

STORMWATER MANUAL: A GUIDE TO STORMWATER REQUIREMENTS FOR LAND DISTURBING ACTIVITIES IN ARLINGTON COUNTY

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Abbreviations

DES – Arlington County Department of Environmental Services

DEQ – Virginia Department of Environmental Quality

ISD – Arlington County Inspection Services Division

MMA - Maintenance and Monitoring Agreement

RPA – Resource Protection Area

SWMF – Stormwater Management Facility

WQIA – Water Quality Impact Assessment

1 Introduction

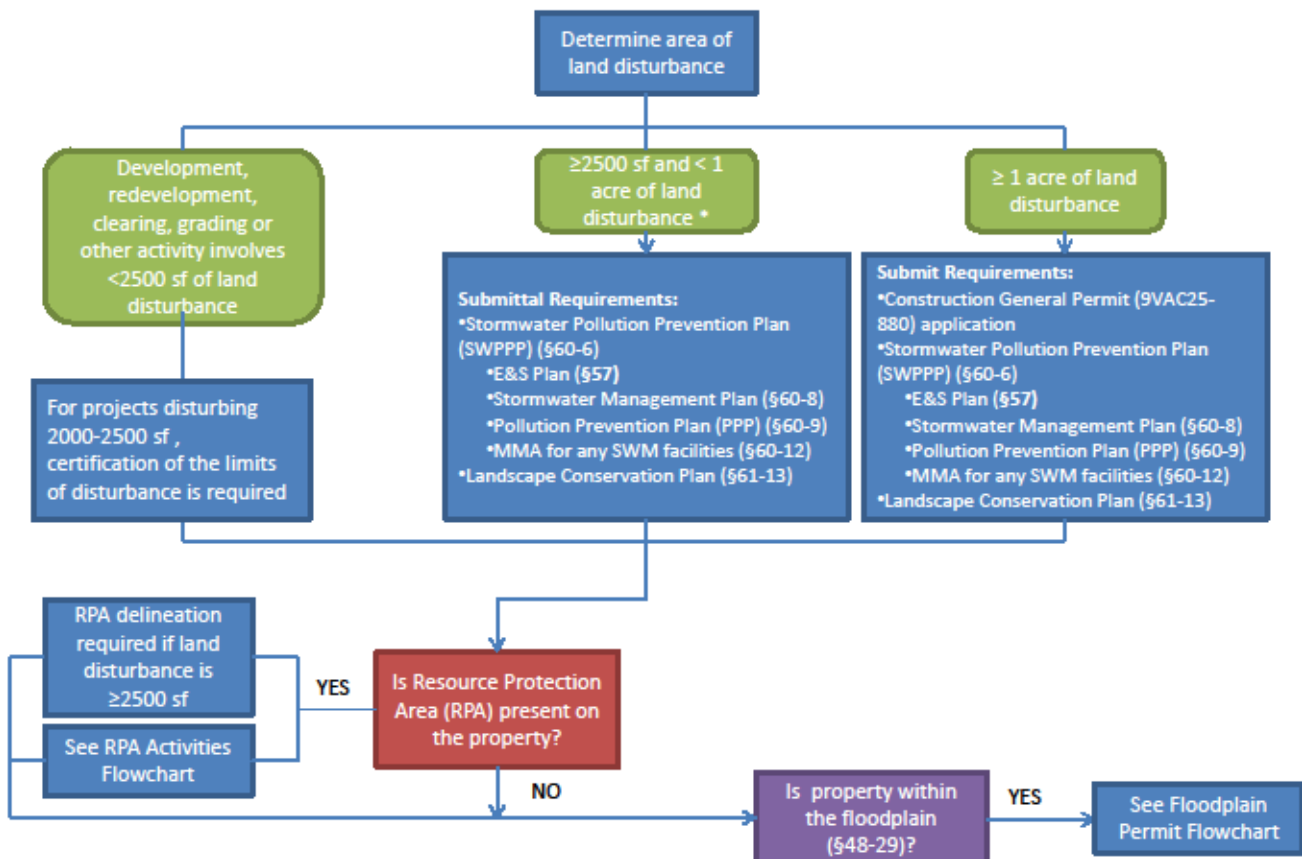
This manual outlines the stormwater requirements for all land disturbing activities in Arlington. A Land Disturbing Activity/Stormwater (LDA) Permit is required for any land disturbing activities that disturb equal to or greater than 2,500 square feet of land, as required by the Erosion and Sediment Control Ordinance (Chapter 57), Stormwater Management Ordinance (Chapter 60), and the Virginia Erosion and Sediment Control Program. Land disturbing activities within Resource Protection Areas (RPAs) regulated under Chesapeake Bay Preservation Ordinance (Chapter 60) are also governed by this manual.

The area of land disturbance includes cumulative land disturbance over two (2) years, which will be calculated for any project during this period that involves structures, paved areas, and/or retaining walls to track whether the cumulative threshold is exceeded.

Projects with land disturbance of 2500 square feet or greater are subject to the requirements of Chapter 2 and 3 of this manual. Any land disturbance in a Resource Protection Area (RPA) is subject to the requirements of Chapter 4 of this manual.

The following flowchart outlines the submission process for activities that will cause land disturbance.

Regulatory Flowchart for determining required submissions for permitted activities



*The Stormwater Pollution Prevention Plan (SWPPP) in §60-6 applies if the cumulative land disturbance on a site will be ≥2500 sf within two years, even if separate permits are obtained.

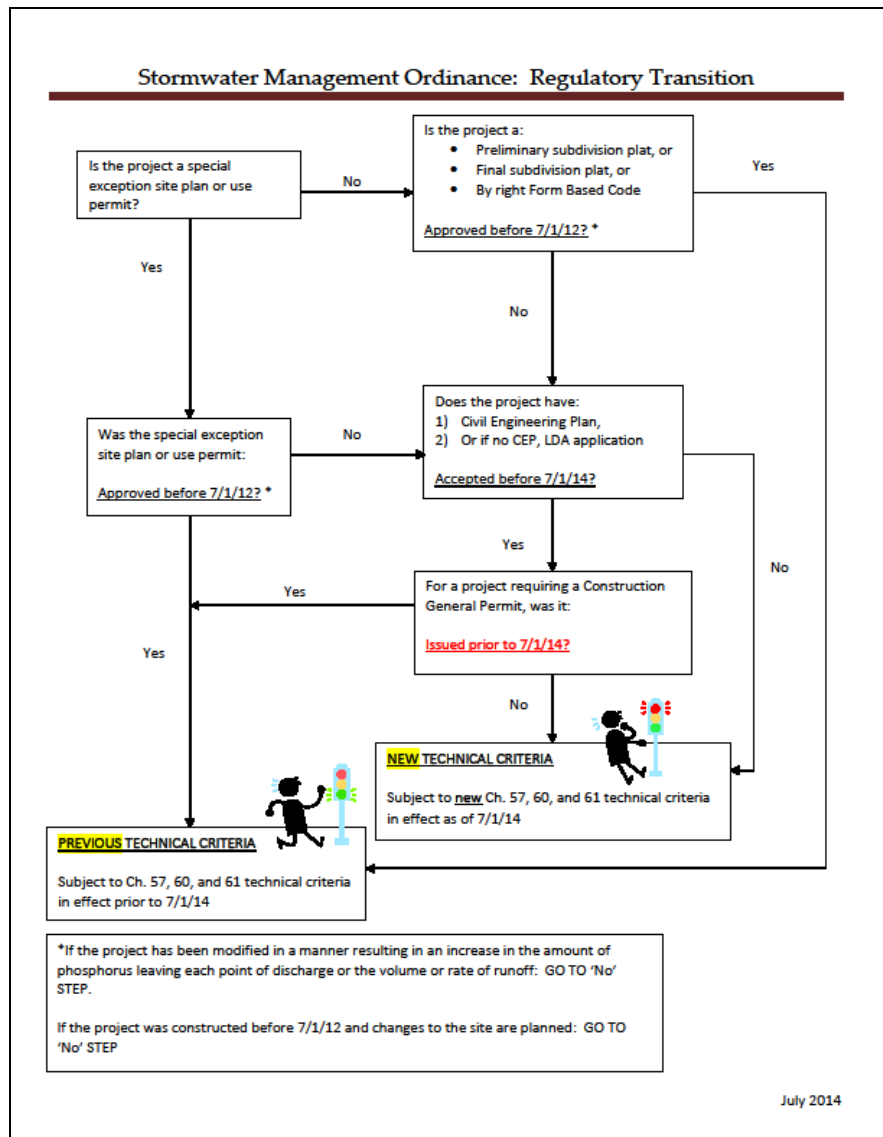
2 Stormwater Pollution Prevention Plan (SWPPP) Requirements

Any activity that disturbs greater than or equal to 2500 square feet requires a Stormwater Pollution Prevention Plan per the requirements of Arlington County Code Chapter 60. This plan contains the following elements:

- Erosion and Sediment (E&S) Control Plan
- Stormwater Management Plan (SWMP)
- Pollution Prevention Plan (P2 Plan)
- Virginia Stormwater Management Program (VSMP) Requirements
- Stormwater Facility Maintenance and Monitoring Agreement (MMA)

2.1 Regulatory Transition

The following flowchart lays out what requirements certain projects are subject to based on the type of project, the plan approval date, and the type of permits obtained. In some cases, projects will be reviewed under previous versions of the regulations.



2.2 Erosion and Sediment (E&S) Control Plan

An erosion and sediment control plan must be submitted that satisfies the requirements of Arlington County's [Erosion and Sediment Control Ordinance](#) (Chapter 57 of the County Code).

Specifically, the E&S plan must:

- Minimize the construction footprint.
- Delineate the limits of clearing and grading, including details about how these limits will be physically marked in the field.
- Delineate the RPA boundary (see Chapter 4 of this Manual), including details about how this boundary will be physically marked in the field.
- Include tree protection measures required under the approved Landscape Conservation Plan to ensure protection during clearing, grading, and all phases of construction.
- Provide for a single ingress/egress point for construction activities, unless otherwise approved by the County Manager.
- Include a general note tailored to the site conditions that includes the language “The County E&S inspector has the authority to require additional controls as needed.”

2.3 Stormwater Management Plan (SWMP)

The Stormwater Management Plan (SWMP) contains the elements in Section 2.3.1 in addition to including the details of any stormwater management facility (SWMF) used to meet the requirements of Sections 2.3.2 and 2.3.3. A stormwater management facility (SWMF) is a control measure that manages stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow and may also be called a best management practice (BMP).

2.3.1 Contents of Plan

All plans must be signed and sealed by a professional registered in the Commonwealth of Virginia and must include the following items:

- Contact information including the name, address, and telephone number of the owner and the RPC number and parcel number of the property or properties affected;
- A narrative that includes a description of current site conditions and final site conditions;
- A general description of the proposed stormwater management facilities and the mechanism through which the facilities will be operated and maintained after construction is complete;
- A map or maps of the site that depicts the topography of the site and includes:
 - All contributing drainage areas including pre-development and post-development areas;
 - Existing streams, ponds, culverts, ditches, wetlands, other water bodies, and floodplains;
 - Soil types, infiltration rates (using test procedures in Virginia Stormwater BMP Clearinghouse Appendix 8-A), and depth of water table at location of proposed SWMFs (if SWMF uses infiltration);
 - Forest cover, and other vegetative areas;
 - Current land use including existing structures (and downspouts), roads, and locations of known utilities and easements;
 - Sufficient information on adjoining parcels to assess the impacts of stormwater from the site on these parcels;
 - The limits of clearing and grading, and the proposed drainage patterns on the site;

- Proposed buildings (including downspouts), roads, parking areas, utilities, and stormwater management facilities;
- Completed and executed copy of Stormwater Facility Monitoring and Maintenance Agreement (MMA);
- Hydrologic and hydraulic computations outlined in Section 2.3.2, including runoff characteristics;
- Runoff reduction computations outlined in Section 2.3.3.

2.3.1.1 Impervious cover removal

Impervious cover removed from a property prior to LDA permit application can be counted as part of the existing land cover conditions as follows:

1. If no LDA or other demolition permit was obtained for the removal, the impervious cover removed may be counted for up to five (5) years from the date of removal if acceptable, time-referenced documentation is provided to the Director. Examples of acceptable documentation may include but are not limited to photographs (aerial and ground-based) and contractor invoices.

The Director will determine whether the documentation verifies the timing and amount of removal and, if so, the credit provided will be the verifiable surface area of impervious cover removed.

After five (5) years, the credit provided will be 50 percent of the verifiable surface area removed, with no credit provided after 10 years.

2. If an LDA or other demolition permit was obtained for the removal of the impervious cover, the surface area of impervious cover removal documented with the permit information may be counted as follows:

All projects except County projects

Time from date of removal permit issuance to date of LDA permit application	Pro-rated impervious cover removal credit
0 - 5 years	100% credit
>5 - 10 years	75% credit
>10 - 15 years	50% credit
>15 - 20 years	25% credit
>20 years	0% credit

County projects

Because of the long planning, civic engagement, and funding timelines associated with County projects, including the 10-year planning horizon for the Capital Improvement Plan, full (100%) credit for impervious cover removal will be provided for 10 years from the date that permit(s) were issued for the impervious cover removal.

Following the end of the 10-year full credit period, the pro-rated crediting is the same as for other projects:

Time from date of removal permit issuance to date of LDA permit application	Pro-rated impervious cover removal credit
0 – 10 years	100% credit
>10 - 15 years	50% credit
>15 - 20 years	25% credit
>20 years	0% credit

3. For impervious cover removal within Resource Protection Areas (RPAs) regulated under Chapter 61 (Chesapeake Bay Preservation Ordinance), the following policies govern:

A. Determination of 'allowable redevelopment' under 61-7.A.2:

Redevelopment outside of locally designated Intensely Developed Areas designated by the County shall be permitted only if there is no increase in the amount of impervious cover within the RPA and there is no further encroachment within the RPA....

Any impervious cover removed from a site within the preceding (2) years may be counted as impervious cover for the pre-development condition, if a valid demolition permit was obtained for the project or other time-referenced documentation, as set forth in 1. above, is provided that is acceptable to the Director.

- B. Determination of existing impervious cover for calculating compliance with the stormwater management requirements of Chapter 60: The policies outlined under 1. and 2. above govern, as applicable.

2.3.2 Water Quantity Technical Criteria

All land disturbing activities greater than or equal to 2500 square feet are required to follow the steps in the Compliance Flow Chart for Water Quantity and subsequent flow charts to achieve compliance using the technical criteria outlined in the following sections.

A [Water Quantity Energy Balance Worksheet](#) is provided on the County's webpage to assist with this analysis.

Requirements for Channel Protection downstream analysis:

Pipe system/channel analysis is to ensure that the 2-yr 24-hour storm will not cause erosion. Criteria listed below must be provided for the pipe system analysis. Downstream analysis should be taken to the 1% rule based on drainage area or peak flow for discharge from the entire drainage area for the storm event.

