



City of Raleigh

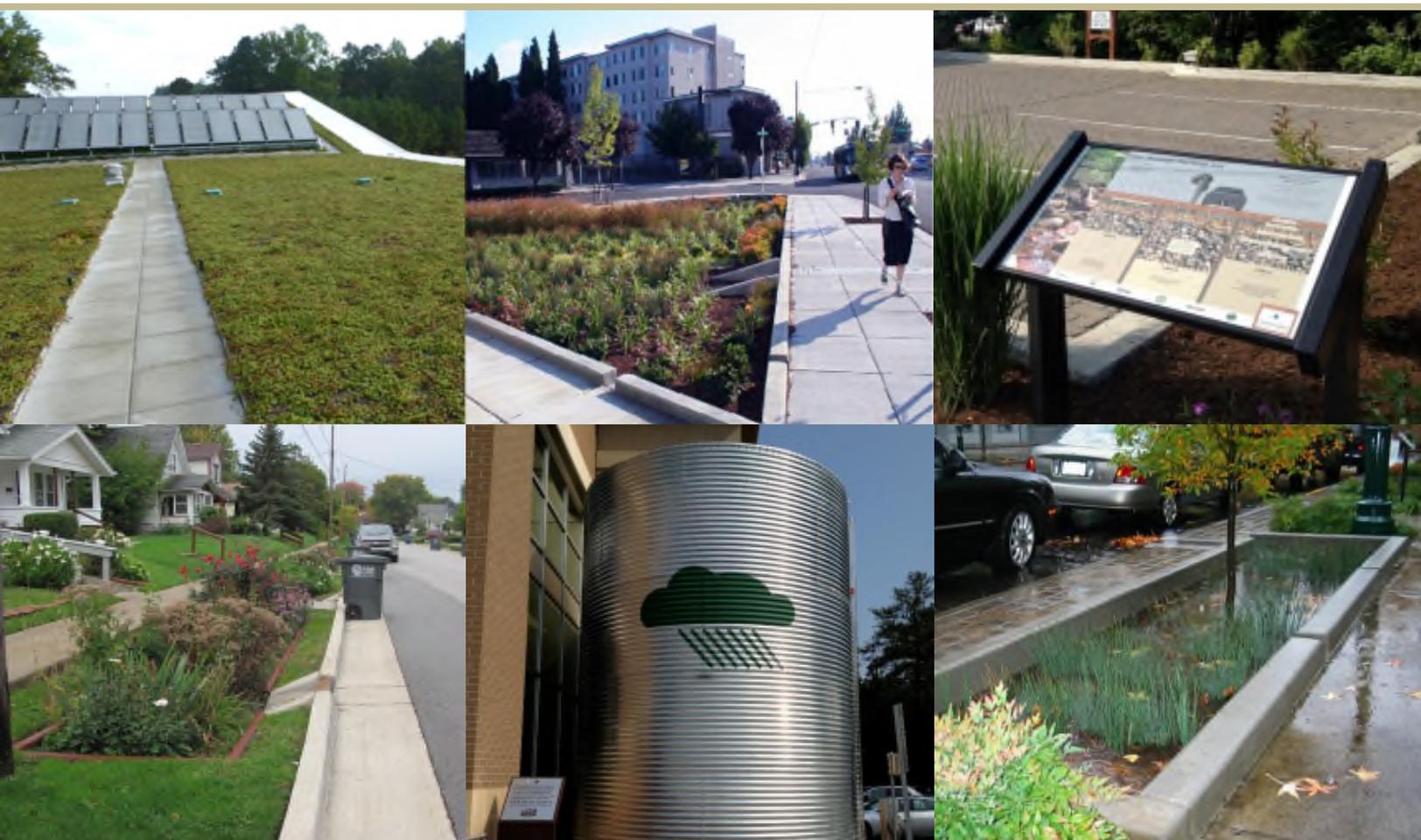
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Code Review Work Group Report

Advancing Green Infrastructure and Low Impact Development in Raleigh

May 3, 2016



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In addition, Tom Hosey and Christine Darges from the City's Development Services Department and Daniel King from the Public Works Department provided invaluable input on the Expedited Review Focus Group.

EXECUTIVE SUMMARY

The Raleigh City Council has voiced strong commitment to improving the health of local streams, lakes, and the Neuse River by promoting use of green infrastructure and low impact development (GI/LID) for addressing the main source of pollutants and damaging flows in Raleigh's streams – stormwater runoff from developed land. Council adopted a number of GI/LID policies as part of the City's 2030 Comprehensive Plan and the Raleigh Strategic Plan. However, some of these policies are not yet reflected in the City code or in staff-level policies and practices. Pursuant to the strategic GI/LID Work Plan Council endorsed in March, 2015, the purpose of this Code Review Work Group Report is to propose clear and effective policies and standards that Council, staff, citizens, businesses, and the development community can support and use in implementing GI/LID, and can be considered in the City's implementation of its Strategic Plan and future updates of the UDO and policies.

The Code Review Work Group and its focus groups held nine meetings to review and discuss the existing City code, policies, standards, and practices that pose barriers to GI/LID and to develop recommendations. The Work Group was intentionally diverse in response to the complexity of its tasks.

The Work Group's review of City code, policies, and manuals found that the City already is implementing some strong GI/LID measures, most notably progressive parking design provisions that help reduce overall impervious area and development costs and provisions encouraging infill and redevelopment.

This review also identified approximately 25 gaps and barriers that, if remedied, could better promote the use of GI/LID. The Work Group recommends changes to City code and practices intended to remove or reduce these barriers. The following are the most noteworthy topics addressed in the recommendations:

- Encouraging use of GI/LID in the water supply watersheds to meet current stormwater management standards, rather than encouraging regional facilities or requiring traditional wet ponds. Use of GI/LID can result in reduced stormwater runoff volume, velocity, and pollutant loading impacts as well as potentially lower infrastructure costs.
- Allowing or encouraging GI/LID practices to serve multiple functions in a development's required landscape areas. A multi-functional approach decreases overall landscaping and stormwater management costs and does not require stormwater management to "compete" for available, valuable land area on the site.
- Allowing developers to install GI/LID in street rights-of-way (ROWS) to treat and manage street stormwater runoff and receive stormwater credit for such practices. This approach can create more developable land area on the development site (where a stormwater pond otherwise would treat street runoff), can reduce infrastructure costs, and can provide more site design flexibility.
- Providing more flexibility in development site design to accommodate GI/LID practices.

The Work Group also evaluated possible incentives the City might offer developers to encourage them to use GI/LID practices in new development and redevelopment projects. Based on experience with processes being used by other communities, the Work Group concluded that adding a special process for expediting review of development applications with GI/LID and possibly other "green" elements is likely to be the most effective incentive for advancing GI/LID and green design. The City does not currently have expedited review for green building, and the Work Group recommends a two-tiered Green Expedited Review process. The Work Group also recommends changes to the City's existing Stormwater Quality Cost Share Program to target only sensitive watershed areas (rather than a city-wide program).

Table 1 of this report highlights barriers considered essential or very important by the Work Group, along with the types of developments and projects impacted by these barriers. Table 2 provides specific code revision language recommended to address those barriers. Appendix 1 shows how GI/LID can be incorporated into the City's Street Design Manual.

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1.0 INTRODUCTION

The Raleigh City Council has voiced strong commitment to improving the health of local streams, lakes, and the Neuse River by promoting use of green infrastructure and low impact development (GI/LID) for addressing the main source of pollutants and damaging flows in Raleigh's streams – stormwater runoff from developed land. Council adopted a number of GI/LID policies as part of the City's 2030 Comprehensive Plan and the Raleigh Strategic Plan. However, some of these policies are not yet reflected in the City code or in staff-level policies and practices.

At various times since the early 2000's, City staff, the Stormwater Management Advisory Commission (SMAC), the Environmental Advisory Board (EAB), the Planning Commission, and Council have discussed whether and how to advance the use of GI/LID on City projects and on private land development projects. In February 2013, SMAC presented recommendations to Council for advancing GI/LID with an overall theme of communicating to the land development community that "Raleigh welcomes LID". In response, Council directed City staff to evaluate SMAC's recommendations and report to Council about actions needed to implement them. On staff's recommendation, the City retained the services of Tetra Tech, Inc. to provide technical expertise and experience with implementing GI/LID on a municipal scale and to facilitate a process for how the City should approach advancing GI/LID.

From late 2013 through 2014, a Work Plan for Advancing Green Infrastructure and Low Impact Development in Raleigh (GI/LID Work Plan) was developed using a deliberative and collaborative process involving City staff from numerous operations and stakeholders from the City of Raleigh citizen boards and councils, development organizations, environmental and conservation organizations, and citizen advocacy organizations.

In March, 2015, Council endorsed the GI/LID Work Plan. Six of the Work Plan tasks were divided into two categories and assigned to two related work groups made up of City staff and external community stakeholders:

Code Review Work Group:

- Review the City code for barriers and recommend revisions
- Review potential incentives for implementing GI/LID and recommend new incentives
- Prepare design templates for streets to accommodate GI/LID while maintaining essential City functions

Implementation Work Group:

- Evaluate options for a GI/LID cost-benefit tool that can be used by staff and development applicants and recommend next steps
- Develop site planning factsheets that show how GI/LID can be incorporated into different types and scales of development



Figure 1 NCSU Central Campus before and after installation of GI/LID shows how this approach can beautify a site.

- Develop guidelines for the City's maintenance of GI/LID practices specifically and for stormwater management measures generally

This report conveys key findings and recommendation of the Code Review Work Group regarding its three tasks. Advancing the use of GI/LID in a community depends on a set of municipal ordinances that both support and encourage GI/LID principles and practices. The Work Group and its focus groups had nine meetings to review and discuss the existing City code, policies, standards, and practices that pose barriers to GI/LID and to develop recommendations. The Work Group was intentionally diverse in response to the complexity of its tasks.

GI/LID considerations are woven through the body of municipal code and barriers to using GI/LID often are embedded in the code's various ordinances, sometimes in subtle ways. Barriers can take many forms. For example, the code sometimes treat vegetated GI/LID practices as being in addition to, rather than integrated with, requirements for open space, landscaping, setbacks, screening, trees, and other vegetation, which can unnecessarily make GI/LID an extra project cost. Other barriers can cause delays and add costs associated with variances, design adjustments, plan approvals, permits, and inspections.

In conveying its message that Raleigh welcomes GI and LID as part of new development and redevelopment, the City wants to ensure that its code and policies support and encourage use of GI/LID. Given the breadth of GI/LID practices, this means going beyond examining City stormwater policies and standards to evaluating key provisions in the City code, including the Unified Development Ordinance (UDO), and related policies that affect the feasibility, effectiveness, and cost of implementing GI/LID and then preparing code language that can address barriers to GI/LID. To be successful, this process must consider goals for land development and redevelopment in Raleigh and the range of roles and functions of City operations.

The purpose of this Code Review Work Group Report is to propose clear and effective policies and standards that City Council, City staff, and the development community can support and use in implementing GI/LID and that can be considered in future updates of City code and policies.

Findings and recommendations of the Implementation Work Group are provided in a separate report.

2.0 APPROACH

To provide a framework for reviewing relevant sections of the City code, Tetra Tech used its GI/LID Code Review Checklist Tool (hereafter referred to as the "Checklist"). The Checklist draws on Tetra Tech's experience reviewing local codes for GI/LID opportunities and barriers and on widely accepted guidance documents (including Integrating LID into Local Codes – A Guide for Local Governments, Puget Sound Partnership, 2011; Low Impact Development Model Ordinance Guidance Document, Urban Waters Resource Research Council and American Society of Civil Engineers, Draft 2013; and Better Site Design Handbook, Center for Watershed Protection, 1998). The Checklist is organized by five key goals supporting GI/LID, described in Section 3. The Checklist has been used to support GI/LID program development in a number of communities, most recently in San Diego, CA; San Antonio, TX; Griffin, GA; Phoenix, AZ; and Durham, NC.

The Work Group's review of City code identified existing City policies and regulations that already encourage or support use of GI/LID. This review also identified language and provisions that clearly limit or prevent the use of GI/LID, that create ambiguity that tends to discourage or prevent its use, and that are now absent, but if added, could better enable or encourage the use of GI/LID.

In conducting this review, the potential use of a broad range of GI/LID techniques was anticipated, including downspout disconnection; rainwater harvesting; rain gardens; planter boxes; bioswales; permeable pavements; green streets; green parking design; green roofs; urban tree cover; and preservation of open spaces.

Prior to conducting the code review, Tetra Tech worked with City staff to identify the most pertinent items to review and narrowed the focus to the following ordinances (all in Division II – Code of General Ordinances), policies, and standards:

- Part 7 Solid Waste Services
 - Chapter 2, Section 7-2005 Pre-collection Practices, Removal of Rubbish, Weeds, and other Refuse
- Part 10A Unified Development Ordinance
 - Chapter 1 Introductory Provisions
 - 1.4 Building Types
 - 1.5 Measurement, Exceptions, & General Rules of Applicability
 - Chapter 2 Residential Districts
 - All sections
 - Chapter 3 Mixed Use Districts
 - 3.1 Mixed Use District Standards
 - Chapter 4 Special Districts
 - All sections
 - Chapter 5 Overlay Districts
 - 5.2 Environmental Overlays
 - 5.5 Transit Overlays
 - Chapter 7 General Development Standards
 - 7.1 Parking
 - 7.2 Landscaping and Screening
 - Chapter 8 Subdivision and Site Plan Standards
 - All sections
 - Chapter 9 Natural Resource Protection
 - All sections
- Section 8-2012 Access to and Obstruction of Manholes and Easements
- City of Raleigh Public Utilities Manual
- City of Raleigh Street Design Manual
- City of Raleigh Stormwater Management Design Manual
- City of Raleigh Tree Manual
- City of Raleigh Solid Waste Collection Design Manual



Figure 2 The Code Review Work Group met several times over seven month period.



