



**Virginia Green Infrastructure Directory**

The single-minded approach of rushing stormwater over pavement, into pipes and pumping it out of cities needs to be reevaluated. The Chesapeake Bay Foundation supports a “nature-based” approach to stormwater management that utilizes natural processes to decrease reliance on and take pressure off of grey infrastructure systems, while celebrating the region’s abundant water resources. Natural processes slow, store and filter stormwater where it falls, allowing it to return to the groundwater system. Nature-based solutions are commonly known as stormwater best management practices (BMPs) and/or “green infrastructure” and include systems such as rain gardens, permeable pavement, retention ponds, constructed wetlands and other bioretention systems that slow, store and filter stormwater. Below are some projects that have been completed in Virginia that are good examples of the potential held by these sorts of solutions.

**Rain Gardens**

Shallow landscaped depression designed to intercept, treat, and infiltrate stormwater before it becomes runoff. Water is directed into them by pipes, swales, or curb openings. Usually designed to withstand the extremes of moisture and concentrations of nutrients, particularly nitrogen and phosphorus that are found in stormwater runoff. Two basic types of rain gardens: Under-drained and self-contained. Both types of rain gardens are used to improve stormwater quality, reduce runoff volumes and generally facilitate infiltration of cleaned water. Which type of garden is selected to be built is a balance of volumes of water to be treated, existing soil conditions, available space, and budget for the project.



**Floyd E. Kellam High Rain Garden**

2665 West Neck Road, Virginia Beach, VA 23456

\*Rain gardens throughout the parking lot, surrounding school perimeter and in the interior courtyard.



**Great Neck Middle Rain Garden**

1848 N. Great Neck Road, Virginia Beach, VA 23454

\*Rain gardens surrounding school and throughout the parking lot



**College Park Elementary**  
1110 Bennington Road, Virginia Beach, VA 23464



**VBCPS Office of Transportation**  
1677 Harpers Road, Virginia Beach, VA 23454  
\* Rain garden in parking lot and center of building adjacent to outdoor walkway, small buffer to the right of the building, and green roof on the top right of the building.



**Kemps Landing/Old Donation**  
2509 Seaboard Road, Virginia Beach, VA 23456



**Norfolk Naval Air Station**  
Bellinger Boulevard, Norfolk, VA  
\*Restricted access. In front of VAW-120.



**Beach Garden Park**  
Holly Road, Virginia Beach, VA 23451



**Virginia Beach Middle**  
600 25<sup>th</sup> Street, Virginia Beach, VA 23451



**Hermitage Museum and Gardens**  
7637 North Shore Road, Norfolk, VA 23505



**Hampton Roads Agricultural Research and Extension Center**  
1444 Diamond Springs Rd, Virginia Beach, VA 23455

\*Call Curator of Gardens & Grounds (757-423-2052 ext. 202) for a tour.



**Virginia Beach SPCA**  
3040 Holland Road, Virginia Beach, VA 23453



**Virginia Zoo**  
3500 Granby Street, Norfolk, VA 23502

### Permeable Pavers

Engineered hardscaping surface that allows water to flow through it, reducing or even eliminating runoff generated during a storm event. This reduction in volume results in flood control and reduces the need for traditional stormwater infrastructure (piping, catch basins, stormwater ponds, curbing, etc.). Pollutants are captured during infiltration, reducing pollutant load to local waterways. Infiltrated runoff recharges groundwater supplies, improves flow in streams, and reduces the need for landscaping irrigation.



**Little Creek Naval Base**  
Virginia Beach, VA  
\*Restricted access.  
Off Seabee Drive, between Helicopter Rd. / Desert Point Rd.



**Fort Story**  
Officer's Circle, Virginia Beach, VA  
\*Restricted access.



**Portsmouth Naval Hospital**  
620 John Paul Jones Circle, Portsmouth, VA 23708  
\*Located at Hospital Point Park.



12<sup>th</sup> Street, Richmond, VA 23219  
\*Street adjacent to CBF's office



5<sup>th</sup> Street, Richmond, VA 23219  
\* Crosswalks adjacent to Coliseum



Monument Avenue, Richmond, VA 23220  
\*Pervious road between statues.  
Shown: Jefferson Davis monument at south end of street.



**Virginia Beach Boardwalk**  
Oceanfront, Virginia Beach, VA 23451  
\*All numbered streets from 1<sup>st</sup> to 40<sup>th</sup>.



**Ferguson Center**  
Avenue of the Arts, Newport News, VA 23606

**Green Alleys**

Converted alleys from asphalt or concrete to permeable pavers that reduce runoff in industrial/urban areas. Permeable pavers are engineered hardscaping surface that allows water to flow through it, reducing or even eliminating runoff generated during a storm event. This reduction results in flood control and reduces the need for traditional stormwater infrastructure (piping, catch basins, stormwater ponds, curbing, etc.)



Alley way behind St Christopher's Road  
Richmond, VA 23226



12<sup>th</sup> Street Alley  
Richmond, VA 23226

## Riparian Buffer

Vegetated area that acts as a “buffer strip,” usually forested, which helps shade and partially protect a stream, river or lake from the impact of adjacent land uses, thereby increasing water quality. This buffer also helps to prevent shore erosion which also helps in water quality. The vegetation that is used when creating riparian buffers are native plants that are water tolerable plants.



**Beach Garden Park**  
Holly Road, Virginia Beach, VA 23451



**Riparian Buffer Garden**  
Virginia Beach, VA 23451

## Green Roofs

Vegetative layer grown on a rooftop. Reduces runoff as well as reducing temperatures on the roof and surrounding air. By reducing temperatures on the roof and in the surrounding air you are reducing the ‘heat island’ effect in cities and can decrease temperatures by up to ten degrees.



