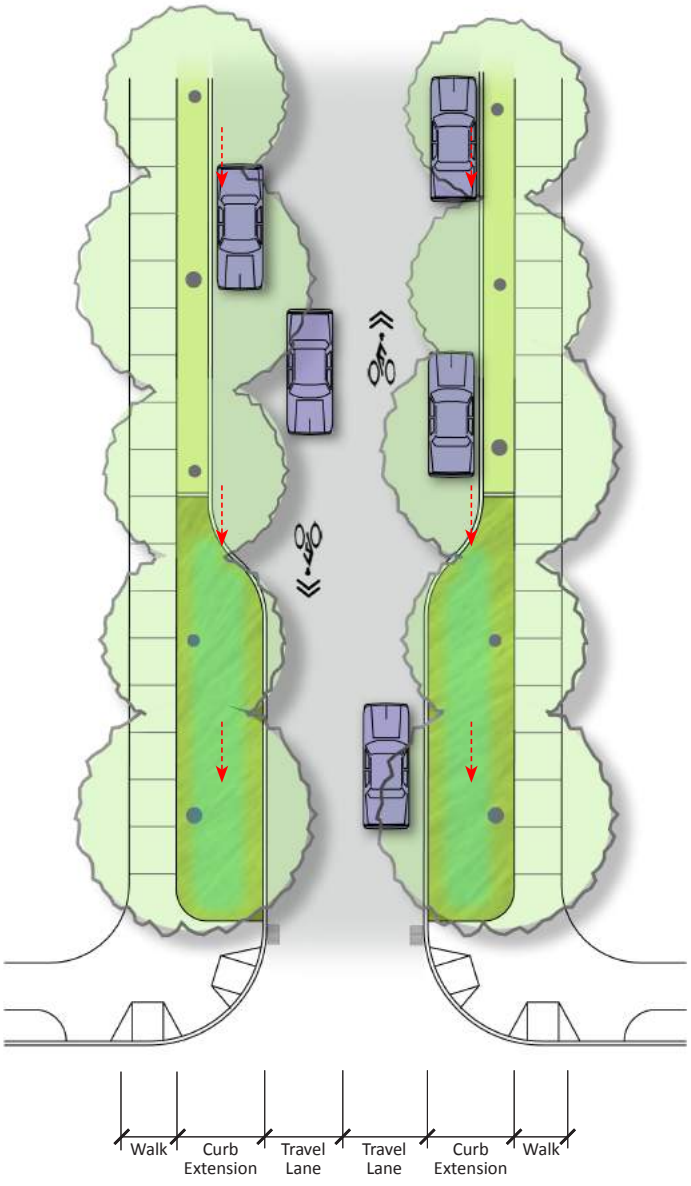
Section 7

Green Street and Parking Lot Examples

Green Street and Parking Lot Examples



7.1 RESIDENTIAL STORMWATER CURB EXTENSIONS AT INTERSECTIONS

This residential street example illustrates how stormwater curb extensions can be easily retrofitted alongside the existing curb line. Runoff from the street can simply enter these landscape areas and overflow into the existing drain inlets. Because this street has a lot of unused on-street parking, installing curb extensions does not adversely impact existing parking. With the new stormwater curb extensions and street trees in place, the narrower street provides a more aesthetically pleasing and potentially safer traffic environment.

URBAN RAIN DESIGN

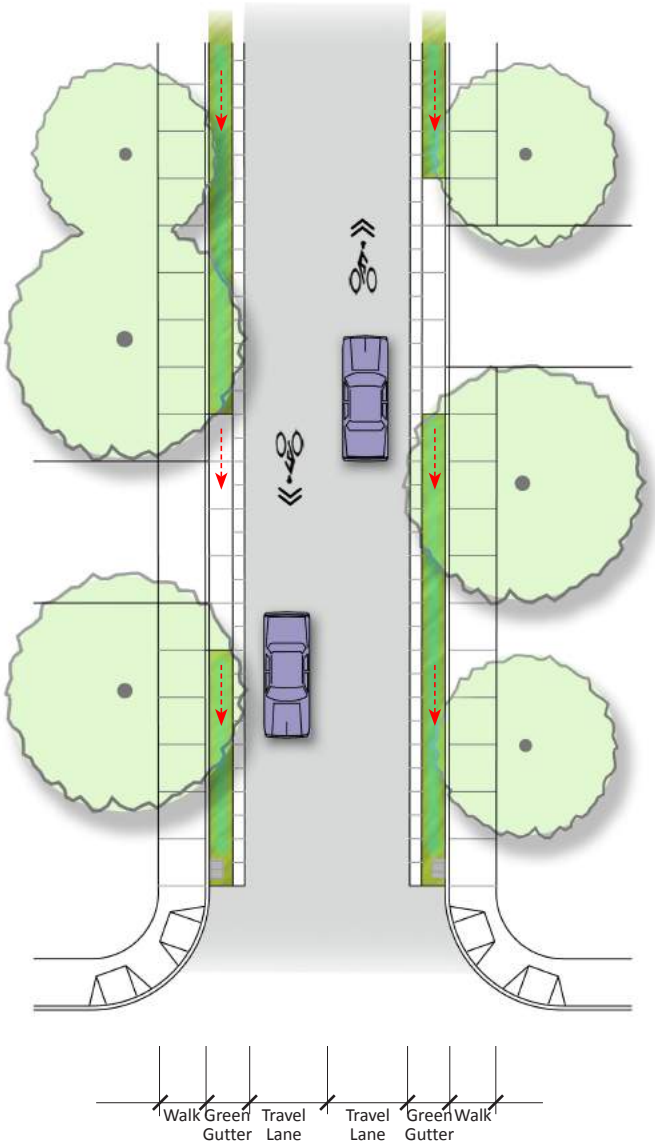
▲ *EXISTING: A typical low-density residential street in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same residential street retrofitted with stormwater curb extensions, as well as additional street trees. In this example, the curb extension is only within the street leaving the existing curb in place.*

7.2 RESIDENTIAL GREEN GUTTERS

Residential streets that have a wide right-of-way and do not need on-street parking are good candidates for retrofitting with a green gutter system. A green gutter is a narrow stormwater planter that can be placed alongside streets. The example below shows that removing a few of feet of asphalt on one side of this street provides enough space for a green gutter system without impeding two-way travel along the street.



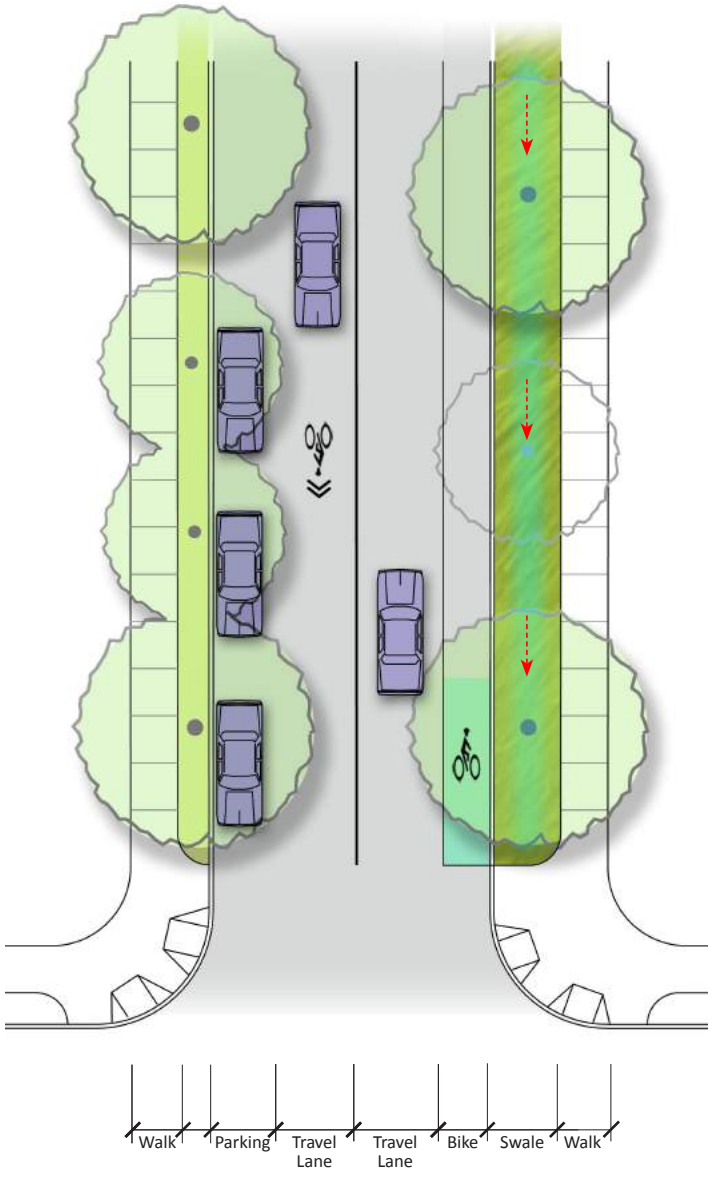
URBAN RAIN DESIGN

▲ *EXISTING: A typical low-density residential street in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same residential street retrofitted with a green gutter. In this example, the green gutter is only within the street leaving the existing curb in place and replaces the failing asphalt area.*

Green Street and Parking Lot Examples



7.3 RESIDENTIAL VEGETATED SWALES

Many residential streets in Vermont are overly wide and have large impervious areas. Green Streets reduce impervious area and help green the character of the street by introducing vegetated swales along the street curb lines. Runoff from the street enters these landscaped areas and overflows into the existing drain inlets. If a street is particularly wide, introducing bike lanes in conjunction with stormwater systems helps provide enhanced mobility for all users.