Figure 3 Example barrier: curb cuts, needed to drain water to GI/LID, are not allowed

- City of Raleigh Cross Connection Handbook
- City of Raleigh Street and Sidewalk Improvement Ordinance
- City of Raleigh Street and Sidewalk Improvement Policy
- City of Raleigh Comprehensive Plan polices related to tree canopy

The Checklist tool was tailored for use in the City of Raleigh given the City's unique conditions and priorities. After an initial review of City code and manuals, City staff were interviewed to clarify how certain code provisions are implemented and to identify internal concerns and operational policies as they relate to GI/LID in development plan review. A Draft Memorandum and Checklist were provided to the Code Review Work Group, and a meeting was held with the Work Group to discuss initial findings and revisions, including:

- Did the draft Checklist identify anything as a barrier that is not a barrier?
- Are there barriers or proactive incentives (discussed below) not yet identified?
- What are the most important barriers and proactive incentives to address in the coming months?

The Draft Memorandum and Checklist were modified to reflect the Work Group's discussion and recommendations regarding the most important barriers to address through possible code revisions.

The Work Group also evaluated potential proactive incentives – policies that offer something to developers in exchange for using GI/LID. The Work Group ranked a menu of potential policy incentives in terms of those most promising for additional research and, after hearing findings of that research, further narrowed the list of proactive incentives that it wished to develop in more detail. Two focus groups considered policy recommendations for proactive incentives, and the Work Group endorsed creating a new Green Development Expedited Review Program and modifying the City's existing Stormwater Quality Cost Share Program.

Street template details incorporating GI/LID were developed through interviews, field exercises with City staff, focus group meetings, and discussions with the Work Group. The Work Group endorsed the street templates and new standard design details that can be incorporated into the Raleigh Street Design Manual.

3.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

Findings and recommendations of the Code Review Work Group are organized according to the following goals that GI/LID is intended to achieve:

- | | |
|---------|--|
| Goal #1 | Minimize connected impervious areas. |
| Goal #2 | Preserve and enhance the hydrologic function of pervious areas. |
| Goal #3 | Harvest rainwater to enhance potable and non-potable water supply. |
| Goal #4 | Allow and encourage the use of multi-use stormwater controls. |
| Goal #5 | Manage stormwater to sustain stream functions. |

For each GI/LID goal, Section 3.1 through 3.5 highlight the findings of the review of policies and codes, noting barriers and gaps that were rated by the Work Group as "essential" or "very important" to address and the types of recommended code revision language for addressing each barrier. Table 1 summarizes

the identified barriers and the types of land development impacted by each barrier. Table 2 provides the specific sections of the City code and manuals that are recommended for revision to address each barrier, with recommended revisions noted in underline and ~~strike through~~. Addressing these code and manual provisions would support use of GI/LID by providing more site design flexibility, reducing redundant site demands and associated costs, and in some cases yielding more developable land area.

Some communities go an additional step – taking a more proactive approach. They actively encourage GI/LID by providing bonus incentives such as cost-sharing with property owners for installation of GI/LID BMPs that go beyond regulatory requirements and providing expedited development review. Section 3.6 discusses the proactive incentives for advancing GI/LID recommended by the Code Review Work Group.

3.1 GOAL #1: MINIMIZE CONNECTED IMPERVIOUS AREAS

Mitigating Runoff from Connected Impervious Areas

Connected impervious areas include rooftops, driveways, compacted lawns, and other impervious surfaces that drain directly to (and in effect discharge to) a storm drainage collection system or a stream. Impervious areas on a development site can be “disconnected” from the City’s storm drainage system by routing it to natural areas, landscape areas, or storage areas where it can be used and infiltrated. Disconnecting impervious surfaces is low cost and has been shown to reduce the volume and peak rates of stormwater runoff. The City UDO’s definition of impervious area does not distinguish between disconnected and connected impervious surfaces. Adding a definition to UDO that reflects the NC Stormwater Best Management Practices Manual definition of disconnected impervious surface will help encourage this GI/LID practice.

Flexibility in Locating Stormwater Best Management Practices in the Street Right-of-Way

Streets are a significant source of stormwater runoff in Raleigh. As the City implements street improvement projects, including new streets, “complete streets”, “green streets”, maintenance, widening, and installation of traffic calming devices, there will be opportunities for integrating GI/LID to mitigate stormwater runoff impacts and improve the appearance of the right-of-way (ROW) area. The ROW also is an area over which the City has control and can use to help advance GI/LID. The Work Group recommends adding a new policy to the City’s Comprehensive Plan: For city street improvement projects, integrate GI/LID to the extent practicable to mitigate stormwater runoff impacts and improve the appearance of the ROW area.

If private sector developers could install GI/LID in the ROW to manage and treat street runoff, more developable land area would be made available on the project site where a stormwater pond otherwise would have treated street runoff. This can be especially important in infill and downtown areas with tight space constraints. The Work Group recommends a new policy for the Street Design Manual expressly allowing developers to install GI/LID in the ROW to treat and manage street stormwater runoff and for them to receive stormwater credit for such practices.



Figure 4 Not explicitly allowed or encouraged

The Work Group identified street cross sections in the UDO that appear to offer good opportunity for GI/LID adaptation, provide community benefits, and are likely to be used in Raleigh. These street types include: Mixed Use Streets (Avenue 3-Lane, Parallel Parking; Avenue 4-Lane, Parallel Parking; and Main Street, Parallel Parking) and Local Streets (all neighborhood street cross sections and the multi-family street cross section). The Work Group developed and recommends that the City adopt new standard design details that show how GI/LID practices can be accommodated in the ROW for these types of streets while providing essential City functions such as stormwater drainage, solid waste collection, fire response, and utility placement. When the City or a development applicant wishes to incorporate GI/LID into street design, these standard details (see Appendix1), if incorporated into the Street Design Manual, will provide the guidance needed. The Work Group also recommends revising the Street Design Manual's and the Street and Sidewalk Improvement Curb and Gutter policies to not require curb and gutter for all streets and to expressly allow alternative curb systems to enable stormwater to drain from the street to GI/LID BMPs.

The City has begun incorporating GI/LID elements into street corridor project designs, such as East Cabarrus Green Street, Six Forks Road, and Sandy Forks Road. These projects, in combination with fewer barriers in the City code, will support advancing GI/LID in Raleigh.

Parking

The UDO has progressive parking provisions that help reduce overall impervious area, provide adequate parking space, and reduce development costs. This includes allowing reduced parking dimensions for stall depth and width; allowing pervious pavement/pavers for off-street parking; reduced parking space requirements for commercial and office areas compared to traditional parking requirements; opportunities for shared parking, remote parking, and valet parking; and the option to use in-lieu payments rather than individual parking lots.

However, in Raleigh, a designated Tree City USA community, parking space requirements may not be reduced to preserve significant stands of trees or mature trees. More parking area yields more paving, stormwater runoff, and infrastructure costs, and when healthy, mature trees on site are removed, it can additionally result in a loss of natural green infrastructure and beauty as well as increased urban heat island impacts. The Work Group recommends allowing a reduction of parking for preservation of healthy trees.

An important barrier to GI/LID in the UDO is in the landscaping requirement for parking areas: GI/LID BMPs are not explicitly allowed or encouraged in the parking medians, parking perimeters, and screening areas. Not explicitly allowing GI/LID BMPs in parking lot landscaping implies that the City prefers status quo of landscaping and stormwater management devices being separate features. This implied preference increases overall landscaping and stormwater management costs and requires stormwater management to "compete" for available, valuable land area on the site rather than using multi-functional approach. Therefore, the Work Group recommended explicitly allowing GI/LID to be used to meet parking lot landscaping requirements and to be constructed in designated landscape areas.



Figure 5 GI/LID not explicitly allowed in parking landscaping areas

Buildings

The UDO explicitly allows green roofs. It also explicitly allows rainwater collection systems, such as cisterns, to be located in side and rear setback areas. However, the code does not explicitly allow setbacks/side yards to accommodate vegetated GI/LID BMPs. Explicitly allowing GI/LID BMPs in setback and side yards will encourage locating them where they may be most effective. The Work Group recommends that the building and parking setbacks be allowed to accommodate GI/LID, as long as such GI/LID designs do not compromise public safety, such as sight triangles.

Clustering Development/Infill/Redevelopment

The UDO allows cluster development and encourages infill and redevelopment. For example the code reduces parking requirements within 1,320 feet of transit stops; provides a payment in-lieu parking option for the Downtown District and Transit Overlay Districts; reduces setback requirements for residential infill compatibility, mixed use developments, and conservation development; and exempts a redevelopment's existing impervious area from stormwater requirements. No GI/LID key barriers were identified related to infill and redevelopment.

3.2 GOAL #2: PRESERVE AND ENHANCE THE HYDROLOGIC FUNCTION OF PERVIOUS AREAS

Site Disturbance, Vegetation, and Building Footprint

Designing a site to limit disturbance and preserve natural drainage pathways can help preserve the hydrologic function of the site and help prevent erosion. The UDO Sedimentation and Erosion Control states as its objective: Identify on-site critical areas which are subject to erosion and off-site areas which are vulnerable to damage from erosion or sedimentation, and provide special attention to these areas. However, there is no guidance on what such a critical area is or how to protect it. The Work Group recommends clarifications in the UDO, in the Raleigh Guidelines for Land Disturbing Activities, and Stormwater Design Manual to provide such guidance.

Stream Buffers

Stream buffers are an important open space element and, the wider the buffer, the more floodwater storage capacity, stormwater treatment, and infiltration are provided. Currently Raleigh has less stringent requirements for stream buffer width than several neighboring jurisdictions in the Triangle. The Work Group recommends revising the UDO to provide an open space bonus in return for protection of wider stream buffers. This could be an incentive for this important GI/LID element.



Figure 6 Limiting site disturbance to preserve trees and stream buffers are important elements of GI/LID

3.3 GOAL #3: HARVEST RAINWATER TO ENHANCE POTABLE AND NONPOTABLE WATER SUPPLY

Plumbing Codes and Building Codes

The State plumbing code and building code and the City's codes allow rainwater harvesting for both exterior uses (e.g. irrigation) and interior uses (e.g. toilet flushing). However, it is recommended that the City examine and clarify internal policies regarding use of harvested rainwater.

Unified Development Ordinance

There is a requirement in the UDO to connect altered watercourses/drainage to the public drainage system and for grading the site and use of drainage structures when natural drainage systems are used. These provisions appear to conflict with distributing rooftop runoff to natural areas or landscaped areas, and generally with the GI/LID approach to managing, distributing, and infiltrating stormwater on site. The Work Group recommended revising the Drainage Section to clarify that GI/LID is allowed and encouraged.

3.4 GOAL #4: ALLOW AND ENCOURAGE MULTI-USE STORMWATER CONTROLS

Landscape and Open Space Areas

Some of the largest barriers identified in the code review pertain to allowing or encouraging GI/LID to serve multiple purposes in a development's required landscape areas. For example, in the UDO:

- Bioretention and other vegetated GI/LID BMPs are not explicitly allowed in a development's designated landscape areas or perimeter and parking screening areas.
- Bioretention and other vegetated GI/LID BMPs are not given credit as "landscaping" to count toward required landscaping.
- Landscaping planting requirements (the spacing, dimensions, and plant types) are not conducive to bioretention, bioswales, raingardens, and constructed wetlands.
- Tree planting requirements do not allow the use of raingardens, tree boxes, tree planters.



Figure 7 Multi-use landscaping not explicitly allowed or encouraged

- Existing trees do not count toward stormwater and landscaping requirements.
- Vegetated GI/LID may not be used to help meet the requirements for new landscaping trees in the right-of-ways (e.g. streetscape trees).

Not explicitly allowing GI/LID BMPs in required designated landscape areas/amenity areas implies that the City prefers status quo of landscaping and stormwater management devices being separate features. This implied preference increases overall landscaping and stormwater management costs and requires stormwater management to compete for available, valuable land area on the site rather than using a multi-functional approach. The Work Group recommends revising 15 provisions in the UDO and Street Design Manual pertaining to landscaping, protective yards, screening, and streetscapes.

3.5 GOAL #5: MANAGE STORMWATER TO SUSTAIN STREAM FUNCTIONS

Performance Standards

The UDO generally allows both traditional stormwater BMPs and GI/LID BMPs to be used in meeting stormwater performance standards, except in drinking water supply watersheds where the UDO requires the use of traditional stormwater BMPs to meet performance standards (i.e. GI/LID is not explicitly allowed and traditional wet ponds are explicitly required). This requirement for traditional stormwater BMPs in the water supply watersheds—and the general lack of encouragement of GI/LID city-wide—can result in higher stormwater volume, velocity, and pollutant loading impacts, less groundwater and stream recharge, as well as potentially higher infrastructure costs.

The Code Review Work Group recommends a revision to the Stormwater Design Manual (replacing the stated preference for regional stormwater facilities with a preference for GI/LID) and a revision to the UDO (replacing a requirement for wet ponds in the Watershed Areas, allowing both GI/LID and traditional stormwater practices). As noted in Section 3.6, an Expedited Green Review is recommended to further advance GI/LID. The program would expedite projects that provide stormwater volume matching for the 90th percentile storm event.

The UDO's stormwater performance standards' threshold of applicability allows significant development without requiring surface water drainage and peak discharge stormwater control plans. Development sites with 15 percent or less impervious area are exempt from active stormwater control measures for peak discharge control. Numerous studies show impacts to water quality and stream health at very low levels of watershed impervious cover. The Work Group recommends the threshold of applicability for stormwater controls be revised to 10 percent impervious area.

3.6 PROVIDE PROACTIVE GI/LID INCENTIVES

Expedited Review for GI/LID and Energy-Efficient Building

Based on research of processes being used by other communities, expedited review may be the most effective incentive for advancing GI/LID and green design. The City does not currently have expedited review for green building.

