6. GREEN GUTTER

6.1 DESCRIPTION

A green gutter is a type of bioretention facility located within a street section near the gutter line. This fact sheet illustrates the use of a green gutter between the vehicular lanes of a roadway and a bike lane. A green gutter is intended to provide water quality treatment of runoff from the street and adjacent bike lane and pedestrian zone if the bike lane slopes toward the green gutter. If the bike lane drains toward the sidewalk (as might be the case in a retrofit condition), the green gutter drains the vehicular lanes. Stormwater runoff enters the green gutter through a curb opening and chase-type inlet, spreads over the planting media, infiltrates vertically downward, and exits through an underdrain. Treatment processes include filtration, soil adsorption, and plant uptake.

Green gutters should be well vegetated to maximize functionality and attractiveness. While a variety of vegetation can potentially thrive in these green gutters, a neat clean appearance is recommended by using a simple palette that primarily includes native grasses. Except as noted, a green gutter follows the design guidance provided in the Bioretention Fact Sheet in Urban Drainage and Flood Control District’s (UDFCD) Urban Storm Drainage Criteria Manual, Volume 3 (USDCM Vol. 3). This fact sheet provides specific design guidance for the application of bioretention to a green gutter. Detailed drawings and notes are provided at the back of this fact sheet to further illustrate the design of green gutters.

Figure 23 illustrates how a green gutter can be integrated into a typical street section. The figure shows the basic elements of the green gutter in cross section and in perspective. Figure 24 represents an isometric diagram of a green gutter stormwater planter.

![Green Gutter Diagram](source: Stream Design. 2015.)
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Green gutters are intended to run down the length of a block with gaps as necessary to provide pedestrian access across the green gutter. They are appropriate to capture stormwater on roadways that do not receive a deleterious amount of deicing salts. If serving just the public right-of-way (ROW; street, bike lane, and pedestrian zone), a continuous section of a 3 foot wide green gutter can satisfy the crown to ROW line water quality requirements for Denver’s local, collector, or arterial roadway classifications for total ROW widths up to 110 feet.

Other types of green infrastructure described in these fact sheets can be implemented in combination with green gutter stormwater planters. Table 1 in the Introduction provides information on approximate drainage areas that can be treated by various types of green infrastructure BMPs.

6.2 USES AND RECOMMENDATIONS

Green gutters are intended to run down the length of a block with gaps as necessary to provide pedestrian access across the green gutter. They are appropriate to capture stormwater on roadways that do not receive a deleterious amount of deicing salts. If serving just the public right-of-way (ROW; street, bike lane, and pedestrian zone), a continuous section of a 3 foot wide green gutter can satisfy the crown to ROW line water quality requirements for Denver’s local, collector, or arterial roadway classifications for total ROW widths up to 110 feet.

In an urban design context, green gutters are primarily used to separate uses for aesthetic or safety purposes, such as the example of the bike lane adjacent to a major roadway. As such, the design of green gutters should emphasize safety above all. Aesthetic considerations for these green gutters should focus on assuring their integration into the design of the overall streetscape and/or district urban design character, including the use of similar or complementary materials, colors, and design.

In addition, green gutters should be planned and designed to accommodate necessary pedestrian cross traffic, and their length should be determined to assure smooth pedestrian flow through a district or neighborhood. As green gutters are intended to be installed within street ROWs, all requirements for vehicular

FIGURE 24. Green Gutter

6.3 GREEN GUTTER AESTHETICS AND URBAN DESIGN

In an urban design context, green gutters are primarily used to separate uses for aesthetic or safety purposes, such as the example of the bike lane adjacent to a major roadway. As such, the design of green gutters should emphasize safety above all. Aesthetic considerations for these green gutters should focus on assuring their integration into the design of the overall streetscape and/or district urban design character, including the use of similar or complementary materials, colors, and design.

In addition, green gutters should be planned and designed to accommodate necessary pedestrian cross traffic, and their length should be determined to assure smooth pedestrian flow through a district or neighborhood. As green gutters are intended to be installed within street ROWs, all requirements for vehicular
safety per the City of Denver Public Works standards must be maintained, including the maintaining of proper sight distance at intersections. In addition, green gutter design must comply with the Denver Public Works Transportation Standards and Details.

