be flexible to account for varying factors:
    - Underlying Soil: Much of Durham is underlain by Triassic Basin clay soil, which by itself, is low in permeability when compared to sand or silty soil.
    - Definition of gravel:
        - What size is it? For example, does it include the larger stone used for railroad ballast?
        - What material is it?
            - Open graded gravel is generally one size, relatively uncompacted, with more void space.
            - ABC stone (Aggregate Base Course) tends to be more compacted with less void space due to fines.
            - Asphalt millings – will rebind together given heat
    - One size does not fit all in terms of how much water will infiltrate a given "gravel" surface

Respectfully submitted by:

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Calculation of Built-Upon Area when Partially Impervious Surfaces are Present

SECTION 51.(e) The Environmental Review Commission shall study State stormwater programs, including how partially impervious surfaces are treated in the calculation of built-upon area under those programs. The Environmental Review Commission shall report its findings and recommendations to the 2014 Regular Session of the 2013 General Assembly. LOB Room 414

Partially impervious surfaces should be given credit proportional to the volume of runoff that the surface infiltrates as compared to an impervious surface. Volume reduction should be based on soil infiltration rate measured at the site. Where clay soils are present, partially impervious surfaces must be engineered. All partially impervious surfaces need to be properly constructed to ensure the underlying soils maintain their permeability. It is appropriate to reduce Built-Upon Area based on the volume of rainwater that the surface infiltrates.

When runoff is not properly managed, impervious surfaces cause flooding and water quality degradation

Local flooding

- Areas of the City of Durham experience property damage as a result of local flooding. In the early years of our program, much of our effort was to addressing local flooding.

Water quality mandates

- Durham is the most regulated city in North Carolina.
- Durham County has five different water supply sources requiring water supply watershed protection: Lake Michie Reservoir, Little River Reservoir, Eno River intake, Jordan Lake Reservoir and Falls Lake Reservoir.
- Our earliest efforts to protect drinking water began in 1984, with WSWS kicking in in 1994
- Durham is subject to three different Nutrient Sensitive Water Strategies: Neuse, Jordan, and Falls. Our first Nutrient Strategy requirements kicked in early 2001 almost 13 years ago.

Program to reduce impacts of flooding, protect water quality

- The City's Stormwater Program has an operating budget of $13.6 million.
- Our stormwater Capital Program over the next three years is expected to be near $18 million.
- Our capital program includes replacing failing infrastructure, mitigating property damage from flooding, and retrofitting existing developed areas to treat stormwater runoff in order to protect downstream drinking water.

Common denominator

- The common denominator both in flooding and in nutrient runoff is impervious surface.
- Impervious surface is the single most important factor in increasing runoff which contributes to property damage from flooding.
- Impervious surface is the single most important factor in increasing nutrient loading from urban areas. We are not seeing high concentrations of nutrients in our urban streams compared to undeveloped areas. But there is a huge increase in runoff volume, and that volume is carrying more nutrients.

We've Kept it (Impervious) Simple

- NC has historically used a very clean, simple approach for Phase II stormwater, WSWS and coastal protection.
- Treat stormwater runoff from all impervious areas for a certain rainfall event depth, the design storm.
- Simple works well when the goal is not especially demanding.

Reality check

- Impervious ARE NOT all equal;
    - Roadway runoff directly piped to a stream, versus a roof that drains to a large lawn.
    - Roadway runoff from an asphalt parking lot versus from a parking lot with a properly constructed permeable pavement section.
    - Roadways of compacted crush-and-run gravel (ABC stone) are impervious, and contribute sediment from gravel fines during heavy rain.
- To properly account for the permeable pavement and the disconnected rooftop, the process has to get more complicated, but it is not unmanageable.
- Other states have adopted methods that we could learn from:
    - New Jersey focuses on effective impervious area; they have calculation procedures to apply where, say, rooftop runoff is directed to lawns.
    - Many states focus on directly connected impervious area.
    - In many Chesapeake Bay states, instead of being asked to calculate pounds of nitrogen and phosphorous kept out of the Bay – cities and counties are instead being asked to manage stormwater runoff from a certain percentage of their effective impervious cover.
    - If you can determine how much rainwater is infiltrated or lost over a given area, it is straightforward process to calculate the reduction in impervious area.
- Underlying soil and proper construction are critical (e.g. farmers are advised not to work their soil too early in the spring because working soil that is wet results in soil compaction)

Effective impervious area

- A partially impervious surface needs to be properly engineered and properly constructed for it to function with the underlying soil.
- Built upon area reduction credit for partially impervious surfaces should be calculated based on the volume of runoff that the surface infiltrates, (The Simple Method or the Runoff Reduction Method)
- Soil infiltration rates should be measured prior to construction.

John H. Cox
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