For projects that discharge into a pipe system the following information must be provided on the plans:

1. A table that provides the following at every point of inflow along the conveyance:
 - a. From
 - b. To
 - c. Drainage area in acres
 - d. Runoff Coef. "C"
 - e. Incremental CA
 - f. Accumulated CA
 - g. Time of Conc. – "I" in/hr
 - h. Time of Conc. – To pipe in min.
 - i. Incremental "Q"
 - j. Accumulated "Q"
 - k. Pipe Diameter in inches
 - l. Pipe Material Type
 - m. Mannings coefficient "N" for pipe
 - n. Pipe slope in %
 - o. Max "Q" cfs for pipe
 - p. Velocity fps
 - q. Time in pipe minimum
 - r. Length in feet
 - s. Fall in feet
 - t. Invert upper
 - u. Invert lower
2. Profiles of conveyance system must be provided and include the following:
 - a. Structure id
 - b. Pipes
 - c. Structures – top elevation and inverts
 - d. Existing grade
 - e. Hydraulic grad line for 10-yr 24-hour storm

If the downstream analysis extends beyond the pipe system, the criteria below must be used. If the pipe system discharges into a restored natural conveyance, the restored section design storm for the entire basin needs to be used to check for erosion. Note that the 1% rule for peak flow is based on the 1-yr 24-hr storm, not the 2-yr 24-hour storm.

1. Channel/ditch will be checked to ensure that the 2-yr 24-hour storm design storm will not cause erosion.
2. Plans must include cross-sections. The cross-sections should be chosen at appropriate locations that are perpendicular to the channel. Cross-sections should be taken at a minimum at the outlet of the stormwater conveyance and breaks in channel/ditch grades. Maximum spacing between cross-sections is 100 ft.

Requirements for Flood Control downstream analysis:

For projects that discharge into a channel or ditch the following must be provided on the plans:

1. Channel/ditch capacity will be checked to ensure that the 10-yr 24-hour storm design storm will not overtop the banks.
2. Plans must include cross-sections. The cross-sections should be chosen at appropriate locations that are perpendicular to the channel. Cross-sections should be taken at a

minimum at the outlet of the stormwater conveyance and breaks in channel/ditch grades. Maximum spacing between cross-sections is 100 ft.

Requirements for Sheetflow:

All properties must satisfy the sheetflow provisions of 9VAC25-870-66:

Increased volumes of sheetflow resulting from pervious or disconnected impervious areas, or from physical spreading of concentrated flow through level spreaders, must be identified and evaluated for potential impacts on down-gradient properties or resources. Increased volumes of sheet flow that will cause or contribute to erosion, sedimentation, or flooding of down gradient properties or resources shall be diverted to a stormwater management facility or a stormwater conveyance system that conveys the runoff without causing down gradient erosion, sedimentation, or flooding.

Situations where the project cannot meet the requirements of 1-3 in the Sheetflow flowchart, could require additional storage with the use of rain gardens, dry wells, etc.

Dry wells designed to meet the sheetflow requirements can be manufactured wells or pits of stone. The well shall be designed for 25% of 1" of runoff if dissipating flow directly from a downspout. The minimum size is 2'x2'x2', the maximum depth is 3'. If drainage is piped directly into the well, the downspout directed towards the drywell should have a leaf guard, the inflow pipe shall be set at a minimum 0.5% slope, and the upstream invert elevation shall be higher than the ground elevation above the well. The dry well can be designed with a pop-up emitter as the emergency overflow and the observation well. If designed with turf coverage, the topsoil and turf layer shall provide 6-8" coverage on top of the well and be separated from the stone reservoir by geotextile. Dry wells shall meet the siting criteria of infiltration facilities (see Design Specification 8).

An executed Stormwater Facility Monitoring and Maintenance Agreement (MMA) is required for projects with dry wells only.

Material Specifications for Dry Wells. Below is the table of material specifications for dry wells.

Material Specifications for Dry Wells

Material	Specification
Stone	VDOT No. 57
Observation Well/ Overflow	Install a vertical 4 or 6-inch Schedule 40 PVC perforated pipe, with a pop-up emitter and anchor plate. Pipe perforations are 3/8 inches at 6 inches on center.
Anchor Plate	Install a 6" square metal plate for installations with 4" PVC pipe. Install an 8" square plate for installations with 6" PVC pipe.
Surface Cover	Install a 3-inch layer of river stone or pea gravel. Turf is acceptable when there is subsurface inflow (e.g., a roof leader).
Filter Fabric	Must be installed on the dry well sides. When turf is used as a surface cover, fabric shall be installed along the top between the stone layer and the surface cover. Use non-woven polypropylene geotextile with a flow rate of > 110 gallons/min./sq. ft. (e.g., Geotex 351 or equivalent).
Cleanout	Threaded metal rod with plate at the end installed in the observation well to facilitate cleanout.

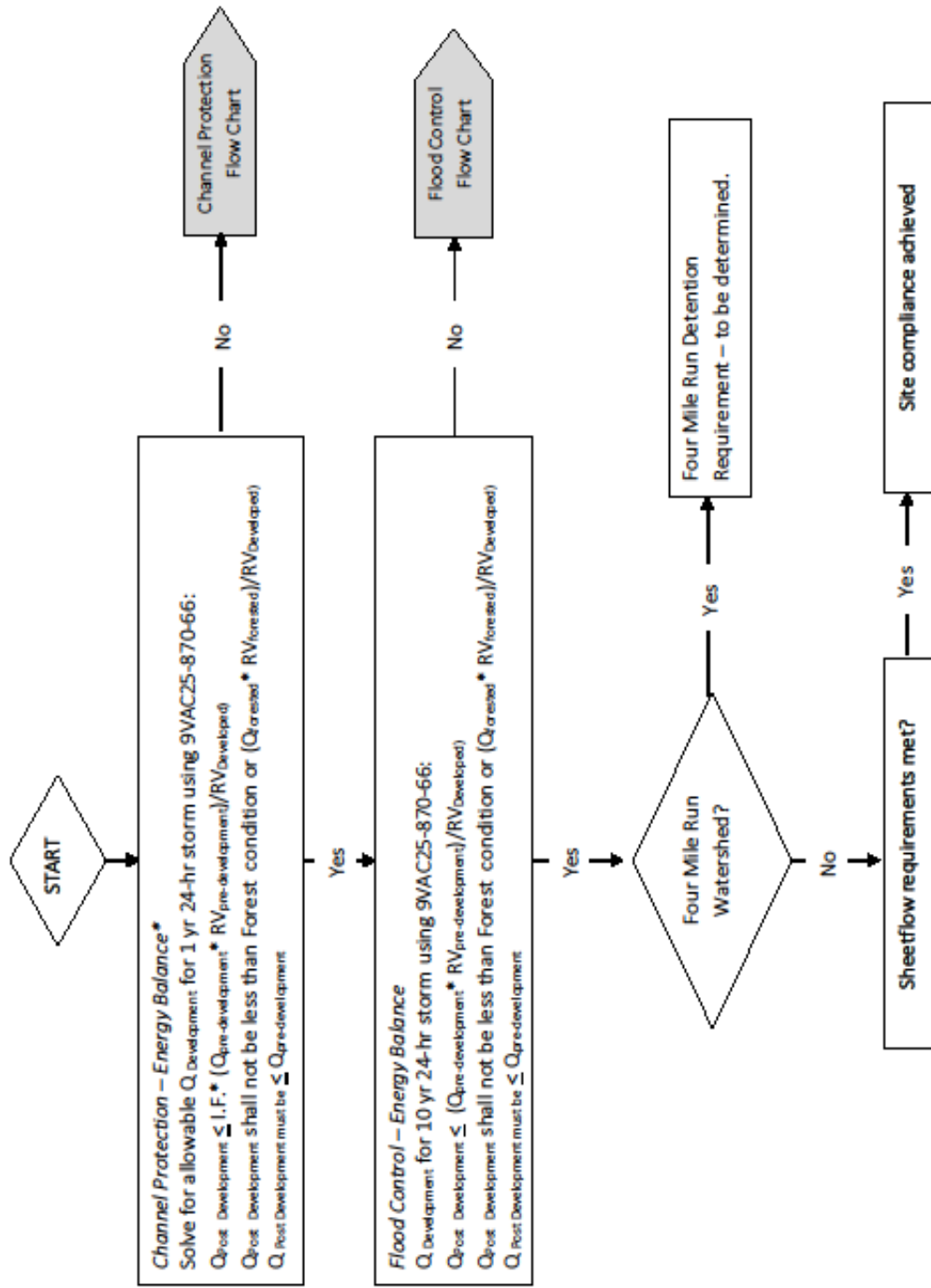
Below is the standard maintenance schedule for dry wells to be included on plans. If a manufactured device is proposed the manufacturer's guidance can be used instead.

Maintenance Schedule for Dry Wells:

Maintenance Activity	Schedule
<ul style="list-style-type: none"> • Remove leaves and debris in gutter at leaf guard. • Remove leaves and debris from observation well/overflow. • Inspect the condition of the overflow or pop-up emitter and make sure it is still capped and functioning. 	Annually
<ul style="list-style-type: none"> • Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Construction Installation. Projects with only dry wells to meet the sheetflow requirement (no other SWMFs are needed) need to submit a completed dry well construction inspection checklist, photos and materials tickets (Appendix G). The completed checklist does not need to be signed by a professional.

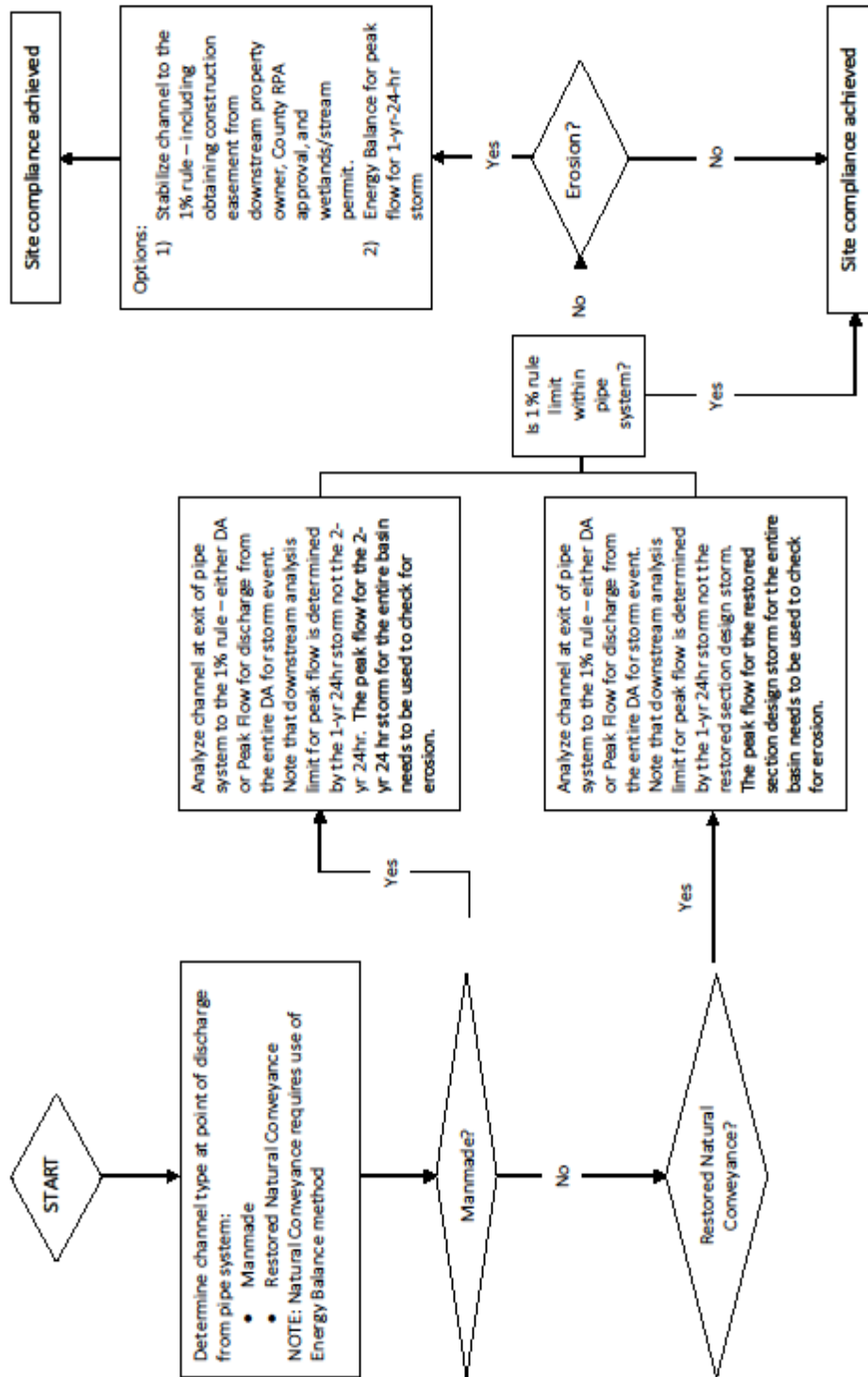
Compliance Flow Chart for Water Quantity



*This approach is the only approach allowed for discharges to natural channels. It can also be used for manmade and restored channels. If the applicant chooses not to use this approach for manmade and restored channels, proceed to 'Channel Protection Flow Chart.'

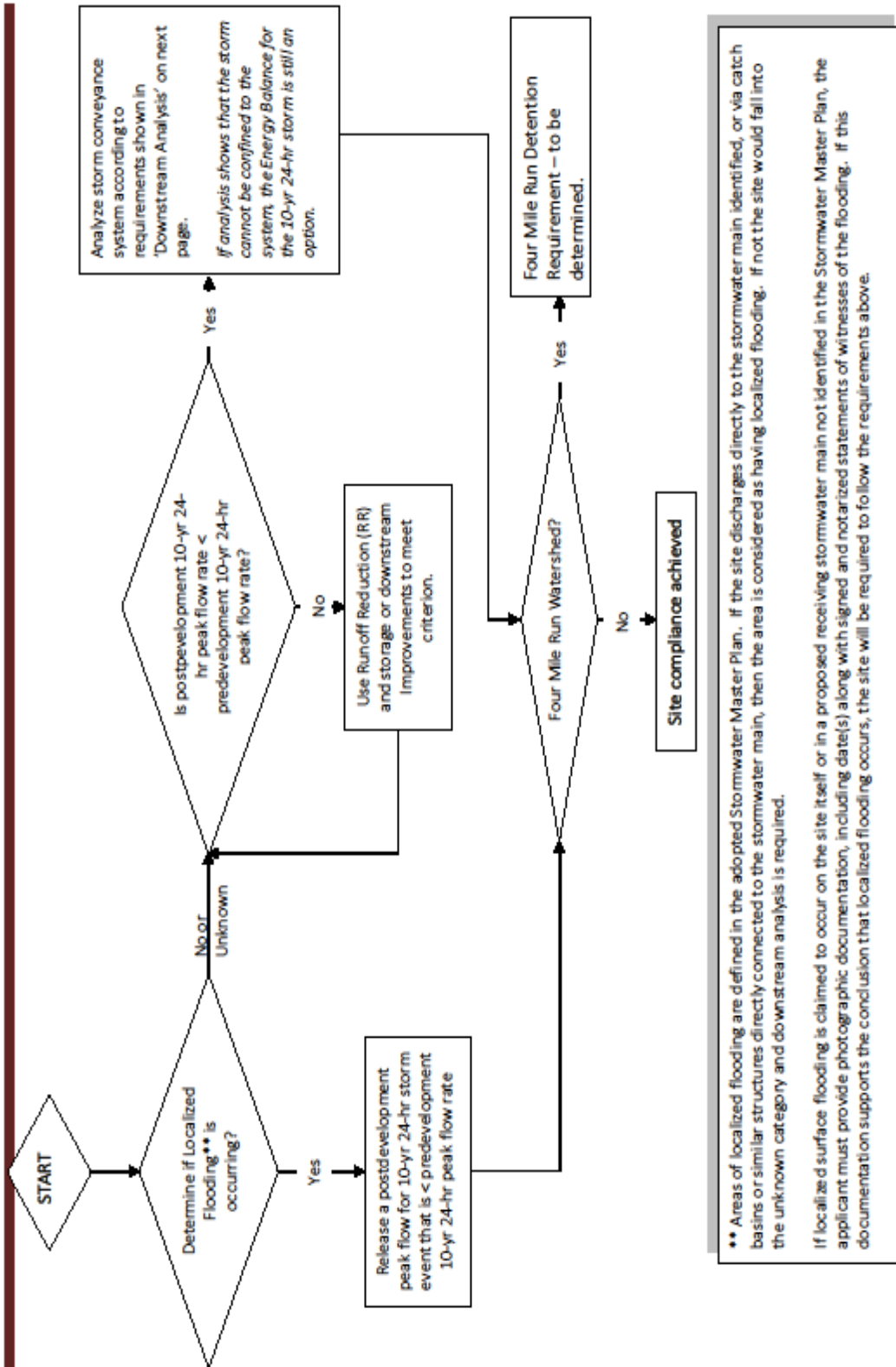
July 2014

Channel Protection Flow Chart



July 2014

Flood Control Flow Chart



** Areas of localized flooding are defined in the adopted Stormwater Master Plan. If the site discharges directly to the stormwater main identified, or via catch basins or similar structures directly connected to the stormwater main, then the area is considered as having localized flooding. If not the site would fall into the unknown category and downstream analysis is required.