The City's Development Services staff highlighted elements of the City's development review process that need to be considered in developing expedited review processes:

- The City has one development project coordinator that serves as a point of contact for applicants. One additional project coordinator position is planned/budgeted.
- The City has a popular expedited review process that development applicants can use, but must pay a higher review fee (\$800/hr.).
- Local governments that have long standard review times (e.g. 60 to 90 days) can conceivably cut review time in half with an expedited permit process, making the expedited process attractive to the development community. Because the City already is completing initial permit reviews within 10 days (and subsequent reviews within seven days), an expedited process in Raleigh would need to offer additional benefits.
- If an expedited review process were to focus on reducing the number of times an applicant has to go through the review cycle, and not on the initial review, the expedited review process probably would be attractive to the development community.
- When an application also needs permit from NCDOT or NCDEQ, the state's review process takes 2 to 3 months. This long review time tends to slow the City's permit review process, which could negate benefits of expediting the City's review process.
- Once a site plan and a building permit are approved, construction and City inspections begin. While an inspection may be performed within one day of notification, delays along the way can occur before a Certificate of Occupancy is issued. Reducing such delays could be an incentive for GI/LID.
- Face-to-face review time and "hand holding" through the development review process would be highly desirable to applicants so they know what to expect.

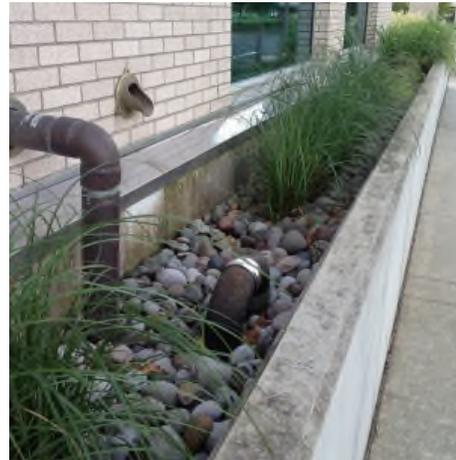


Figure 8 Encouraging green design through expedited review



Figure 9 Encouraging green design through expedited review

The Code Review Work Group recommends the City establish a green expedited review process (Green Raleigh Review) to encourage developers to incorporate GI/LID practices and other green practices into site development designs. This recommendation provides for two tiers – a basic tier (Tier 1) that would encourage use of GI/LID practices and a more comprehensive Tier (Tier 2) that would encourage use of green building energy practices in addition to GI/LID practices, described below.

Proposed “Green Raleigh Review” Process for Expedited Review

The Code Review Work Group recommends two tiers for expedited green review. Tier 1 would require GI/LID predevelopment/post-development stormwater runoff matching for the site plan phase. For Tier 2, the applicant must first obtain site plan approval under Tier 1 plus propose energy-efficient building practices for the building permit phase. Benefits to the site development applicant would include the following:

- Assigned contacts. Each eligible project would have an assigned point of contact/project coordinator from project intake through final site plan approval, and another assigned point of contact/field coordinator through building plan approval, to advocate for these projects and facilitate the review and approval process.
- Access to the Green Team. Eligible project applicants would meet face-to-face with a new Green Team during a weekly Green Raleigh Review meeting. Within time now allotted for weekly Express Review, two slots would be made available: one for a Tier 1 site plan review, and one for a Tier 2 building plan review. Each review would be completed in a 2- to 3-hour meeting. Reviews during this time would not necessarily be exclusive to Green Raleigh Review; other project reviews would continue, as a matter of routine. However, two Express Review slots would be opened for Green Raleigh Review projects, as needed.
- Five-day reviews/approval. Site plans and building plans reviewed on Green Day Review would each be approved within five business days.
- Fee waiver. Review fees would be waived.

Green Raleigh Review: Proposed Requirements and Review Process

Tier 1: GI/LID for Stormwater Runoff Volume Match

For preliminary site plans, the applicant would propose to use stormwater GI/LID practices for pre- and post-construction runoff volume match. The following is the proposed standard for “runoff volume match”:

The volume of stormwater runoff leaving site after development is less than or equal to the volume of runoff before development for the 90th percentile storm event.

This standard is the same as the standard in NC Department of Environmental Quality’s Storm-EZ Permitting Tool, which the state uses to promote and encourage the use of GI/LID.

To meet this standard, the applicant must use approved stormwater GI/LID practices, including but not limited to:

- Bioretention
- Green roofs
- Porous pavement
- Alternative streets (e.g. GI/LID in the ROW and designs that minimize impervious area)

- Credits for existing and proposed trees
- Disconnections of pavement runoff (e.g. sidewalk runoff to natural area or permeable area)
- Rainwater harvesting systems (not including rain barrels)
- Disconnections of rooftop runoff

The following are recommended required steps for Tier 1 site plan review, ending with site plan approval:

Step 1. Pre-meeting sketch review (fee waived)

Step 2. E-submittal of preliminary site plan

(Maximum 10 day interval between Steps 2 and 3 to allow Green Team to be assigned and review plan submittal.)

Step 3. Face-to-face Green Team Review on Green Day (fee waived)

Step 4. Staff Review and approval of site plan. (5 days)

(Maximum 5 day interval between Steps 3 & 4 to allow for preparation of staff report, and management review and approval).

[Note: By state law, applicants are required to wait a minimum of 30 days for a site plan appeal before initiating the Building Permit application process. Other applicable conditions must be met as well.]

Tier 1 expedited review ends at the approval of the site plan.

Tier 2: Energy-Efficient Building Practices

To be eligible for expedited review of **building permits** via Tier 2, the applicant must first obtain approval of the proposed development's site plan via Tier 1, AND propose to use at least one of the following green building energy practices: geothermal systems, photovoltaic panels, and solar thermal panels.

The following are recommended required steps for Tier 2 building plan review:

Step 1. Pre-submittal conference (fee waived)

Step 2. E-submittal of building permit application

(Maximum 10 day interval between Steps 2 & 3 to allow Green Team to be assigned and review permit application submittal.)

Step 3. Face-to-face Green Team Review on Green Wednesday (fee waived)

Step 4. Permit issuance (5 days)

(Maximum 5 day interval between Steps 3 & 4 to allow for staff/management review and approval and calculation of fees).

Tier 2 would end with certificate of occupancy. The project field coordinator would serve as the single point of contact and would work with the applicant through scheduling of inspections through issuance of certificate of occupancy to facilitate and expedite the process.

Resources Needed

The heart of the Green Raleigh Review would be a new "Green Team" composed of subject-matter experts including Site Plan and Building Permit staff. The Green Team would interact/work with the Express Review Manager in scheduling project reviews. For energy-efficient building elements currently beyond the expertise of staff review, such as geothermal systems, the City could use outside contracted

consultants as needed, particularly in the program start-up phase. The selected Green Team staff would continue to review standard projects; however, they would be trained in the steps above to expedite Green Raleigh Review projects. Green Raleigh Review would have a coordinator that would serve two roles: project coordinator and overall facilitator/coordinator/promotor of the Green Raleigh Review process.

The Green Raleigh Review process would add additional workload for staff and may warrant additional staff resources.

Changes to the Existing Stormwater Quality Cost Share Program

The City currently implements a stormwater cost share program available to property owners citywide for installing and maintaining stormwater treatment devices that are not required to comply with existing stormwater management requirements. Participants receive a contribution by the City to the cost of designing and constructing the stormwater treatment device. The City's cost contribution is 75 percent, except in six Priority Water Quality Target Areas, where the City's cost contribution is 90 percent. The Target Areas are two water supply watersheds, two stream basins designated as impaired, and the Downtown Overlay District.

The Code Review Work Group recommended the following regarding advancing GI/LID through the City's Stormwater Quality Cost Share Program:

- (1) providing a free site evaluation for the property owner to help determine the best opportunity GI/LID sites and types;
- (2) helping fund/cost-sharing the BMP;
- (3) advertising and promoting the cost-share program, particularly in the City's water supply watershed and impaired watersheds.
- (4) considering overall level of impervious area treated when setting priorities with limited cost-share funding.

The City of Raleigh's Stormwater Quality Cost Share Resolution and Policy may need to be amended accordingly. Based on experience with a cost share program in Washington D.C., the City may wish to consider auto-enrolling participating properties in the City's stormwater fee credit/adjustment program as an added incentive. This may also require a revision of the Stormwater Quality Cost Share Resolution and Policy.



Figure 10 City of Raleigh Cost-Share Program

4.0 CONCLUSIONS AND NEXT STEPS

The City recognizes the important potential of broad use of GI/LID for reducing negative impacts of stormwater runoff from developed land, the main source of pollutants and damaging flows in Raleigh's streams. The City also recognizes additional benefits resulting from use of GI/LID, including conserving and protecting water supply sources and open space, creating more bikeable and walkable streets, reducing urban heat island effect, and improving air quality.

Review of City code, policies, and manuals by the Code Review Work Group found that the City already is implementing some strong GI/LID measures, most notably progressive parking design provisions that help reduce overall impervious area and development costs, and provisions encouraging infill and redevelopment.

This review also identified approximately 25 gaps and barriers that, if remedied, could better promote the use of GI/LID. Table 1 highlights those barriers considered essential or very important, along with the types of developments and projects impacted by these barriers. Table 2 provides specific code revision language recommended to address those barriers. Appendix 1 shows how GI/LID can be incorporated into the City's Street Design Manual. These revisions, along with the recommended Green Expedited Review process and a revised Stormwater Quality Cost Share Program, are a strong package to advance GI/LID in Raleigh.

This report with recommendations of the Code Review Work Group, along with a companion report with recommendations of the Implementation Work Group, will be reviewed by the City's Stormwater Management Advisory Commission, and will be presented to City Council for consideration and direction to staff regarding implementation of the recommendations.

Table 1. Summary of Significant Barriers to Use of GI/LID

✓ = Applicable to developer or city initiated project

BARRIER OR GAP	TYPES OF DEVELOPMENTS/PROJECTS IMPACTED BY BARRIER	
	Residential	Non-Residential
Goal #1: Minimize Impervious Areas		
No distinction between connected impervious area and disconnected impervious area.	✓ (All)	✓ (All)
No explicit allowance for alternative curb systems in street projects including GI/LID.	✓ (All, except Sensitive Area Streets, streets built before 1950, or where City has no plans for future curb and gutter as part of street improvements or neighborhood plans)	✓ (All, except Sensitive Area Streets, streets built before 1950, or where City has no plans for future curb and gutter as part of street improvements or neighborhood plans)
No policy for City street improvement projects to integrate GI/LID BMPs.	✓ (All)	✓ (All)
No explicit allowance for curb bumpouts or GI/LID BMPs in the right-of-ways.	✓ (All)	✓ (All)
Parking space requirements may not be reduced to preserve significant stands of trees or mature trees.	✓ (All)	✓ (All)
GI/LID BMPs are not explicitly allowed in parking medians and parking perimeter landscaping.	✓ (Multi-family Residential, Attached, Townhouse, Apartment, Mixed Use, Manufactured Housing), Planned Development)	✓ (Mixed Use, Commercial, Industrial, Campus, Planned Development)

BARRIER OR GAP	TYPES OF DEVELOPMENTS/PROJECTS IMPACTED BY BARRIER	
	Residential	Non-Residential
Adjacent on-street parking does not count toward off-street parking requirements.	✓ All	✓ All
Site setbacks, side yards, and rear yards may not be reduced to accommodate GI/LID BMPs (except rain barrels in side yard and rear yard setbacks).	✓ (All residential district, mixed use, and special districts)	✓ (All residential district, mixed use, and special districts)
Goal #2: Preserving Hydrologic Function		
Building footprints are not required/encouraged to avoid highly erodible soils or soils with high permeability.	✓ (All)	✓ (All)
Site designs are not required or encouraged to preserve natural drainage patterns.	✓ (All)	✓ (All)
No open space bonus is provided for providing a wider stream buffer than required.	✓ (Compact Development, Conservation Development, Cottage Court, Conservation Management District, Manufactured Housing, Campus Planned Development, Life Care Community)	
Goal # 3: Harvest Rainwater to Enhance Water Supply		
Distributing rooftop runoff to natural areas or landscaped areas conflicts with requirement to connect to public drainage system.	✓ (All)	✓ (All)
Goal # 4: Allow Multi-Use Stormwater Controls		

TYPES OF DEVELOPMENTS/PROJECTS IMPACTED BY BARRIER		
BARRIER OR GAP	Residential	Non-Residential
<p>Vegetated GI/LID BMPs are not explicitly allowed to be constructed in required designated landscape areas/amenity areas or count towards required landscaping/amenities.</p>	<p style="color: blue; font-size: 2em;">✓</p> <p><u>Tree Conservation</u> All subdivision tracts or site plan parcels at least 2 acres</p> <p><u>Outdoor Amenity Areas</u> Mixed Use Townhouses, Apartments, Mixed Use Building</p>	<p style="color: blue; font-size: 2em;">✓</p> <p><u>Transitional Protective Yard</u> Commercial Uses: Day Care, Remote Parking, Animal Care, Vehicle Sales Industrial Uses: Heavy, Self Service Storage, Vehicle Repair, Warehouse & Distribution School and Civic Uses: Life Care Community, Utilities, Telecommunication Tower</p> <p><u>Street Protective Yard</u> Commercial Uses: Vehicle Sales Industrial Uses: Heavy, Self-Service Storage, Vehicle Repair, Warehouse & Distribution School and Civic Uses: Utilities Telecommunication Tower</p> <p><u>Screening</u> Drive-thru Facilities; Loading Areas; Service Areas; Mechanical Wall-Mounted, and Ground-Mounted Equipment Parking Lot Landscaping</p> <p><u>Outdoor Amenity Areas</u> General Building, Mixed Use Building, Civic Building</p>
<p>Landscape requirements do not allow plantings conducive to GI/LID.</p>	<p style="color: blue; font-size: 2em;">✓</p> <p>See landscape requirements above.</p>	<p style="color: blue; font-size: 2em;">✓</p> <p>See landscape requirements above.</p>

BARRIER OR GAP	TYPES OF DEVELOPMENTS/PROJECTS IMPACTED BY BARRIER	
	Residential	Non-Residential
Tree planting requirements do not explicitly allow use of vegetated GI/LID BMPs.	✓ See landscape requirements above.	✓ See landscape requirements above.
Vegetated GI/LID BMPs cannot be used to help meet new required streetscape trees or trees required in street right-of-way.	✓ (All)	✓ (All)
Vegetated GI/LID BMPs are not explicitly allowed to count toward the site's required parking landscaping and screening areas.	✓ (Multi-family Residential, Attached, Townhouse, Apartment, Mixed Use, Manufactured Housing), Planned Development)	✓ (Mixed Use, Commercial, Industrial, Campus, Planned Development)
There is no explicit allowance for GI/LID to be constructed in designated sewer easements.	✓ (All)	✓ (All)
Goal # 5: Manage Stormwater to Sustain Stream Functions		
The performance standards do not encourage or require that some portion of the stormwater be retained on site. Instead there is a requirement to connect to the storm drainage system.	✓ (All)	✓ (All)
The stormwater performance standards threshold of applicability allows significant development without stormwater control plans.	✓ (Subdivisions with lots exceeding 1 acre and all developments where lot imperviousness does not exceed 15%).	
The code does not encourage or require the use of GI/LID BMPs to meet the stormwater performance standards. There is a requirement to connect to the storm drainage system.	✓ (All)	✓ (All)

Table 2. Code and Policy GI/LID Barriers and Recommended Language to Address Them

GOAL #1: MINIMIZE CONNECTED IMPERVIOUS AREA

Objective: Minimize impervious area associated with streets.

