LID vs. GSI: Development Process

Avoidance (LID)
- Map natural infrastructure
- Preserve open spaces, natural areas, trees and native soils
- Retain natural hydrologic and topographic features in site plan

Minimization (LID)
- Limit and disconnect impervious surfaces
- Mimic and maximize pre-development hydrologic processes
- Integrate practices that provide co-benefits and multifunctional areas

Mitigation (GSI)
- Implement runoff source control measures
- Employ natural processes to treat and retain stormwater
- Provide treatment and attenuation in multiple areas across the site
Low Impact Development (LID) Implementation Guidebook with Ordinance Recommendations
Agenda

Project Overview
Katrina Locke
Sustainability and Resilience Manager, Volusia County

LID Implementation Guidebook
Michelle “Mo” Morrison
Planner, East Central Florida Regional Planning Council

LID Ordinance Recommendations
Jerry Murphy, JD, AICP, CFM
UF/IFAS Program for Resource Efficient Communities
State Specialized Program Agent (SSPA) – Flood Resilient Communities
Katrina Locke
Volusia County, Sustainability & Resilience Manager
klocke@volusia.org
Community Planning Technical Assistance Grant, Ch 163.3168, F.S.

Help communities find creative solutions to foster vibrant, healthy communities, while protecting the functions of important state resources and facilities

- Advance resilient, nature-based stormwater strategies
- Consider mechanisms, incentives, and processes to incorporate LID in Volusia County site planning and stormwater management
- Share outcomes throughout East Central Florida region
Implementing Resilience

Infrastructure and Environment
Encourage development of cross-disciplinary plans, policies and strategies to protect the health, safety and economic welfare of residents, businesses and visitors through recognition that natural disasters, changes to climate, and human manipulation require careful consideration of when and how to develop infrastructure, natural resources and a built environment that can withstand and adapt to these changes.

Objectives
- Prioritize the use of Green Infrastructure as a first line of defense.
- Promote interconnectivity of natural lands for habitat migration.
- Enhance stormwater systems to be more resilient.
- Improve water quality in surface water bodies.
- Incorporate resiliency into local and regional plans, policies, processes and objectives.
- Preserve and adapt the built environment to keep people safe from and mitigate current and future natural hazards.
- Improve community mobility while improving vulnerable transportation infrastructure.
Definition of LID and GSI

**LID:** (Low Impact Development) a comprehensive *site planning* and *design strategy* for *maintaining the predevelopment hydrologic regime* (peak discharge rate, timing, and volume) and mitigating pollutant loads from land development using *distributed structural and non-structural design techniques*. The goals of LID are to *avoid and minimize* additional runoff produced from site development.

**GSI:** (green stormwater infrastructure) includes the range of *structural and non-structural retention and detention measures* that infiltrate, evaporate, detain, filter, or store stormwater runoff closer to the source. The goal of GSI is to *mitigate* the runoff produced from site development.
LID vs. GSI: Development Process

**Avoidance (LID)**
- Map natural infrastructure
- Preserve open spaces, natural areas, trees and native soils
- Retain natural hydrologic and topographic features in site plan

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- Limit and disconnect impervious surfaces
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- Integrate practices that provide co-benefits and multifunctional areas

**Mitigation (GSI)**
- Implement runoff source control measures
- Employ natural processes to treat and retain stormwater
- Provide treatment and attenuation in multiple areas across the site

Intro to LID+GSI Community Scoping and Code Audit Tool, MRC LID Conference (Oct. 2022), Eban Bean
# Grant Phases

## February

**LID Regional Roundtable (RR)**
- LID technical experts from permitting, design, implementation
- Understand LID barriers & challenges
- Brainstorm LID opportunities & strategies

## March

**Develop LID Ordinance Recommendations**
- Review RR lessons learned
- Review Comp Plans & LDRs
- Review Best Practices & implementation cases
- Draft LID Ordinance recommendations

**Volusia ENRAC Meeting**
- Introduce grant project
- Share RR lessons learned
- Discuss LID Ordinance recommendations

**Regional Resilience Collaborative Green, Gray, Blue Infrastructure TAC Meeting**
- Discuss Draft LID Implementation Guidebook & Ordinance Recommendations

## April

**Develop LID Implementation Guidebook**
- Review BMPs (Appendix)
- Sample LID/GSI GOPs & LDRs
- Sample LID/GSI Implementations
- Sample LID/GSI Technical Manuals