If localized surface flooding is claimed to occur on the site itself or in a proposed receiving stormwater main not identified in the Stormwater Master Plan, the applicant must provide photographic documentation, including date(s) along with signed and notarized statements of witnesses of the flooding. If this documentation supports the conclusion that localized flooding occurs, the site will be required to follow the requirements above.

July 2014

Flood Control Flow Chart

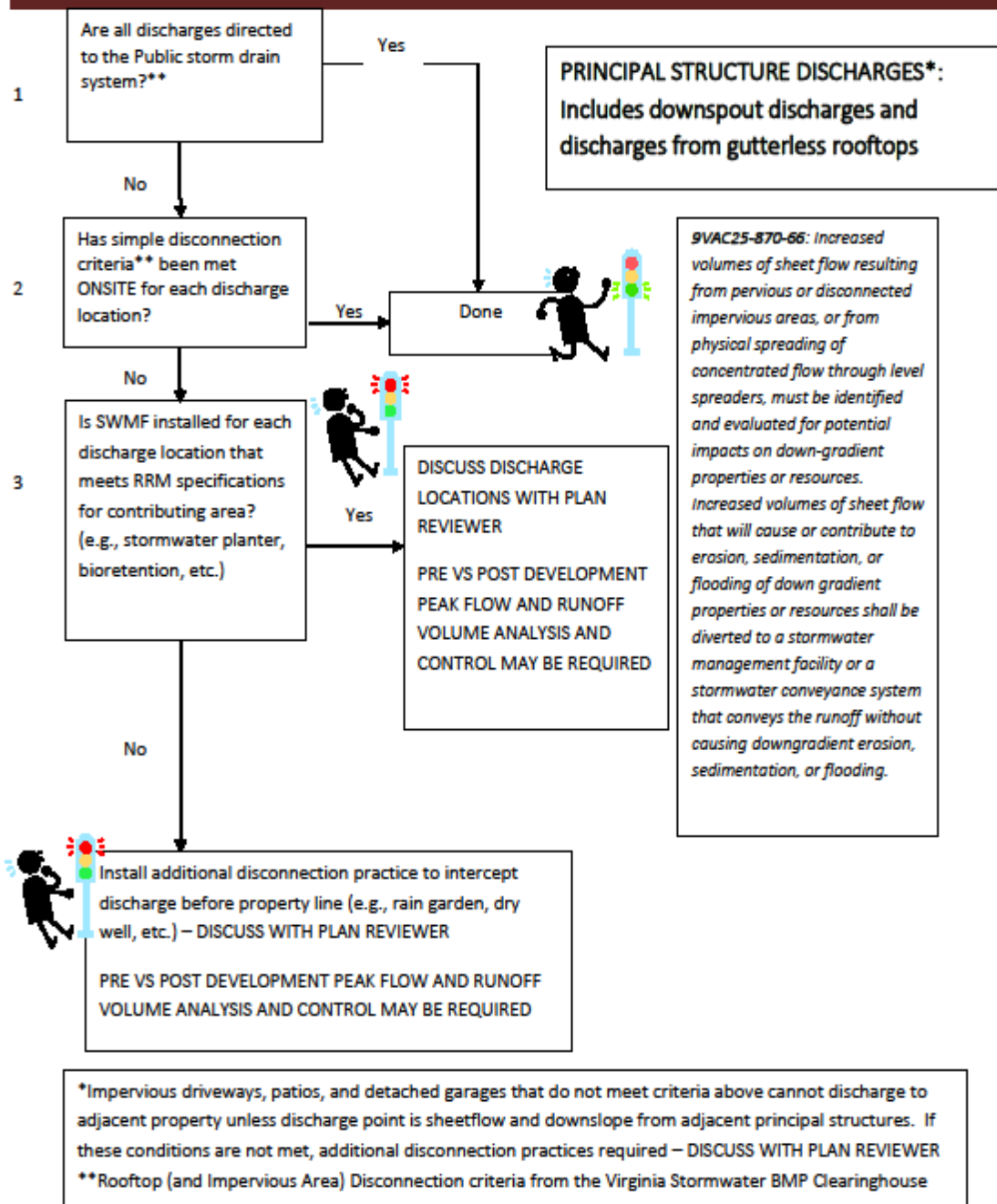
Downstream Analysis

If the peak flow from the post-development 10-year 24-hour storm is proposed to be contained within the stormwater conveyance system, then an analysis of the system to ensure the discharge stays within the system must be conducted to a point where:

- o The site's contributing drainage area is less than or equal to 1.0% of the total watershed area draining to a point of analysis in the downstream stormwater conveyance system;
- o Based on peak flow rate, the site's peak flow rate from the 10-year 24-hour storm event is less than or equal to 1.0% of the existing peak flow rate from the 10-year 24-hour storm event prior to the implementation of any stormwater quantity control measures; or
- o The stormwater conveyance system enters a mapped floodplain or other flood prone area, adopted by ordinance, of any VSMP Authority.
- o Arlington County Flood Control downstream analysis documentation and computational criteria must be met.

July 2014

Compliance Flowchart for Sheetflow



July 2014

2.3.3 Water Quality Technical Criteria

All Stormwater Management Plans should be prepared in conjunction with the Virginia Stormwater Management Handbook. Refer to Chapter 8 Design Checklists using the approved Best Management Practices (BMPs) from the [Virginia Stormwater BMP Clearinghouse](#) (with the modifications noted in “Stormwater Management Facility Design Considerations”), in addition to the following:

1. A copy of the Runoff Reduction spreadsheet (from Arlington County’s website) including a completed [Stormwater Management Facility and Site Data Spreadsheet](#) for the proposed SWMFs which includes:
 - The type of facilities (using the naming convention from the Clearinghouse);
 - Address;
 - Total and impervious acres treated for each SWMF; and
 - The watershed and sixth order hydrologic unit code (from the County’s mapping software) into which the facility will discharge.
2. Description of maintenance responsibilities. If a shared SWMF or SWMFs are used to meet code requirements, then a Homeowners Association shall be developed that outlines how each lot will contribute to the inspection and maintenance needs for the facility or facilities. The facility or facilities will be located within a private easement to the Homeowners Association or each lot will have their own stormwater management facility or facilities and a maintenance agreement will be recorded for each individual lot.
3. Material specifications, construction inspection checklist and maintenance schedule for each SWMF.

The Director of DES may preclude the use of any SWMF otherwise allowed, or require more stringent conditions upon its use, for a specific land-disturbing project based on a review of the stormwater management plan and project site conditions. Such limitations shall be based on site-specific concerns.

Stormwater Management Facility Design Considerations

The specifications below are clarifications or adjustments to the Virginia Stormwater BMP Clearinghouse Design Specifications that are specific to their use in Arlington.

Underdrains shall not concentrate flow. The use of pop-up emitters (and other techniques used to dissipate flow) are accepted, provided their use is appropriate as determined by a professional licensed in the State of Virginia or a County field inspector. Underdrains that discharge on slopes steeper than 10 percent shall have downstream protection. Underdrains should have the appropriate cover and discharge 10 feet from property boundaries.

Setbacks. Stormwater management facilities must comply with the minimum setback requirements established by the Virginia Stormwater BMP Clearinghouse. This also includes the setbacks from neighboring structures.

Waterproofing. If the proposed SWMF does not meet the minimum setback requirements (established by the Virginia Stormwater BMP Clearinghouse), the design must include waterproofing features specified and sealed by the engineer. The following note must be added to the plans:

Arlington County does not review the waterproofing design and the owner/developer agrees to hold Arlington County harmless in the event of failure.

Soil testing. Testing for infiltration rate and depth of seasonal high water table is required according to testing procedure outlined in the Clearinghouse Design Specification No. 8,

Appendix 8-A (Version 2.0, 2013). All soil evaluations, including test profile pits, soil borings, and permeability tests shall be conducted under the supervision of a licensed Soil Scientist. Per the testing procedure, the seasonally high-water table (SHWT) may be determined using soil morphology throughout the year by a certified professional with training and experience in soil morphology. SHWT determination by direct observation of the groundwater level should be performed during the months of November through May. Professional engineers registered in Virginia with experience in the field of geotechnical engineering with certified training in soil morphology may also be certified to determine the SHWT.

Design Specification No. 1: Rooftop (and Impervious Area) Disconnection. All of the design specifications are taken from the Clearinghouse Design Specification No. 1.

Design Specification No. 2: Sheetflow to Vegetated Filter Strip or Conserved Open Space. All of the design specifications are taken from the Clearinghouse Design Specification No. 2 with the following clarifications:

Location. Proposed conserved open space area should be adjacent to a protected natural area such as publicly-owned parks and resource management areas and privately owned areas under perpetual conservation or other third party easement. It must be situated as to not result in negative impacts to existing natural resources such as wetlands.

The end of the proposed vegetated filter strips must flow into a protected natural area.

Size. The resulting conserved open space must create a contiguous natural area of a minimum of 2 acres, at least 0.25 acres or greater must be converted to conserved open space at a time.

Design. The length of the vegetated filter strips should be designed using the minimum length required for the steepest slope on any one part of the strip.

Construction. The gravel diaphragm or engineered level spreader should be installed first and then the compost amendments incorporated into the vegetated filter strip. Vegetation needs to achieve 90% coverage before flow can be diverted to the diaphragm or engineered level spreader regardless of existing vegetation or seeding of amended soils is used to achieve dense cover.

Maintenance. On private property, a third party conservation easement must be obtained or exist for the area. For existing natural areas, a long-term vegetation management plan including an invasive management plan (IMP) is required. For existing areas of turf or invasive plants, a restoration plan including a planting plan to provide 90% cover with native plants and invasive management plan is required. Managed meadow is an acceptable interim condition, but the ultimate goal is reforestation. Soils are to remain undisturbed. On public property, educational signage, funding must be identified for at least five years of maintenance, and a Memorandum of Understanding (MOU) for long-term maintenance are required.

Design Specification No. 3: Grass Channels. All of the design specifications are taken from the Design Specification No. 3.

Design Specification No. 4: Soil Compost Amendment. The following table clarifies the specifications for Soil Compost Amendment in the Clearinghouse Design Specification No. 4. This SWMF can only be used in series with another SWMF.

Short-Cut Method to Determine Compost and Incorporation Depths for Soils

	Contributing Impervious Cover to Soil Amendment Area Ratio ¹							
	IC/SA = 0 ²		IC/SA = 0.5		IC/SA = 0.75		IC/SA = 1.0 ³	
Soil Type	B	C/D	B	C/D	B	C/D	B	C/D
Compost (in) ⁴	2-3	3-4	3 – 4.5	4.5-6	4- 6	6-8	6-8	8-10
Incorporation Depth (in)	6 - 8	8-10.5	8-10	10-12	15-16.5	16.5-18	18-21	21-24
Incorporation Method	Rototiller		Rototiller		Subsoiler		Subsoiler	

Notes:

¹ IC = contrib. impervious cover (sq. ft.) and SA = surface area of compost amendment (sq. ft.)

² For amendment of compacted lawns that do not receive off-site runoff

³ In general, IC/SA ratios greater than 1 should be avoided

⁴ Depth of compost added

Design Specification No. 5: Vegetated Roof. All of the design specifications are taken from the Clearinghouse Design Specification No. 5 with the following clarification:

Maintenance Activities for Vegetated Roofs. The following is the list of maintenance activities for vegetated roofs. The table is to be included on plans proposing vegetated roofs.

Vegetated Roof Maintenance Schedule

Maintenance Activity	Schedule
<ul style="list-style-type: none"> Water to promote plant growth and survival. Inspect the vegetated roof and replace any dead or dying vegetation. 	As Needed (Following Construction)
<ul style="list-style-type: none"> Inspect the waterproof membrane for leaking or cracks. Annual fertilization (first five years). Weeding to remove invasive plants. Inspect roof drains, scuppers and gutters to ensure they are not overgrown or have organic matter deposits. Remove any accumulated organic matter or debris. Inspect the green roof for dead, dying, or invasive vegetation. Plant replacement vegetation as needed to maintain 80% plant coverage. 	Semi-Annually
<ul style="list-style-type: none"> Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Design Specification No. 6: Rainwater Harvesting. All of the design specifications are taken from the Clearinghouse Design Specification No. 6.

Design Specification No. 7: Permeable Pavement. The design specifications are taken from the Clearinghouse Design Specification No. 7 with the following changes:

Slope. Permeable pavement systems may not be constructed in areas where the adjacent slopes are steeper than 20 percent. The slope of the surface of the permeable pavement systems shall be from 1 to 10 percent. The bottom slope of a permeable pavement installation should be as flat as possible (i.e., 0 percent longitudinal and lateral slopes) to enable even distribution and infiltration of stormwater. On sloped sites (greater than 5%), internal flow barriers (i.e. check dams) can be used to achieve the 0% slope on the bottom. If an underdrain will be used in conjunction with the flow barriers, it can be installed over the top of the barriers, or parallel to the barriers with an underdrain in each cell.

Standard details for both concrete and gravel flow barriers are provided on the Stormwater Management Ordinance webpage (details SWM#3 & 4).

Testing. The full permeability of the pavement surface shall be tested by application of clean water at a rate of at least 5 gpm over the entire surface. All water must infiltrate directly without puddle formation or surface runoff.

Driveway aisles constructed of permeable pavement are not allowed because of the difficulty in construction and maintenance of the center strip.

Porous Asphalt is not an accepted type of permeable pavement due to the difficulty of proper installation, lack of an industry certification program, burdensome maintenance record, and short lifespan.