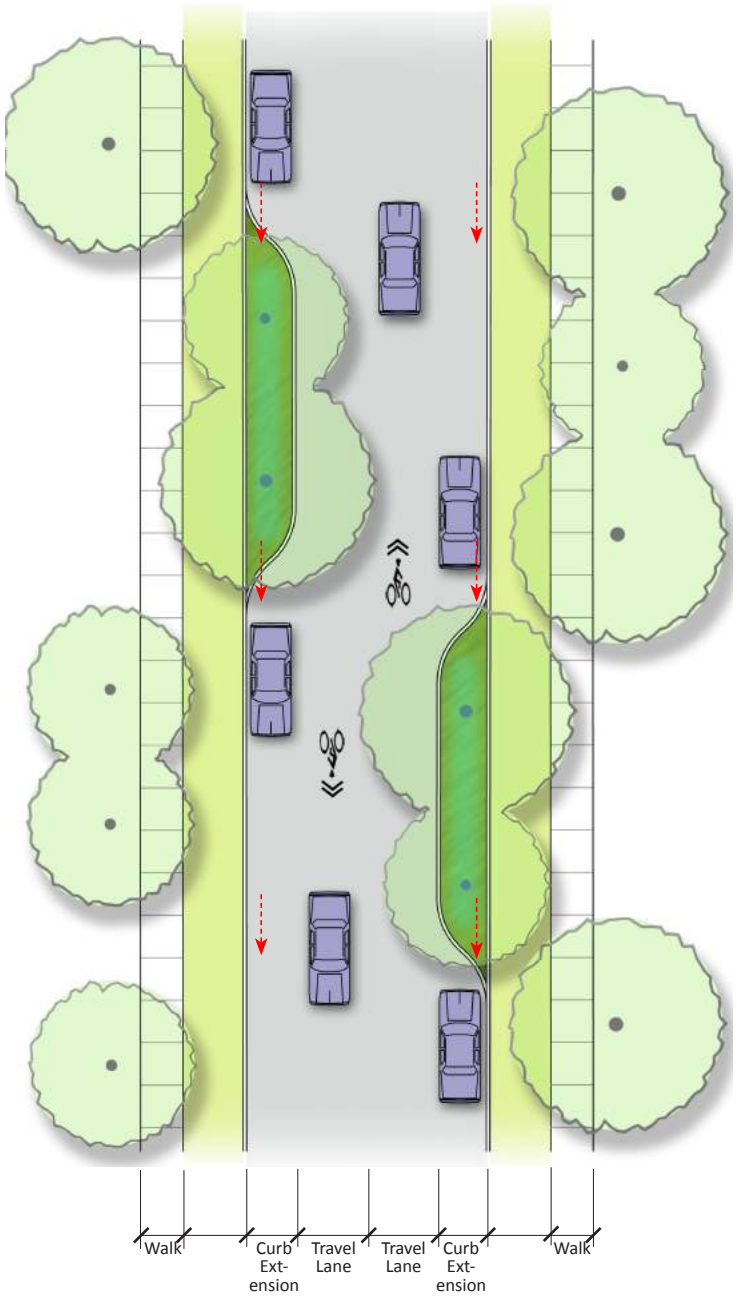
URBAN RAIN DESIGN

▲ *EXISTING: A typical low-density residential street in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same residential street retrofitted with a vegetated swale, optional bike lane, as well as additional street trees. In this example, the vegetated swale helps separate the sidewalk zone from vehicular traffic.*

Green Street and Parking Lot Examples



7.4 MID-BLOCK STORMWATER CURB EXTENSIONS

Stormwater curb extensions are not limited to intersection conditions, but can also be located along a street's mid-block. Mid-block curb extensions can be designed in many shapes and either in a symmetrical or staggered pattern to create a traffic calming feature. The illustration below shows mid-block curb extensions used on both sides of the street in a staggered pattern.

SOPHIE SAUVÉ

▲ *EXISTING: A typical low-density residential street in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same residential street retrofitted with staggered mid-block stormwater curb extensions. Take note that the staggered condition helps create a traffic calming feature.*

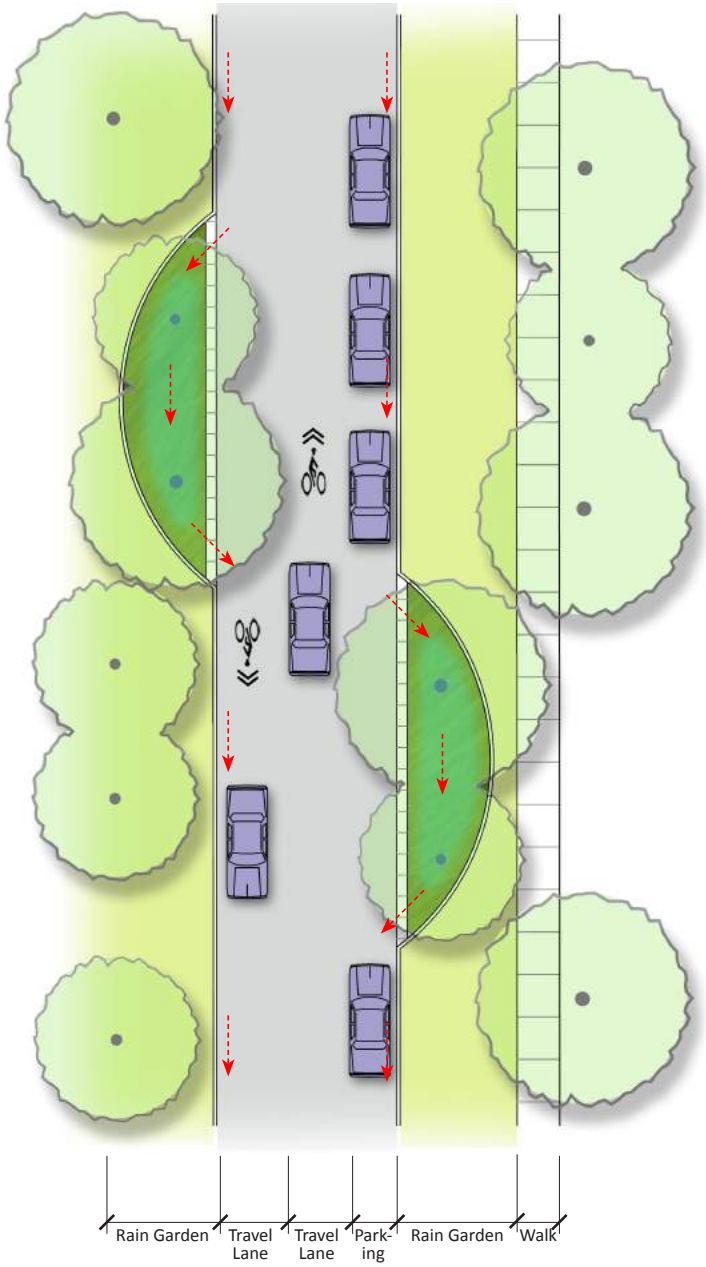
Green Street and Parking Lot Examples

7.5 ODD ANGLED INTERSECTION RAIN GARDENS

Many residential streets in Vermont have intersections with acute angles and do not conform to the standard city grid pattern. This can sometimes result in an inefficient layout with open swaths of impervious asphalt area and difficult crossings for pedestrians. Depending on how much right-of-way is available, these street intersections can be realigned to increase spatial efficiency and create opportunities for stormwater facilities and enhanced pedestrian crossings. The illustration below shows how a 4-point intersection with odd angles can be realigned with new rain gardens and pedestrian crossings.

▲ *EXISTING: A typical low-density residential street intersection with odd angles in Middlebury, Vermont.*

▲ *RETROFIT OPPORTUNITY: The same residential streets in Middlebury retrofitted with multiple rain gardens once the intersection is realigned.*



7.6 RESIDENTIAL STREET-SIDE RAIN GARDENS

In residential neighborhoods, where there is a considerable amount of landscape space between the street edge and the sidewalk zone (or if there is no sidewalk), larger rain gardens can be installed to accept runoff. These rain gardens can conform to any shape and can receive runoff from the street and/or the residential lot. The example shown below is a rain garden that captures runoff from both the street and surrounding residential lots.