Objective: Minimize impervious area associated with parking.

Objective: Minimize impervious area associated with driveways and sidewalks.

Objective: Cluster development.

Objective: Incorporate sustainable hydrology practices into urban redevelopment.

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
Overall Effective Impervious Area	
<p>1. No distinction between connected impervious area and disconnected impervious area.</p> <p><i>Why is this important?</i></p> <p>DIS is low cost and has been proven to reduce the volume and flows associated with stormwater runoff.</p>	<p>UDO Definitions</p> <p>Add Definition to UDO that reflects the NC Stormwater Best Management Practices Manual definition of disconnected impervious surface:</p> <p><u>Disconnected Impervious Surface (DIS) is the practice of directing stormwater runoff from built-upon areas to properly sized, sloped, and vegetated pervious surfaces. DIS is low cost and has been proven to reduce the volume and flows associated with stormwater runoff.</u></p> <p>Add Definition to UDO for GI/LID.</p> <p><u>GI/LID: Green Infrastructure (GI) is the collection of an area's landscape features (vegetation, soils, and natural processes) that help manage stormwater. This can include structurally engineered practices (such as green roofs, bioretention areas, and bioswales) and natural areas (such as woods, wetlands, and meadows). Low Impact Development (LID) is an approach to land development (or redevelopment) that relies on and mimics natural processes to manage stormwater as close to its source as possible. Key principles of LID include (1) preserving and recreating natural landscape features to match undeveloped land stormwater infiltration and runoff volumes, and (2) minimizing connected impervious area to create functional</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
	<p><u>and appealing site drainage that treats stormwater as a resource rather than a waste. In addition to stormwater management, GI/LID can enhance site aesthetics, improve air quality, reduce urban heat island impacts, provide shading, create wildlife habitat, reduce energy consumption, reduce infrastructure costs, and increase property values.</u></p>
<p>Streets</p>	
<p>1. No explicit allowance for alternative curb systems in street projects including GI/LID.</p> <p><i>Why is this important?</i></p> <p>There is no outlet for stormwater to drain from street to GI/LID BMP.</p>	<p>Draft City of Raleigh Street Design Manual Article 12.4 Curb and Gutter</p> <p>All public roadways inside the corporate limits of the City, and outside the City when water and sewer is connected to the City utility system, shall be constructed with <u>standard curb and gutter or an alternative curb system to accommodate GI/LID stormwater management. Alternative curb systems include flat curb, standard curb with openings, or other curb systems as approved by the Public Works Director. Details for standard curb and gutter and alternative curb systems can be viewed in the City of Raleigh Standard Details. See Detail T-10-26.1 for the standard curb and gutter installation, and Details [X] for alternative curb installation.</u></p> <p>Street and Sidewalk Improvement Ordinance</p> <p>Section – 2015 Variances</p> <p>(c)Design and construction variances may include but are not limited to the following:</p> <p>(1)Curb and gutter on one side and shoulder on the other side;</p> <p>(2)(1)Header curbs; and</p> <p>(3)Shoulder and swale design;</p> <p>(4)(2)Pedestrian walkways on public property outside the street right-of-way.</p> <p>Street and Sidewalk Improvement On-Line Petition Request Form</p> <p>Type of Request</p> <p><input type="radio"/> Pave a dirt/gravel street</p> <p><input type="radio"/> Sidewalk Construction</p> <p><input type="radio"/> Street Improvements (add curb and gutter to an existing street)</p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
	<p><input type="radio"/> Street Resurfacing (streets without curb and gutter)</p> <p>Is there existing curb and gutter along the requested section of sidewalk?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>See Appendix 1 draft standard design details for curb options and other GI/LID street design elements.</p>
<p>2. No policy for City street projects to integrate GI/LID BMPs, where practical.</p> <p><u>Why is this important?</u></p> <p>Streets are a significant source of stormwater runoff in the City. As the City conducts street improvement projects, including new streets, maintenance, widening, complete street design, or installation of traffic calming devices, there is an opportunity to integrate GI/LID to mitigate stormwater runoff impacts and beautify the right-of-way area. The right-of-way is also an area that the City has control over, therefore can use to help advance GI/LID.</p>	<p>Update City of Raleigh 2030 Comprehensive Plan Update</p> <p>Note: The 2030 Comprehensive Plan includes several policies regarding green streets in the Downtown area, with four streets prioritized for green street “public realm improvements” (map DT-4), and innovative stormwater facilities such as tree boxes, raingardens, and porous pavement included in the Green Street Design Standards in Action DT 2.8. In the future, there could be other good opportunities, both inside and outside the downtown district, to incorporate GI/LID during street improvement projects. During the update of the 2030 Comprehensive Plan, which is underway, the City may wish to add a more far reaching green streets policy, such as: <u>For city street improvement projects, including new streets, maintenance, widening, complete street design, installation of traffic calming devices, or other street improvement measures to the extent practicable, integrate GI/LID to mitigate stormwater runoff impacts and beautify the right-of-way area.</u></p> <p>If such a policy is adopted in the Comprehensive Plan, update the City of Raleigh Street Design Manual accordingly.</p>
<p>3. No explicit allowance for curb bumpouts and medians with GI/LID BMPs in the right-of-ways for treatment of stormwater runoff and traffic calming.</p> <p><u>Why is this important?</u></p> <p>Such bumpouts and medians with GI/LID BMP can generate multiple neighborhood benefits including managing stormwater from right-of-way,</p>	<p>Draft City of Raleigh Street Design Manual Article 3.3.3.C Neighborhood Streets</p> <p>Last sentence</p> <p>Traffic calming design elements, such as intersection bulbouts can help moderate vehicle speeds on Neighborhood Streets; <u>multifunctional bulbouts that include GI/LID BMPs for stormwater management are encouraged.</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>and serving as traffic calming devices, beautifying the right-of-way, and providing neighborhood/streetscape amenities.</p>	<p>Draft City of Raleigh Street Design Manual Article 3.3.3.C Main Street, Parallel or Angular Parking</p> <p>Fourth Sentence</p> <p>Additional landscaping and traffic calming techniques that are ideal on Main Street include, but are not limited to, street trees with grated wells, <u>bioretention areas/planters</u>, curb bulbouts <u>with bioretention</u>, and a relatively high density of street furniture and public art.</p> <p>Draft City of Raleigh Street Design Manual Article 3.2.4. Major Streets</p> <p>2nd paragraph, last sentence</p> <p>Landscape medians (<u>including those incorporating GI/LID BMPs</u>) separate and buffer through traffic from a local access....</p> <p>See Appendix 1 draft standard design details for GI/LID street design elements.</p> <p>Recommendation on GI/LID treatment of stormwater in the right-of-way from GI/LID in ROW Focus Group.</p> <p>Note: The Focus Group recommended a new policy for the Street Design Manual expressly allowing developers to install GI/LID in the ROW to treat and manage street stormwater runoff and receive stormwater credit for such practices.</p> <p>City of Raleigh Side Walk Petition Program</p> <p>Note: The Work Group recommended reviewing and revising this program to incorporate consideration of GI/LID implementation as part of petition projects.</p>
<p>Parking</p>	
<p>1. Parking space requirements may not be reduced to preserve significant stands of trees or mature trees.</p> <p><u>Why is this important?</u></p> <p>More parking area yields more paving, stormwater runoff, and infrastructure costs, and when healthy, mature trees on site are removed,</p>	<p>UDO Sec. 7.1.4. Vehicle Parking Reductions</p> <p>Add</p> <p><u>E. To allow an existing or new development to preserve significant stands of trees within or adjacent to a parking lot, the number of required off-street parking spaces may be reduced by the Planning Director by up to ten percent (10%).</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>it can additionally result in a loss of natural green infrastructure and beauty as well as increased urban heat island impacts.</p>	
<p>2. GI/LID BMPs are not explicitly allowed in parking lot island landscaping.</p> <p><i>Why is this important?</i></p> <p>Not explicitly allowing GI/LID BMPs in parking lot landscaping implies that the City prefers status quo of landscaping and stormwater management devices being separate features. This increases overall landscaping and stormwater management costs, and requires stormwater management to “compete” for available, valuable land on the site rather than using multi-functional approach.</p>	<p>UDO Sec. 7.1.7 Vehicle Parking Lot Landscaping</p> <p>A.1.The intent of the vehicle parking lot landscaping requirements is to minimize the visual impacts of large areas of vehicular parking as viewed by the public right-of-way, <u>minimize the impacts of stormwater runoff</u>, and dissipate the effects of the urban heat island.</p> <p>G. <u>Multifunctional Functional GI/LID BMPs. Encourage multifunctional GI/LID BMPs and provide incentives for their use. GI/LID vegetated BMPs may be used to meet the interior island and median island landscaping requirements of this Chapter, and may be constructed in the designated landscape areas if part of an approved storm water management plan for the site. The tree planting requirements shall be met within the GI/LID BMP area and/or elsewhere on the site.</u></p>
<p>3. Adjacent on-street parking may not count toward off-street parking requirements in order to preserve significant stands of trees or mature trees.</p> <p><i>Why is this important?</i></p> <p>More parking area yields more paving, stormwater runoff, and infrastructure costs, and when healthy, mature trees on site are removed, it can additionally result in a loss of natural green infrastructure and beauty as well as increased urban heat island impacts.</p>	<p>UDO Sec. 7.1.4. Vehicle Parking Reductions</p> <p>Add</p> <p><u>F. Adjacent on-street parking may count toward off-street parking requirements to preserve significant stands of trees within or adjacent to a parking lot. The number of required off-street parking spaces may be reduced by the Planning Director by up to ten percent (10%).</u></p>
<p>Buildings and Lot Layout</p>	
<p>1. Site setbacks, side yards, and rear yards may not be reduced to accommodate GI/LID BMPs (except rain barrels in side yard and rear yard setbacks).</p> <p><i>Why is this important?</i></p> <p>Where GI/LID practices are located on a site affects their overall effectiveness. Therefore, setback, side yard, and rear yard constraints</p>	<p>UDO Sec. 1.5.4 Building Setbacks</p> <p>Add</p> <p><u>F. In order to encourage GI/LID BMPs and optimize GI/LID site design, required primary street, side street, side, and rear setbacks in Chapter 2, Chapter 3, and Chapter 4 may accommodate GI/LID BMPs, provided such setbacks meet fire code standards. The GI/LID BMPs may not compromise public safety such as the sight distance triangles defined in the City of Raleigh Street Design Manual.</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>decrease the site design flexibility and potential effectiveness of GI/LID. It also requires stormwater management to “compete” for available, valuable land on the site rather than using a multi-functional approach.</p>	<p>UDO Sec. 1.5.5 Parking Setbacks</p> <p>Add</p> <p><u>E. In order to encourage GI/LID BMPs and optimize GI/LID site design, required primary street, side street, side, and rear setbacks in Chapter 2, Chapter 3, and Chapter 4 may accommodate GI/LID BMPs, provided such setbacks meet fire code standards. The GI/LID BMPs may not compromise public safety such as the sight distance triangles defined in the City of Raleigh Street Design Manual.</u></p>
<p>2. There is no City policy encouraging GI/LID in the development and redevelopment of City-owned facilities and projects.</p> <p><i>Why is this important?</i></p> <p>Such a policy would allow the City to lead by example. City initiated development and redevelopment projects are land areas that the City has control over, therefore can use to help advance GI/LID. This is also an element of the City's strategic plan.</p>	<p>City Resolution for GI/LID in New Construction</p> <p>Adopt a City Resolution for GI/LID in New City Construction. As a model, use the existing City Resolution to Improve Energy Efficiency in Buildings (adopted by City Council May 6, 2008). The GI/LID in New City Construction resolution should include tiered stormwater design standards for different scales of city development and redevelopment. For example, the Energy Efficiency in Buildings Resolution established higher standards for buildings with 10,000 sq.ft. or more than those with less than 10,000 sq.ft.</p> <p>Update of 2030 Comprehensive Plan</p> <p>Add a policy regarding use of GI/LID in new city construction projects.</p>

GOAL #2: PRESERVE HYDROLOGIC FUNCTIONS OF PERVIOUS AREAS

Objective: Minimize building footprint/envelope area.

Objective: Minimize site disturbance, sedimentation, and erosion.

Objective: Preserve sensitive wetlands.

Objective: Preserve sensitive soils.

Objective: Preserve sensitive stream buffers.

