Land Development Services

Technical Bulletin

Subject: Localized Flooding Mitigation Policy for Residential Infill Development-Detention Requirements **Date: 8/5/22** **No.: 22-06**

Summary: The Localized Flooding Mitigation Policy for Residential Infill Development-Detention Requirements (policy) establishes criteria and a standard method to limit expected increases in stormwater flows generated by residential infill lot development. The value is in simpler design and review while protecting downstream properties and waterways from these stormwater increases. The policy also provides a consistent and predictable path to complying with stormwater regulations for residential infill lots. It also clarifies interpretation of these regulations and provides simplified design standards and procedures.

Effective Date: This policy is applicable to all non-bonded residential infill lot development plans submitted after September 5, 2022.

Background: Unmanaged stormwater runoff contributes to localized flooding and erosion of properties and stream channels, especially in urbanized watersheds and established neighborhoods in Fairfax County (County). Increased stormwater flows from residential infill lot development contribute to these problems. Recent research from Virginia Polytechnic Institute and State University (Assessment of Residential Infill Development on Stormwater) analyzed residential infill development trends in the County and documented the development's cumulative impact on increasing stormwater volume, finding:

- From 2002 to 2015, the Dead Run watershed's imperviousness increased from 29% to 33%, resulting in a 3.5% increase of runoff volume from the 10-year/24-hour storm event.
- Over one-third of the cumulative runoff volume increases in the Dead Run Watershed during the study period was generated from lots exempt from water quantity controls.
- If future infill development follows the same trend, the area of analysis will witness a 0.3% increase in imperviousness per year.

A Center For Watershed Protection study (Impacts of Impervious Cover) also projects most stream quality indicators decline when watershed imperviousness cover exceeds 10%, with severe degradation expected at 25%. The cumulative yearly increase of imperviousness from residential infill in largely developed watersheds will result in continued degradation of already impaired streams.

The increase in imperviousness across the county has increased stormwater runoff quantity, causing stream channel degradation, insufficient storm sewer networks, and inadequate overland

drainage in existing neighborhoods. In response, the Director of Land Development Services (Director) has determined additional attention must be given to onsite mitigation of increased imperviousness.

The County functions as a Virginia Erosion and Sediment Control Program (VESCP) authority. As identified in Chapter 104 (Erosion and Sediment Control) of the County Code of Ordinances, Land Development Services (LDS) has the responsibility within this program to ensure residential infill lot development provides appropriate mitigation to minimize its contributions to general drainage and outfall problems stated above. Minimum Standard (MS) 19 of the Virginia Erosion and Sediment Control Regulations (9VAC25-840-40.19.c), as incorporated at Fairfax County Code § 104-1-8, allows LDS to identify stormwater detention as the most valuable measure to the VESCP to provide appropriate mitigation for residential infill lot development projects (not otherwise exempted). Fairfax County Code § 104-1-8, also applies the County's Public Facilities Manual (PFM) to all residential infill lot development projects identified in this paragraph. Consequently, many residential infill lot development situations warrant onsite stormwater detention.

LDS has stated in a prior industry notice "that for residential infill lots discharging runoff as sheet flow, unless there is no increase in the peak rate of the 10-year frequency storm runoff after development or redevelopment, the Director may require onsite stormwater management measures to control water quantity" where increase in flows would cause adverse impact.

At a minimum, the design professional must evaluate the 2-year/2-hour and 10-year/2-hour storms when designing retention and detention facilities within the County (PFM 6-1301.5). The 10-year/2-hour rainfall depth is 2.56 inches (PFM Table 6.13). The County, for decades, has allowed detention facility design to be based on either the 2-hour (for drainage areas < 20 acres) design storms or the 24-hour design storms, and the state has acknowledged this practice (9VAC25-870-72.E) by formalizing the allowed use of the Modified Rational Method that generates the 2-hour detention design hydrographs.