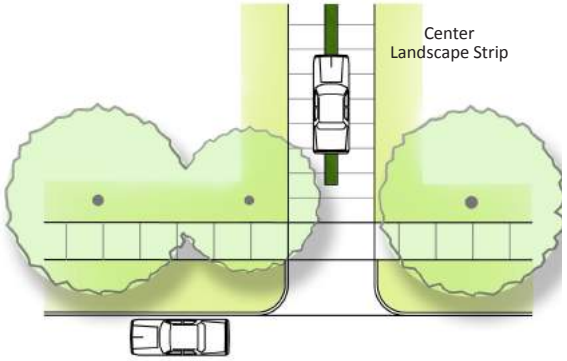
URBAN RAIN DESIGN

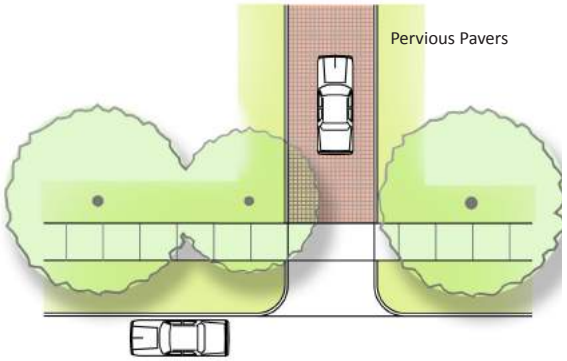
▲ *EXISTING: A typical low-density residential street in Vermont.*

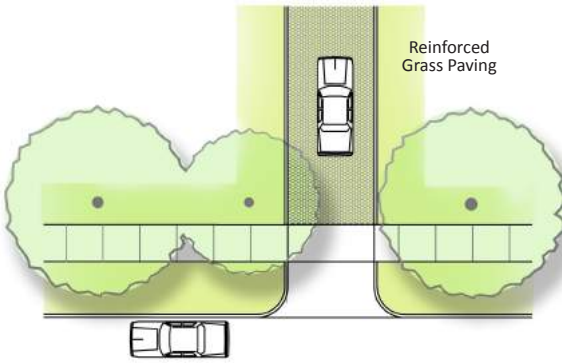
RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same residential street retrofitted with a rain garden. Take note that esign incorporated an existing catch basin as part of the design.*

Green Street and Parking Lot Examples







7.7 RESIDENTIAL DRIVEWAY OPTIONS

Many residential driveways in Vermont are long and continuous areas of asphalt or impermeable gravel that contribute stormwater runoff to the site. The following residential driveway examples illustrate how existing concrete or gravel driveways can be retrofitted with pervious interlocking concrete pavers, driveway grass strips, or reinforced grass paving systems.

URBAN RAIN DESIGN

▲ *EXAMPLE: A typical low-density residential driveway using pervious concrete.*

URBAN RAIN DESIGN

▲ *EXAMPLE: A typical low-density residential driveway with minimal paving and a center landscape strip.*

Green Street and Parking Lot Examples

IMPLEMENTED RESIDENTIAL GREEN STREET EXAMPLES

▲ A pair of stormwater curb extensions along a residential street captures runoff and also preserves existing mature street trees.

▲ A green gutter along a neighborhood street combined with a pervious concrete sidewalk.

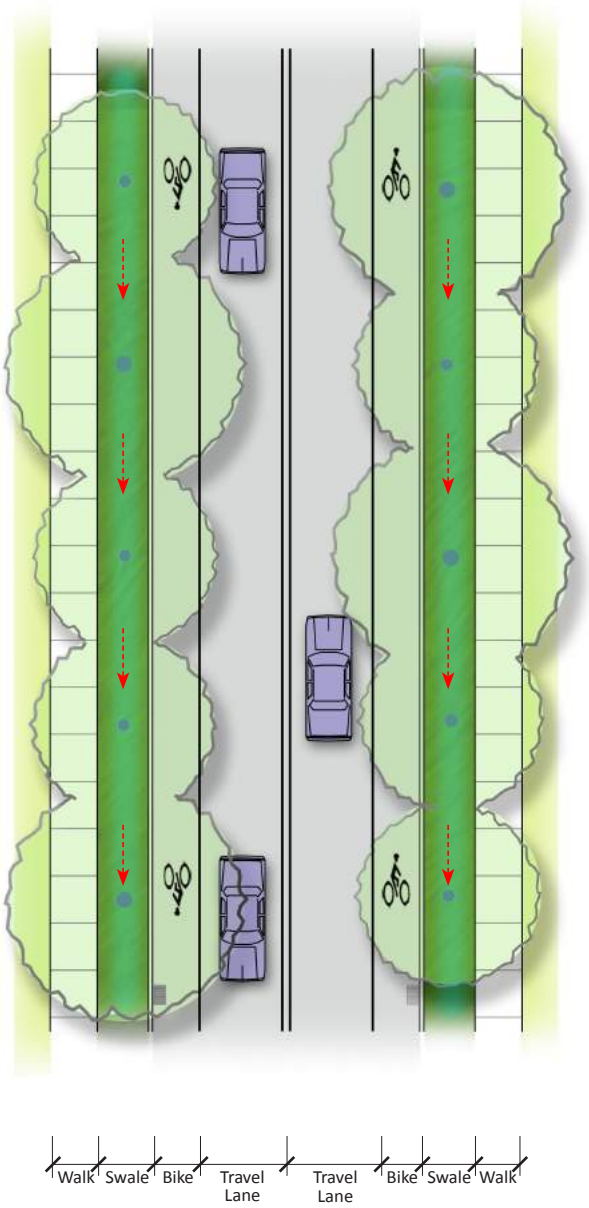
▲ A narrow residential street with a “curbless” street profile and a series of inter-connected vegetated swales.

▲ A “front yard” rain garden accepts runoff from both the street and residential lot.

▲ A long continuous stormwater swale on one side of the street in a new residential development.

▲ A pervious interlocking concrete paver application on a shared residential driveway.

Green Street and Parking Lot Examples



7.8 ARTERIAL VEGETATED SWALES

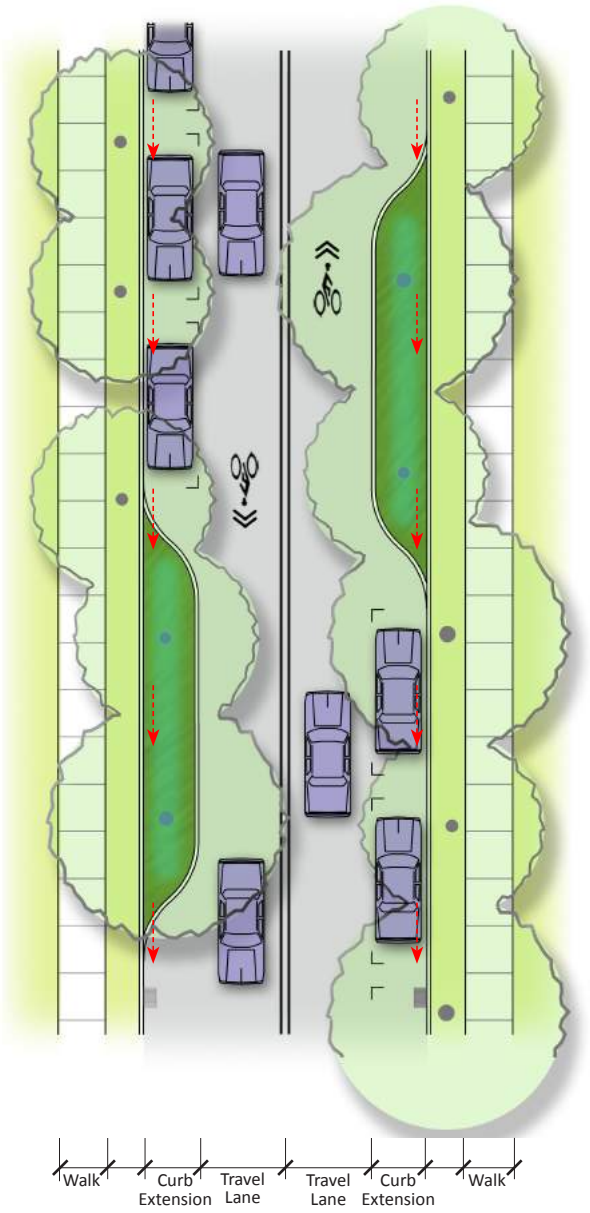
This example shows how a lawn strip along an arterial street can be easily retrofitted with a vegetated swale capturing runoff before it enters a drain inlet. Retrofitting under-used landscape space is often a very cost-effective way to create a green street. Where the native soils have moderate to high infiltration rates, simply re-grading the soil, installing new landscaping, and constructing a series of curb cuts allows water to enter and exit the new vegetated swale. These types of simple retrofit opportunities should be prioritized.

URBAN RAIN DESIGN

▲ *EXISTING: A typical arterial street with an existing lawn strip in Vermont. (Burlington)*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same arterial street retrofitted with a vegetated swale, as well as additional street trees. In this example, the vegetated swale only is within the existing landscape strip leaving the existing curb in place.*



7.9 ARTERIAL STORMWATER CURB EXTENSIONS

Along select arterial streets, converting some on-street parking into stormwater curb extensions provides room for green space and street trees. Smaller curb extensions could be placed close together, or, conversely, larger curb extensions could be spaced further apart. This newly introduced landscape area next to the sidewalk can help buffer the pedestrian zone from high-speed traffic, as well as treat stormwater runoff.