Concrete Grid Pavers are not approved for use as permeable pavement unless the design professional demonstrates to the satisfaction of the Director that the design provides equal or better performance than permeable interlocking concrete pavers and pervious concrete both for long term permeability and structural integrity.

Plastic Reinforced Grid Paving Systems are not approved as permeable paving systems unless the design professional demonstrates to the satisfaction of the Director that the design provides equal or better performance than permeable interlocking concrete pavers and pervious concrete both for long term permeability and structural integrity.

Other pavement surfaces. Besides permeable interlocking pavers and porous concrete, other types of permeable pavement surfaces are permitted upon the discretion of the DES Director. The other permeable surfaces must meet the subsurface layer requirements for storage, the surface layer must accept water at a rate 5 gal/min/ft², and the surface must be maintainable.

Artificial Turf Fields may be treated as a permeable pavement provided the subsurface layer requirements for storage and the surface layer accepts water at a rate 5 gal/min/ft².

Permeable Interlocking Paver:

Permeable interlocking pavers shall conform to all requirements of Interlocking Concrete Paver Institute (ICPI) Technical Specification Number 18 (or equivalent). All installations shall be performed by qualified personnel.

Installations of permeable interlocking concrete pavers shall be overseen by an ICPI certified installer. The installer shall be on site, overseeing each installation, during all stone reservoir/base and paver installation.

Pervious Concrete:

Pervious Concrete work shall conform to all requirements of ACI 522.1, "Specification for Pervious Concrete Pavement" published by the American Concrete Institute.

Installation of pervious concrete shall only be performed by qualified personnel. A National Ready Mixed Concrete Association (NRMCA) Certified Pervious Concrete Craftsman or Installer should be on site, overseeing each placement crew, during all concrete placement and finishing operations. Each placement crew should have at least two NRMCA certified Pervious Concrete Technicians (per ACI 522.1-13).

Material Specifications for Permeable Pavements. Below is the table of material specifications for permeable pavements.

Material Specifications for Underneath the Permeable Pavements

Material	Specification	Notes
Bedding Layer	PC: None PICP: 2 in. depth of No. 8 stone above 4 inches of No. 57	ASTM D448 size No. 8 stone (e.g. 3/8 to 3/16 inch in size). ASTM D448 size No. 57 stone (e.g. 1 1/2 to 1/2 inch in size) Should be washed, clean and free of all fines.
Reservoir Layer	PC: No. 57 stone PICP: No. 2 or 3 stone	PC: ASTM D448 size No. 57 stone (e.g. 1 1/2 to 1/2 inch in size) PICP: No. 2 Stone (e.g. 3 inch to 3/4 inch in size) or No. 3 Stone. Depth is based on the pavement structural and hydraulic requirements. Should be washed, clean and free of all fines.
Underdrain	Use 4 to 6 inch diameter perforated schedule 40 PVC pipe, with 3/8-inch perforations at 6 inches on center; each underdrain installed at a minimum 0.5% slope located 20 feet or less from the next pipe (or equivalent corrugated HDPE may be used for non-vehicular applications). Perforated pipe installed for the full length of the permeable pavement cell, and non-perforated pipe, as needed, is used to connect with the storm drain system. T's and Y's installed as needed, depending on the underdrain configuration. Extend cleanout pipes to the surface with caps.	
Filter Layer	The underlying native soils should be separated from the stone reservoir by a 6 to 8 inch layer of coarse sand (e.g. ASTM C 33, gradation) or use an appropriate filter fabric for the particular application based on AASHTO M288-06. At a minimum the fabric shall have a Flow Rate greater than 125 gpm/sq. ft. (ASTM D4491), and an Apparent Opening Size (AOS) equivalent to a US # 70 or # 80 sieve (ASTM D4751). The geotextile AOS selection is based on the percent passing the No. 200 sieve in "A" Soil subgrade, using FHWA or AASHTO selection criteria.	
Observation Well	Use a perforated 4 to 6 inch vertical schedule 40 PVC pipe (AASHTO M 252) with a cap, installed flush with the surface. Applications in vehicular areas shall have a metal cap. All applications shall have an observation well installed.	

*PC: Permeable Concrete, PICP: Permeable Interlocking Concrete Pavers with an open surface of 5-15%.

Construction Installation. The installation and inspection of the construction of permeable pavement is to follow the Construction Inspection Checklist. The checklist is to be included on the plan (Appendix G).

Maintenance Activities for Permeable Pavement. The following is the list of maintenance activities for permeable pavement. The table is to be included on plans proposing permeable pavement.

Permeable Pavement Maintenance Schedule

Maintenance	Schedule
<ul style="list-style-type: none"> • Check observation wells 3 days after a storm event in excess of 1/2 inch in depth. Standing water observed in the well after three days is a clear indication of clogging. • Inspect the surface of the permeable pavement for evidence of sediment deposition, organic debris, staining or ponding that may indicate surface clogging. If any signs of clogging are noted, schedule a vacuum sweeper (no brooms or water spray) to remove deposited material. • Inspect the structural integrity of the pavement surface, looking for signs of surface deterioration, such as slumping, cracking, spalling or broken pavers. Replace or repair affected areas, as necessary. • Check inlets, pretreatment cells and any flow diversion structures for sediment buildup and structural damage. Note if any sediment needs to be removed. • Inspect the condition of the observation well and make sure it is still capped. • Generally, inspect any contributing drainage area for any controllable sources of sediment or erosion. 	Annually
<ul style="list-style-type: none"> • Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Design Specification No. 8: Infiltration Practices

Infiltration-only systems installed to date under Chapter 60 have experienced high failure rates. These failures have placed burdens on builders and property owners, including inability to obtain certificates of occupancy, unanticipated added costs at the end of construction, and subsequent costs and disruption for property owners following construction.

Failure of these infiltration systems to meet minimum percolation rates and pass inspection at the end of construction requires submission of a revised stormwater management plan to meet the Ordinance’s compliance requirements. No certificate of occupancy will be issued until the revised plan is approved and the new stormwater management facilities constructed and approved.

Construction of stormwater management facilities required under a revised plan after a project is otherwise completed can present substantial engineering and siting challenges as well as add unanticipated time and costs.

Most builders and design professionals do not choose infiltration as a compliance tool because of the degree of associated risk and uncertainty. You are strongly encouraged

to consider these risks and potential consequences for you and your clients in choosing infiltration as a primary compliance tool for your project.

Additionally, DEQ Design Specification No. 8 states: Sites that have been previously graded or disturbed do not retain their original soil permeability due to compaction. Therefore, such sites are not good candidates for infiltration practices.

The design specifications are taken from the Clearinghouse Design Specification No. 8 with the following changes:

Siting. Infiltration facilities may not be constructed on slopes steeper than 15 percent. In addition, facilities shall be set back a minimum of 10 feet from the property line from the down gradient property, facilities shall be set back a minimum of 5 feet from the property line from the up-gradient property. Infiltration facilities shall be located so that percolation infiltration does not saturate soil within 4 feet of public roadway subgrades.

Contributing Drainage Area. The maximum ratio of contributing impervious surface to the surface area of infiltration will be 3:1 regardless of the rate of infiltration of the underlying soils because of the risk of failure of the underlying soils over time. The maximum ratio of total contributing area to the surface area of the infiltration will be 5:1.

Sizing. The maximum length or width of an infiltration trench is 16 feet or less for SFD infill project (Smaller excavators have an 8-foot reach.) If a dimension greater than 16 feet is required, the plan must specify the type of equipment to be used to construct the trench in order to excavate the trench from the side. Equipment should be kept off the floor area of the trench to prevent soil compaction.

Micro-Infiltration design (treating 250-2500 sq ft) requires an observation well and 2 pretreatment techniques for Level 1 designs. Pretreatment techniques include leaf gutter screens, grass filter strips, and sump pit. Level 2 designs require 3 pretreatment techniques.

Material Specifications for Infiltration Trench. Below is the table of material specifications for infiltration trenches.

Material Specifications for Infiltration Trenches

Material	Specification	Notes
Stone	Clean, aggregate with a maximum diameter of 3.5 inches and a minimum diameter of 1.5 inches (VDOT No. 1 Open-Graded Coarse Aggregate) or the equivalent.	
Observation Well	Install a vertical 6-inch Schedule 40 PVC perforated pipe, with a cap and anchor plate.	Install one per 50 feet of length of infiltration the practice.
Trench Bottom	Install a 6 to 8 inch sand layer (VDOT Fine Aggregate, Grade A or B)	
Trench Surface Cover	Install a 3-inch layer of river stone or pea gravel. Turf is acceptable when there is subsurface inflow (e.g., a roof leader).	
Filter Fabric	Filter fabric must be installed on the trench sides. When turf is used as a surface cover, fabric shall be installed along the top between the stone layer and the surface cover. Use non-woven polypropylene geotextile with a flow rate of > 110 gallons/min./sq. ft. (e.g., Geotex 351 or equivalent).	

Overflow Collection Pipe (where needed)	Use 6-inch rigid schedule 40 PVC pipe, with 3/8" perforations at 6 inches on center, installed at a slope of 1% for the length of the infiltration practice.	Install non-perforated pipe with one or more caps, as needed.
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Construction Installation. The installation and inspection of the construction of an infiltration trench is to follow the Construction Inspection Checklist (See Appendix G). The checklist is to be included on the plan.

Maintenance Activities for Infiltration Trenches. The following is the list of maintenance activities for infiltration trenches. The table is to be included on plans proposing infiltration trenches.

Infiltration Trench Maintenance Schedule

Maintenance	Schedule
<ul style="list-style-type: none"> • Replace pea gravel/topsoil and top surface filter fabric (when clogged). • Mow vegetated filter strips as necessary and remove the clippings. 	As needed
<ul style="list-style-type: none"> • Ensure that the contributing drainage area, inlets, and facility surface are clear of debris. • Ensure that the contributing drainage area is stabilized. • Remove sediment and oil/grease from pre-treatment devices, as well as from overflow structures. • Repair undercut and eroded areas at inflow and outflow structures. 	Quarterly
<ul style="list-style-type: none"> • Check observation wells 3 days after a storm event in excess of 1/2 inch in depth. Standing water observed in the well after three days is a clear indication of clogging. • Inspect pre-treatment devices and diversion structures for sediment build-up and structural damage. • Remove trees that start to grow in the vicinity of the infiltration facility. 	Semi-annual inspection
<ul style="list-style-type: none"> • Clean out accumulated sediments from the pre-treatment cell. 	Annually
<ul style="list-style-type: none"> • Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Design Specification No. 9: Bioretention (including Urban Bioretention)

The design specifications are taken from the Clearinghouse Design Specification No. 9 with the following changes:

Siting. Bioretention facilities may not be constructed on slopes steeper than 15 percent. Facilities shall be set back a minimum of 10 feet from the property line from the down gradient property, facilities shall be set back a minimum of 5 feet from the property line from the up gradient property. The underdrain outlet shall be a minimum of 10 feet from property lines. An underdrain should be installed, connected and capped on sites where feasible.

Side slopes should be 3:1 for bioretention (excluding Urban Bioretention).

Berm. Fill for the berm and overflow weir of a bioretention basin or filter, shall consist of clean material free of organic matter, rubbish, frozen soil, snow, ice, particles with sizes larger than 3 inches, or other deleterious material. Fill shall be placed in 8- to 12-inch lifts and compacted to at least 95 percent of Standard Proctor Maximum Density in accordance with ASTM D-698, AASHTO T-99, or VDOT specifications. Compaction equipment shall not be allowed within the

facility on the soil bed. The top of the berm and the invert of the overflow weir shall be constructed level at the design elevation.

Planting Plan. Bioretention basin planting plans and plant specifications shall be prepared by a certified landscape architect, horticulturist, or other qualified individual who has knowledge of the environmental tolerance, ecological functions, and ecological impacts of plant species. A minimum of 75% of the plants shall be locally native, and the remaining shall be not aggressive or invasive. In lieu of submitting a professionally prepared planting plan, microbioretentions and urban bioretentions can use the species listed in DEQ Specification 8: Table 9.5 or [Fairfax's bioretention planting list](#).

Sizing. The sizing of bioretention facilities should follow the Clearinghouse Design Specification No. 9 (Version 2.0, 2013).

Material Specifications for Bioretention. The following is the table of material specifications for bioretention basins.

Bioretention Basin Material Specifications

Material	Specification	Notes
Filter Media Composition	Filter Media to contain: <ul style="list-style-type: none"> • 80%-90% sand with >75% being coarse to very coarse • 10%-20% soil fines • 3%-5% organic matter in the form of plant based compost meeting Clearinghouse Design Specification #4, Section 6.5 	The volume of filter media based on 110% of the plan volume, to account for settling or compaction.
Filter Media Testing	Plant available P within Low+ (L+) to Medium (M) per DCR 2014 Nutrient Management Criteria (18-40 mg/kg P for the Mehlich III procedure) and CEC >5	The media can be procured from approved filter media vendors or mixed onsite with testing results meeting standard for both texture and nutrient composition.
Mulch Layer	Use aged, shredded hardwood bark mulch	Lay a 2 to 3 inch layer on the surface of the filter bed.
Geotextile/Liner	Use a non-woven geotextile fabric with a flow rate of > 110 gal./min./sq. ft. (e.g., Geotex 351 or equivalent)	Apply only to the vertical sides and 2' on each side of the underdrain. Do not install at the bottom or between layers.
Choking Layer	3 inch layer of pea gravel or VDOT #8 stone which is laid over the underdrain stone.	
Stone Jacket for Underdrain and/or Storage Layer	1 inch stone should be double-washed and clean and free of all fines (e.g., VDOT #57 stone).	12 inches for the underdrain; 12 to 18 inches for the stone storage layer, if needed
Underdrains, Cleanouts, and Observation Wells	Use 6 inch rigid schedule 40 PVC pipe for bioretention basins, with 3/8-inch perforations at 6 inches on center, maximum of 3 rows of perforations; position each underdrain on a 1% or 2% slope located no more than 20 feet from the next pipe.	All bioretentions are to have an observation well, cleanout or overflow pipe. Lay the perforated pipe under the length of the bioretention cell, and install non-perforated pipe as needed to connect with the storm drain system. Install T's and Y's as needed, depending on the underdrain

		configuration. Extend cleanout pipes to the surface with vented caps at the Ts and Ys.
Plant Materials	Tree –minimum 1 inch caliper, 15' on-center. Shrub – minimum 30 inches high, 10' on-center. Perennials/Herbaceous - container-grown at 18-24 inches on center	A planting plan is required such that: For Level 1 designs – there is 75% surface coverage within 2 years For Level 2 designs – there is 90% surface coverage within 2 years

Construction Installation. The installation and inspection of the construction of bioretentions are to follow the Construction Inspection Checklist for Bioretention (See Appendix G). The checklist is to be included on the plan.

Maintenance Activities for Bioretention. The following is the list of maintenance activities for bioretention. The table is to be included on plans proposing bioretention.