**Volusia ENRAC Meeting**
- Deep dive into Draft LID Ordinance Recommendations

## May

**Revise**
- LID Ordinance Template & Recommendations
- LID Implementation Guidebook

**Share Results**
- Conduct & record virtual meeting to share LID Implementation Guidebook & Ordinance Recommendations

## Summer

**Grant Project End 6.13.23**
- Submit LID Ordinance Recommendations to FDEO

**ECFRPC Website**
- Share webinar recording, LID Ordinance Recommendations & Implementation Guidebook
LID Regional Roundtable Highlights

Presentations
LID Best Practice Strategies – UF/IFAS
- Source Control
- Mitigating Impacts: Current Trends
- Florida Stormwater Rules
Case Study - Volusia LID Implementation Challenges

Roundtable Discussions
- Priority challenges/barriers to LID/GSI
- Strategies for priority challenges

Technical experts (79) from across the East Central Florida region
Regional Priority LID Challenges

- Local Code Inhibits LID
- Code Enforcement
- Streamline Design Process
- Maintenance (Cost/Labor/Training)
- Lack of Regional Approach (Uniform Policies & Codes)
- Regulations & Regulator Involvement
- Public Education/Training (recorded webinar)

Reducing Landscaping Impacts
The Villages (Sumter County) Source: UF/IFA
Michelle “Mo” Morrison
East Central Florida Regional Planning Council, Planner
mmorrison@ecfrpc.org
Contents

LID/GSI Implementation Examples
- Commercial
- Residential
- Municipal

LID/GSI Policy and Code Examples
- Required/Incentivized
- Green Parking

LID Pollutant Removal Formulae & Technical Manuals

Appendix - Best Management Practices

Resources

LID/GSI Policies & Codes Spreadsheet
Grove Roots Brewing Co.  
(Winter Haven, FL)

- Infill, redevelopment
- Reduced and disconnected a previously 100% impervious area from the City’s piped stormwater conveyance system
- Infiltrates ~100% stormwater on site
- Integrated system of roof gutters/downspouts, infiltration basins, parking areas graded to flow into grassed swales, open areas, and trees
- Parking lot bioswales
- Mechanical reworking of compacted soil
LID GSI Implementation: Commercial

**PF Chang’s (Sarasota, FL)**
- Rain gardens capture roof runoff
- Pervious pavers in driveway and parking lot
- More of site for restaurant & parking, avoided need for retention pond

*Photo Source: Sarasota County Government (https://www.sarasota.wateratlas.usf.edu/lid/#rain-gardens)*

This rain garden at P. F. Chang’s, in downtown Sarasota, uses decorative rocks and plants with a variety of leaf shapes and colors to provide visual interest.

This rain garden uses palms, shrubs, and native bunchgrasses to give a natural feel to the outdoor patio. It also provides a noise and visual buffer from the busy urban roadways adjacent to the restaurant.
LID GSI Implementation: Commercial

Marathon Gas Station  (Sarasota, FL)
- Rain garden diverts driveway stormwater
- Attractive landscaping

Photo Source: Sarasota County Government (https://www.sarasota.wateratlas.usf.edu/lid/#rain-gardens)
LID GSI Implementation: Multi Family

**Tupelo Vue (Winter Haven, FL)**

- 5-story apartment complex
- Infill, redevelopment
- Infiltrate ~100% stormwater on site
- Integrated system of roof gutters/downspouts, infiltration basins/ponds, grassed bioswales and open areas, and trees
- Drainage and biological capacity of soils restored through mechanical reworking of soils and soil amendments using native topsoil
- Redevelopment included removal of all existing impervious areas (structures and pavement)
- Under-building parking reduced impervious area by 50%
- LID practices located within routinely maintained landscaped areas

*Source: Winter Haven From Gray to Green Enhanced Stormwater Permit Design Manual (Appendix D)*
LID GSI Implementation: Residential

El Prado Stormwater Garden (Tampa, FL)
- SWFWMD Cost-Share Funding Project
- Created to address stormwater flooding in residential areas
- Amended soils, bioretention, gravel pathway & storage areas, native vegetation

The Nature Conservancy All Rights Photo credit: Roberto Gonzalez
Babcock Ranch (Charlotte County)