It can be concluded, then, that stormwater storage capacity equal to 2.56 inches of rainfall, as direct runoff, from proposed increases in impervious area provides a reasonable detention criterion to apply to individual residential infill lots within the County. This criterion should significantly reduce the potential to exacerbate downstream erosion and flooding problems by minimizing corresponding increases in 2-year and 10-year peak runoff rates from this type of development. The design rainfall depth specified in this policy is larger than rainfall depths associated with approximately 98% of the annual storm events (of any duration) that normally occur in the County (Figure 2, Runoff Reduction Method). The proposed detention storage capacity determined by design tools of this policy should then be reasonably sufficient to minimize infill lot flow increases for these storm events and should also impact infill lot flow increases positively for some larger storm events.

Policy:

Designers must analyze downstream networks for adequacy of outfall systems or may presume inadequate outfall conditions and apply the detention requirements of this policy.

Presumption of inadequate outfall and voluntary application of this policy to any residential infill lot development project eliminates the need to develop an adequate outfall analysis. This presumption may reduce the overall number of submittals per project compared to finding an inadequate outfall during a plan review cycle. The County will review all outfall analyses and consider all known downstream flooding and erosion problems.

This policy establishes the Simple Infill Detention Method (SIDM) to comply with stormwater quantity regulations by providing onsite detention storage capacity for a stormwater volume equal to 2.56 inches of rainfall assumed to be direct runoff from the proposed net increase in total impervious area.

Increases of less than 160 square feet of impervious area over existing conditions may be exempted from this policy on lots exempted from the Stormwater Management Ordinance (SWMO). Lots that are subject to the SWMO have no exempted increase in impervious areas. This policy applies to all such development, regardless of whether the disturbed area's stormwater discharge will be concentrated or sheet flow.

All outfall analyses must consider known downstream conditions. If an inadequate outfall is found, or an adequate outfall cannot be demonstrated, management of increases in flow is required to not exacerbate flooding and erosion problems downstream. Designers not wishing to use tools in this policy may continue to design stormwater management facilities using existing methods to prevent exacerbating downstream erosion and flooding problems.

The SIDM is described in Attachment A and is the recommended compliance method when detention is required on infill lot developments. The attachment identifies standards and procedures recommended for implementing this policy and provides calculation tools and design details for designers to easily comply with detention requirements. Standards and procedures may be updated by the Director as the SIDM evolves. SIDM design tools are available here: https://www.fairfaxcounty.gov/landdevelopment/stormwater-management-design-residential-infill-lot-grading-plans

Limitations: This policy is intended to mitigate impacts of new residential infill lot development on flooding and property/channel erosion but is not expected to resolve existing localized flooding and erosion problems. It also does not provide solutions to flooding and erosion, or increased flooding and erosion, attributable to all storms.

If you have any questions, please contact Matthew Hansen in the Site Development and Inspections Division at Matthew.Hansen@fairfaxcounty.gov or **703-324-1720, TTY 711.**

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Attachment[s]: Attachment A - Simple Infill Detention Method (SIDM)**Attachment A –**

Simple Infill Detention Method (SIDM)

A Simple Method for Developing Infill Lot Detention Computations and Facility Designs:
The Director of Land Development Services establishes the Simple Infill Detention Method (SIDM) for application to non-bonded residential infill lot projects (only) in order to:

- provide a simple and consistent pathway to comply with Localized Flooding Mitigation Policy-Detention Requirements and several stormwater regulations applicable to residential infill lots.
- minimize County plan review times and designer frustration.
- incorporate interpretations of applicable stormwater regulations directly into designs; and
- foster implementation of simple design processes.

Application of the SIDM to a residential infill lot project should result in a detention facility design that appropriately mitigates stormwater impacts related to increases in impervious areas and may be substituted for more detailed hydraulic design analyses. Compliance with SIDM for non-bonded residential infill lot projects satisfies detention and outfall channel/flood protection requirements of Virginia Erosion and Sediment Control Regulations Minimum Standard 19 (9VAC25-840-40.19), the Stormwater Management Ordinance (SWMO) – Fairfax County, Virginia - Code of Ordinances, Chapter 124, and Fairfax County Public Facilities Manual (PFM).

