

Summary Fact Sheet

Category: 4.0 Site Design Strategies

Practice: 4.2 Flow Splitters

General Description: A flow splitter allows the runoff volume from a drainage area to be split into two or more quantities (“sub-volumes”). Typically, flow splitters are used to isolate the water quality volume (WQV) in order to provide water quality treatment or manage a portion of a storm event with one or more BMPs. The WQV is typically defined as the first 0.5” to 1’ of rain over the impervious drainage area. Alternately, a flow splitter can be used to divert high flows to prevent resuspension of captured pollutants in a BMP.

Each sub-volume is directed to an on- or off-line BMP or to a conventional stormwater conveyance. For instance, the first flush of runoff (i.e. WQV) from a parking lot can be directed to a bioretention cell to provide water quality treatment and the remainder can be diverted to a conventional curb inlet. Alternately, the entire runoff volume can be routed through a bioretention cell and then split. As a rule, multiple flow splitters should be used in small-scale drainage areas throughout a site, rather than using one flow splitter for the entire volume of runoff from the site.

Water Quantity Controls

The simple weir equation is used to size weir-type flow splitters. Manning’s equation can be used to size pipe-based flow splitters. Design variables for weirs are height, width, and V-notch angle (if applicable). Design variables for pipes are roughness, slope, and diameter. Weirs and/or pipes in a flow splitter will be custom-designed according to the total runoff volume and the magnitude of the sub-volumes.

Flow splitters can be designed to split flows in two ways:

- Based on a given magnitude, such as the pre-development runoff volume or peak discharge rate for the water quality storm, or
- Proportionally, in which case the magnitudes will vary but the proportion of runoff volumes flowing through each weir remains constant. An example is the ratio of the pre-development peak discharge rate to the increase in the peak discharge rate caused by development.

The weir geometry determines the peak discharge rate that can pass through each weir. However, each peak discharge rate is proportional to a runoff volume, such as the WQV.

Water Quality Controls

Flow splitters by themselves have no inherent water quality characteristics. However, the ability to direct a specific quantity or proportion of runoff to a BMP may help to optimize the pollutant removal efficiency for the site. The water quality improvements are related to the water quality benefits of the BMP or BMPs to which split flows are directed. Common BMPs associated with a flow splitter are bioretention and sand filters.

Location: Flow splitters may be placed at any point in a flow path, as long as BMPs or conveyances are present to capture the split flows. They can be configured to accept sheet, concentrated, or piped flow. Typical locations are curbs and manholes. To split flows from

small-scale drainage areas, flow splitters typically should be located at a point at which flows are unconcentrated.

Design Construction and Materials: Flow splitters are typically constructed of the same material as the surrounding stormwater conveyance (for instance, a curb or a manhole). Concrete is typical. Plastic or metal weir inserts may be also be used. If weirs are used to split flows, construction costs may simply be the extra labor and material required to construct the concrete forms. Additional costs may be associated with pipe installation, although the use of a particular pipe may already be part of the design, regardless of the use of a flow splitter.

Item	Unit	Estimated unit cost
Reinforced concrete construction (3000 psi)	C.Y.	\$125 - \$175
Precast concrete manhole	Ea.	\$3500 - \$5500
Customized weir insert (plastic or metal)	Ea.	\$100 - \$300
Outfall piping from flow splitter	L.F.	Varies by material and diameter

Cost: The cost for a flow splitter to treat runoff from ½ impervious acre is comprised of both the installation cost and annualized costs. A flow splitter is assumed to have a lifespan of 25 years, at which point it will be removed and replaced.

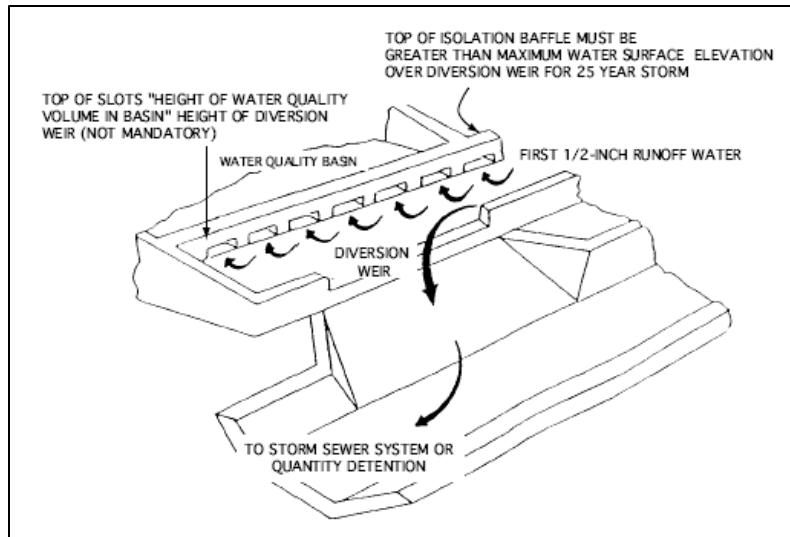
Item	Required Cost per Year (2005 Dollars)													
	0	1	2	3	4	5	6	7	8	9	10	...	25	
Installation ¹	2,000													
Debris Removal		100	100	100	100	100	100	100	100	100	100			
Concrete Inspection		50	50	50	50	50	50	50	50	50	50			
Concrete Repair						1000							1000	
Remove & Replace														2,000
Total Cost	2,000	150	150	150	150	1150	150	150	150	150	150		1150	2,000
Annualized Cost	\$375/ year (includes replacement in year 25)													

¹Developer Cost. Not included in annualized cost.

Maintenance: Inspect concrete structures for cracking and spalling annually in the spring. Repair as needed. Remove accumulated debris four (4) times per year to ensure proper hydraulic performance. Note that debris removal and inspection costs can potentially be molded into the maintenance cost schedule for the associated BMP(s).

Performance and Inspection: To ensure proper performance, visually inspect that flows are being split in the intended proportions and that they are being conveyed to the intended destination (e.g. BMP or conveyance structure). This is especially important for flow splitters in which pipes are used to split the flow. Perform this inspection:

- annually in spring, and
- after extreme events (e.g. after hurricanes).



Example of a flow splitter used for an Austin sand filter

Source: *Northern VA BMP Handbook Addendum: Sand Filtration Systems*

Potential LEED Credits:

Primary: Sustainable Sites – Credit 6 “Stormwater Management” (1-2 Points)

Other: Innovation & Design Process (1-4 Points)

Links to Additional Information:

Echols, S.P. 2002. Split-flow method: Introduction of a new stormwater strategy. *Stormwater - The Journal for Surface Water Quality Professionals*, 3(5): 16-32.