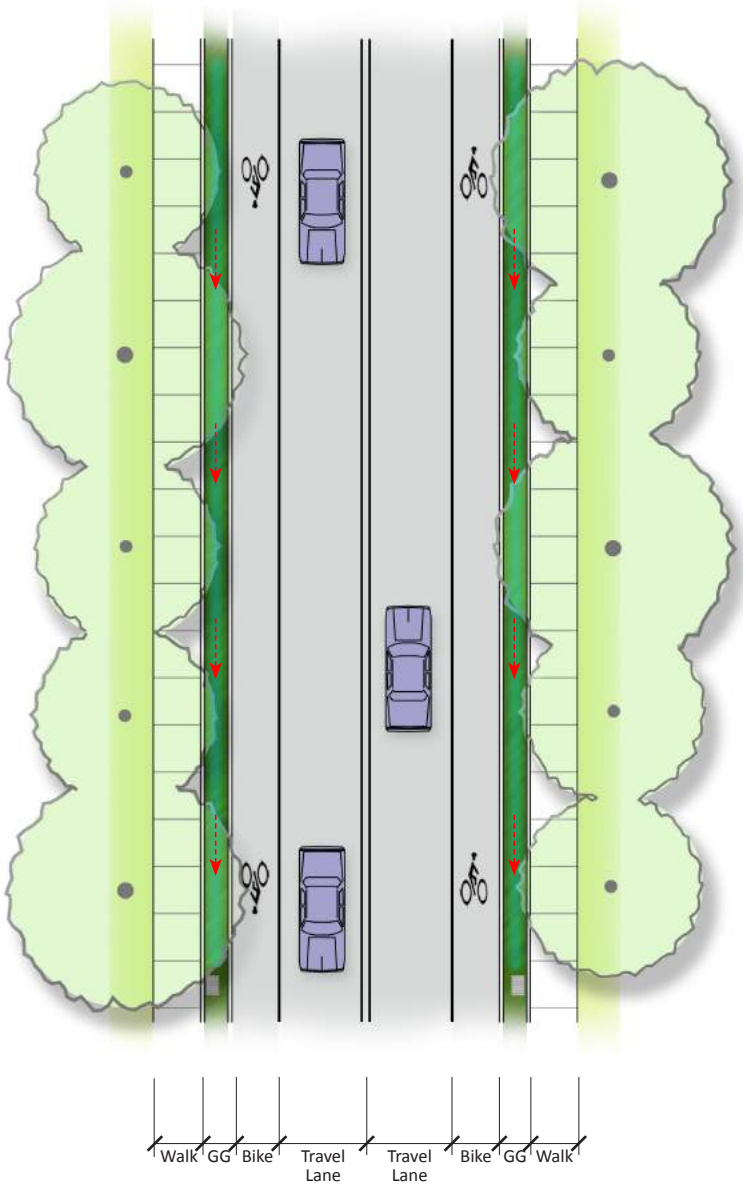
URBAN RAIN DESIGN

▲ *EXISTING: A typical arterial street with on-street parking in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same arterial street retrofitted with a stormwater curb extension.*

Green Street and Parking Lot Examples



7.10 ARTERIAL GREEN GUTTERS

This existing lawn strip is only approximately 5 feet wide. While too narrow for a stormwater swale, it can accommodate a narrower green gutter system. The example shown below replaces the existing lawn strip with a shallow green gutter. The green gutter also helps provide a buffer between the high-speed traffic of the arterial and pedestrians using the sidewalk.

SOPHIE SAUVÉ

▲ *EXISTING: A typical arterial street with a narrow grass strip in Vermont. (Williamstown)*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same arterial street retrofitted with a green gutter system, as well as additional street trees.*

Green Street and Parking Lot Examples

IMPLEMENTED ARTERIAL GREEN STREET EXAMPLES

▲ This arterial street utilizes a vegetated swale for managing street runoff and a pervious concrete sidewalk.

▲ A green gutter along an arterial street helps separate vehicular traffic from pedestrians.

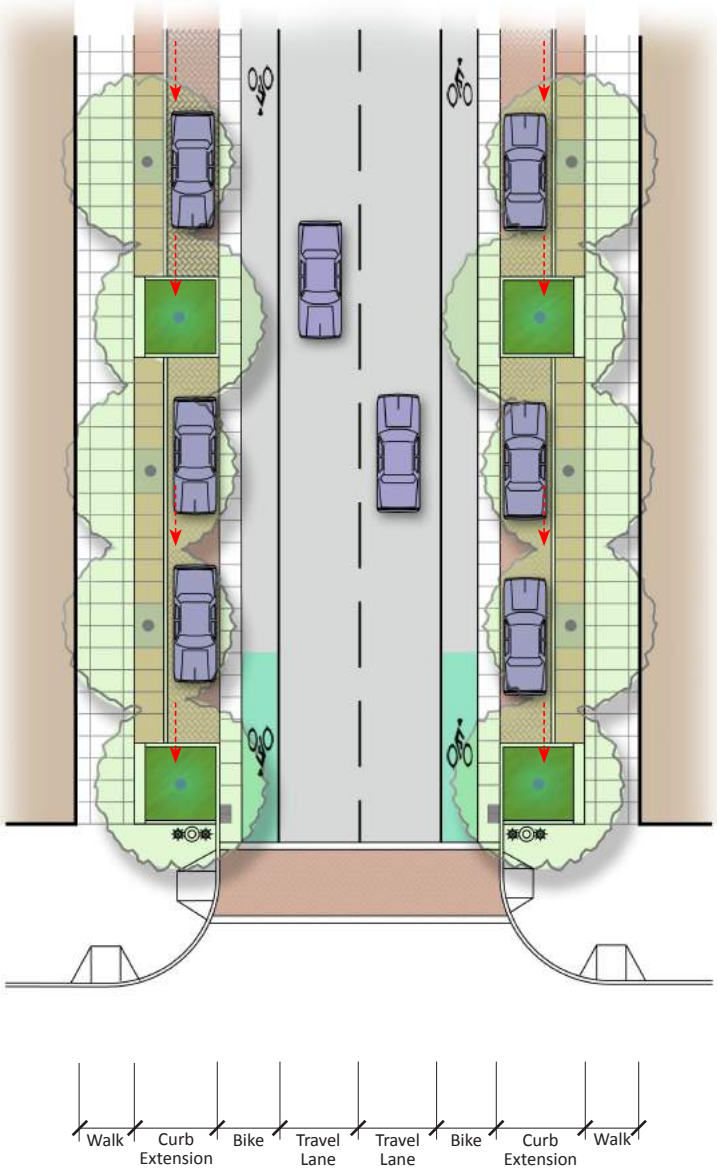
▲ Stormwater curb extensions along this arterial street also help shorten pedestrian crossing distances.

▲ This rain garden along an arterial street boldly greens the street.

▲ Stormwater planters provide buffers for a multi-use path.

▲ An arterial street with stormwater curb extensions and pervious paving parking zone.

Green Street and Parking Lot Examples

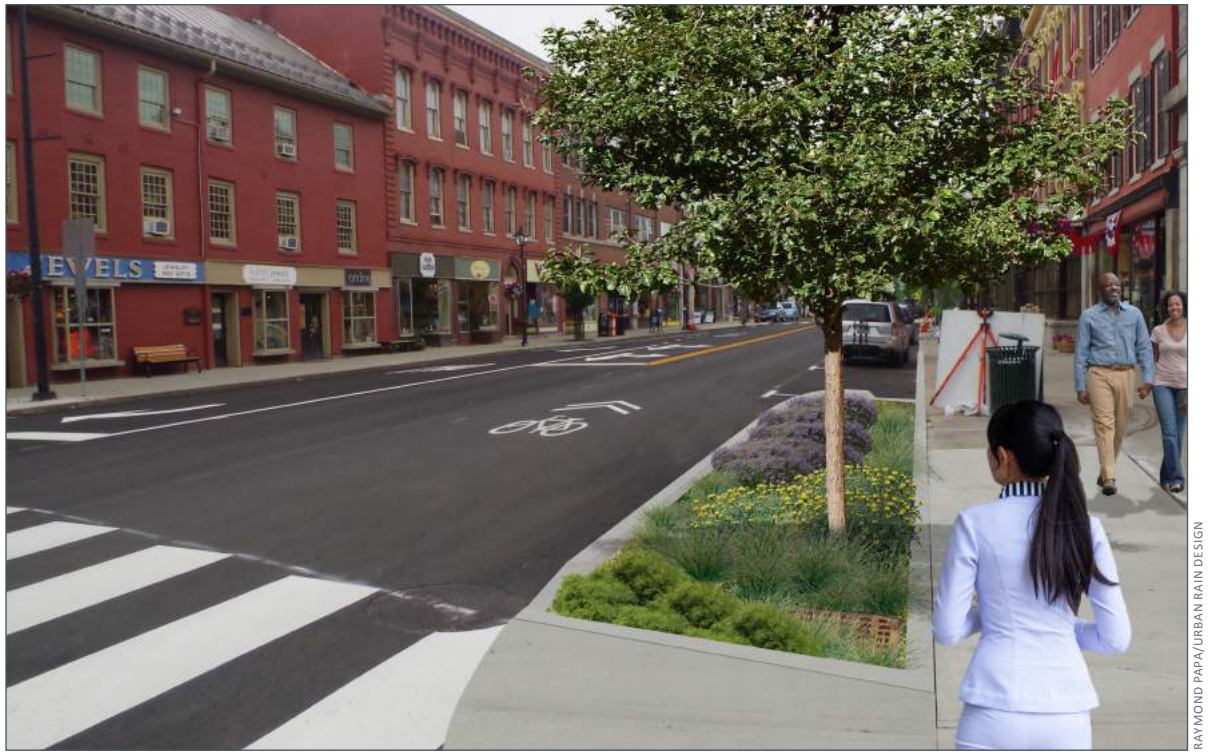


7.11 COMMERCIAL STORMWATER CURB EXTENSIONS WITH PARALLEL PARKING

Downtown main streets at midblock and at intersections can benefit from additional green space in the form of curb extensions. Also known as bump outs, curb extensions can soften the look of the street, provide space for stormwater management, provide refuge for pedestrian crossings, or create opportunities for outdoor seating. The example below illustrates how a curb extension captures a portion of the existing parking zone with a stormwater curb extension to manage street runoff.

