

# Bioretention

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Stormwater bioretention, also known as “rain gardens,” are landscaped depressions that collect and filter surface water runoff. Plants and microorganisms in the ponding area use excess nutrients in the water for growth, while trapping sediment and removing pollutants.

When bioretention systems are installed during construction they are cheap and easy to install. They can be used almost anywhere water collects, from commercial and industrial parking lots, to your backyard. In addition to stormwater treatment, these areas provide natural habitat for wildlife, as well as flood control and windbreaks. Maintenance is also relatively minimal and cheap. They offer nitrogen removal in a wide variety of locations and settings and can be quite aesthetically pleasing!



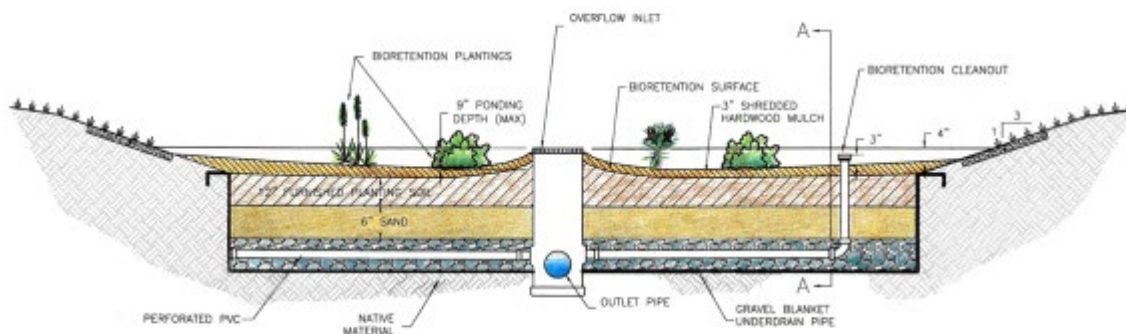
Beautiful bioretention basin at Water Street in Plymouth Center, Massachusetts, transforming stormwater from a potential source of pollution into a source of sustenance for plants and wildlife.

**How does it work?**

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Bioretention treats collected stormwater by ponding water in shallow depressions underlain by a sandy soil media, which acts as a filter for runoff. The runoff passes through a grass buffer to reduce velocity and filter particulates. As it moves through the sandbed, it is distributed over a ponding area for gradual infiltration. The organic/mulch layer filters pollutants and provides habitat for microorganisms, which can degrade contaminants and petroleum-based products. Pollutants in runoff are settled, filtered, adsorbed, taken up, immobilized and/or transformed. This diverse and effective array of pollutant retention makes bioretention an appealing management practice for many environmental concerns.



Schematic Diagram of a Bioretention Cell, from the Cape Cod Commission  
**What are the benefits?**

- Can remove up to 75% of nitrogen from contaminated water
- Useful in commercial, residential and industrial areas (think parking lots and roadway medians) – using curbs and gutter collection
- Relatively cheap if installing in new development
- Maintenance is relatively minimal, with costs comparable to traditional landscaping
- Are easy to include in smaller areas, like parking lot islands
- Other benefits include aesthetic improvement of paved areas, flood control, habitat, noise buffering and acting as a windbreak
- Can also decrease costs for traditional stormwater conveyance systems

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### Technology Performance

Nitrogen Removal

25-90%

Cost Efficiency

\$156 to \$1900/kgN

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Bioretention performance and cost estimated by the Cape Cod Commission. Exact values will depend on site-specific characteristics.

#### What are the potential obstacles?

- Can be costly to retrofit existing sites to include a bioretention area
- May require annual removal of dead biomass
- In denser soils, may require an underdrain
- Effectiveness depends on adequate contact time
- Not appropriate in areas where water table is within 6 ft of ground surface or where surrounding soil is unstable
- Concern about soil freezing, preventing runoff from infiltrating



Bioretention cell in Massachusetts. Although small, this basin captures runoff from residential areas and helps protect water resources.

### Where can I see this?

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[Click to see an interactive map of green infrastructure sites in the Cape Cod area.](#)

Many rain gardens already exist in Cape Cod in residential and commercial spaces including:

- Barnstable Municipal Airport (multiple basins on the property)
- Bismore Park Visitor Center
- Water Street in Plymouth, MA along the waterfront



Bioretention cells provide stormwater treatment and offer environmental beautification to urban areas.

### **Frequently Asked Questions**

*Can bioretention be used to filter out other pollutants besides nitrogen?*

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Yes, many studies have shown that in addition to nutrient mitigation, bioretention has a high performance for total suspended solids and particulates, as well as metals and hydrocarbons. In addition, bioretention has the potential to remove Contaminants of Emerging Concern (CEC), and some aerobic bacteria in the root zone can break down petroleum products.

*What kinds of plants are used in bioretention basins?*

There are many different types of plants that can be utilized in a bioretention system, depending on the site characteristics and environmental needs. In general, native species that are able to handle the different environmental conditions of a basin should be selected over turf grasses and invasive species.

*Why should this be implemented on Cape Cod?*