6.4 GEOMETRY
The conceptual design details at the back of this fact sheet illustrate the geometry and design features of a green gutter. The details are intended to provide a basis for the designer’s final construction documents, although a site specific design will be necessary addressing geotechnical issues, structural design, utility protection and relocation, tying in underdrain to a downstream storm drain or outfall, irrigation design, vegetation plan, and associated final design and construction document preparation tasks.

WIDTH
Green gutters should be made as wide as possible within the available roadway section based on desired widths of the vehicular lanes and bike lane. A recommended minimum width is 3 feet from inside of curb to inside of curb.

LENGTH AND GUTTER PROFILE
The length of a green gutter is established based on the need to provide periodic pedestrian access and also based on the length and width necessary to obtain a specific water quality capture volume (WQCV) associated with the upstream drainage area to be treated. Since the top of the bioretention media will be horizontal in longitudinal profile while the street and top of curbs will slope, periodic drops may be necessary as shown in the details to “stairstep” the media and water quality water surface down in a downstream direction.

Figure 25 provides guidance on maximum length of each green gutter section based upon the longitudinal slope of the roadway and the vertical drop across the bioretention media.
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6.5 GREEN GUTTER DESIGN CONSIDERATIONS

WQCV ZONE

In keeping with USDCM Vol. 3 criteria for bioretention facilities, a WQCV zone is required above the planting media. This zone is measured from the top of the media to the elevation of the flow line at the inlet that controls when water will start to flow out of the planter and down the gutter. Although it is possible to design green gutters with a water quality depth as great as 12 inches, from an aesthetic standpoint it is desirable to keep the top of the media as high as possible relative to the adjacent pavement elevation. For this reason, the top of the media will typically be set 5 inches to 9 inches below the water quality water surface. The details at the end of the fact sheet illustrate the critical flow line elevation that defines the water quality water surface.

Additional information on inlet layout and sizing is provided in Section 2.2 Design Criteria.

OTHER PLANTER COMPONENTS

Section 2.2 Design Criteria provides information regarding the following components of a green gutter stormwater planter:

- bioretention media
- underdrain system
- flow control structure
- walls
- spillway
- liner

6.6 VEGETATION

BASIC GRASS COVER PLANTING

Given the limited width of the green gutter and the relatively challenging growing conditions created by the surrounding hardscape, the planting plan recommended for most green gutter applications is the “Basic Grass Cover” concept. This concept consists of a simple arrangement of primarily native grasses to create full coverage of the bioretention media. This planting scheme is intended to create a “wall to wall” planting of low to mid height native grasses. Variety can be created within the planter by alternating masses of grass species, or inserting clusters of accent grasses that contrast from the main species in size, color, or texture (all plant heights should be below 30 inches). While regular maintenance is required, the simple design of the Basic Grass Cover allows easier identification of weeds by maintenance staff. Designers should take into account mature sizes of plant material when developing planting layout plans to assure that the established plant material is not planted so close to planter edges that plants significantly exceed the limits of the planting area and create hazards for adjoining use areas. Information on sizes and spacing of recommended species is provided in Appendix C.
6. GREEN GUTTER

6.7 GREEN GUTTER DETAILS

A typical design of a green gutter is illustrated in a series of detail drawings in this section. The details indicate various elements of the planter and representative dimensions. The designer is responsible for preparing final construction drawings suitable for the specific conditions, water quality requirements, utilities and constraints existing in the location where the BMP is to be sited. A geotechnical engineer shall consult on soil conditions and recommendations for lining. A structural engineer, with input from the geotechnical engineer shall design concrete elements, including wall thickness, reinforcing (reinforcing shown in details is representative only), any foundation components such as footings or bottom slab, and subgrade/bedding/ backfill specifications. A site-specific design will also be necessary addressing utility protection and relocation, tying in underdrain to a downstream storm drain or outfall, irrigation design, vegetation plan, and associated final design and construction document preparation tasks.

The following design notes apply to the detail drawings.