SOPHIE SAUVÉ

▲ *EXISTING: A typical downtown main street parking zone in Vermont.*



RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same downtown main street retrofitted with a stormwater curb extension.*

7.12 COMMERCIAL STORMWATER CURB EXTENSIONS WITH ANGLED PARKING

Angled parking along downtown main streets is very common in Vermont. Although parallel parking is a more efficient use of space, there are some green street options available for an area with angled parking. One potential green street scenario is to consolidate one or more parking spaces into a stormwater curb extension. Converting angled parking spaces into curb extensions adds more landscaping to the street, which also has the potential to enhance the aesthetics of storefront businesses.

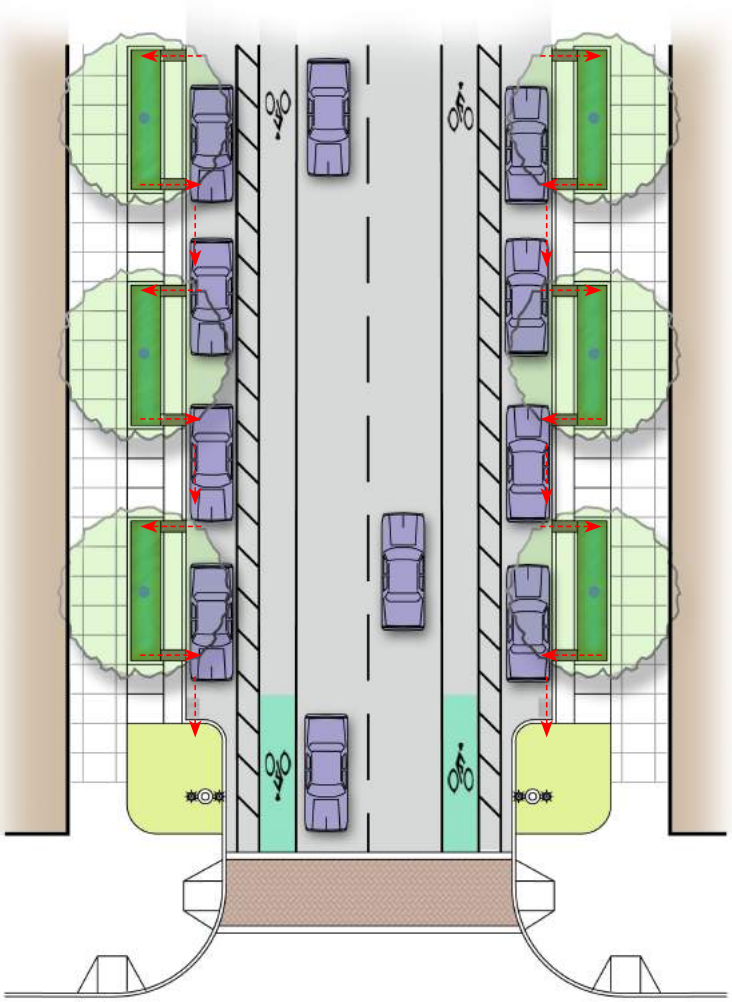
▲ *EXISTING: A typical downtown main street with angled parking in Vermont.*

▲ *RETROFIT OPPORTUNITY: The same downtown main street retrofitted with stormwater curb extension. In this example, the stormwater curb extension also uses space that is already striped as "no parking".*

Green Street and Parking Lot Examples

7.13 COMMERCIAL STORMWATER PLANTERS WITH ON-STREET PARKING

Where space allows, stormwater planters can be added to the furnishing zone - the portion of the sidewalk used for street trees, landscaping, transit stops, street lights, and site furnishings - while retaining on-street parking. Pedestrian circulation can be accommodated by creating walkways in between the planters and a pedestrian egress zone adjacent to on-street parking. The retrofit opportunity illustrated below shows how a flow-through or infiltration planter can be inserted between the sidewalk and parking zone of the street. In more urban downtown areas, using planters is advantageous because they allow for stormwater treatment in limited spaces.



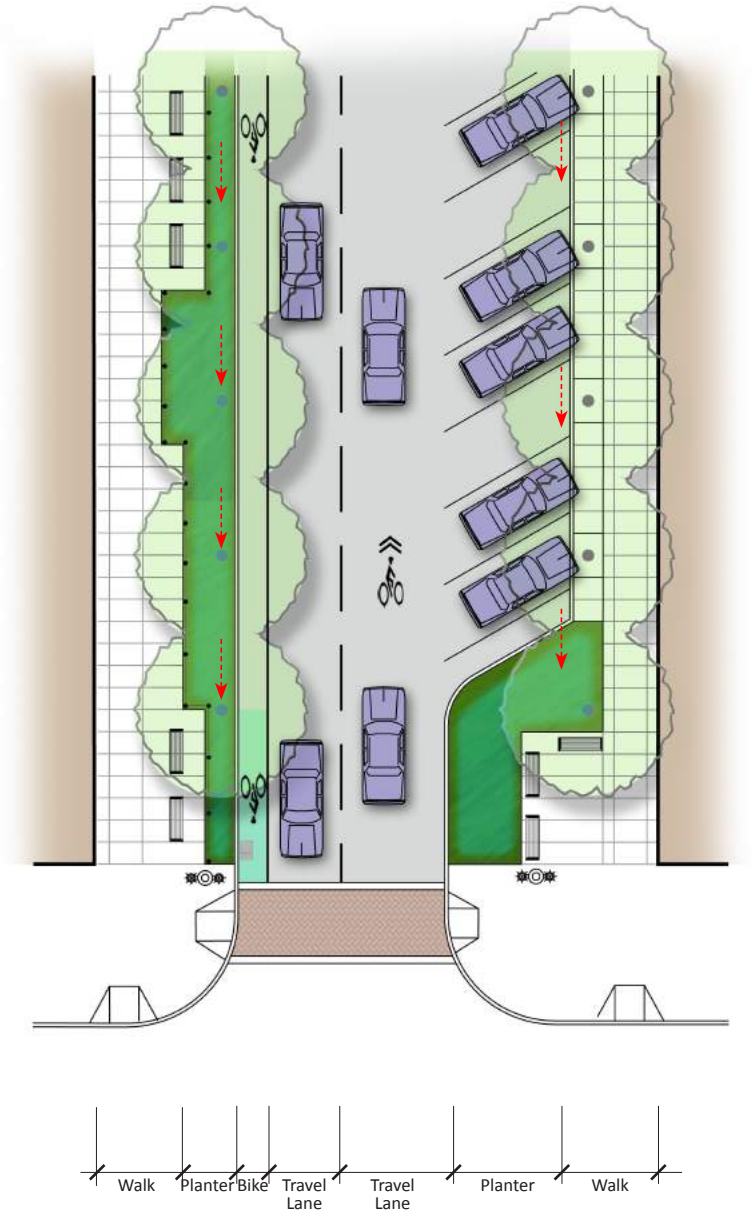
URBAN RAIN DESIGN

▲ *EXISTING: A typical commercial main street with on-street parking in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same downtown main street retrofitted with a series of stormwater planters.*