Bioretention Maintenance Schedule

Maintenance	Frequency
<ul style="list-style-type: none"> Spot weeding, erosion repair, trash removal, and mulch raking 	Twice during growing season
<ul style="list-style-type: none"> Add reinforcement planting to maintain the desired vegetation density Remove invasive plants using recommended control methods Stabilize the contributing drainage area to prevent erosion 	As needed
<ul style="list-style-type: none"> Spring inspection and cleanup Supplement mulch to maintain a 2-3 inch layer Prune trees and shrubs 	Annually
<ul style="list-style-type: none"> Remove sediment in pre-treatment cells and inflow points 	Once every 2 to 3 years
<ul style="list-style-type: none"> Replace the mulch layer 	Every 3 years
<ul style="list-style-type: none"> Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Microbioretention

A microbioretention means a bioretention that treats 2500 sf of impervious area or less and has a ponding depth of 6” or less. A rain garden is a microbioretention that does not meet all of the specifications in this section, such as the underdrain, depth of soil media or infiltration rates of underlying soils and is used for meeting sheetflow and quantity requirements only.

Material Specifications for Microbioretention. Below is the table of material specifications for microbioretentions.

Microbioretention Material Specifications

Material	Specification	Notes
Filter Media Composition	Filter Media to contain: <ul style="list-style-type: none"> • 80%-90% sand with >75% being coarse to very coarse • 10%-20% soil fines • 3%-5% organic matter in the form of plant based compost meeting Clearinghouse Design Specification #4, Section 6.5 	The volume of filter media based on 110% of the plan volume, to account for settling or compaction.
Filter Media Testing	Plant available P within Low+ (L+) to Medium (M) per DCR 2014 Nutrient Management Criteria (18-40 mg/kg P for the Mehlich III procedure) and CEC >5	The media must be procured from approved filter media vendors.
Mulch Layer	Use aged, shredded hardwood bark mulch	Lay a 2 to 3 inch layer on the surface of the filter bed.
Geotextile/Liner	Use a non-woven geotextile fabric with a flow rate of > 110 gal./min./sq. ft. (e.g., Geotex 351 or equivalent)	Apply only to the vertical sides and 2' on each side of the underdrain. Do not install at the bottom or between layers.
Choking Layer	3 inch layer of pea gravel or VDOT #8 stone which is laid over the underdrain stone.	
Stone Jacket for Underdrain and/or Storage Layer	1 inch stone should be double-washed and clean and free of all fines (e.g., VDOT #57 stone).	Minimum 6 inches or 12 inches if an underdrain is specified
Underdrains, Cleanouts, and Observation Wells	Corrugated HDPE or equivalent, with 3/8-inch perforations at 6 inches on center, maximum of 3 rows of perforations; position each underdrain on a 1% or 2% slope located no more than 20 feet from the next pipe OR none if soil infiltration requirements met (Level II design).	All bioretentions are to have an observation well, cleanout or overflow pipe. Lay the perforated pipe under the length of the bioretention cell, and install non-perforated pipe as needed to connect with the storm drain system. Install T's and Y's as needed, depending on the underdrain configuration. Extend cleanout pipes to the surface with vented caps at the Ts and Ys.
Plant Materials	1 quart-sized perennial installed per 1-2 sf and 1 3-gallon shrub installed per 7.5 sf over entire ponding area from DEQ Specification 9: Table 9.5	For Level 1 designs – choose either herbaceous and/or shrubs For Level 2 designs – choose any 2 of herbaceous, shrubs, or trees

Berm. Fill for the berm and overflow weir shall consist of clean material free of organic matter, rubbish, frozen soil, snow, ice, particles with sizes larger than 3 inches, or other deleterious

material. Fill shall be placed in 6-inch lifts and hand tamped. The berm shall be stabilized the same day it is installed, using either sod or matting.

Construction Installation. The installation and inspection of the construction of microbioretentions are to follow the Construction Inspection Checklist for Bioretention (See Appendix G). The checklist is to be included on the plan.

Maintenance Schedule. The table of maintenance activities for bioretention should be included on plans proposing microbioretentions.

Urban Bioretention (Planter Box and Tree Filter)

An urban bioretention is a microbioretention that is installed in a container. The container can be poured in place concrete, concrete block or 6x6" pressure treated wood. The maximum drainage area to an urban bioretention is 2500 square feet. Larger drainage area may be allowed with sufficient flow controls and other mechanisms to ensure proper function, and safety. However, the urban bioretention filter must then be designed in accordance with the Level I bioretention filter criteria.

The proposed land cover to be used in the runoff reduction spreadsheet for an urban bioretention is managed turf.

Planter Box

A standard detail for urban bioretention – planter box and associated dry well is provided on the Stormwater Management Ordinance webpage (detail SWM#5). Plan views shall show the location of the overflow and inflow (downspout), and they shall be located as far apart as possible to limit short-circuiting.

Location. Long term maintenance and the health of the plants are critical to the function of planter boxes, therefore planter boxes cannot be installed beneath decks and other projections from the home, including cantilevered bump-outs, overhangs, fireplaces, AC units, etc.

Structure Design. The wall of the planter box can be constructed of a variety of materials provided that a structural engineer certifies the load is acceptable on the foundation on the architectural drawings reviewed and approved by ISD.

Downspouts connecting to planter boxes with greater than a three (3) story drop may be allowed when designed with sufficient energy dissipation.

Underdrain. The underdrain must discharge to a dry well and multiple underdrains must not discharge to the same location.

Dry Well Design. If a dry well is designed as an outfall from a planter box, it shall be designed for 25% of the remaining runoff from the planter box. The minimum size of the dry well is 2'x2'x2', the maximum depth is 3'. See Section 2.3.3, Requirements for Sheetflow, for additional guidance. See Design Specification No. 8: Infiltration Practices, for siting criteria.

Material Specifications. Below is the table of material specifications for stormwater planter boxes.

Planter Box Material Specifications

Material	Specification	Notes
Waterproofing	Watertight shell or impermeable liner	Use a thirty mil (minimum) PVC Geomembrane liner or equivalent.
Filter Media Composition	Filter Media to contain: <ul style="list-style-type: none"> • 80%-90% sand with >75% being coarse to very coarse • 10%-20% soil fines • 3%-5% organic matter in the form of plant based compost meeting Clearinghouse Design Specification #4, Section 6.5 	The volume of filter media based on 110% of the plan volume, to account for settling or compaction.
Filter Media Testing	Plant available P within Low+ (L+) to Medium (M) per DCR 2014 Nutrient Management Criteria (18-40 mg/kg P for the Mehlich III procedure) and CEC >5	The media must be procured from approved filter media vendors.
Mulch Layer	Use aged, shredded hardwood bark mulch	Lay a 2 to 3 inch layer on the surface of the filter bed.
Choking Layer	3 inch layer of pea gravel or VDOT #8 stone which is laid over the underdrain stone.	
Stone Jacket for Underdrain and/or Storage Layer	1 inch stone should be double-washed and clean and free of all fines (e.g., VDOT #57 stone).	12 inches for the underdrain
Underdrains and Overflows	Use 4 inch rigid schedule 40 PVC pipe with 3/8-inch perforations at 6 inches on center, maximum of 3 rows of perforations; position each underdrain on a 1% or 2% slope.	Lay the perforated pipe under the length of the planter box, and install non-perforated pipe as needed to connect with the storm drain system. Install T's and Y's as needed, depending on the underdrain configuration. Extend overflow pipes to the surface with vented caps.
Plant Materials	1 quart-sized perennial installed per 1-2 sf and/or 1 3-gallon shrub installed per 7.5 sf over entire ponding area from DEQ Specification 9: Table 9.5	Choose either herbaceous and/or shrubs

Construction Installation: The installation and inspection of the construction of stormwater planter boxes are to follow the Construction Inspection Checklist for Urban Bioretention (See Appendix G). The checklist is to be included on the plan.

Maintenance Activities for Planter Boxes. The following is the list of maintenance activities for planter boxes. The table is to be included on plans proposing planter boxes.

Planter Box Maintenance Schedule

Maintenance	Frequency
<ul style="list-style-type: none"> Spot weeding, erosion repair, trash removal, and mulch raking 	Twice during growing season
<ul style="list-style-type: none"> Add reinforcement planting to maintain the desired vegetation density Remove invasive plants using recommended control methods Stabilize the contributing drainage area to prevent erosion 	As needed
<ul style="list-style-type: none"> Spring inspection and cleanup Supplement mulch to maintain a 2-3 inch layer Prune trees and shrubs Examine for the ponding depth and adjust accordingly Inspect inflows and overflow for erosion Inspect for structural deficiencies and repair 	Annually
<ul style="list-style-type: none"> Remove sediment in pre-treatment cells and inflow points 	Once every 2 to 3 years
<ul style="list-style-type: none"> Replace the mulch layer 	Every 3 years
<ul style="list-style-type: none"> Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Tree Filter

Stormwater tree filters are street level urban bioretention that take water from impervious surfaces such as roadways, sidewalks and plazas with a canopy tree incorporated. Underdrains must discharge to the storm sewer network.

Inflows. Use the [Portland SW-330](#) or equivalent for the curb cut detail with splash block.

Soil Media Depth. Stormwater tree filters include a canopy tree in their design and therefore the soil depth should be 48 inches.

Material Specifications. Below is the table of material specifications for stormwater tree filters.

Stormwater Tree Filter Material Specifications

Material	Specification	Notes
Filter Media	Meets the available P and CEC per DEQ Specification No.9 (2013) and to contain: <ul style="list-style-type: none"> • 80%-90% sand with >75% being coarse to very coarse • 10%-20% soil fines • 3%-5% organic matter in the form of plant based compost meeting Clearinghouse Design Specification #4, Section 6.5 	The media must be procured from approved filter media vendors. The volume of filter media based on 110% of the plan volume, to account for settling or compaction.
Mulch Layer	Use aged, shredded hardwood bark mulch	Lay a 2 to 3 inch layer on the surface of the filter bed.
Choking Layer	Pea gravel or VDOT #8 stone which is laid over the underdrain stone.	
Stone Jacket for Underdrain and/or Storage Layer	Stone should be washed and clean and free of all fines (e.g., VDOT #57 stone).	12 inches for the underdrain
Underdrains and Overflows	Use 6 inch rigid schedule 40 PVC pipe with 3/8-inch perforations at 6 inches on center, maximum of 3 rows of perforations; position each underdrain on a 1% or 2% slope.	Lay the perforated pipe under the length of the stormwater tree filter, and install non-perforated pipe as needed to connect with the storm drain system. Install T's and Y's as needed, depending on the underdrain configuration. Extend overflow pipes to the surface with atrium or beehive grates.
Plant Materials	Per approved landscape plan	Includes canopy tree; Trees must be set on top of a compacted bioretention soil base (mound). The soil base must be compacted to 85-90% proctor.

Construction Installation: The installation and inspection of the construction of stormwater tree filters are to follow the Construction Inspection Checklist for Urban Bioretention (See Appendix G). The checklist is to be included on the plan.

Maintenance Activities for Stormwater Tree Filters. The following is the list of maintenance activities for stormwater tree filters.

Tree Filter Maintenance Schedule

Maintenance	Frequency
<ul style="list-style-type: none"> • Spot weeding, erosion repair, trash removal, and mulch raking 	Twice during growing season
<ul style="list-style-type: none"> • Add reinforcement planting to maintain the desired vegetation density • Remove invasive plants using recommended control methods • Stabilize the contributing drainage area to prevent erosion 	As needed
<ul style="list-style-type: none"> • Spring inspection and cleanup • Supplement mulch to maintain a 2-3 inch layer • Prune trees and shrubs • Examine for the ponding depth and adjust accordingly • Inspect inflows and overflow for erosion • Inspect for structural deficiencies and repair 	Annually
<ul style="list-style-type: none"> • Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Design Specification No. 10: Dry Swales. All of the design specifications are taken from the Clearinghouse Design Specification No. 10 with the following changes:

Material Specifications. Below is the table of material specifications for dry swales.

Dry Swale Material Specifications

Material	Specification	Notes
Filter Media Composition	Filter Media to contain: <ul style="list-style-type: none"> • 80%-90% sand with >75% being coarse to very coarse • 10%-20% soil fines • 3%-5% organic matter in the form of plant based compost meeting Clearinghouse Design Specification #4, Section 6.5 	The volume of filter media based on 110% of the plan volume, to account for settling or compaction.
Filter Media Testing	Plant available P within Low+ (L+) to Medium (M) per DCR 2014 Nutrient Management Criteria (18-40 mg/kg P for the Mehlich III procedure) and CEC >5	The media can be procured from approved filter media vendors or mixed onsite with testing results meeting standard for both texture and nutrient composition.
Surface Cover	Turf or river stone.	
Top Soil	4 inch surface depth of loamy sand or sandy loam texture, with less than 5% clay content, a corrected pH of 6 to 7, and at least 2% organic matter.	
Filter Fabric	Use a non-woven polypropylene geotextile fabric with a flow rate of > 110 gal./min./sq. ft. (e.g., Geotex 351 or equivalent); Apply immediately above the underdrain only. Do not install at the bottom or between layers.	
Choking Layer	A 2 to 4 inch layer of sand over a 2 inch layer of choker stone (typically #8 washed gravel) laid above the underdrain stone	
Stone and/or Storage Layer	A 9 to 18 inch layer (depending on the desired depth of the storage layer) of #57 stone, should be double-washed and clean and free of all soil and fines.	
Underdrains, Cleanouts, and Observation Wells	Use 6 inch rigid schedule 40 PVC pipe with 3/8-inch perforations at 6 inches on center, maximum of 3 rows of perforations.	Install perforated pipe for the full length of the Dry Swale cell. Use non-perforated pipe, as needed to connect with the storm drain system.
Vegetation	Plant species as specified on the landscaping plan.	
Check Dams	Use non-erosive material such as wood, gabions, riprap or concrete. All check dams should be underlain with filter fabric and include weep holes. Wood used for check dams should consist of pressure-treated logs or timbers, or water resistant tree species such as cedar, hemlock, swamp oak or locust.	
Erosion Control Fabric	Where flow velocities dictate, use woven biodegradable erosion control fabric or mats (EC2) that are durable enough to last at least 2 growing seasons.	

Construction Installation: The installation and inspection of the construction of dry swales are to follow the Construction Inspection Checklist for Dry Swales (See Appendix G). The checklist is to be included on the plan.

Maintenance Activities for Dry Swale. The following is the list of maintenance activities for dry swales. The table is to be included on the plan.

Dry Swale Maintenance Schedule

Maintenance	Frequency
<ul style="list-style-type: none"> • Spot weeding, erosion repair, and trash removal. 	Twice during growing season
<ul style="list-style-type: none"> • Add reinforcement planting to maintain the desired vegetation density. • Remove invasive plants using recommended control methods. 	As needed
<ul style="list-style-type: none"> • Check to see if 95% turf cover or vegetation density has been achieved in the bed and banks of the dry swale. • Check for sediment buildup at curb cuts, gravel diaphragms or pavement edges that prevents flow from getting into the dry swale, and check for other signs of bypassing. • Check for any winter- or salt-killed vegetation. • Check inflow points for clogging or accumulated sand, sediment and trash, and remove it. • Inspect dry swale side slopes and grass filter strips for evidence of any rill or gully erosion, and repair it. • Check the dry swale for evidence of excessive ponding or concentrated flows, and take appropriate remedial action. • When sediment accumulation is noted, look for any bare soil or sediment sources in the contributing drainage area, and stabilize them immediately. • Check for clogged or slow-draining soil media, a crust formed on the top layer, inappropriate soil media, or other causes of insufficient filtering time, and restore proper filtration characteristics. • Inspect upstream and downstream of check dams for evidence of undercutting or erosion, and remove trash or blockages at weepholes. 	Annually
<ul style="list-style-type: none"> • Inspected and certified by a professional licensed in the State of Virginia 	Once every 5 years

Design Specification No. 11: Wet Swales. All of the design specifications are taken from the Clearinghouse Design Specification No. 11.