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
Site Disturbance & Building Footprint	
<p>1. Building footprints are not encouraged to avoid highly erodible soils or soils with high permeability.</p> <p><u>Why is this important?</u></p> <p>Lack of attention to where the building footprint is located can potentially result in more on-site erosion, more stream erosion due to higher runoff velocity, and less natural infiltration on the site.</p>	<p>UDO Sec.9.4.3 Erosion and Sediment Control Objectives</p> <p>A.1. Identify Critical Areas</p> <p>Identify on-site areas which are subject to erosion and off-site areas which are vulnerable to damage from erosion or sedimentation, and provide special attention to these areas. <u>Such areas include highly erodible soils, steep slopes, high infiltration soils, wetlands, and riparian buffers.</u></p> <p>Note: Outside of the Objectives subsection, there is no other reference in Article 9.4 Erosion and Sediment Control to the “critical areas”. The Raleigh Guidelines for Land Disturbing Activities, adopted by reference in this UDO section, does not reference “critical areas” or provide guidance on what is meant by “providing special attention” to critical or sensitive areas. The Guidelines could be amended to include language similar to the NC LID Guidebook (section 3.6) which discusses resource protection areas. The Guidelines should also be amended to address grading practices that can be used to reduce damage from erosion and sedimentation. Finally, the Guidelines should be amended to include clarifying definitions.</p>
<p>2. Site designs are not encouraged to preserve natural drainage patterns.</p> <p><u>Why is this important?</u></p>	<p>City of Raleigh Stormwater Design Manual 1.3.2 Stormwater Management Policies: Water Quality</p> <p><u>J. Where possible natural drainage pathways, conveyances, and buffers should be preserved so long as they are stable.</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>When natural drainage patterns are not preserved, there is potentially more site disturbance, compaction, and stormwater runoff as well as higher infrastructure costs.</p>	
<p>Stream Buffers</p>	
<p>1. No open space bonus is provided for providing a wider stream buffer than required.</p> <p><i>Why is this important?</i></p> <p>Stream buffers are a critical open space element and the wider the buffer the more stormwater treatment and infiltration provided. Currently Raleigh has less stringent requirements for stream buffer width than several neighboring jurisdictions in the Triangle. Providing an open space bonus to developers in return for protection of wider stream buffers could be an incentive for GI/LID.</p> <p>[Note: Increasing the stream buffer width requirement is likely prohibited by recent state legislation. Therefore, no increase of required buffer width is proposed.]</p>	<p>UDO Sec. 9.2.3 A.1. General Rules for All Natural Resource Buffers</p> <p>Add</p> <p><u>d. Sites exceeding the minimum natural resource buffer requirement may receive an open space bonus based on a proportional sliding scale factor of 1 to 2 (i.e. if the buffer is ten (10) percent greater than the minimum, the open space bonus credit factor would be 1.1; if fifty (50) percent greater than the minimum, the open space bonus credit factor would be 1.5, and the maximum bonus credit factor would be 2.0). This credit may meet up to fifty (50) percent of the site's open space requirements, prorated by the percent increase in buffer area.</u></p>

GOAL #3: HARVEST RAINWATER TO ENHANCE POTABLE & NONPOTABLE WATER SUPPLY

Objective: Through plumbing code provisions, enhance rainwater harvesting and water conservation.

Objective: Through the building code and zoning code, allow the use of rooftop runoff disconnection and rainwater harvesting by routing rainwater to natural and landscape areas throughout the site.

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>1. There is a requirement to connect altered watercourses/drainage to the public drainage system and for grading the site and use of drainage structures when natural drainage systems are used.</p> <p><u>Why is this important?</u></p> <p>These provisions appear to conflict with distributing rooftop runoff to natural areas or landscaped areas, and generally with the GI/LID approach to managing, distributing, and infiltrating stormwater on site.</p>	<p>UDO Sec. 8.8.2 Retaining Stormwater Onsite and Piping of Watercourses</p> <p>B. <u>The City encourages retaining stormwater onsite through rainwater harvesting, infiltration, and/or evaporation and through preserving natural drainage features. All natural watercourses shall remain open and unaltered unless piping, enclosing, or altering is requested and justified., but then only when the following conditions are met:</u></p> <p>1. The developer must <u>consider the use of GI/LID practices as a part the site's approved stormwater management plan and/or connect the development pipe system to an existing public or private pipe storm drainage system when such system is determined by the Director of Public Works to be reasonably accessible.</u></p> <p>7. Where natural drainage systems are used or where an approved pipe drainage system cannot be connected to an existing public pipe drainage system, a developer must do all the grading <u>grade to assure positive flow of stormwaters of the design storm and provide all drainage structures that are necessary to properly carry stormwater to locations which are acceptable to the Public Works Director. Such grading shall not preclude the use of practices that retain the stormwater onsite.</u></p>

GOAL #4: ALLOW AND ENCOURAGE MULTI-USE STORMWATER CONTROLS

Objective: Allow and encourage stormwater controls as multiple use in open space areas.

Objective: Allow and encourage stormwater controls as multiple use in landscaped areas.

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
Landscaped Areas	
<p>1. Vegetated GI/LID BMPs are not explicitly allowed to be constructed in required designated landscape areas/amenity areas or count towards required landscaping/amenities.</p> <p><u>Why is this important?</u></p> <p>Not explicitly allowing GI/LID BMPs in required designated landscape areas/amenity areas implies that the City prefers status quo of landscaping and stormwater management devices being separate features. This increases overall landscaping and stormwater management costs, and requires stormwater management to “compete” for available, valuable land on the site rather than using a multi-functional approach.</p>	<p>UDO Sec.7.2.4.A. Transitional Protective Yards</p> <p>Add</p> <p><u>4. Vegetated GI/LID BMPs shall be allowed in Transitional Protective Yard Types A2, B1 and B2. In order to accommodate GI/LID BMPs the number of shrubs may be reduced in Protective Yards by ten (10) percent, and all shrubs may be twenty-four (24) inches when planted.</u></p> <p>UDO Sec.7.2.4.B. Street Protective Yards</p> <p>Add</p> <p><u>4. Vegetated GI/LID BMPs shall be allowed in Street Protective Yard Types C1, C2, and C3. In order to accommodate GI/LID BMPs the number of shrubs may be reduced in Protective Yards by ten (10) percent, and all shrubs may be twenty-four (24) inches when planted.</u></p> <p>UDO Sec. 7.2.5 Screening</p> <p><u>4. Two options shall be allowed in lieu of compact evergreen hedge: (1) Vegetated GI/LID practices such as bioretention and bioswales part of an approved stormwater management plan, if properly designed to provide stormwater management and screening functions; or (2) a screening wall with a minimum height of forty-eight (48) inches may be installed. The wall must be compatible with the principal building in terms of texture, quality, material, and color.</u></p> <p>UDO Sec. 1.5.3.C. Coverage General Requirements</p> <p><u>7. Above-ground stormwater detention facilities shall not be considered an outdoor amenity area. However, vegetated GI/LID BMPs such as a bioretention areas, raingardens, and rainwater harvesting features shall be considered outdoor amenity areas.</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
	<p>UDO Sec. 1.5.3.D Additional Requirements for Urban Plazas</p> <p>2. Amenity areas may contain any one of the following: benches, seats, tables, eating areas, plazas, courtyards, fountains, <u>vegetated GI/LID BMPs such as a bioretention areas or raingardens, and rainwater harvesting features, active recreation areas, or public art. Above-ground or below ground stormwater detention facilities shall not be considered an outdoor amenity but may be included.</u></p>
<p>2. Landscape requirements in some cases preclude plantings conducive to GI/LID.</p> <p><u>Why is this important?</u></p> <p>Effective GI/LID BMPs require appropriate types, sizes, and spacing of plants.</p>	<p>See UDO Sec. 7.2.4.A., 7.2.4.B, and 7.2.5 recommendation in # 1 above.</p> <p>UDO Sec. 7.2.7.C. Design and Installation Plant Material</p> <p>4. Additional Requirements for Trees in a Protective Yard</p> <p>a. In a protective yard, 50% of required trees shall be locally-adaptive evergreen species, <u>unless such planting is part of an approved GI/LID BMP for the site.</u></p> <p>b. Protective Yard</p> <p>Add</p> <p><u>vi. To accommodate multi-functional GI/LID BMPs part of an approved stormwater management plan, the number of shrubs may be reduced in Protective Yards by ten (10) percent, a portion of the evergreen species may be substituted for non-evergreen species, and all shrubs may be twenty-four (24) inches when planted, if properly designed to provide stormwater management and screening functions.</u></p>
<p>3. Tree planting requirements do not explicitly allow use of vegetated GI/LID BMPs. Vegetated GI/LID BMPs cannot be used to help meet new required street trees and streetscape planting area requirements.</p> <p><u>Why is this important?</u></p> <p>Lack of specific allowance for integrating GI/LID with street tree and streetscape requirements implies that the City prefers status quo of landscaping and stormwater management devices being separate features. This increases overall landscaping and stormwater management costs rather than using a multi-functional approach.</p>	<p>UDO Sec. 8.4.1.D New Streets Tree Planting</p> <p>Add</p> <p><u>5. Up to twenty (20) percent of the new required understory street trees and ten (10) percent of new required shade trees may be offset by installing a vegetated GI/LID BMP such as a stormwater tree box or planter box. A maintenance plan must be approved for the GI/LID BMPs in the planting area.</u></p> <p>UDO Sec. 8.5.1.D Existing Streets Tree Planting</p> <p>Add</p> <p><u>5. Up to twenty (20) percent of the new required understory street trees and ten (10) percent of new required shade trees may be offset by installing a vegetated GI/LID BMP such as a stormwater tree box or planter box. A maintenance plan must be approved for the GI/LID BMPs in the planting area.</u></p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
	<p>UDO Sec. 8.5.2 Streetscape Types</p> <p>The required streetscape type is determined by the zoning district or by the designated frontage. Where there is conflict between a designated frontage and the zoning district, the designated frontage standard applies. <u>The City encourages the use of multifunctional vegetated GI/LID BMPs in the streetscape. The dimensional standards for planting area, tree spacing, and utility placement and the planting type may be varied to accommodate GI/LID BMPs. If more than one streetscape can be used,</u>†The Planning and Development Officer shall make the final determination of <u>streetscape type</u>. Design specifications for streetscape improvements can be found in the Raleigh Street Design Manual and City Tree Manual.</p> <p>Draft City of Raleigh Street Design Manual Article 11.1 A Streetscape Types</p> <p>The required streetscape type is determined by the zoning district or by the designated frontage. Where there is conflict between a designated frontage and the zoning district, the designated frontage standard applies. <u>The City encourages the use of multifunctional vegetated GI/LID BMPs in the streetscape. The dimensional standards for planting area, tree spacing, and utility placement and the planting type may be varied to accommodate GI/LID BMPs. If more than one streetscape can be used,</u>†The Planning and Development Officer shall make the final determination of <u>streetscape type</u>. Design specifications for streetscape improvements can be found in the Raleigh Street Design Manual and City Tree Manual.</p> <p>Draft City of Raleigh Street Design Manual Article 11.2.4 Planting Area</p> <p>A. All required street trees shall be installed in the planting area per the City of Raleigh Standards and the City Tree Manual. <u>Preservation of healthy trees in the planting area is encouraged. As an alternative to planting area requirements of this section, up to twenty (20) percent of the new required street trees may be offset by installing a vegetated GI/LID BMP such as a stormwater tree box or planter box. A maintenance plan must be approved for the GI/LID BMPs in the planting area.</u></p> <p>Also see UDO Sec. 7.2.4.A., 7.2.4.B, and 7.2.5 recommendation in #1 above.</p>
<p>4. Vegetated GI/LID BMPs are not explicitly allowed to count toward the site's required parking landscaping and screening areas.</p> <p><u>Why is this important?</u></p>	<p>UDO Sec. 7.1.7 Vehicle Parking Lot Landscaping</p> <p>A.1.The intent of the vehicle parking lot landscaping requirements is to minimize the visual impacts of large areas of vehicular parking as viewed by the public right-of-way, reduce <u>the impacts of stormwater runoff</u>, and dissipate the effects of the urban heat island.</p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>Lack of specific allowance to integrate GI/LID with the site's parking landscaping and screening area requirements implies that the City prefers status quo of landscaping and stormwater management devices being separate features. This increases overall landscaping and stormwater management costs, and requires stormwater management to "compete" for available land on the site rather than using a multi-functional approach.</p>	<p><u>G. Multifunctional GI/LID BMPs. Encourage multifunctional GI/LID BMPs and provide incentives for their use. GI/LID vegetated BMPs may be used to meet the interior island and median island landscaping requirements of this chapter, and may be constructed in the designated landscape areas if part of an approved storm water management plan for the site. The tree planting requirements shall be met within the GI/LID BMP area and/or elsewhere on the site.</u></p>
<p>5. There is no explicit allowance for GI/LID practices to be constructed in designated water and sewer easement areas, if properly designed.</p> <p><u>Why is this important?</u></p> <p>Water and sewer easements may constitute a significant land area suitable for GI/LID practices.</p>	<p>Public Utilities Handbook: Sewer Design Standards 1.a.</p> <p>5. No person shall place any part of a structure, construction fill material, permanent equipment, or impoundment on sanitary sewer easements or mains. Prohibited structures include buildings, houses, air conditioning units /heat pumps, decks, garages, tool or storage sheds, swimming pools, non GI/LID stormwater control devices stormwater control devices, walls, and fences. <u>GI/LID stormwater control devices may be permitted at the discretion of the Director in accordance with policies in Appendix [X].</u> Fences may be allowed across easements as long as there is an access gate the full width of the easement. No fences may be installed longitudinally (lengthwise) within easements. All permanent easements shall be graded and smoothed to allow sufficient access and use for mowing equipment and maintenance vehicles prior to acceptance by the City <u>excepting other approved uses as noted above.</u>; typically a minimum of 3:1 slope will be required.</p> <p>6. No person shall plant trees, shrubs, or other plants within a sewer easement, <u>excepting those inherent to an approved GI/LID stormwater control device</u>, without prior written approval from the Director of the Public Utilities Department. Any such plantings approved by the Director shall be done so at the risk of the property owner having to replace the plantings due to removal by the City during maintenance activities.</p> <p>Note: An Appendix will be added to the Handbook noting the conditions under which GI/LID practices may be permitted in the Sewer Easement area.</p>