DESIGN NOTES

1. INLET WIDTH VARIES BASED ON UPSTREAM IMPERVIOUS AREA AND STREET SLOPE, WITH A MINIMUM WIDTH OF 2 FEET AND A MAXIMUM WIDTH OF 3 FEET. SEE CRITERIA FOR SIZING INLET WIDTH IN INTRODUCTION SECTION.
3. STRUCTURAL ENGINEER, WITH INPUT FROM GEOTECHNICAL ENGINEER, SHALL DESIGN WALL DIMENSIONS, REINFORCING, ANY FOUNDATION COMPONENTS SUCH AS FOOTINGS OR BOTTOM SLAB, AND SUBGRADE/BEDDING/BACKFILL SPECIFICATIONS.
4. IN AREAS WHERE PARKING IS ALLOWED, THE MINIMUM STEP-OUT ZONE WIDTH FROM BACK OF CURB TO OUTER WALL OF PLANTER IS 2 FEET 6 INCHES. IN AREAS WHERE PARKING IS NOT ALLOWED, THE MINIMUM RECOMMENDED SPLASH STRIP WIDTH FROM BACK OF CURB TO OUTER WALL OF PLANTER IS 1 FOOT 6 INCHES.
5. FOR STREET SLOPES LESS THAN 5.5 PERCENT, THE ELEVATION OF THE FLOW LINE AT POINT A REPRESENTS THE WATER SURFACE ELEVATION ABOVE WHICH WATER IN THE PLANTER WOULD START TO FLOW OUT AND BE CONVEYED DOWN THE GUTTER. THIS ELEVATION IS EQUAL TO THE WATER QUALITY WATER SURFACE AND IS THE TOP OF THE WATER QUALITY CAPTURE VOLUME (WQCV).
6. FOR STREET SLOPES GREATER THAN 5.5 PERCENT, THE ELEVATION OF THE FLOW LINE AT POINT B REPRESENTS THE WATER SURFACE ELEVATION ABOVE WHICH WATER IN THE PLANTER WOULD START TO FLOW OUT AND BE
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Conveyed down the gutter. This elevation is equal to the water quality water surface and is the top of the water quality capture volume.

7. The water control structure is comprised of an incline water level control structure as shown in the details. This structure houses a control orifice designed to release the WQCV in 12 hours and a weir set within 2 inches below to 2 inches above the water quality water surface. The water control structure shall be an agri drain inline water level control structure as manufactured by Agri Drain Corporation, or approved equivalent.

8. The underdrain shall meet the material and slot specifications identified in USDCM Volume 3. The minimum length of slotted underdrain shall be 4 feet.

9. The water quality water surface is the top of the WQCV and is equal to the elevation of the flow line at point A for street slopes less than 5.5 percent and at point B for street slopes greater than 5.5 percent.

10. Bioretention media shall meet the specifications identified in the design criteria section of the introduction. Top of media shall be per plan and a minimum of 6 inches and a maximum of 9 inches below the WQCV water surface elevation.

11. Filter material shall meet the specifications identified in USDCM Volume 3. Filter material (not bioretention media) shall be compacted to a density of not less than 70 percent of relative density determined in accordance with ASTM D4253 and D4254 (for fines content less than 5 percent).

12. The underdrain cleanout shall consist of 4 inch polyvinyl chloride (PVC) pipe with two 45 degree bends and a threaded cap set 2 inches above the top of the bioretention media.

13. Provide a gap in the sidewall or depressed section (spillway) at the downstream end of the streetside planter wall at least 2 feet long to ensure that overflows from planter will exit on the streetside. The crest of the spillway shall be set at the WQCV water surface elevation.

14. Structural backfill shall consist of CDOT class 1 or 2 structure backfill, as determined by engineer and compacted to at least 95 percent of maximum density in accordance with ASTM D698.
GREEN GUTTER STORMWATER PLANTER - SECTION

SCALE: 1"=3'

1 SUPERSCRIPT NUMBERS REFER TO DESIGN NOTES PRECEDING THESE DETAILS
GREEN GUTTER SECTION

SUPERSCRIPT NUMBERS REFER TO DESIGN NOTES PRECEDING THESE DETAILS

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SCALE: 1"=3'

1 SUPERSCRIPT NUMBERS REFER TO DESIGN NOTES PRECEDING THESE DETAILS

GREEN GUTTER INLET SECTION

SCALE: 1"=3'

1 SUPERSCRIPT NUMBERS REFER TO DESIGN NOTES PRECEDING THESE DETAILS