Design Specification No. 12: Filtering Practices. All of the design specifications are taken from the Clearinghouse Design Specification No. 12.

Design Specification No. 13: Constructed Wetlands. All of the design specifications are taken from the Clearinghouse Design Specification No. 13.

Design Specification No. 14: Wet Ponds. All of the design specifications are taken from the Clearinghouse Design Specification No. 14.

Design Specification No. 15: Extended Detention Dry Ponds. All of the design specifications are taken from the Clearinghouse Design Specification No. 15.

2.4 Pollution Prevention Plan (P2 Plan)

A Pollution Prevention Plan (P2 Plan), required by County Code Section 60-9, shall be developed, implemented, and updated as necessary and must detail the design, installation, implementation, and maintenance of effective pollution prevention measures to minimize the discharge of pollutants.

At a minimum the P2 Plan shall include Sections 2.0, 5.0, and 7.0 from [Appendix B](#) including a detail for each practice proposed on the plans.

The following notes must be added to the plans to address Pollution Prevention:

- Only the following non-stormwater discharges are authorized by Arlington County's MS4 permit, unless the State Water Control Board, the Virginia Soil and Water Conservation Board (Board), or Arlington County determines the discharge to be a significant source of pollutants to surface waters: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)); uncontaminated pumped ground water; discharges from potable water sources; foundation drains; air conditioning condensation; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; individual residential car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; discharges or flows from fire fighting; and, other activities generating discharges identified by the Department of Environmental Quality as not requiring VPDES authorization.
- Appropriate controls must be implemented to prevent any non-stormwater discharges not included on the above list (e.g., concrete wash water, paint wash water, vehicle wash water, detergent wash water, etc.) from being discharged into Arlington County's MS4 system, which includes the curb and gutter system, as well as catch basins and other storm drain inlets, or stream network.
- Per Chapter 26 of the Arlington County Code, it shall be unlawful for any person to discharge directly or indirectly into the storm sewer system or state waters, any substance likely, in the opinion of the County Manager, to have an adverse effect on the storm sewer system or state waters.

2.5 Registration Statement Requirements

For any construction activities resulting in land disturbance equal to or greater than one acre, applicants must submit a [Registration Statement](#) to Arlington County with the Stormwater Pollution Prevention Plan (SWPPP). The Registration Statement will be forwarded to DEQ for permit issuance when Arlington County approves the SWPPP. The applicant will pay the county portion of the permit fee at the DES Front Counter. DEQ will notify the applicant the amount of the fee and payment methods for state portion of the permit fee.

When the project is complete the applicant must submit a [Notice of Termination](#) to Arlington County.

2.6 Stormwater Facility Maintenance and Monitoring Agreement (MMA)

A [Stormwater Facility Maintenance and Monitoring Agreement](#) (MMA) is required for all regulated activities that propose a SWMF. A copy of the blank agreement is to be included on the plan sheets (see Appendix A for the agreement). An original, completed, signed, and notarized maintenance agreement needs to be submitted to the County at the time of SWPPP

submission. The agreement is subject to review and may require resubmission in order to be approved.

2.7 Construction Operator Inspections and As-built Certification

A Responsible Land Disturber (RLD) or DEQ certified stormwater inspector employed by the operator shall be onsite and conduct the inspections required by the P2 Plan according to the schedule outlined on the approved plan (either once every 4 business days; or once every 5 business days and no later than 48 hours following 0.25" of rain within 24 hours as measured at an Arlington County approved data logging rain gauge).

Inspections shall take place, during construction of the stormwater facility, by a licensed design professional (civil engineer, land surveyor or landscape architect). In accordance with standard practice, the actual inspections may be performed by an individual under responsible charge of the licensed professional. The licensed professional shall certify the facility if he/she finds that the facility was constructed in accordance with the approved plans using the "Construction Inspection Checklist" for the appropriate SWMF (see Appendix G). The licensed professional's certification along with any material delivery tickets and results of the tests and inspections shall be submitted to the County prior to issuance of the Certificate of Occupancy and closure of the LDA permit. As-built plans shall include invert elevations and verification of size of the facility. The Construction Inspection Checklist for Permeable Pavement (permeable concrete and permeable pavers) must include a copy of the installer's certificate and/or certification number (ICPI certification required for installation of permeable pavers; NRMCA certification required for installation of permeable concrete). Review of the certification documentation takes a minimum of 5 business days to review. Appendix G outlines additional details based on project type.

2.8 Enforcement

Inspection reports from construction inspections conducted by Arlington County staff will be transmitted via email to the permittee and property owner. Any inspection items that result in a Notice of Violation (NOV) will have a required corrective action date noted on the report. Failure to correct NOV items by the corrective action date may lead to issuance of a Stop Work Order and/or potential revocation of the LDA permit, per 60-17.B. Permit revocation will have the same effect as a Stop Work Order AND require the property owner to apply for a new LDA permit.

2.9 Requirements for Single Family Residences Built Separately

Single-family residences that are separately built, disturbing less than one acre and not part of a larger common plan of development or sale (including additions or modifications to existing single-family detached residential structures) shall be considered a regulated land disturbing activity. This section outlines the less stringent criteria that only these types of projects are allowed to use. All other criteria in Chapter 2 of this manual apply.

- These projects at a minimum must meet the Sheetflow requirements (9VAC25-870-66 and 60-11.C); see Section 2.3.2.
- These projects can get Level I permeable pavement credit for pavement designs with the twelve (12) inches of stone storage and no underdrain in soils that do not percolate at a rate >0.5 " hour, provided they are designed to drawdown within 24 hours. This design is only applicable if the pavement is not receiving additional run-on from other pervious or impervious areas. Construction materials, installation and certification requirements are the same as described elsewhere. No soil infiltration testing is required, however the depth to the seasonal groundwater table is required. A standard detail for residential paver installations is provided on the Stormwater Management Ordinance webpage (detail SWM#2).

- These projects can get Level 1 urban bioretention (planter box) credit for designs utilizing only 18” of soil media. Other design criteria, construction materials, installation and certification requirements are the same as described elsewhere.

2.10 Fee Schedule

[County fees](#) for stormwater plan review and permitting were revised for FY 2019. State established fees that local governments must charge for all regulated land disturbing activities have not changed since they went into effect in 2014. The State regulations require 28 percent of the fee to be remitted to DEQ for program oversight. The state portion of the fee should be paid separately to the state through the Construction General Permit process.

2.11 Bonds

With sole discretion, the Director may consider requests to post performance bonds to obtain a Certificate of Occupancy (CO) before SWMF as-built requirements, final stabilization measures, and tree and other vegetation planting requirements are satisfied only under the following circumstances:

1. SWMFs required under Chapter 60 or Chapter 61

- Vegetation required for SWMFs cannot be planted because of circumstances outside the planting season.
- Subdivisions: where required SWMF(s) are to be installed on an ‘outlot’ and the sequence of construction for the outlot SWMF(s) requires final stabilization of the SWMF drainage area(s) prior to construction.

The Director will not approve the use of performance bonds for SWMFs that rely solely on infiltration due to the high failure rates of such systems at the end of construction.

2. Permanent stabilization measures required under Chapter 60

- Vegetative stabilization is unable to occur because of circumstances outside the planting season.
- Temporary stabilization measures must be installed—and inspected and approved by DES.

3. Tree and other planting required under Chapter 61

- Planting is unable to occur because of circumstances outside the planting season.

Before the Director will approve a performance bond, an amendment to the Stormwater Management Facility Maintenance and Monitoring Agreement (MMA) must be recorded to specify that the current landowner posting the bond retains the right of access and remains responsible for construction of the required SWMFs and, if applicable, planting of trees and other landscaping for the lot until DES approves the as-built certification for each SWMF.

The planting season is between September 15 – December 15 and March 1 – June 15.

The process can take 2-3 business days, please email StormwaterReview@arlingtonva.us to obtain a copy of the paperwork required. Letters of credit or cash deposits are the only types of surety accepted. The LDA permit is required to remain active until the SWMF as-built certification is accepted and the trees have been planted.

For each tree the bond amount posted shall be \$700. For stormwater management facilities the amount of the bond posted shall include the price of labor and materials to be installed (including any removal if necessary) and the amount of the outstanding as-built certification. The estimate shall be line items and sealed by a professional (engineer, land surveyor or landscape architect). The estimate is reviewed by the County prior to acceptance. ***The use of the performance bond tool will not be available when construction schedules or closing deadlines did not account for SWMF construction requirements and timelines.***

2.12 Post Construction Inspection and Maintenance Requirements

Owners of stormwater management facilities are required to maintain their facilities in accordance with the Maintenance and Monitoring Agreement and inspect their facilities annually. Letters will be mailed to owners in September reminding them of their obligations with a due date of mid-November. Inspection reports are to be submitted to the County using the online inspections forms and are required to include the following of photos of the facility:

- Bioretention and planter boxes: three (3) photos are required.
 1. Close-up photo of the inflow/downspout discharge and splash block/rocks
 2. Facility's location with the home or building in the background
 3. Ponding depth (including a ruler)
- Permeable pavement: two (2) photos are required:
 1. Pavement's location with the home or building in the background
 2. Close-up photo of pavement showing approximately 10 pavers in the whole photo.
- Infiltration trenches: two (2) photos are required:
 1. Close-up of the observation well with the cap removed
 2. Facility's location with the home or building in the background
- Underground detention: two (2) photos are required.
 1. Underground detention structure's location
 2. Close-up of the outlet structure showing that it is clear of any debris

Failure of the owner to submit the required inspection report and photos for each facility will subject the owner to an inspection conducted by the County and the owner will be back charged the costs. Owners that fail to submit complete inspection reports, including all the required data and photos for each facility, could also be subject to an inspection conducted by the County and the owner will be back charged the costs. Additionally, failure of the owner to complete any required maintenance to the facilities will result in the County performing the maintenance and the owner will be charged those costs.

- Inspection administrative fees: \$100
- Maintenance administrative fees: \$200

3 Landscape Conservation Plan Requirements

In accordance with § 61-13.C, a Landscape Conservation Plan must be submitted and approved before any demolition or clearing and grading may occur on a lot or parcel. This plan and any revisions must be prepared and/or certified by a certified arborist or landscape architect. Major alterations to an approved landscape conservation plan, such as changes to the limit of disturbance or construction footprint, removal of preserved trees, or adjustments to tree species or planting locations, require plan resubmission and approval prior to issuance of a certificate of occupancy. Minor preservation or planting changes, such as modification to fencing or other landscaping, shall be cleared by the County Urban Forester, before installation.

In addition to this section, a [Tree Protection Guidelines](#), [Tree Protection Plan Example](#), [Landscape Plan Example](#), [Tree Notification Letter Example](#) and a [Landscape Plan Checklist](#) are available as guidance.

The General Performance Standards for Development in Chesapeake Bay Preservation Areas (§ 61.10.A-C) will be applied to review of Landscape Plans. In accordance with § 61.10.A-B, the limit of disturbance, inclusive of the construction footprint and all utilities and stormwater infrastructure, shall be minimized to provide for tree preservation. Tree preservation shall be maximized to meet the tree canopy requirements of § 61-10.C.

For projects in the Resource Protection Area requiring a major Water Quality Impact Assessment, the landscape conservation element (§ 61.12.C.3) shall be addressed through the Landscape Conservation Plan. Additional requirements, over and above those outlined in this section, may be imposed as authorized by the Chesapeake Bay Preservation Ordinance, to protect water quality.

No trees shall be removed prior to plan approval. Trees removed prior to plan approval shall be replaced in accordance with the [Tree Replacement Guidelines](#), above the required tree canopy targets.

On a project by project basis, as deemed necessary by the County Urban Forester at the plan review stage to ensure implementation of the approved Landscape Conservation Plan, the County Urban Forester may require a private project arborist to monitor a site and provide regular reports on tree preservation and planting.

3.1 Plan Requirements for 4.1 Site Plan and Other Conditioned Projects

For site plans subject to conditions requiring tree replacement, such as plans governed by [Arlington County Administrative Regulation 4.1](#), and conditioned use permits, the Chesapeake Bay Preservation Ordinance Landscape Conservation Plan requirement shall be satisfied by the submission of the standard [Tree Protection/Replacement Plan](#) and [Landscape Plan](#) currently required under 4.1. The following additional requirements for 4.1 site plans also apply:

The 4.1 [Tree Protection/Replacement Plan](#) must include the Resource Protection Area (RPA) delineation (Section 4.3), if an RPA exists on the site. If an RPA exists on the site, additional information also may be required, as outlined in Section 4 of this guidance manual.

The 4.1 [Landscape Plan](#) must satisfy the 4.1 tree replacement requirements and the Chesapeake Bay Preservation Ordinance tree canopy coverage requirements and must include a delineation of the post-development tree canopy at 20 years maturity. If the 4.1 tree replacement requirements do not satisfy the Chesapeake Bay Preservation Ordinance tree canopy requirements, additional trees must be planted to meet the canopy requirements. Projected 20-year tree canopy area for each tree to be planted must be included in the Planting Schedule table.

For 4.1 site plans, and other conditioned projects, the entire canopy of street trees planted within the project property lines, in accordance with the approved 4.1 [Landscape Plan](#), including any canopy area over the public right-of-way, may be counted towards the Chesapeake Bay Preservation Ordinance canopy requirements for the site.

3.2 Plan Requirements

For all projects subject to the plan of development process under § 61-13 (including Use Permits) a Landscape Conservation Plan shall be prepared and submitted that meets the requirements below. Landscape Conservation plans shall be to scale, with a north arrow and be clearly legible. For single homes, on single lots under 1 acre, plans shall be drawn to a minimum scale of 1:10.