GOAL #5: MANAGE STORMWATER TO SUSTAIN STREAM FUNCTIONS

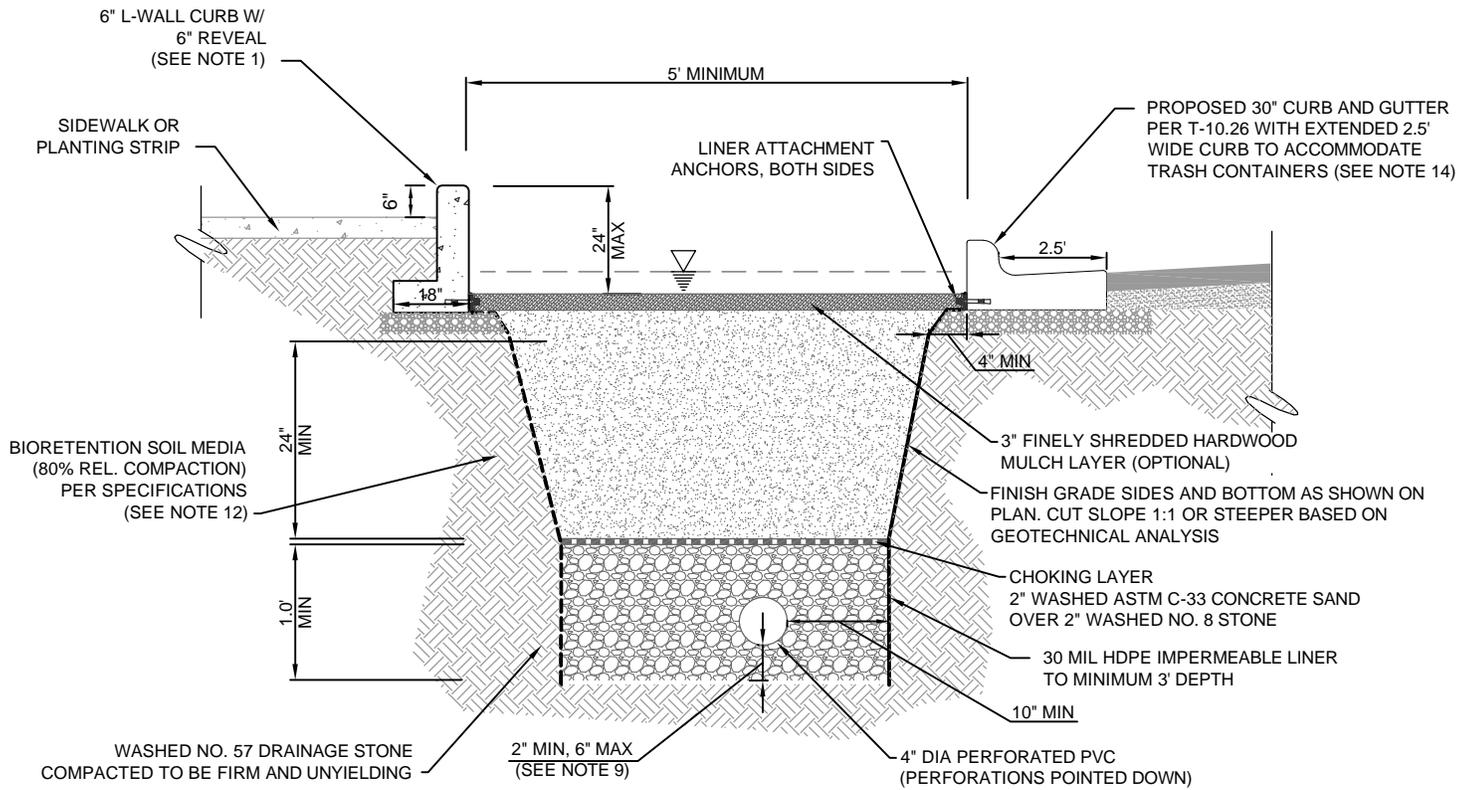
- Objective: Replicate the predevelopment hydrology of the site, to the extent practicable.
- Objective: Maintain water quality functions of the watershed. Objective: Minimize channel erosion impacts.
- Objective: Minimize flooding impacts.
- Objective: Inspect BMPs to ensure proper construction and design.
- Objective: Long-term maintenance.

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
Performance Standards	
<p>1. Existing performance standards do not encourage or require that some portion of the stormwater be retained on site and provide no proactive incentives for retaining stormwater. Also, there is explicit language encouraging regional facilities and discouraging infiltration devices, and there is a requirement to connect altered watercourse/drainage to the storm drainage system.</p> <p><u>Why is this important?</u></p> <p>The existing performance standards require stormwater BMPs to detain, treat, and discharge stormwater and do not encourage retention of stormwater on site through the use of GI/LID. Requiring of incentivizing retention can result in lower stormwater volume, velocity, and pollutant loading impacts as well as potentially lower infrastructure costs.</p>	<p>See proposed Expedited Review for GI/LID and Green Building</p> <p>City of Raleigh Stormwater Design Manual Sec. 1.3.2 Water Quality</p> <p><u>Insert new first paragraph:</u></p> <p><u>In recognition of the benefits of GI/LID, it is the policy of the City to encourage the implementation of GI/LID; provided however, nothing in this section of the Design Manual shall be interpreted as mandating GI/LID.</u></p> <p>These policies implemented citywide, measurable performance goals... (Note: continue existing paragraph as written).</p> <p>A. When a new development project is located within a Water Supply Watershed Protection Area, the more stringent rules apply.</p> <p>B. Regional and/or minor regional facilities are preferable to on-site BMPs.</p> <p>C. B. A timeline for design and construction of <u>on-site and</u> regional controls must be provided, beginning when the first project in such a drainage area is approved.</p> <p>D. C. The preferred BMPs will be <u>GI/LID (contact the City Stormwater Management Division for information about specific GI/LID practices)</u>. retention facilities, preferably wet ponds. Bioretention, buffers, vegetated swales, and artificial wetlands are acceptable BMPs.</p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
	<p>E. Infiltration-based BMPs, such as trenches and pits, should be avoided.</p> <p>F. D. BMPs that require frequent replacement of media are not recommended.</p> <p>(Note: Renumber and continue remaining existing policies G. through I. as written.)</p> <p>UDO Sec. 8.8.2 Retaining Stormwater Onsite and Piping of Watercourses</p> <p>B. <u>The City encourages retaining stormwater onsite through rainwater harvesting, infiltration, and/or evaporation and through preserving natural drainage features.</u> All natural watercourses shall remain open and unaltered unless piping, enclosing, or altering is requested and justified..., but then only when the following conditions are met:</p> <p>1. The developer must <u>consider the use of GI/LID practices as a part the site's approved stormwater management plan and/or</u> connect the development pipe system to an existing public or private pipe storm drainage system when such system is determined by the Director of Public Works to be reasonably accessible.</p> <p>7. Where natural drainage systems are used or where an approved pipe drainage system cannot be connected to an existing public pipe drainage system, a developer must do all the grading grade to assure positive flow of stormwaters of the design storm and provide all drainage structures that are necessary to properly carry stormwater to locations which are acceptable to the Public Works Director. <u>Such grading shall not preclude the use of practices that retain the stormwater onsite.</u></p>
<p>2. The stormwater performance standards threshold of applicability allows significant development without surface water drainage and peak discharge stormwater control plans. Sites with 15% or less impervious area are exempt from active stormwater control measures for peak discharge control.</p> <p><i>Why is this important?</i></p> <p>Numerous studies show impacts to water quality and stream health at very low levels of watershed impervious cover.</p>	<p>UDO Sec. 8.8.3 Surface Water Drainage Stormwater Control Plans</p> <p>B. This requirement may not apply to a subdivision where all proposed lots exceed 1 acre in size <u>and impervious area is less than ten [10]%</u>.</p> <p>UDO Sec. 9.2.2E.2.c Stormwater Runoff Control Exemptions</p> <p>The maximum impervious surface coverage for the lot, including existing impervious cover is not more than 45-10 %, and the remaining pervious portions of the lot are utilized to convey and control the stormwater.to the maximum extent practical.</p>
<p>3. The code does not encourage or require the use of GI/LID BMPs to meet the stormwater performance standards.</p>	<p>See proposed Expedited Review for GI/LID and Green Building</p>

Barrier and Why It's Important	Revised Code and Policy Language (To Address Barriers)
<p>In Watershed Protection Areas, which are the City's primary protection areas, traditional detention BMPs are considered to be equal to retention. In the secondary (and larger) protective areas, traditional, less protective wet ponds are specifically required.</p> <p>City-wide, there is a requirement to connect to the storm drainage system.</p> <p><i>Why is this important?</i></p> <p>The UDO generally treats traditional stormwater BMPs as equal to GI/LID BMPs in meeting stormwater performance standards, except in drinking water supply watersheds where the UDO requires the use of traditional stormwater BMPs to meet performance standards (i.e. GI/LID is not explicitly allowed). This can result in higher stormwater volume, velocity, and pollutant loading impacts as well as potentially higher infrastructure costs.</p> <p>Note: The North Carolina Water Supply Regulations, last updated in 2007, state that if a development selects the high density option (as defined in the rules), then engineered stormwater controls must be employed to control runoff from the first inch of rainfall. The rules do not specify that wetponds or traditional BMPs must be used to meet this performance standard. The City may not adopt new water supply regulations that exceed the state's requirements. Although the Work Group does not recommended a requirement for GI/LID in the watershed, it did taking a step beyond allowing GI/LID to presuming its use unless it is 1.25X the cost of the next best stormwater management alternative. During the UDO update process, this proposed presumptive use will need to be reviewed by the City Attorney to ensure it does not exceed the state's requirements. If such a conflict exists, the code could be revised to explicitly allow use of GI/LID in the watershed areas.</p>	<p>UDO Sec. 9.5.1.C Urban Watershed Protection Overlay District Required Stormwater Measures</p> <p>1.a. Retained for either infiltration into the soil, <u>for water harvesting and use on the site, or for evaporation into the air and;</u></p> <p>1.b. Detained for at least a 12-hour period; or</p> <p>1.c. Captured by an approved stormwater treatment device.</p> <p>UDO Sec. 9.5.2.C Falls Watershed Protection Overlay District Required Stormwater Measures</p> <p>1.a.i. Retained for either infiltration into the soil, <u>for water harvesting and use on the site, or for evaporation into the air and;</u></p> <p>1.a.ii. Detained for at least a 12-hour period; or</p> <p>1.a.iii. Captured by an approved stormwater treatment device.</p> <p>1.b. Additional impervious surface coverage is allowed in secondary reservoir watershed protection areas when the first inch of rainfall (including the amount from the first 24% impervious surface coverage) is captured by a wetpond <u>by an approved stormwater treatment device. Such runoff must be managed using GI/LID in accordance with Sec.9.5.2.C.3 below unless the cost of GI/LID is more than 1.25 times the next best alternative stormwater design that meets City requirements.</u></p> <p>2.b. Stormwater Runoff from Streets</p> <p>Where impervious surface cover is greater than 12% in any primary water supply watershed or greater than 24% in any secondary water supply watershed protection area, the first inch of rainfall from any streets must be captured in a wetpond <u>managed using GI/LID in accordance with Sec.9.5.2.C.3 below unless the cost of GI/LID is more than 1.25 times the next best alternative stormwater design that meets City requirements.</u></p> <p>3. <u>GI/LID Policy in Secondary Protection Areas</u> Wet Ponds</p> <p>When impervious surfaces exceed 24% in secondary reservoir watershed protection areas, the first inch of rainfall within the entire development shall be captured in a wetpond of standing water <u>managed using GI/LID unless the cost of GI/LID is more than 1.25 times the next best alternative stormwater design that meets City requirements.</u></p>

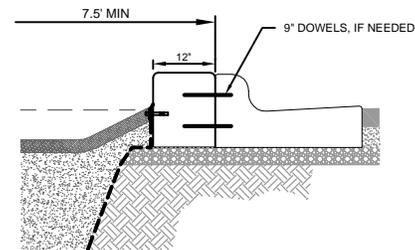
APPENDIX I – STANDARD DETAILS FOR THE DESIGN OF GREEN INFRASTRUCTURE IN THE RALEIGH RIGHT-OF-WAY