SIDM design tools are available at this website for infill lot plan designers:
https://www.fairfaxcounty.gov/landdevelopment/stormwater-management-design-residential-infill-lot-grading-plans

Eligibility:
Any land-disturbing activity in excess of 2,500 square feet proposed for non-bonded residential infill development in Fairfax County (County) should apply SIDM design procedures and details -- subject to limitations identified below -- to satisfy detention design and analysis requirements. The designer will otherwise provide more comprehensive detention design analysis, facility details and outfall channel/flood protection analyses described in the SWMO, the PFM, MS 19, and applicable portions of the Stormwater Management Plan Completeness Checklist.

Acceptable Detention Practices:
Simple designs with standard details for the following practices and facility types have been developed for application to non-bonded residential infill lot projects (only) in the County.

- Urban Bioretention Planter Box (UPB1 & UPB2)
- Bioretention-Detention Rain Garden (RG)
- Underground Pipe Detention (UPD)

Note: the UPB1 & UPB2 facilities are eligible for Virginia Runoff Reduction Method (VRRM) Level 1 water quality credit, as VRRM Urban Bioretention practice 2.i, per the Virginia Department of Environmental Quality (DEQ) Stormwater Design Specification No. 9 (DEQ-9). The RG facility is not currently eligible for Best Management Practices (BMP) water quality credit but has been proposed to DEQ as a facility design that should qualify for Level 1 bioretention credit. The UPD facility is not eligible for water quality credit.

Detention Practice Design Requirements:

General – Each UPB1, UPB2, RG, and UPD facility must be designed with (1) a facility-specific Standard Design Calculations Spreadsheet and (2) a Standard Design [Plan] Sheet. A Standard Pretreatment/Outlet Protection Details [Plan] Sheet, and a Standard General Site SWM/BMP Data [Plan] Sheet, have also been developed and must be used in facility design.

Plan sheets needed to propose a facility design are the (1) General Site Data Sheet; (2) the facility Design Sheet(s); and (3) the Pretreatment/Outlet Sheet. All calculations required to demonstrate an appropriate facility design are first extracted from the facility's calculations spreadsheet and then inserted onto the facility's Design [Plan] Sheet (per the specific instructions contained in the AutoCAD file for each individual facility's Design Sheet).

Facility Sizing – The designer must enter limited requested data on the DesignCalcs tab of a facility's Design Calculations spreadsheet to size an individual facility and each facility-type spreadsheet allows two or more (depending on the type) of the same facility type to be designed for an individual lot. Any one or more of the four facility types may be proposed in a detention design for an individual lot. Then, for each different facility type proposed, and the corresponding spreadsheet needed for that design, total additional impervious surface area created by the proposed land disturbance must be entered as well as the portion of this onsite total the designer wishes to allocate to the particular facility type. (This allocation is typically based on the designer's proposed location for a facility and the drainage area that is or can be directed to that location.) The remainder of the data the designer must enter to size a facility are facility-type specific and identified below, along with additional design limitations:

- Urban Bioretention Planter Box 1 (UPB1)
    - Up to five individual facilities can be designed for a single lot with one spreadsheet.
    - Remaining general data entry: Yes or No, to distinguish whether BMP credit is to be claimed.
    - Remaining individual facility data entries: ID (numbers and/or letters) of the impervious area to be drained to the facility and proposed width of facility.
    - Only roof area is permitted to drain to this facility type, with no more than 2,500 sq. ft. allowed to drain to an individual facility.
    - This is the only facility type allowed to be located within 10 feet of a residential structure.

- Urban Bioretention Planter Box 2 (UPB2)
    - Up to three individual facilities can be designed for a single lot with one spreadsheet.
    - Remaining general data entry: Yes or No, to distinguish whether BMP credit is to be claimed.
    - Remaining individual facility data entries: ID (numbers and/or letters) of the onsite impervious area to be drained to the facility, and proposed width and soil media depth for that facility.
    - Only onsite impervious area is permitted to drain to this facility type, with no more than 5,500 sq. ft. allowed to drain to an individual facility.
    - This facility type must be located at least 10 feet from a residential structure.