The Landscape Plan shall include:

1. Tree preservation, to the greatest extent practicable, in accordance with § 61.10.A-B. The limit of disturbance, inclusive of the construction footprint and all utilities and stormwater infrastructure, shall be minimized to maximize preserved tree canopy.
2. A tree preservation plan, a planting plan, and details on separate sheets.
3. All existing trees and other woody vegetation on the site of three (3) inches or greater diameter at breast height (DBH, 4.5 feet above grade), including species type and current condition as a numerical rating from 1 to 100 (per the Guide for Tree Appraisal, 10th Edition). Where there are groups of trees, the entire stand may be delineated as a whole rather than individual trees. However, the critical root zone for the stand shall reflect the actual composition of the stand and the species composition of the stand shall be provided. RPA trees should be identified as being in the RPA on the tree inventory table.
4. Preservation of all trees outside of the construction footprint, except non-native invasive and high-risk trees (condition rating < 50 percent), to the maximum extent practicable.
5. All trees and other woody vegetation three (3) inches or greater DBH proposed to be removed and the reason for removal (e.g., construction footprint, site lines, disease, etc.). Proposed tree removals within the RPA must be specifically identified as being proposed to be removed from the RPA.
6. All trees and other woody vegetation three (3) inches or greater DBH proposed to be protected outside the construction footprint, along with the tree protection measures taken to ensure protection during clearing, grading, and all phases of construction.
 - In accordance with § 61-10.B, tree protection measures must include protective barriers at or beyond the critical root zone of each tree to be protected, to the maximum extent practicable. Encroachments into the critical root zone of protected trees that are necessary for the proposed use or development shall include appropriate mitigation measures as defined in the [Tree Protection Guidelines](#), as deemed necessary.
 - The critical root zone shall be determined and shown for all on-site and adjacent off-site trees and woody vegetation according to the [Tree Protection Detail for Determining Critical Root Zone \(Appendix F\)](#).
 - The location of existing and proposed utilities shall be shown.
 - On the tree inventory table, identify the percentage of critical root zone impacted. Where trees are 30% or more impacted, and preserved, show how root impact is minimized through alternative root protection methods, or how critical root zone may not reflect the actual location of roots (such as a critical root zone overlapping an existing building).
 - Tree protection shall be a minimum 4' chain link fence mounted on vertical pipes driven 2' into the ground with no gates (except for 4.1 site plans, where a minimum of 6' high chain link fence is required). Where tree protection and silt fence are in line, super silt fence may substitute for chain link fence.
 - Tree protection notification signs in English and Spanish must be posted on each protective barrier, designed according to the detail provided in [Appendix F](#).
 - Tree protection fencing must be installed and inspected after a pre-construction meeting with the County Urban Forester and prior to any land disturbing activity (including utility work or vegetation clearing) on the property.
 - All tree protection fencing shall remain in place until all activities involving construction vehicle movement on the site, the stockpiling of materials on the site, or clearing, grading, landscaping, digging, or trenching on the site have ceased or until the time of final site stabilization, whichever occurs last.

- Tree protection areas shall have all non-native invasive vines removed at the end of the project. Where deemed necessary by the County Urban Forester to ensure tree survival, the protection area shall be covered with shredded hardwood mulch, or other organic mulch as approved by the County Urban Forester.
 - Field changes can be made by the County Urban Forester, where reasonable field changes will improve tree preservation and/or planting survival.
 - When preserved tree condition changes significantly during construction, even due to situations outside of the control of the project manager, the County Urban Forester may require resubmission of the plan.
7. Location of the critical root zone for any jointly-owned trees and trees on adjacent properties along with protective barriers, closing access to the tree protection area, at or beyond the critical root zone, to the maximum extent practicable if it extends onto the site.
- Encroachments into the critical root zone of jointly-owned trees or trees on adjacent properties that are necessary for the proposed use or development shall include appropriate mitigation measures such as root pruning.
 - Where construction activities encroach into the critical root zone of jointly-owned trees or trees on adjacent property, property owners are required to notify joint or adjacent property owners in writing by certified mail. Notification shall include contact information for the sender, a description of any possible tree impacts and a copy of the plan.
 - The responsibility for resolving any jointly-owned or adjacent property tree issues shall be with the owner.
 - Trees on public property shall be protected to the maximum extent practicable. Where public trees are found not to be salvageable, replacement shall be in accordance with the County's Tree Replacement Guidelines and [Administrative Regulation 4.3: Tree Planting on Public Land](#).
8. The Resource Protection Area (RPA) delineation (Section 4.2), if an RPA exists on the site.
9. All vegetation proposed to be planted after construction. Proposed planting shall be shown on the plan and detailed in a Plant List.
- **Within the Resource Protection Area (RPA), only native species may be planted.** In the RPA, cultivars of native species may be used for foundation plantings, specimen trees and other principal landscaping elements, but may not be used for riparian buffer restoration, reforestation or mitigation plantings or for plantings adjacent to natural areas or parkland.
 - Non-native species may be planted outside of the RPA. However, to encourage the use of native trees, native tree species planted outside of the RPA will receive a 1.25 canopy credit. Tree canopy coverage calculations are detailed below and in the [20-Year Tree Canopy Worksheet \(Appendix E\)](#).
 - The Plant List shall include plant spacing for trees, shrubs and ground cover plants.
 - The Plant List shall provide diversity to ensure the 20-Year Tree Canopy coverage. When ten (10) or fewer medium-large and large trees are proposed, a maximum of three (3) trees of each species shall be specified. A single species cannot constitute the entirety of the plant list if more than one (1) tree is to be planted. When more than ten (10) medium-large and large trees are to be planted, the plant list shall include a minimum of five (5) species with the number of trees distributed evenly, unless otherwise approved by the Director.

- The Plant List shall not include any species found on the [Non-Native Invasive Plants of Arlington County, Virginia](#) or any other regionally invasive or potentially invasive plant as determined by the Director.
 - Tree planting procedures shall be in accordance with [the Tree Planting Detail in Appendix F](#).
 - When trees and other required landscape materials cannot be planted within the planting season (September 15 – December 15, March 1 – June 15), a planting deferral may be required by the County Urban Forester. A bond, equivalent to the cost required to plant and maintain any deferred landscaping for two years shall be posted, as part of the stormwater bond, to be released after planting and inspection by the County Urban Forester. See Section 2.11 for more information.
10. The planting notes included in [Appendix F](#).
11. Calculation of the post-development tree canopy at 20 years maturity to determine compliance with the minimum tree canopy requirements of § 61-10.C.

3.3 Native Plants

For the purpose of this document, a native plant is defined as a plant that is indigenous to northern Virginia. Only native plant species or cultivars of natives may be planted within the Resource Protection Area. Cultivars of native plant species may not be used for habitat restoration, reforestation and mitigation within the RPA and adjacent to natural areas or parkland except as approved by the Director. In the RPA, cultivars of natives may be used for foundation plantings, specimen trees and other principally landscaping elements.

Resources for selecting native plant species for RPA projects include:

- [20-Year Tree Canopy Worksheet \(Appendix E\)](#);
- [Virginia Department of Conservation and Recreation's Riparian Buffer plant list \(<http://www.dcr.virginia.gov/natural-heritage/document/riparian-nat-plants.pdf>\)](#);
- [Keeping It Natural!](#), a natural areas planting guide for Arlington County and Alexandria; and
- the [Virginia Digital Plant Atlas](#) (<http://www.vaplantatlas.org/index.php?do=start>)

3.4 Tree Canopy Coverage Calculations

Determination of the tree canopy at 20 years maturity shall be in accordance with the tree canopy coverage information in the [20-Year Tree Canopy Worksheet \(Appendix E\)](#). This information is based on data compiled by the Virginia Nursery and Landscape Association. Cultivars or species not included on the 20 Year Canopy Coverage list require review by the Director. Canopy credit, if granted, will be based on published documentation of mature size.

Tree canopy calculation shall also be subject to the following conditions:

- Total canopy area is calculated as the sum of preserved canopy and projected 20-year canopy for new trees.
- At the discretion of the Director, the canopy of existing trees to be protected on the site may not be counted towards the post-development canopy requirement if there are significant encroachments into the critical root zone of such trees that substantially threaten tree survival. Where encroachments will impact 30% or more of the critical root zone of a preserved tree, the plan shall provide for minimization of root impacts through alternative root protection methods, or identify why the critical root zone may not reflect the actual location of roots (such as due to overlap of critical root zones or the location of existing structures).

- To further encourage preservation of existing trees and account for future canopy growth, a 2.0 canopy area credit may be applied to the canopy area of existing trees, identified on the [20-Year Tree Canopy Worksheet \(Appendix E\)](#) as having a Medium, Medium-Large or Large canopy size, to be protected on the site, if the Director determines those trees are sufficiently protected. Trees identified on the 20-Year Tree Canopy Worksheet as having a Small or Small-Medium canopy size will not receive this credit.
- Tree canopy credit will not be given for tree species designated as invasive on the [Non-Native Invasive Plants of Arlington County, Virginia](#) list.
- The canopy of existing understory trees will not be credited where such trees are completely beneath the canopy of existing overstory trees on the same property.
- Newly planted trees may not be planted closer together than 10 feet for small and small-medium trees, 15 feet for medium trees, 20 feet for medium-large trees and large trees, unless otherwise approved by the Director.
- Where there is a desire for more closely planted trees as a hedge, the 20-year tree canopy for the hedge can be valued as 10 square feet (sf) per 5 linear feet (lf) of hedge, to a maximum of 150 square feet.
- To encourage planting of native species, new native trees planted outside of the RPA will receive a 1.25 canopy area credit. Cultivars of native species planted outside of the RPA may also receive the canopy credit bonus for natives, based upon published documentation of mature size, unless otherwise determined during review by the Director. New native trees planted within the RPA may be counted towards the tree canopy requirement, but do not receive the canopy credit bonus for planting native species. The canopy area of trees on adjacent properties may not be counted towards the canopy requirement, unless: a.) such trees are County-designated Heritage, Specimen, or Memorial trees in accordance with Chapter 67; or b.) the canopy area of such trees covers more than 50% of the site.
- Any public easement located on private property beyond the public right-of-way, such as a public street right-of-way, may be subtracted from the total site area in determining tree canopy coverage requirements. For example, for a single-family home parcel, there may be a public easement for sidewalk beyond the street right-of-way which could be subtracted. For a new subdivision with a new public street, any public easement beyond the street right-of-way may be subtracted, but not the area of the street itself, since this is part of the overall development footprint of the project which will likely have impacts on existing trees. If areas are subtracted, trees preserved in these areas shall not be counted for canopy calculations.

3.5 Exemptions

Dedicated school sites, playing fields, or other non-wooded public recreation areas, and other facilities and uses of a similar nature are exempt from the tree canopy coverage requirements outlined in § 61-10.C, but are required to submit a landscape conservation plan. A landscape conservation plan is not required for activities exempt from the Chesapeake Bay Preservation Plan of Development Requirements (§ 61-13, see Section 4.7 below).

4 Resource Protection Area Requirements

If a Resource Protection Area (RPA) exists on a site, an [RPA delineation](#) (see Section 4.3) and a [Water Quality Impact Assessment \(WQIA, see Section 4.5\)](#) are required. A WQIA may also be required for other projects depending on the nature and location of the proposed activity. In addition, certain activities, such as building a new house or expansion of an existing structure,

are only allowed if an exception (requiring completion of [Appendix D: Exception Request Form](#)) has been granted in accordance with § 61-16.

The flowchart in Section 4.2 outlines the overall process for complying with RPA requirements, including when an exception is required.

4.1 Resource Protection Area

The Resource Protection Area (RPA) is defined in Section § 61-5 of Arlington County's [Chesapeake Bay Preservation Ordinance](#).

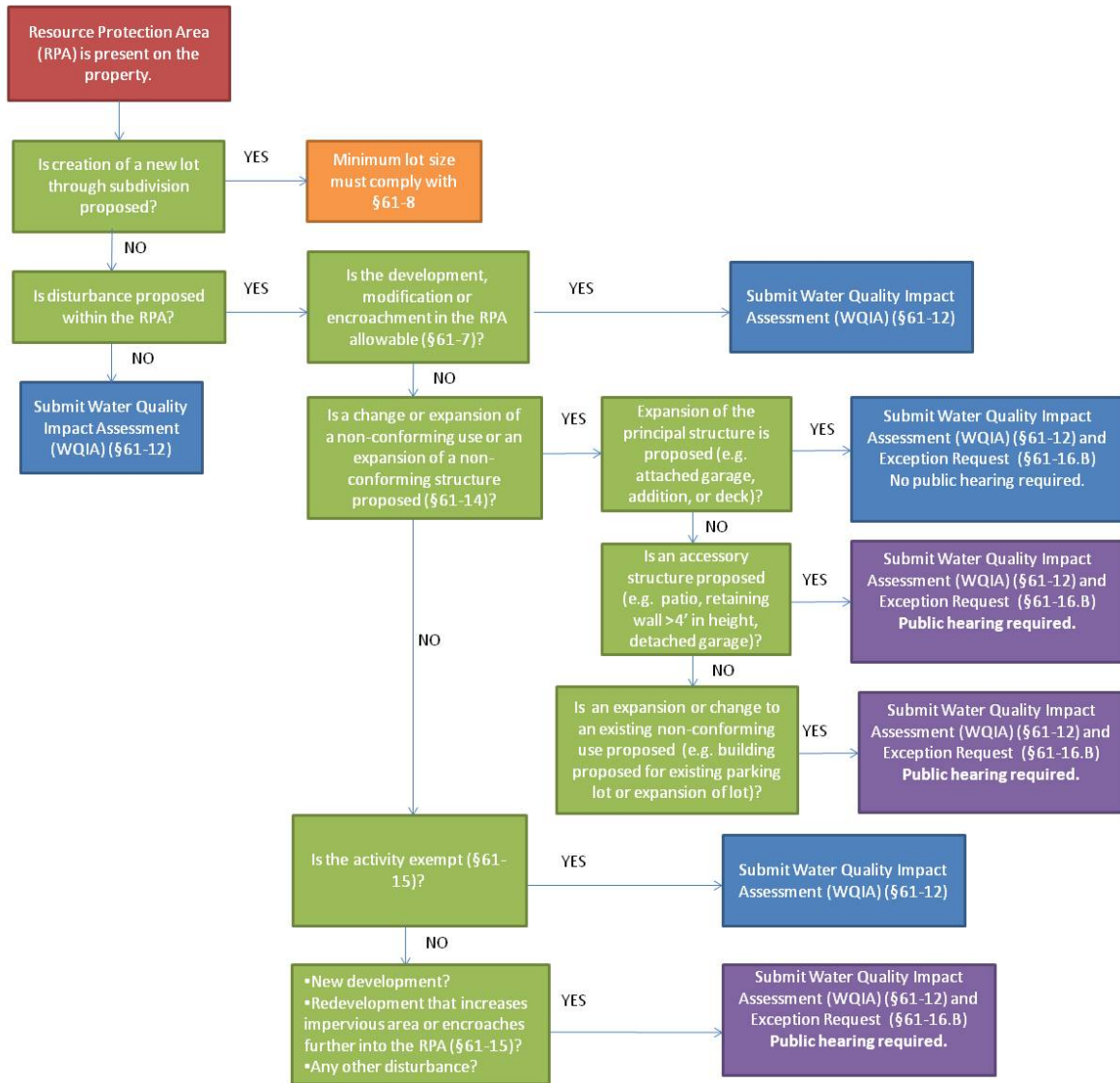
The RPA includes:

- tidal wetlands and shores,
- non-tidal wetlands contiguous to tidal wetlands or perennial streams
- natural stream channels
- man-made open stream channels
- a minimum 100 foot buffer adjacent to these water bodies
- steep slopes greater than or equal to 25 percent contiguous to the 100 foot buffer
- contiguous steep slopes greater than or equal to 15 percent in the Potomac Palisades area of the County from Chain Bridge to the County boundary (as well as other such areas as may be designated by the County Board under § 61-5.B.1.e).

The County's adopted Chesapeake Bay Protection Area Map, available in Suite 800 of the County office building, serves as a guide to the general location of RPAs so that property owners can determine if an RPA exists on a given property. Arlington County's [interactive Resource Protection Areas map](#) also can be used for this purpose.

Arlington County's adopted CBPA map includes contiguous steep slopes 25 percent or greater as determined using a digital elevation model (DEM) based on 2-foot contour interval topography. Due to limitations of this model, the RPA delineation (see Section 4.2) may vary from the mapped RPA.