**Floyd E. Kellam High**  
2665 West Neck Road, Virginia Beach, VA 23456  
\*Interior green roof visible from upper walkway (left in picture)



**College Park Elementary**  
1110 Bennington Road, Virginia Beach, VA 23464



**VBCPS Office of Transportation**  
1677 Harpers Road Virginia Beach, VA 23454  
\*Green roof on the top right of the building.



**Naval Air Base Norfolk**  
Navy Legal Service Office, Portsmouth, VA  
\*Restricted access.



**Armada Hoffer Tower**  
222 Central Park Avenue #2100, Virginia Beach, VA 23462  
\*20<sup>th</sup> floor. (Photo: Stephen M. Katz, The Virginian Pilot.)



**Norfolk Botanical Gardens**  
6700 Azalea Garden Road, Norfolk, VA 23518  
\*Paid entry.



**Hampton Roads Transit**  
509 E 18<sup>th</sup> Street, Norfolk, VA 23504



**Virginia Living Museum**  
524 J Clyde Morris Blvd, Newport News, VA 23601

### **Rainwater Harvesting**

Collecting rainwater from roofs and other impervious surfaces into containers (cisterns, rain barrels, etc.) for storage and reuse in irrigation, flushing toilets, showers, drinking water (proper treatment may be required), and groundwater recharge.



**Renaissance Academy**  
5100 Cleveland Street, Virginia Beach, VA 23462



**College Park Elementary**  
1110 Bennington Road, Virginia Beach, VA 23464



**Floyd E. Kellam High**

2665 West Neck Road, Virginia Beach, VA 23456

\*One large rainwater collection tank on the left of the school's front entrance



**Brock Environmental Center**

3663 Marlin Bay Dr

Virginia Beach, VA 23455

**Infiltration Basin**

Infiltration basins are a type of best management practice designed to infiltrate stormwater through permeable soils into the groundwater. Infiltration basins do not release water except by infiltration, evaporation, or emergency overflow during flood conditions. Infiltration of stormwater runoff recharges underground aquifers and stream systems, while also improving water quality by preventing polluted runoff from entering local water bodies.



**Fort Story**

530 Solomons Rd, Virginia Beach, VA 23459

## **Bioswales**

Long, channeled depression or trench that receives rainwater runoff (as from a parking lot) and has vegetation (such as grasses, flowering herbs, and shrubs) and organic matter (such as mulch) to slow water infiltration and filter out pollutants .

-Wet Swales - typically stay wet because the bottom is below the water table. Encourages the growth of wetland vegetation, providing water quality treatment similar to a natural wetland. This stormwater treatment practice also functions as part of the stormwater conveyance system. Wet swales have a relatively low capital cost; however, maintenance can be intensive and expensive when compared to other BMPs.

-Dry Swales - water flow is slowed by a series of check dams. Provides temporary storage, filtration, and infiltration of stormwater runoff. Should remain dry during periods of no rainfall. Designed to reduce pollution through runoff reduction and pollutant removal.



**Little Creek Naval Base**  
NIOC Norfolk, Virginia Beach, VA  
\*Restricted access. Located in parking lot



**Naval Air Station Norfolk**  
Decatur Avenue, Norfolk, VA  
\*Restricted access. Between Piers 10 and 11.



**Kemps Landing/Old Donation**  
2509 Seaboard Road, Virginia Beach, VA 23456



**Brock Environmental Center**  
3663 Marlin Bay Dr. Virginia Beach VA, 23455

## Living Shoreline

Living shorelines represent a number of shoreline protection options that allow for natural coastal processes to remain through the strategic placement of plants, stones, sand fill, and other structural and organic materials along the shoreline. Living shorelines protect tidal shorelines from erosion, filters out pollution, and provides shallow water habitat. Furthermore, these nature-based solutions can often protect land, hold flood water, and prevent erosion as effectively, if not better, than traditional options like bulkheads – many times, at a fraction of the cost.



**Birdsong Wetlands**

6525 Hampton Boulevard, Norfolk, VA 23508

\*At the Larchmont Library



**Virginia Zoo**

3500 Granby Street, Norfolk, VA 23504

\*East end of the parking lot.



**Hermitage Museum and Gardens**

7637 North Shore Road, Norfolk, VA 23505

\*Call Curator of Gardens & Grounds (757-423-2052 ext. 202) for a tour.



**Haven Creek Shoreline**

Norfolk, VA 23504

\*At the corner of Llewellyn Avenue and Delaware Avenue



**Powhatan Village of Werowocomoco**  
Ginny Hill Rd, Gloucester Courthouse, VA 23061



**Shoreline in Little Haven**  
Virginia Beach, VA 23452

**Tree Box Filters**

Tree boxes are essentially urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb polluted runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in dense urban areas and as a streetscaping element.



**Naval Air Station Norfolk**  
Decatur Avenue, Norfolk, VA



14th St, Richmond, VA 23219

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**Additional Projects:**

Permeable Pavers at Ferguson Center (1 Avenue of the Arts, Newport News, VA 23606) and Hampton Convention Center ( 1610 Coliseum Drive, Hampton, VA 23666)

Riparian Buffers at VBCPS Office of Transportation, 1677 Harpers Road, Virginia Beach, VA 23454

Multiple rain gardens surrounding the school of Cape Henry Collegiate 1320 Mill Dam Road, Virginia Beach, VA 23454