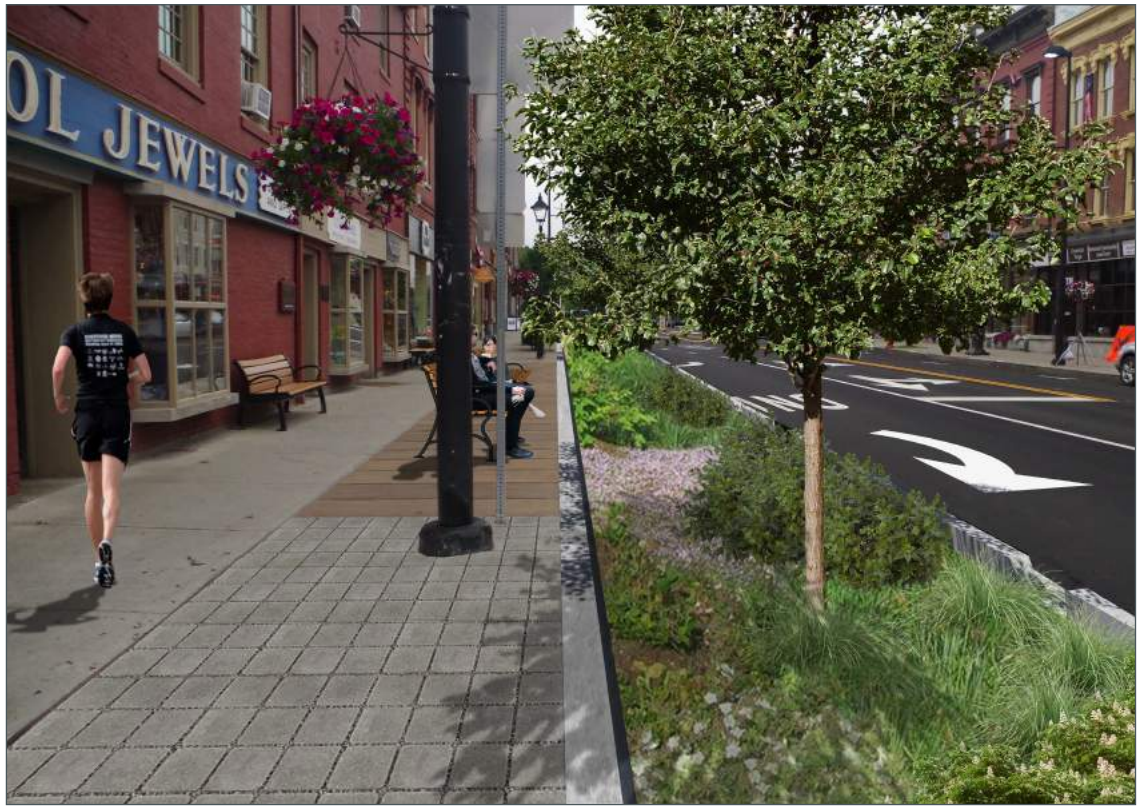
Green Street and Parking Lot Examples



7.14 COMMERCIAL STORMWATER PLANTERS WITHOUT ON-STREET PARKING

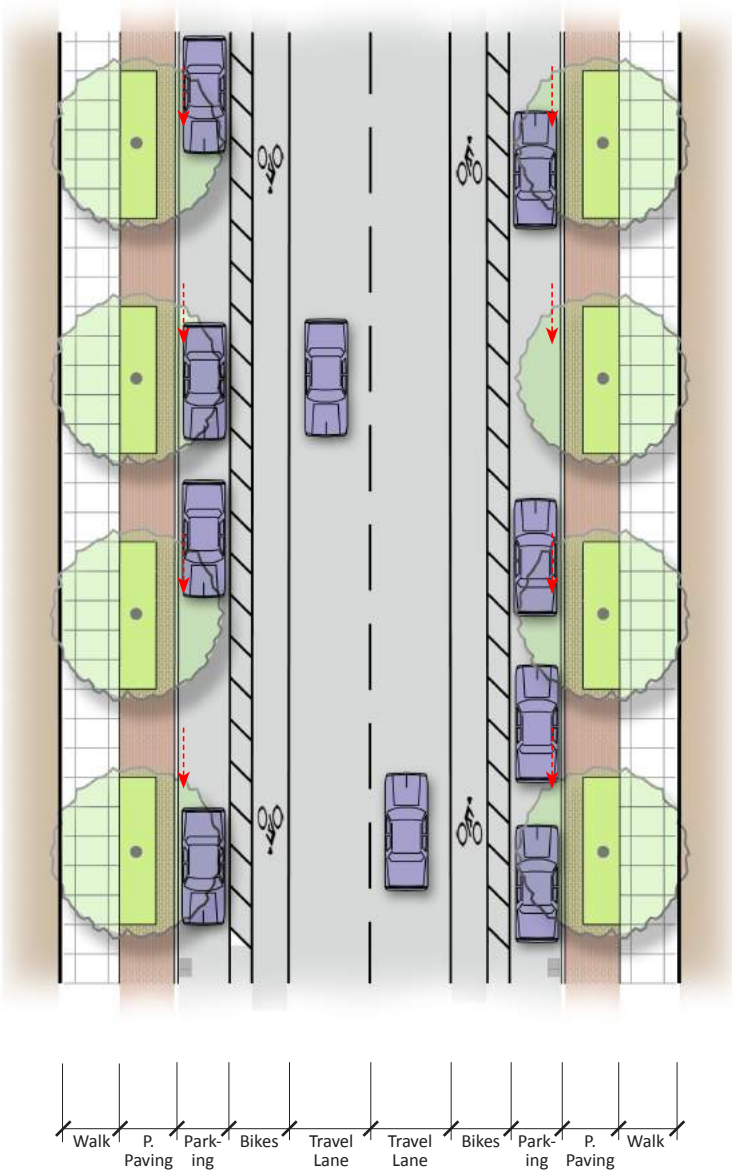
On some downtown main streets there is parking only on one side of the street, leaving the opportunity to create stormwater planters between the street and the sidewalk zone without the need of a parking egress zone. The example below shows an existing downtown main street with a large stormwater planter replacing a lawn area.

▲ *EXISTING: A typical downtown main street with no on-street parking in Vermont.*



▲ *RETROFIT OPPORTUNITY: The same downtown main street retrofitted with a linear stormwater planter and pervious paving furnishing zone.*

Green Street and Parking Lot Examples

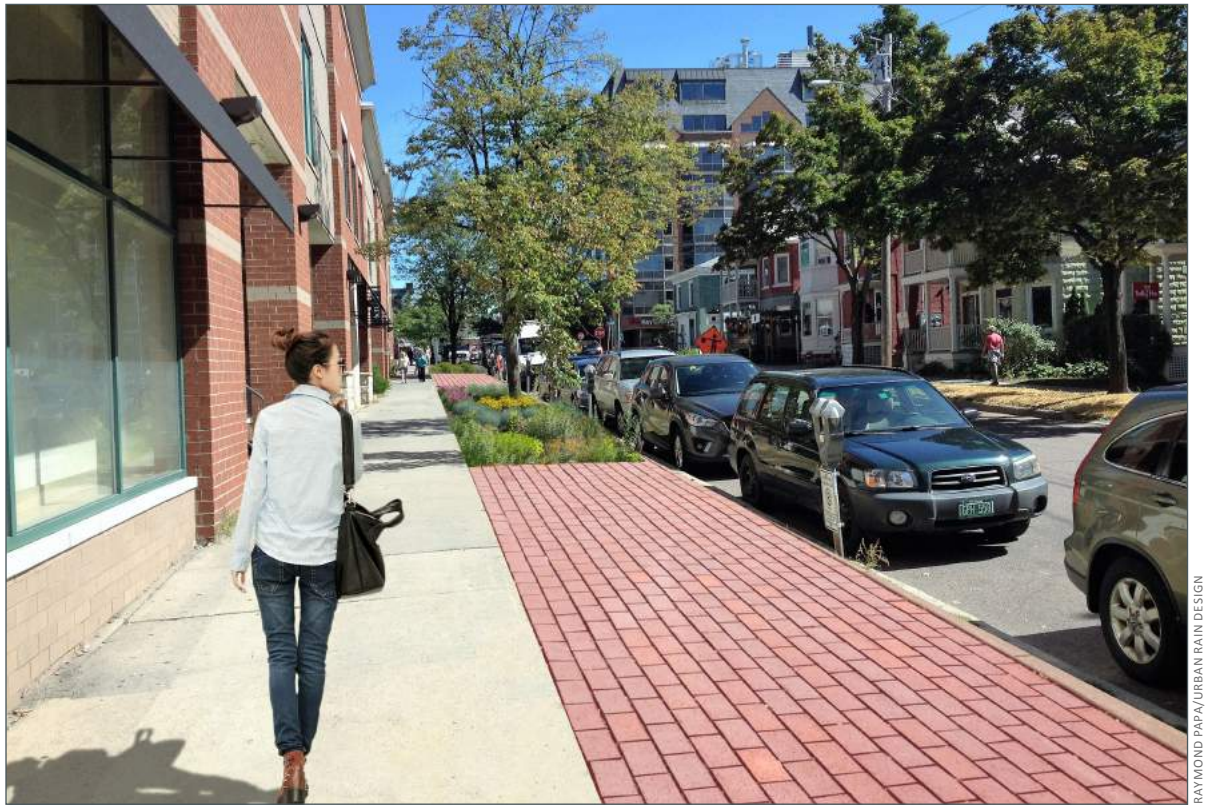


7.15 COMMERCIAL PERVIOUS PAVING IN FURNISHING ZONE

Some downtown main streets experience heavy amounts of pedestrian traffic and may not have sufficient space to introduce stormwater curb extensions or stormwater planters. However, pervious paving can be used in the furnishing zone of the street (between the sidewalk and street) that can manage sidewalk runoff only and provide a stable and aesthetic street condition. The example below retrofits a worn downtown grass parking zone into a pervious paving condition.

URBAN RAIN DESIGN

▲ *EXISTING: A typical downtown street with a trampled grass furnishing zone in Vermont.*



RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same downtown main street retrofitted with pervious paving in the furnishing zone.*

Green Street and Parking Lot Examples

IMPLEMENTED COMMERCIAL GREEN STREET EXAMPLES

▲ A series of stormwater planters allows for on-street parking and pedestrian circulation around the stormwater facilities.