- Bioretention-Detention Rain Garden (RG)
    - Up to three individual facilities can be designed for a single lot with one spreadsheet.
    - Remaining general data entry: total onsite area (impervious + pervious) to be drained to the facility type.
    - Remaining individual facility data entries: ID (numbers and/or letters), of the onsite impervious & total (impervious + pervious) areas to be drained to the facility, and proposed soil media depth for that facility.
    - Only onsite impervious + pervious area is permitted to drain to this facility type; with no more than 5,500 sq. ft., and pervious area at no more than double the actual impervious area, allowed to drain to an individual facility.
    - This facility type must be located at least 10 feet from a residential structure.

- Underground Pipe Detention (UPD)
    - Up to two individual facilities can be designed for a single lot with one spreadsheet
    - Remaining individual facility data entries: ID (numbers and/or letters), of the onsite impervious area to be drained to a facility, and the proposed diameter, material & row length for that facility. The row length can be iterated to optimize the total required equivalent pipe length.
    - Only onsite impervious area is permitted to drain to this facility type, with no less than 600 sq. ft., nor more than 25,000 sq. ft. allowed to drain to an individual facility.
    - Allowed pipe diameters are limited to 24-inch, 30-inch and 36-inch; and allowed materials are limited to HDPE, PP & CAP. A smooth pipe bottom is required.
    - This facility type must be located at least 10 feet from a residential structure.

Facility Details – The Standard Design [Plan] Sheet for each facility type already contains the General, Pretreatment (via reference to the Pretreatment/Outlet Sheet), Structure/Foundation, Materials, Construction, and Maintenance standard notes and/or specifications, as well as standard generalized typical plan and section detail drawings, required for design. The designer's

direct input on all Design Sheets consists of inserting design data tables developed in the corresponding Standard Design Calculations Spreadsheet and providing the drainage area map(s) for the proposed project. Requirements for the drainage map(s) are defined in the General Notes section of each Design Sheet. Designers may also choose to provide supplemental site-specific or project-specific calculations and/or notes. Space has been reserved on each Design Sheet for the design data table inserts and for the designer's drainage map(s) and additional calculations/notes. Some facility-specific details designers must incorporate into the scaled drainage area map(s) – besides drainage area boundaries/measurements and outlet details – or additional calculations/notes are:

- UPB1
    - Depicted facility locations, length/width dimensions, and locations of flow structures & pretreatment devices.
    - Depicted location of each front wall (FW).
    - Callouts for proposed soil media depth if > 18 inches.
    - Structure/foundation calculations, notes, specifications, and detailed drawings.

- UPB2
    - Depicted facility locations, length/width dimensions, and locations of flow structures & pretreatment devices.
    - Depicted location of each front wall (FW).
    - Callouts for proposed soil media depth if more than applicable minimum depth.
    - Structure/foundation calculations, notes, specifications, and detail drawings.

- RG
    - Depicted facility locations and shapes/containment berms, surface area measurements, and locations of flow structures and pretreatment devices/practices.
    - Callouts for proposed soil media depth if more than 24 inches.

- UPD
    - Depicted facility locations and layouts -- including pipe lengths (individual segments and total) and number of rows -- and locations of the flow control structure, the other flow structures, and pretreatment devices.
    - Callouts for proposed system pipe size and material.
    - Flow control structure sections if different than standard sections.
    - Groundwater/bedrock locations and/or system anchorage designs.

Designers must enter limited requested data on the DesignData & DesignData-2 tabs of a facility's Design Calculations spreadsheet to prepare required design data tables for insertion on the corresponding Design Sheet. The DesignData tab includes the Design Data table and the Pretreatment/Outlet table, while the DesignData-2 tab contains the Structure Location table. Some data in these tables are generated internally by the spreadsheet, and data the designer must enter to finish populating the tables for a facility type are identified below:

- UPB1
  - Design Data – design elevations for three key locations.
  - Pretreatment/Outlet – pretreatment practice and outlet protection selections.
  - Structure Location – centerline locations or offset distances for flow structures.
  - Recommended plant list also included in spreadsheet. Proposed Planting Plan to be included on Landscaping Plan Sheet for project.

