





Figure 2. Project partners installed vegetated bioinfiltration swales in this parking lot near the beach.

town and its partners then implemented between 2010 and 2012. Measures included (1) renovating a parking lot to incorporate bioinfiltration vegetated swales (Figure 2) and piping overflow via sub-drains to bioretention cells, (2) installing permeable pavement around the offices and beach restroom facility, (3) reducing the width of beachfront trails and planting trees along the beach property to interrupt the flight path of Canadian geese (whose waste was causing fecal coliform contamination in the water), and (4) constructing a wet vegetated treatment system to collect and treat the stormwater flowing from the neighborhood to the area north of the beach.

## Results

This combination of BMPs has drastically reduced the amount of both fecal coliform and enterococcus, two indicator species of bacteria that come from the intestines of warm blooded animals. Rhode Island uses fecal coliform as the indicator species for its shellfishing standards and enterococcus as the indicator species for its recreational use (bathing) standard. Because both fecal coliform and enterococcus bacteria come from similar sources (i.e., warm blooded animals and humans), when the presence of one indicator organism is reduced, it can be inferred that the presence of the other is also reduced. Data from 2011 reflect the first project BMP implementation, and data from 2013 reflect the first year of full implementation of all BMPs at Bristol Town Beach (Figure 3). The incidence of bacteria levels exceeding the swimming standard reduced significantly from pre- to post- BMP implementation. There was a single closure for four beach days in 2011, and there were two closures for six beach days in 2012. There were no closures at all during the 2013 season, despite a ten-year high rainfall rate, and a single

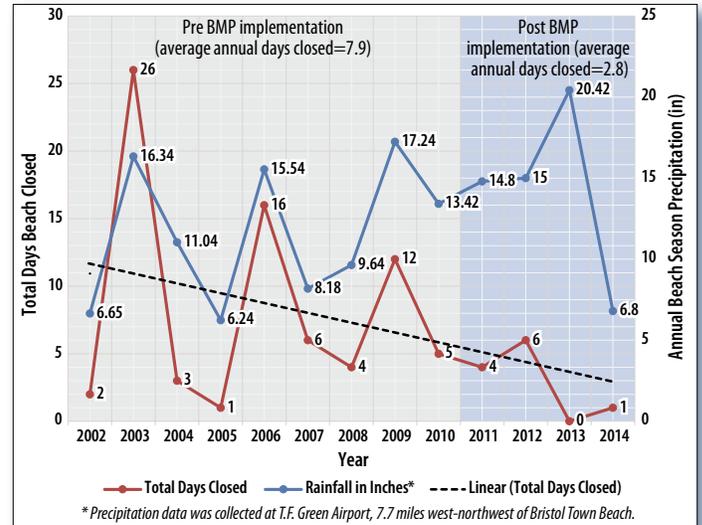


Figure 3. The number of beach closures at Bristol Town Beach declined, despite an increasing trend in area precipitation.

closure day in 2014. The enterococci data collected at Bristol Town Beach reflect that BMP implementation has contributed to near-shore water quality improvements—resulting in a dramatic reduction in the number of beach closures (from an average of eight days per season before the restoration efforts to none during the summer after restoration) and an incremental improvement in the water quality of the shellfish beds immediately offshore.

## Partners and Funding

Water quality improvement at Bristol Beach and Upper Narragansett Bay was the result of a collaborative effort. The town of Bristol, RIDEM, RIDOH, EPA Region I, the Rhode Island Coastal Resources Management Council, and Bristol's environmental engineering consultant worked together to plan the restoration approach. The town of Bristol secured a variety of funding sources to install the restoration projects. They included (1) two CWA section 319 grants (\$234,620 total) from the RIDEM Nonpoint Source Program for a wet vegetated treatment system to treat neighborhood stormwater runoff; (2) \$1,000,000 loan from the Rhode Island State Revolving Fund for parking lot improvements, tree planting to prevent geese on the beach, and permeable pavement around restroom facilities; and (3) a \$100,000 RIDEM Planning and Development Trails Grant to reduce the width of paved paths from 20 feet to 10 feet. The town of Bristol also contributed \$70,000 to support the parking lot improvements.



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