▲ A green gutter along a downtown plaza with metal grates for pedestrian crossing.

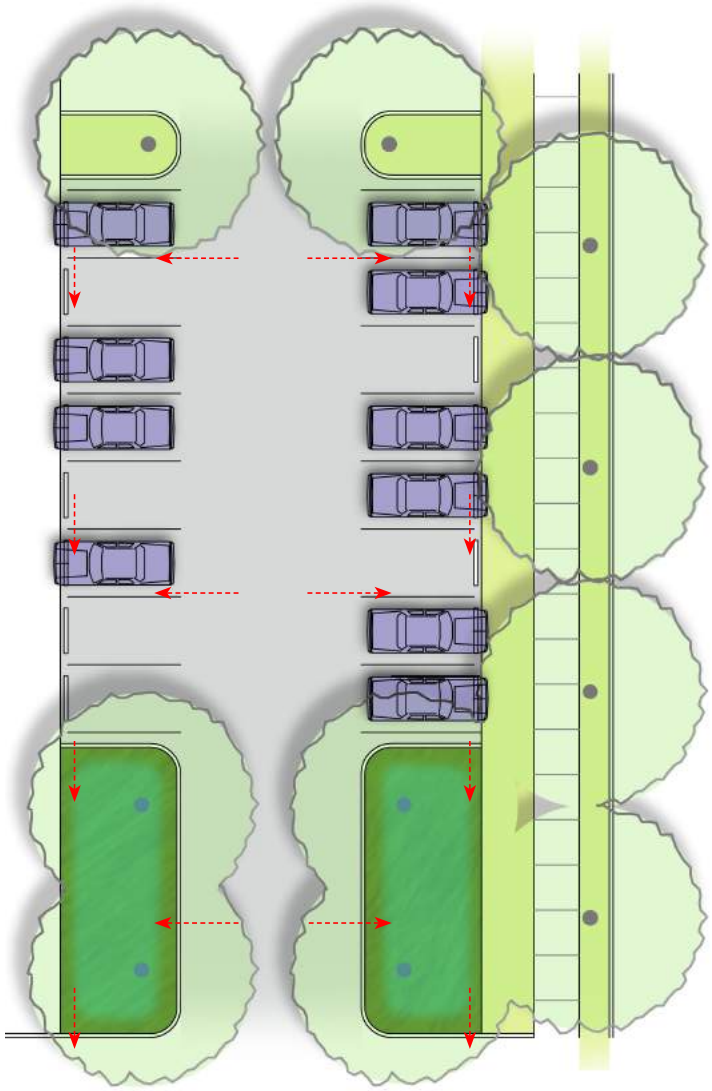
▲ Angled parking can accommodate stormwater curb extensions.

▲ Pervious pavers in the parking zone of this commercial street captures sidewalk and parking runoff.

▲ A downtown plaza is designed with a rain garden and pervious pavers.

▲ An urban tree well accepts street stormwater runoff.

Green Street and Parking Lot Examples



7.16 PARKING LOT STORMWATER PLANTERS IN LANDSCAPE ISLANDS

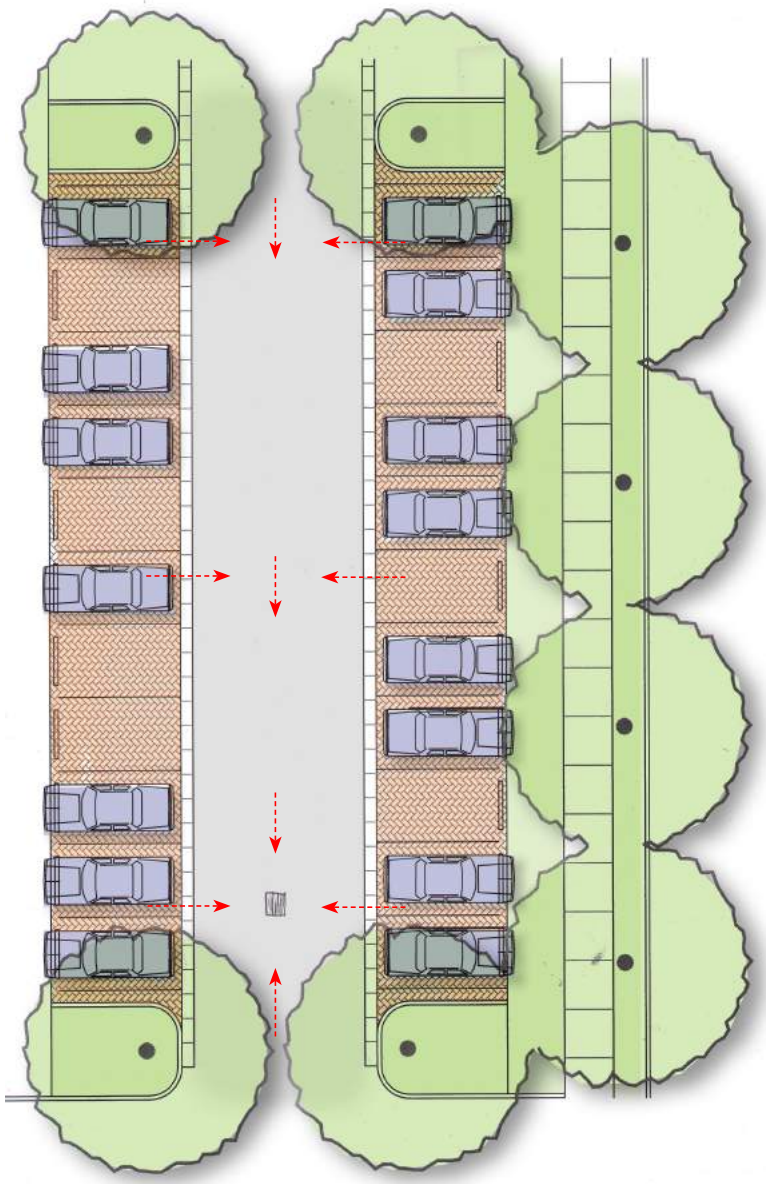
This example shows a parking lot with stormwater planters replacing empty parking stalls. This is one of the simplest parking lot retrofit actions to implement. The best approach is to convert the parking stalls immediately adjacent to a drain inlet. Depending upon the size and parking demand of a parking lot, a series of parking stalls may be consolidated into stormwater planters.

URBAN RAIN DESIGN

▲ *EXISTING: A typical parking lot with empty parking lots in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same parking lot in Middlebury, VT retrofitted with a stormwater planter replacing two parking stalls near the existing drain inlet.*



7.17 PARKING LOT PERVIOUS PAVING IN PARKING STALLS

This example shows a parking lot where stormwater drains into the center of the parking drive aisles (internally drained) as opposed to sheet flow to the periphery of the site. This is a common condition especially with small-scale parking lots. Without redesigning the drainage system, the best and most practical option is to install pervious paving. The illustrated example below employs pervious paving within the parking stalls and allows any excess stormwater runoff to drain into the existing storm inlet.

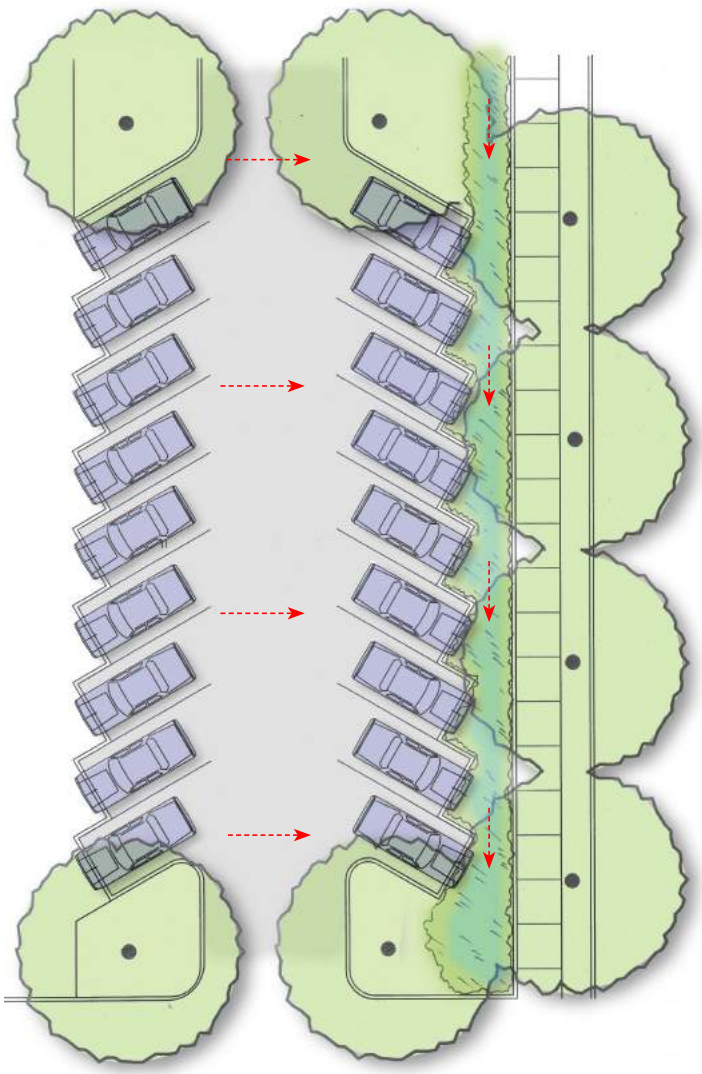
URBAN RAIN DESIGN

▲ *EXISTING: A typical small-scale parking lot in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same parking lot retrofitted with pervious interlocking concrete pavers within the parking stalls.*