- UPB2
  - Design Data – design elevations for three key locations.
  - Pretreatment/Outlet – drainage area source & outlet protection selections.
  - Structure Location – centerline locations or offset distances for flow structures.
  - Recommended plant list also included in spreadsheet. Proposed Planting Plan to be included on Landscaping Plan Sheet for project.

- RG
  - Design Data – design elevations for three key locations.
  - Pretreatment/Outlet – drainage area source, pretreatment practice & outlet protection selections.
  - Structure Location – offset distances for flow structures.
  - Recommended plant list also included in spreadsheet. Proposed Planting Plan to be included on Landscaping Plan Sheet for project.

- UPD
  - Design Data – design elevations for three key locations, and drainage area source & facility configuration selections.
  - Pretreatment/Outlet – outlet protection selections, and minimum ground cover depths.
  - Structure Location – offset distances for excavation pit or trench location, and for flow control structure & outlet discharge locations.

Standard Pretreatment/Outlet Protection Details Sheet – This standard plan sheet must be included in the set required for proposing a project's detention design. The sheet contains the notes, specifications and detail drawings of all allowed pretreatment and outlet protection practices. Permitted pretreatment practices are: gutter screen, in-line leaf strainer, inflow rock (as riprap), debris trap, gravel diaphragm (as flow spreader), grass filter strip, and outlet protection (scour/erosion protection) for any RG inflow pipe. Permitted outlet protection practices are: drywell, grass, turf/sod, small rock (as riprap), existing impervious surface, and connecting to an existing adequate conveyance system. Not all pretreatment practices are available for each facility type, but all outlet protection practices are available for each (although contributing impervious area limitations apply). There is no designer data entry required for this sheet.

Standard General Site SWM/BMP Data Sheet – This standard plan sheet must be included in the set required for proposing a project's detention design. The sheet comes with standard notes,

but most of the content must be provided by the designer. Standard notes include SIDM instructions and design notes common to multiple, if not all, facility types. Designer content responsibilities include, but are not limited to, the following:

- Existing and proposed impervious area sketches/calculations.
- Required portions of VRRM spreadsheet.
- Overland relief narrative and analysis.
- Overall drainage area map including offsite topography.
- Location assessments for facilities & site outfalls including descriptions of downstream receiving systems and potential impacts to adjacent property structures.

Terms of Use:
SIDM is proposed for implementing requirements of this Policy only and provides a direct path to speed, consistency and predictability with regard to design, review and construction of stormwater management facilities proposed for residential infill lot projects. Detention is the primary consideration in development of facility types and practices included in SIDM. Application of SIDM to a project implies acceptance of the following terms of use:

- Established design details, limitations, specifications, etc., for included facility types shall not be violated when SIDM is applied. If the designer would like to modify, for a particular facility type, any one or more of "standard" design data/specifications, etc., or the outcome of the "standard" design calculations, to any degree, that designer must instead choose another facility type or practice, perhaps even outside SIDM, to satisfy the need for the proposed modification. However, only the UPB1, UPB2, RG and UPD facility types and practices qualify for any submittal/review (or other) benefits associated with SIDM as time goes on; and standard design spreadsheets and plan sheets, or parts thereof, created for SIDM shall not be transferred, to any other SWM/BMP practices outside SIDM. The expectation of SIDM usage is non-negotiable standard designs will ultimately constitute at least most residential infill lot project detention designs.

- The County has fully vetted design standards of facility types and practices included in SIDM, and these design standards will only be acceptable in whole, and not in part. Individual assumptions, Code interpretations, methodologies, limitations, etc., included in SIDM design standards are valid only when considered together within SIDM and may not be valid when considered separately or in any other combination outside SIDM.

- SIDM must be used to design facilities that provide 100% of a project's required detention and/or runoff reduction, when applied. Mixing other detention or runoff-reduction practices with practices and facility types included in SIDM is not permitted.