TYPICAL BUMP-OUT BIORETENTION SECTION

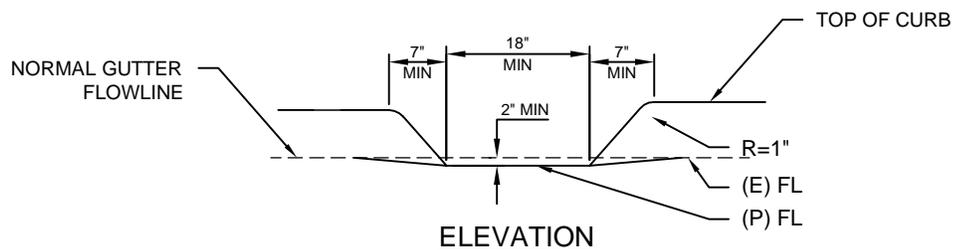
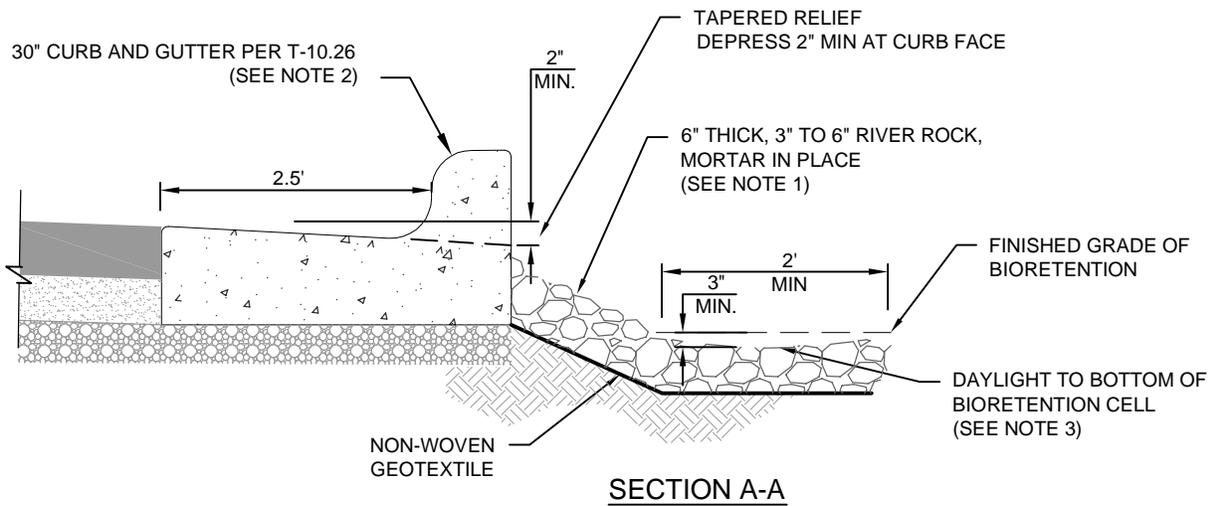
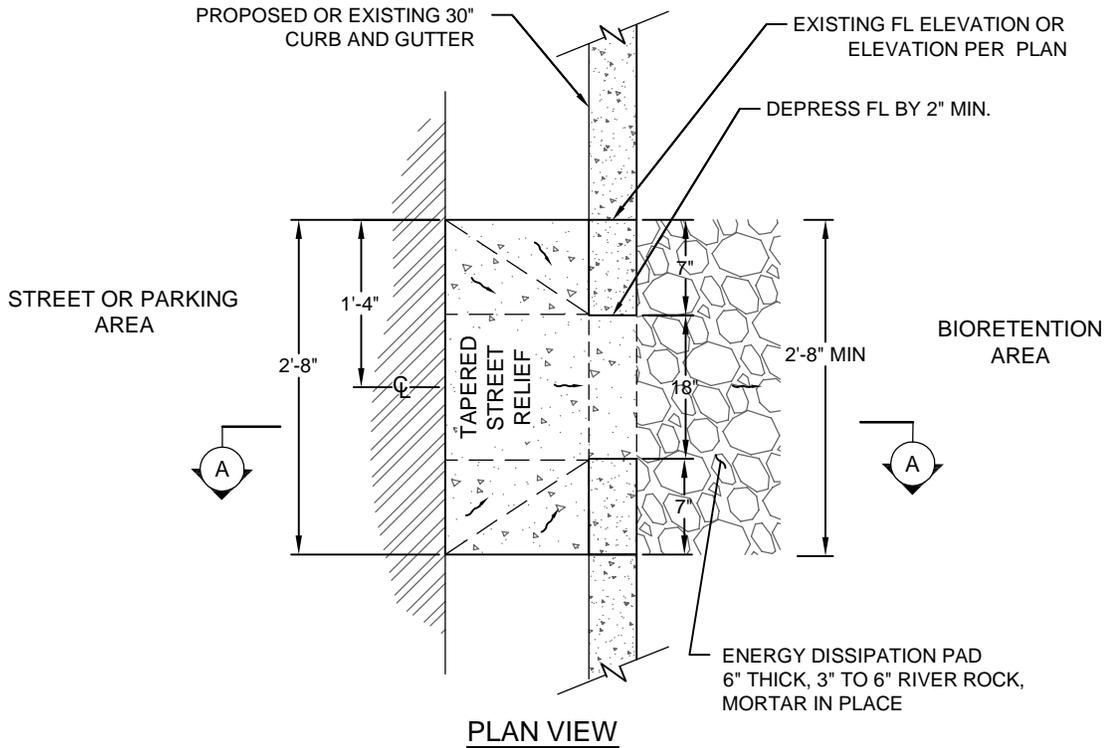
NOTE:

1. EXPANSION JOINTS SHALL BE PLACED AT MAXIMUM 90 FT INTERVAL ALONG CURB.
2. REFER TO DESIGN PLANS FOR HORIZONTAL CONTROL INFORMATION.
3. BMP SIZING IS THE RESPONSIBILITY OF THE DESIGN ENGINEER. SIZING CALCULATIONS SHALL BE SUBMITTED TO THE CITY FOR REVIEW.
4. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RECOMMENDATION OF GEOTECHNICAL INVESTIGATION.
5. IF REQUIRED, REFER TO DESIGN PLANS FOR UNDERDRAIN INVERT ELEVATIONS.
6. REFER TO PLANS FOR UNDERDRAIN CLEANOUT LOCATIONS AND INSTALLATION DETAILS.
7. IF NECESSARY, INSTALL PIPE PENETRATIONS THROUGH IMPERMEABLE LINER ACCORDING TO ASTM D6497.
8. GEOTEXTILE MAY BE UTILIZED IN-LIEU OF AGGREGATE CHOKING LAYER IF APPROVED BY ENGINEER.
9. FOR BIORETENTION SYSTEMS THAT DO NOT REQUIRE AN IMPERMEABLE LINER, A MAXIMUM OFFSET OF 6 INCHES IS REQUIRED BETWEEN THE INVERT OF THE UNDERDRAIN AND BOTTOM OF DRAINAGE LAYER. BOTTOM OF STORAGE LAYER SHALL BE SCARIFIED TO PROMOTE INFILTRATION PRIOR TO BACKFILL.
10. ALL UNDERDRAINS, IF REQUIRED, SHALL CONNECT TO STORM DRAIN OR OTHER DRAINAGE FEATURE.
11. ALL FEATURES INTEGRATED INTO BUMP-OUT BIORETENTION, INCLUDING VEGETATION, SHALL MEET SIGHT DISTANCE REQUIREMENTS PER STREET DESIGN MANUAL AND RECOMMENDED PLANT SPECIES IN THE NC DENR STORMWATER BMP MANUAL.
12. MINIMUM RADIUS FOR BUMP-OUT BIORETENTION SHALL MEET ENGINEERING SPECIFICATIONS IN STREET DESIGN MANUAL DEPENDING ON ROADWAY TYPE.
13. HAND-TAMP BIORETENTION MEDIA IN 8" MAXIMUM LIFTS. NO MECHANICAL COMPACTION ALLOWED. REFER TO NC DENR STORMWATER BMP MANUAL FOR BIORETENTION SOIL MEDIA SPECIFICATIONS.
14. CONCRETE CURB EXTENSIONS ARE RECOMMENDED WHERE PARKING IS IMMEDIATELY ADJACENT, OR WHERE SPEED LIMITS EXCEED 35 MPH. REFER TO CURB EXTENSION DETAIL THIS SHEET.



(OPTIONAL) CONCRETE CURB EXTENSION DETAIL

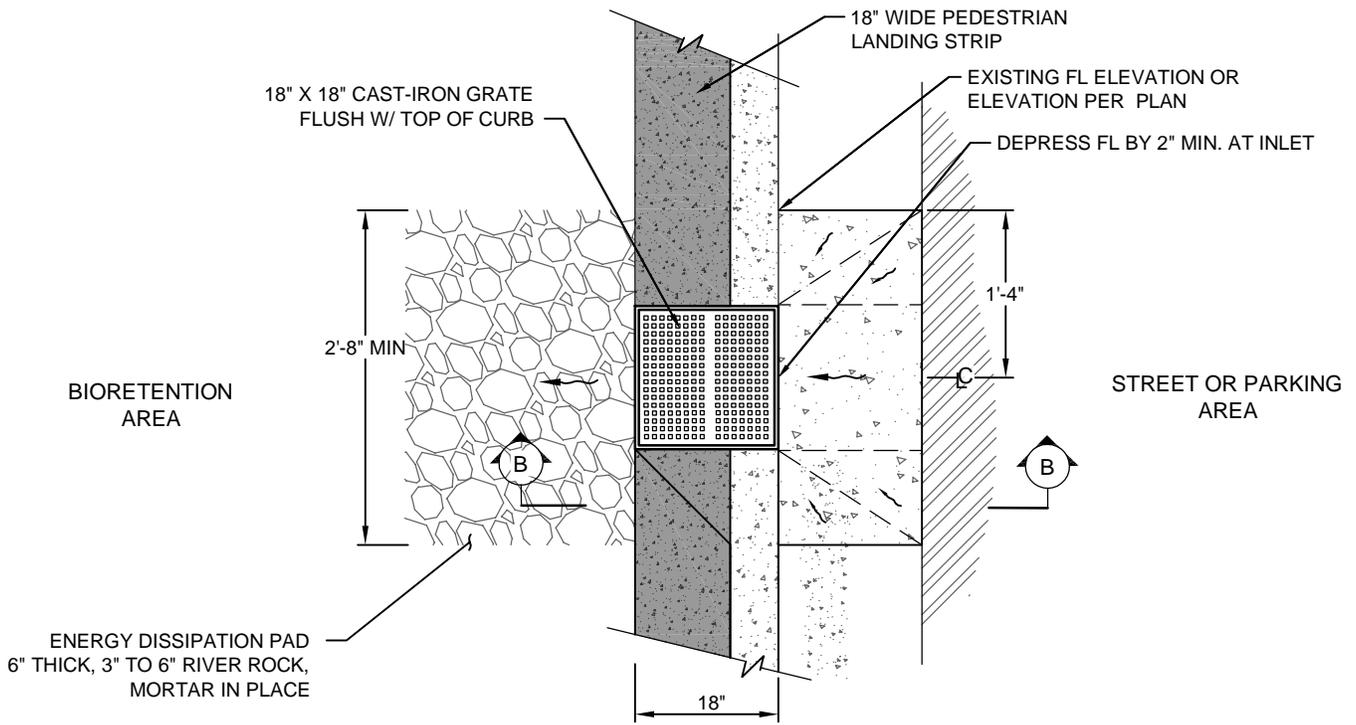
CITY OF RALEIGH		
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CURB-SIDE AND BUMP-OUT BIORETENTION		
SW-XX.XX		



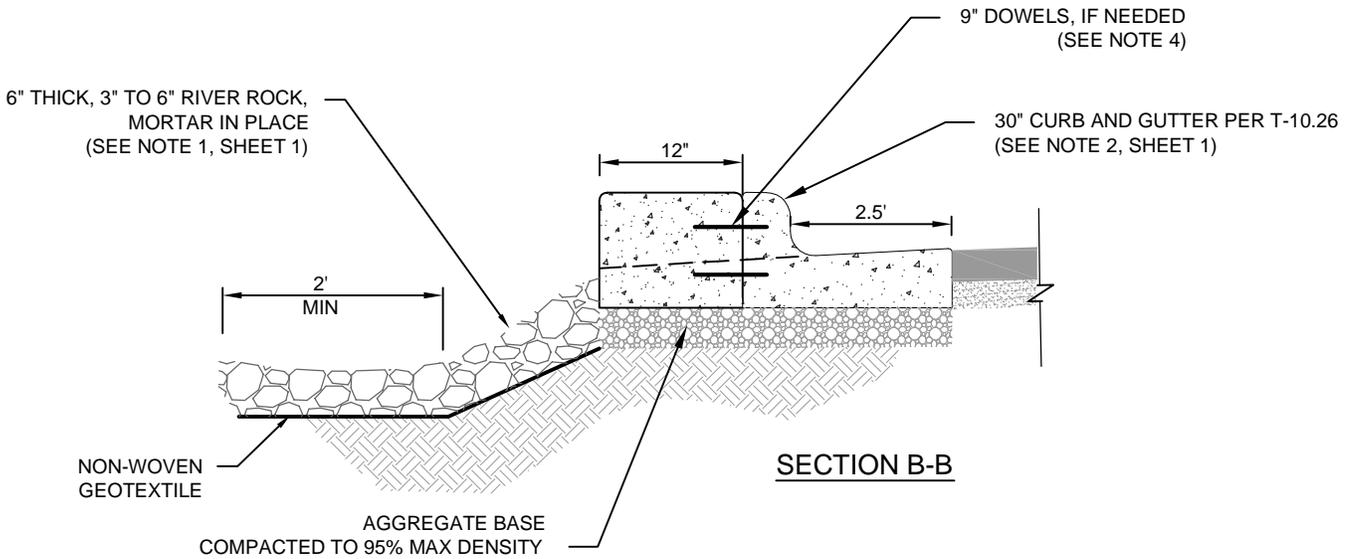
CONSTRUCTION NOTE:

- ENERGY DISSIPATION PAD PROVIDED AS STABILIZED ENTRANCE TO BIOTETENTION SYSTEM. ROCK SHALL BE PLACED IN IRREGULAR PATTERN USING NON-UNIFORM SIZES TO PREVENT PREFERENTIAL FLOW PATHS, INCREASE ENERGY DISSIPATION, AND TO LIMIT THE SURFACE AREA OF EXPOSED MORTAR. ALTERNATIVE PRE-TREATMENT SOLUTIONS WILL BE CONSIDERED.
- WHERE NECESSARY, EXTEND GUTTER TO 2.5' WIDTH TO ACCOMMODATE TRASH CONTAINER PLACEMENT.
- ROCK AND MORTAR INLET PROTECTION SHALL EXTEND ACROSS BOTTOM OF BIORETENTION TO OPPOSITE TOE OF SLOPE, OR 2' MINIMUM. FINISH GRADE OF MORTARED BOTTOM SHALL BE AT LEAST 3" BELOW ADJACENT BIORETENTION BOTTOM ELEVATION TO PROVIDE SEDIMENT STORAGE.