Green Street and Parking Lot Example



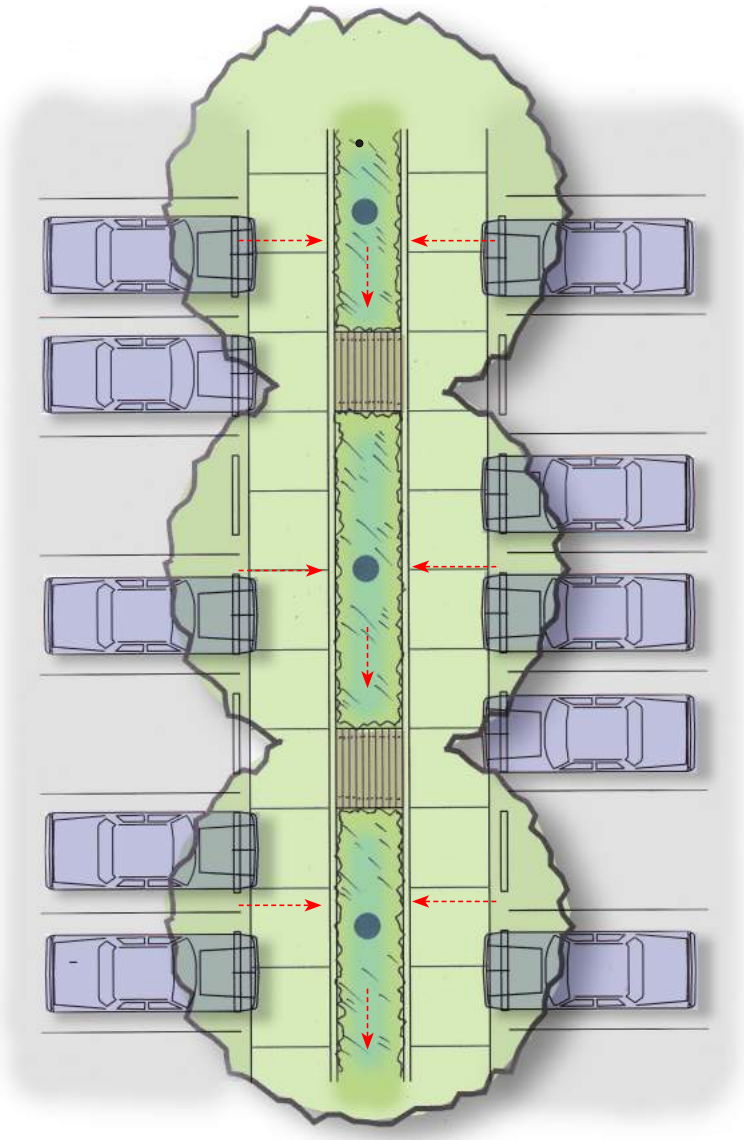
7.18 PARKING LOT PERIMETER VEGETATED SWALE

Frequently, parking lots drain surface runoff towards the perimeter of the site for capture by drain inlets. In this example, there is already a grassed drainage swale at the perimeter parking edge. However, the rim of the overflow inlet is low and allows no retention of stormwater, the short roots of lawn provide little uptake benefit, and there is lack of plant diversity. The illustration below shows a more functional vegetated swale condition.

URBAN RAIN DESIGN

▲ *EXISTING: A typical parking lot with existing perimeter space in Vermont.*

▲ *RETROFIT OPPORTUNITY: The same parking lot perimeter space retrofitted with a vegetated swale. Notice the amount of plant diversity compared to just a mowed lawn space.*



7.19 PARKING LOT CENTER MEDIAN VEGETATED SWALE

The example below shows the length of the parking stalls shortened to provide space for a vegetated swale or planter. Introducing more landscaping and trees within large urban parking lots also keeps asphalt surfaces cooler and helps reduce the urban heat island effect. Depending on the primary pedestrian traffic flow, additional space may be needed to assure that people can safely cross the landscape area without damaging plant material.

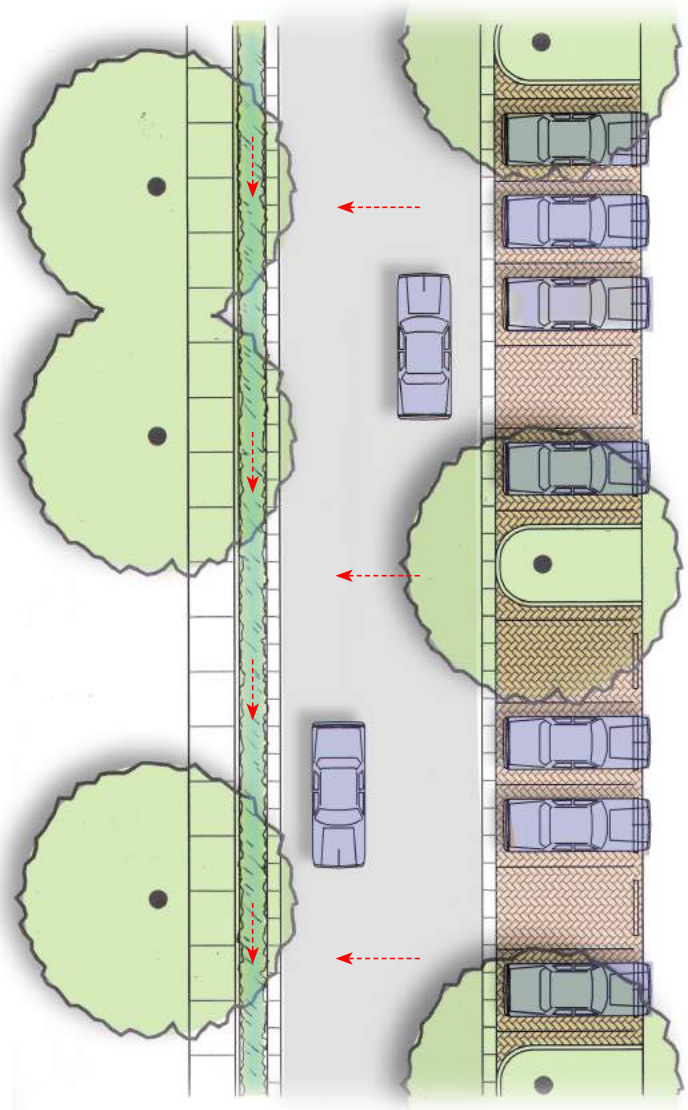
URBAN RAIN DESIGN

▲ *EXISTING: A typical parking lot center median in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same parking lot retrofitted with a vegetated swale median placed between parking stalls. Specific design considerations should be taken to manage pedestrian flow through these landscape areas.*

Green Street and Parking Lot Examples



7.20 PARKING LOT GREEN GUTTER

In many situations, if drainage is flowing towards a space, a few feet of linear space can be taken up in a parking lot for conversion to a green gutter system. Many parking areas are loaded on one side of a drive aisle or there may be a few of feet at the front of parking stalls that can provide enough room for a green gutter. Often drive aisles are oversized and can be reduced in width to accommodate a green gutter. To further enhance stormwater management on-site, pervious paving and a green gutter system can be combined as shown in the illustrated graphic to the left.

URBAN RAIN DESIGN

▲ *EXISTING: A typical oversized parking lot stall in Vermont.*

RAYMOND PAPA/URBAN RAIN DESIGN

▲ *RETROFIT OPPORTUNITY: The same parking lot scenario replacing the first couple of feet of asphalt with a green gutter system.*

7.21 DESIGN STRATEGY MATRIX

STREET/PARKING LOT TYPE	VEGETATED SWALE	STORMWATER PLANTER	RAIN GARDEN	CORNER CURB EXTENSIONS	MIDBLOCK CURB EXTNS.	GREEN GUTTERS	PERVIOUS PAVING*	STREET TREES
High-Volume Pedestrian Street	●	○	○	○	○	●	○	○
Civic/Ceremonial Street	●	○	○	○	○	●	○	○
Walkable Commercial Corridor	◐	○	○	○	○	◐	○	○
Auto-Oriented Commercial/ Industrial Street	○	○	○	○	○	◐	○	○
City Neighborhood Street	○	●	○	○	○	●	○	○
Low-Density Residential Street	○	◐	○	○	○	○	○	○
Local Street	○	◐	○	○	○	○	○	○
Parking Lots	○	○	○	◐	◐	○	○	○

○ Recommended
◐ Possible, but requires design considerations
● Not Recommended

*NOTE: for installation along state routes, coordinate with VTrans early in the process.

KEVIN ROBERT PERRY

PORTLAND, OREGON: A public plaza with a rain garden and pervious paving.