Regulatory Flowchart for determining compliance with RPA requirements (Chapter 61)



4.2 RPA Delineation

All submissions regulated by the plan of development process must include an RPA delineation if an RPA exists on the site. The RPA delineation will be reviewed for compliance with the minimum lot size requirements for new lots (§ 61-8; see Section 4.3) as well as to determine if a WQIA and/or exception request is required for the proposed development.

The site-specific boundaries of the RPA must be identified by the applicant and approved by County staff. The site-specific delineation of RPA boundaries must be conducted in accordance with the [Resource Protection Area: Onsite Buffer Area Delineation](http://www.deq.virginia.gov/Portals/0/DEQ/Water/Guidance/ChesBayPreservAct/RPA-OnsiteBufferAreaDelineation.pdf) guidance document (<http://www.deq.virginia.gov/Portals/0/DEQ/Water/Guidance/ChesBayPreservAct/RPA-OnsiteBufferAreaDelineation.pdf>) provided by the Virginia Department of Environmental Quality (DEQ) The location of this boundary on all submitted plans must be performed by a professional land surveyor according to accepted surveying techniques. An exception is made for plans

involving <2,500 square feet of land disturbance (a delineation procedure for these sites is included below). The field-determined RPA boundary must be shown on the existing conditions plan, the grading plan, the erosion and sediment control plan, the stormwater management plan; and the landscape conservation plan.

All steep slopes of 25 percent or greater contiguous to the minimum 100' RPA boundary must also be delineated on the site plans. The RPA boundary is extended to include these contiguous slopes. Slopes adjacent to the minimum 100-foot RPA boundary must be surveyed in the field by a professional land surveyor according to accepted surveying techniques (except for plans involving <2,500 square feet of land disturbance).

In accordance with § 61-12.B.1, which requires a Water Quality Impact Assessment for disturbance of slopes greater than or equal to 15 percent located adjacent to the landward boundary of the RPA buffer, such slopes must also be delineated on the site plans as described in the preceding paragraph.

For projects where a topographic survey is not required:

- Use [DEQ's RPA delineation guidance](#) to measure the minimum 100' RPA boundary at three locations on the parcel (at each edge and in the middle);
- Mark these locations with flags and measure the distance of each flag perpendicular to the property line or other feature shown on the property's plat (e.g., house, driveway, etc.)
- The RPA boundary can then be related to and shown on the property's plat. For properties with steep slopes, please call (703) 228-4488, TTY (703) 228-4611 for guidance.

4.3 Subdivision Plats

If RPA exists on a lot or lots proposed for subdivision, the RPA delineation must be shown on the plat. Per § 61-8, any lot subdivided after October 1, 1989 must have sufficient area outside the RPA to accommodate the intended development, unless the development can be considered allowable under § 61-7.A.

The following note must also be added to each plat:

The landward component of the Resource Protection Area buffer shall consist of an undisturbed 100-foot wide buffer of vegetation, which shall be retained if present and established where it does not exist. Land development may be allowed in the Resource Protection Area only if it is water dependent or constitutes redevelopment and the criteria for allowable development in Arlington County Chesapeake Bay Preservation Ordinance Section 61-7.2 have been met.

4.4 Water Quality Impact Assessments

A [Water Quality Impact Assessment \(WQIA\)](#) is required under § 61-12 for:

- Any proposed land disturbance or development within an RPA, including development permitted under § 61-7.A
- Any RPA buffer modification or encroachment, including modifications or encroachments permitted under § 61-7.B or C
- Any proposed land disturbance or development on slopes greater than or equal to 15 percent located adjacent to the landward boundary of the RPA buffer
- Exempted activities under § 61-15, include passive recreation facilities and associated amenities (e.g., trails, boardwalks, bike paths etc.), natural resource conservation, and historic preservation.

A WQIA may also be required for development outside of the RPA, depending on the nature of the development and the potential impacts on water quality.

4.4.1 Land disturbance, encroachment and impervious cover

Land disturbance is defined under § 61-3, and includes grading, removing, filling, disturbing or dredging of soils, clearing or grubbing of vegetation, or paving or removal of pavement.

For the purposes of the WQIA, encroachment is expressed as a distance, usually from a structure to the stream or other water body. The edge of the defined streambed or ordinary high water line serves to mark the boundary of the water body. For projects proposing modification or expansion of the primary structure, the location of the existing principal structure, including attached structures such as decks or garages, will be used to determine if an increase in encroachment is proposed. The location of detached structures or accessory uses including but not limited to tool sheds, detached garages, retaining walls, gazebos, pools, patios, and terraces will not be considered for these projects. Additional [guidance on non-conforming structures and uses](#) is provided by DEQ.

Impervious cover is defined under § 61-3, and includes roofs, buildings, parking areas, streets and any other asphalt, concrete or compacted gravel or dirt surfaces. Unmortared brick or flagstone surfaces set in sand are also considered to be impervious. For the purposes of the RPA requirements, pools are also considered to be impervious cover. Any impervious cover removed from a site within the preceding (2) years may be counted as impervious cover for the pre-development condition, if a valid demolition permit was obtained for the project or other documentation is provided that is acceptable to the Director.

4.4.2 Contents of the WQIA

All WQIAs initially require submission of the basic information required in § 61-12.B. The [Water Quality Impact Assessment Data Sheet \(Appendix C\)](#) is the template provided to submit the required information. The submitted WQIA must be complete and must be accompanied by a scaled site-drawing.

The scaled site-drawing and WQIA together must provide the:

- Location of the RPA
- Location and nature of the proposed encroachment into the RPA buffer
- Area of pre- and post-development impervious surfaces on the site and stormwater calculations if appropriate
- Type and location of proposed best management practices to mitigate the proposed encroachment and the location of existing and proposed runoff outfalls or drainage pathways from the property;
- Location of existing vegetation onsite, including the number and type of trees and other vegetation to be removed in the RPA buffer
- Re-vegetation or vegetation enhancement plan that supplements the existing RPA buffer vegetation in a manner that provides for pollutant removal, erosion and runoff control.

Projects that propose to disturb more than five thousand (5,000) square feet in the RPA or that propose encroachment into the seaward fifty (50) ft of the RPA buffer may be required to submit the additional information authorized under § 61-12.C for [Major WQIAs](#) depending on the nature of the activity proposed, site conditions, and potential water quality impacts (e.g., steep slopes, sensitive ecological areas, etc.).

A WQIA for a proposed modification to the RPA buffer must also include the information required in § 61-7.B.4. A WQIA for a proposed public road in the RPA buffer (an exempted

activity) must demonstrate that the alignment and design prevents or minimizes RPA encroachment and minimizes adverse effects on water quality. A WQIA for any exempted activity under § 61-15.D must demonstrate that the intended use will not deteriorate water quality.

4.5 Exceptions

Some activities in the RPA may only occur if an exception to the requirements of the Chesapeake Bay Preservation Ordinance (Chapter 61) is obtained. This section identified common RPA activities that require an exception and describes the process for requesting an exception.

4.5.1 What Activities are Allowed in the RPA Without an Exception?

The following are the typical activities in Arlington that are allowed in the RPA without an exception, subject to the County's review and approval of a [Water Quality Impact Assessment \(WQIA\)](#):

- Redevelopment, as long as impervious cover within the RPA does not increase and there is no further encroachment in the RPA buffer.
- New development, where there would otherwise be a loss of buildable area on the lot because of the RPA buffer. The buildable area size allowed for such development shall be similar in use and scope to structures in the surrounding neighborhood or area.
- Public roads and utilities.
- Minor trimming and clearing of vegetation for reasonable site lines and vistas, as described in § 61-7.B.
- Exempted activities under § 61-15, such as passive recreation facilities and associated amenities (e.g., trails, boardwalks, bike paths etc.), natural resource conservation, and historic preservation.
- Fence projects, provided they do not inhibit or alter flow or require the removal of trees with a diameter of at least three (3) inches.
- Sheds and gazebos, placed in areas of existing turf less than 100 square feet in size.
- Home gardens, individual home repairs and routine home maintenance are allowed in the RPA without a WQIA unless these activities involve the creation of impervious cover, the disturbance of at least 2,500 ft² of land, or the removal of mature trees with a diameter of at least three (3) inches.

4.5.2 What Activities in the RPA Require an Exception?

The following are the typical activities in the RPA in Arlington that require an exception request and approval, along with an approved Water Quality Impact Assessment, to occur:

- Expansion of structures or uses currently located partially or fully in the RPA buffer (non-conforming uses), such as building an addition, deck, or garage for an existing home or expanding an existing parking lot.
- Expansion of an existing structure currently located outside the RPA buffer into the RPA buffer, such as building an addition, deck, or garage for an existing home.
- Redevelopment that involves removing an existing structure currently located partially or fully in the RPA buffer and building a new structure which encroaches farther into the RPA buffer, has a larger footprint in the RPA than the existing structure, or adds impervious cover within the RPA.
- Redevelopment that involves removing an existing structure currently located outside the RPA buffer and building a new structure which encroaches into the RPA buffer.

- New development which encroaches into the RPA buffer, except where the RPA buffer results in a loss of buildable area (see Section 4.5.1 above).
- Redevelopment that changes the existing use in the RPA buffer, such as constructing a commercial building within the footprint of an existing parking lot.
- The removal of trees with a diameter of at least three (3) inches, that is not allowable under § 61-7.B
- New accessory structures or uses such as patios, detached garages, or outbuildings, or expansions of existing accessory structures or uses.
- Retaining walls exceeding 4 feet in height and 1 foot in width. Retaining walls that exceed these dimensions or involve creation of additional impervious cover, disturb more than 2,500 square feet, or remove trees of at least three (3) inches, are considered detached accessory structures and are subject to the Chesapeake Bay Preservation Ordinance Review Committee (CBORC) exception process.

4.5.3 Exception Requests

Requests for exceptions to the requirements of the Chesapeake Bay Preservation Ordinance (Chapter 61) must be made in writing using the [Exception Request Form \(Appendix D\)](#). Most exception requests will be reviewed by the Chesapeake Bay Ordinance Review Committee (CBORC) and heard at a public hearing. In particular, CBORC will review requests for exceptions to the requirements of:

- § 61-7 (Allowable Development, Modifications, and Encroachments in RPAs)
- § 61-14.C.3 (requests to construct, expand or modify nonconforming accessory structures or uses in the RPA buffer)

The Director shall review all other exception requests, including requests to modify nonconforming principal structures in the RPA buffer under § 61-14.C.1 (e.g. additions, decks or garages on an existing home) and requests for exceptions to § 61-10 (General Performance Standards for Development).

For exception requests to modify nonconforming principal structures in the RPA buffer to be heard by the Director, at least 70 percent of the principal structure must remain intact and the modification must be compatible in bulk and scale to those in the surrounding neighborhood or area, as determined by the Director. If these criteria are not met, the modification shall be subject to the exception request requirements for redevelopment under 61-16.A, which require review by CBORC.

For exception requests involving proposed activities in the RPA, the WQIA will be the primary tool to evaluate the request. In addition, for these and other exception requests, CBORC or the Director will review each request based on the criteria in § 61-16.C.

Public notification is also required for all exception requests submitted to CBORC, according to the requirements of § 61-16.D.

4.6 Exempted Activities

The most common activities in Arlington exempted under § 61-15 from both the Plan of Development and RPA requirements of the Chesapeake Bay Preservation Ordinance include public roads (built separately from development projects regulated under § 61-13) and utilities such as electric and gas lines, fiber optic cables, etc. However, these exemptions are contingent upon construction, installation, operation, and maintenance practices that minimize water quality impacts.

Passive recreation facilities such as boardwalks, trails, and pathways also may be exempt from both the Plan of Development and RPA requirements. A WQIA must be submitted for such activities that demonstrates that these activities will not deteriorate water quality, as required by § 61-15.C.

Federal properties are exempt from RPA requirements. However, federal projects must adhere to the General Performance Standards of § 61-10.

4.7 Vegetation Removal and Replacement in the RPA

Allowable modifications to RPA buffers are described in § 61-7.B. Minor trimming and clearing of vegetation for reasonable site lines and vistas and the creation of access paths up to 4 feet in width is allowable upon review of a WQIA and the required site plan. Landowners may also remove noxious vegetation, including non-native invasive plants, poison ivy and poison sumac, as well as dead, diseased or dying trees or shrubs at their discretion. However, vegetation that is removed must be replaced with other vegetation equally effective at limiting runoff and preventing erosion.

Dead, diseased or dying trees with a diameter of a least three (3) inches removed from the RPA under § 61-7.B are required to be replaced within the RPA at 1:1 (1 tree replacement for each tree removed). At the discretion of the Director and in specific circumstances, this requirement may be waived, for example, for removals of dead trees in a natural forested area with significant existing canopy cover.

The removal of trees in conjunction with land disturbance or development is not allowable without an exception. Trees with a diameter of at least three (3) inches removed from the RPA as result of land disturbance or development must be replaced in the RPA in adherence to [Arlington County's Tree Replacement Guidelines](#). Tree replacement within the RPA is required even when, through preservation of canopy or planting outside the RPA, the tree canopy requirements of § 61-10.C are otherwise met. The requirements of § 61-12.A for a net improvement in the RPA buffer vegetation also apply.

Trees with a diameter of a least three (3) inches illegally removed from the RPA must be replaced with species of the same or comparable value as determined by [Arlington County's Tree Replacement Guidelines](#) (§ 61-18.A.4).

Only native plants may be planted in the Resource Protection Area (see Section 8 for more information and links to RPA plant lists). For questions about vegetation removal and replacement, please call (703) 228-4488, TTY (703) 228-4611

4.8 Projects Disturbing Less Than 2,500 Square Feet in the RPA

Projects involving less than 2,500 square feet of land disturbance in the RPA are not subject to the Plan of Development review process in § 61-13. However, the RPA requirements outlined in this Section apply to all projects in the RPA regardless of the area of disturbance. Additionally, such projects are subject to the mitigation requirements incorporated in § 61-7 and § 61-12.

Projects that will:

- add impervious cover within the RPA
- increase encroachment within the RPA,
- remove natural vegetation in the RPA buffer
- remove or impact the critical root zone of trees three (3) inches in diameter or greater within the RPA buffer, or
- disturb 500 square feet or greater within the RPA

are required to demonstrate an on-site overall net improvement in RPA buffer vegetation or riparian habitat and/or a net reduction in pollutant loads.

Reduction of pollutant loads may be accomplished with landscape or stormwater management practices that reduce runoff and minimize erosion. Such practices include but are not limited to rainwater harvesting (with a use plan), rain gardens, pervious surfaces, soil improvement, tree canopy improvements, conversion of lawn to native vegetation and downspout disconnection.

Where the area of disturbance for a project is less than 2500 square feet but greater than 2000 square feet, the limits of the area of disturbance must be physically demarcated on the site and certified by a licensed professional engineer, surveyor, or architect. For additional information, please contact the Development Bureau at (703) 228-3629, TTY (703) 228-4611.

5 Floodplain Requirements

A floodplain is any land area that is susceptible to being inundated by unusual and rapid accumulation of water from any source. The Floodplain Ordinance in [Chapter 48 of the Arlington County Code](#) regulates development in flood zones. A Floodplain Development Permit may be required. The information regarding the review process and requirement can be found in the Floodplain Review Flowchart. The effective Federal Emergency Management Agency (FEMA) floodplain map can be found on [FEMA's webpage](#).