CITY OF RALEIGH		
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CURB-CUT INLET (SHEET 1 OF 2)		
SW-XX.XX		



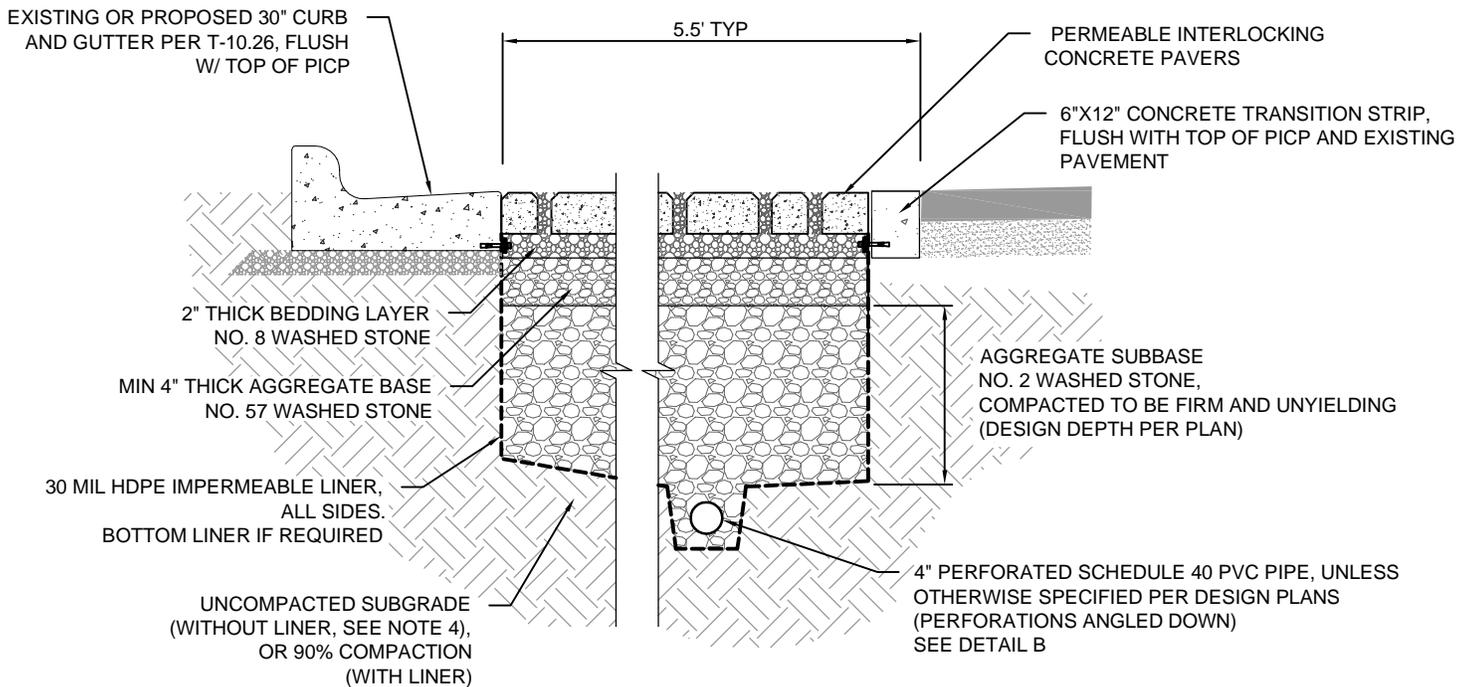
PLAN VIEW
PEDESTRIAN OPTION



PEDESTRIAN OPTION NOTE:

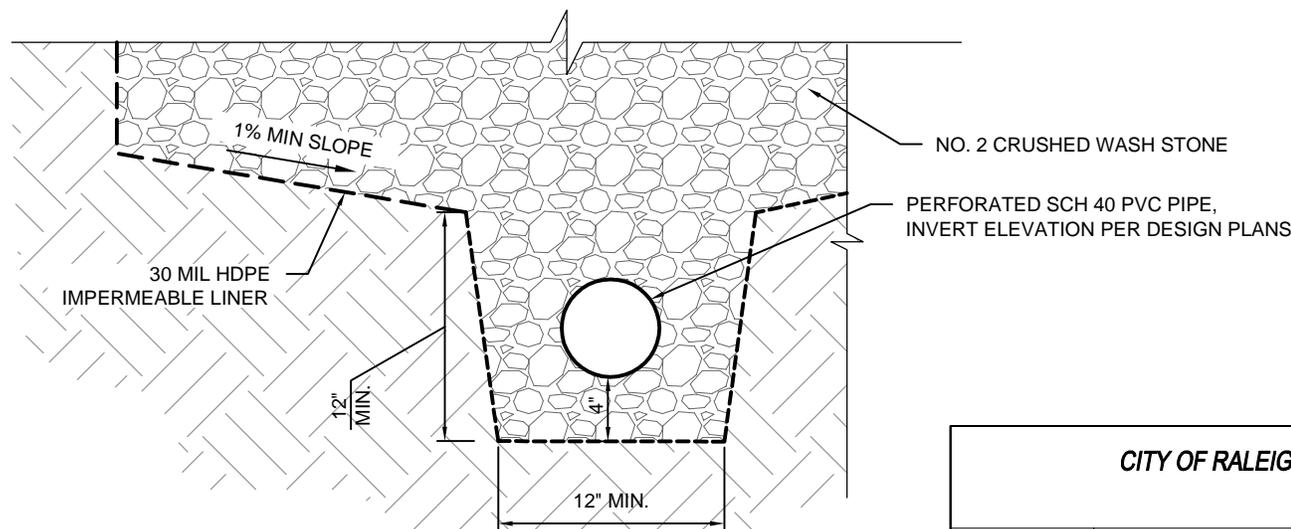
1. CURB CUT SHALL BE 18" WIDE WITH VERTICAL SIDES.
2. GRATE FRAME SHALL BE CAST INTO TOP EDGES OF CURB CUT SO GRATE IS FLUSH WITH TOP OF CURB AND PEDESTRIAN LANDING STRIP.
3. WHERE APPLICABLE, POUR PROPOSED 1' WIDE CONCRETE EXTENDED CURB MONOLITHICALLY WITH THE PROPOSED CURB AND GUTTER.
4. OTHERWISE, ANCHOR CONCRETE STRIP TO EXISTING CURB WITH OILED OR GREASED BAR (1/2" X 9) AT 24" O.C. INSTALL BAR 3" INTO EXISTING CURB. USE CONCRETE ADHESIVE ON THE EXISTING CURB.

CITY OF RALEIGH		
REVISIONS	DATE: 2/23/16	NOT TO SCALE
CURB-CUT INLET (SHEET 2 OF 2)		
SW-XX.XX		



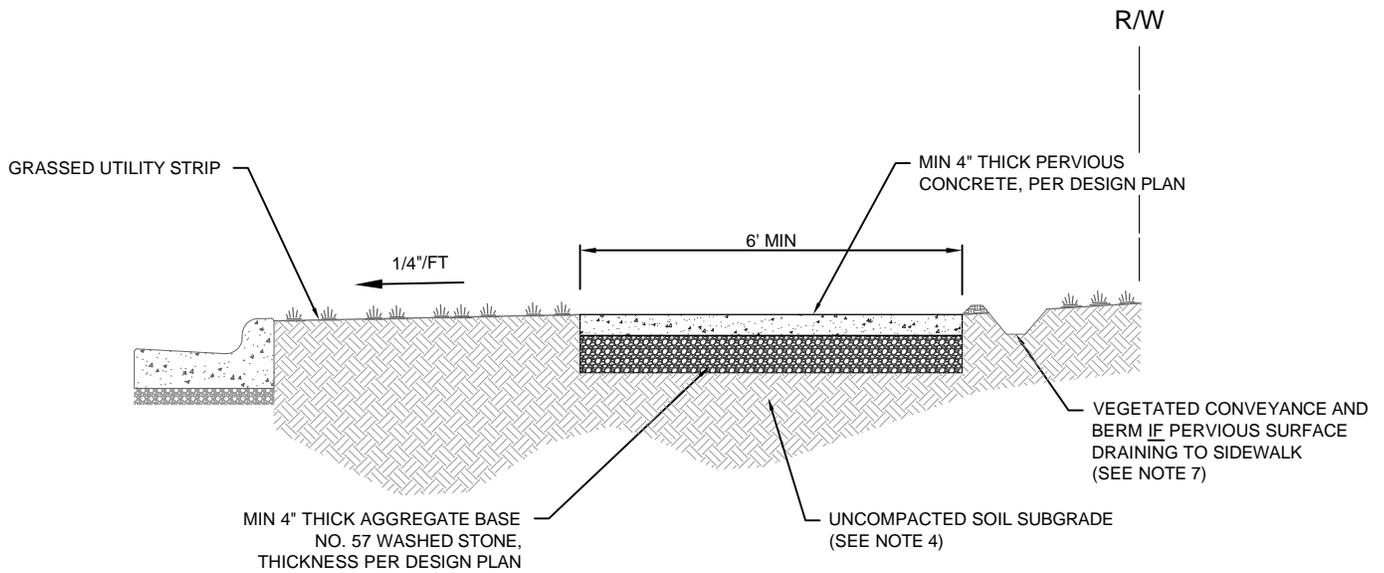
NOTES:

1. ALL PICP SHALL CONFORM TO ASTM C936 AND ADA DESIGN GUIDELINES.
2. SLOPE OF SOIL SUBGRADE SHALL BE 0.5% OR LESS. MAXIMUM PICP SURFACE SLOPE SHALL BE 6%.
3. THE SEASONAL HIGH WATER TABLE SHALL HAVE A MINIMUM 2 FT SEPARATION FROM THE BOTTOM OF THE SUBBASE AGGREGATE STORAGE LAYER.
4. IN HSG B, C, OR D SOILS, THE SURFACE OF THE SUBGRADE UNDER INFILTRATING PICP SYSTEMS SHOULD BE SCARIFIED, RIPPED, OR TRENCHED IMMEDIATELY PRIOR TO AGGREGATE SUBBASE PLACEMENT TO MAINTAIN PRE-CONSTRUCTION SUBGRADE INFILTRATION RATE.
5. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RESULTS OF THE GEOTECHNICAL INVESTIGATION.
6. ELEVATION GRADIENT BETWEEN THE CONCRETE GUTTER AND ADJACENT PICP SHALL NOT EXCEED 1/4"; OTHERWISE, PROVIDE 1:2 BEVEL ON EDGE OF GUTTER.
7. OPEN VOID FILL MEDIA AROUND PICP SHALL BE NO. 8, NO. 9, OR NO. 89 WASHED DRAINAGE STONE DEPENDING ON JOINT SIZE.
8. BOTH PIPE PENETRATIONS THROUGH 30 MIL HDPE LINER, AND ATTACHMENT OF LINER TO CONCRETE CURBS (USING CONCRETE ANCHORS AND BATTEN STRIPS) SHALL BE DONE IN ACCORDANCE WITH ASTM D6497.
9. ALL AGGREGATE SIZED ACCORDING TO ASTM C136.
10. AASHTO LAYER COEFFICIENTS FOR OPEN-GRADED BASE AND SUBBASE SHALL RANGE BETWEEN 0.06 AND 0.10.
11. AASHTO MINIMUM LAYER COEFFICIENT OF 0.3 FOR PAVER AND BEDDING LAYERS IS RECOMMENDED.
12. LOCATE UNDERDRAIN AS SHOWN ON THE IMPROVEMENT PLANS. HORIZONTAL LOCATION MAY VARY WITHIN PAVEMENT SECTION AS LONG AS MINIMUM OFFSET DISTANCES AND BOTTOM SLOPES ARE MAINTAINED.
13. DEPTH OF PERFORATED PVC PIPE MAY BE ADJUSTED TO TIE INTO THE ADJACENT DRAINAGE INFRASTRUCTURE AS NEEDED.



DETAIL B

CITY OF RALEIGH		
REVISIONS	DATE: 2/23/16	NOT TO SCALE
	PERMEABLE PAVER PARKING LANE	
	SW-XX.XX	



NOTES:

1. MATERIALS AND CONSTRUCTION OF PERVIOUS CONCRETE (PC) SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS: MIX DESIGN (ACI 522.1); FRESH UNIT WEIGHTS AND VOIDS (ASTM C1688); FIELD INFILTRATION (ASTM C1701); RAVELING POTENTIAL (ASTM C1747); HARDENED UNIT WEIGHT AND VOID CONTENT (ASTM C1754).
2. RECOMMENDED VOIDS RATIO FOR PC IS 20% (15-25% ACCEPTABLE).
3. SLOPE OF SOIL SUBGRADE SHALL BE 0.5% OR LESS. MAXIMUM PC SURFACE SLOPE SHALL BE 6%.
4. THE SEASONAL HIGH WATER TABLE SHALL BE 2 FEET BELOW THE BOTTOM OF THE SUBBASE AGGREGATE STORAGE LAYER.
5. IN HSG B, C, OR D SOILS, THE SURFACE OF THE SUBGRADE SHOULD BE SCARIFIED, RIPPED, OR TRENCHED IMMEDIATELY PRIOR TO AGGREGATE SUBBASE PLACEMENT TO MAINTAIN PRE-CONSTRUCTION SUBGRADE INFILTRATION RATE.
6. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RESULTS OF THE GEOTECHNICAL INVESTIGATION.
7. IF PERVIOUS RUNOFF DRAINS TO THE PC SIDEWALK, A VEGETATED CONVEYANCE DIVERSION SHALL BE INSTALLED UPGRADIENT AND SIZED FOR SAFE CONVEYANCE OF THE 10-YR, 24-HR STORM.
8. IMPERVIOUS RUNOFF IS ALLOWED TO DRAIN TO THE PC SIDEWALK IN ACCORDANCE WITH DESIGN CRITERIA PROVIDED IN CHAPTER 18 OF THE NC DENR STORMWATER BMP MANUAL.
9. ALL AGGREGATE SIZED ACCORDING TO ASTM C136.
10. AASHTO LAYER COEFFICIENTS FOR OPEN-GRADED BASE AND SUBBASE SHALL RANGE BETWEEN 0.06 AND 0.10.
11. IF REQUIRED BASED ON SITE CONDITIONS, INCLUDING SIGNIFICANT IMPERVIOUS RUN-ON VOLUMES, LOCATE UNDERDRAIN AS SHOWN ON THE IMPROVEMENT PLANS. HORIZONTAL LOCATION MAY VARY WITHIN PAVEMENT SECTION AS LONG AS MINIMUM OFFSET DISTANCES AND BOTTOM SLOPES ARE MAINTAINED. DEPTH OF PERFORATED PVC PIPE MAY BE ADJUSTED TO TIE INTO THE ADJACENT DRAINAGE INFRASTRUCTURE AS NEEDED.

CITY OF RALEIGH		
REVISIONS	DATE: 2/23/16	NOT TO SCALE
	PERVIOUS CONCRETE SIDEWALK	
	SW-XX.XX	