- FGBC Platinum “Florida Green” Land Development Certification
- Low impact native plants & naturalized landscape materials
- 90% stormwater recapture & repurpose
- Earle B. Phelps Award - highest removal of pollutants in transforming wastewater into reclaimed water
- Restored historic water flow
- Stormwater management played key role in disaster mitigation/resilience (Hurricane Ian)
LID GSI Implementation: Residential

Sunbridge Weslyn Park (Osceola County, FL)

- Florida-Friendly Landscaping
- Requirement: Homeowners must abide by landscaping standards

Source: LID Regional Roundtable Presentation by Pierce Jones, UF/IFAS Program for Resource Efficient Communities (2.2.23)

https://issuu.com/tdc6900/docs/sb_communitystandards_landscaping_weslynpark_final
Sarasota County: Municipal & Commercial

- Restroom – reduce runoff, cooling for restroom with no AC, wildlife habitat, native landscaping
- Bar & Grill – funded through Sarasota Bay Estuary Program grant, FFL, cisterns capture excess rainwater used for irrigation and pressure washing building
Escambia County Office Complex (Pensacola, FL)

- Largest FL Green Roof (33,000 sf),
- Biofiltration with native vegetation
- Energy savings

Source: https://gsiphotosflorida.org/project/escambia-county-office-complex/
Cascades Park (Tallahassee, FL)

- 25-acre public park with wildlife, ponds, interconnected multi-use trail system, amphitheater, restaurant, historic markers, playgrounds, open space
- Former brownfield site with runoff, erosion, flash flooding issues
- 2021: Construction on adjacent 5-acre mixed use live-work-play-stay destination
- Biofiltration, bioretention, rain garden, wetland
LID GSI Implementation: Municipal

Sarasota County Cisterns & Rain Barrels
(https://www.sarasota.wateratlas.usf.edu/lid/#rain-barrels-and-cisterns)

**Fire Station #1**
- 3 cisterns capture thousands of gallons of stormwater
- Water used for irrigation, washing trucks & equipment, emergency source for filling fire trucks

**County Government Complex & Sarasota City Hall**
- 2 cisterns @ County Complex: Hundreds of gallons stored from ½” rainfall event, used for irrigation
- City Hall demonstration project for watering flower beds (four 50-gallon rain barrels, FFL landscaping)
Cape Canaveral LID Guide

**Wagner Park**
- Permeable walkways, native plants, bioswale, limited use of grass

**Manatee Sanctuary Park**
- Floating Vegetative Islands/Beemat/Floating Wetlands
- Improve water quality (& decrease odor)
- Growing plant roots sequester excess nutrients
- Periodic harvesting prevents stored nitrogen and phosphorus from entering water
Sandra Stetson Aquatic Center (Deland, FL)

- Stetson Institute for Water & Environmental Resilience
- GSI Demonstration project
- Biofiltration, rain garden, floating wetland system/beemat, native vegetation

Source: https://gsiphotosflorida.org/project/stetson-aquatic-center/
The Nature Conservancy All Rights Photo credit: Tyler Jones
WMD Collaboration Potential

- WMD permit by state law
  - Local jurisdictions can impose stricter requirements (responsible for enforcement)
- Provide technical assistance
- Potential to expedite LID projects
- Consider public pilot projects
  - Collect data (pre- and post-)
  - Benefits future projects
  - Demonstration for private projects
- Cost-share funding
  - Identify hotspots (flooding/water quality)
  - Apply for funding

Ocala Wetlands Recharge Park (cost-share funding)
https://www.sjrwm.com/streamlines/ocala-recharge-park/#gsc.tab=0
# LID GSI Policies and Codes

## Volusia County Comprehensive Plan

**Objective 9.1.2** Volusia County shall at a minimum maintain current standards regulating the design, construction, and management of drainage systems used for stormwater management to the extent financially and environmentally feasible when considering future flood conditions.

Volusia  
Volusia County Comp Plan Drainage Element  

**Policy 9.1.2.6** Volusia County will encourage the use of low-impact development/green infrastructure as a method of stormwater management.

Volusia  
Volusia County Comp Plan Drainage Element  

**Objective 10.1.1** Potable water resources shall be protected and conserved such that the recharge function of the aquifer shall be maintained. Dependence upon the Floridan aquifer for non-potable uses shall be reduced, and withdrawals from the surficial aquifer shall not cause damage to the resource.

Volusia  
Volusia County Comp Plan Groundwater Aquifer Recharge Element  

**Policy 10.1.1.13** Volusia County shall encourage the use of green infrastructure and low impact development.

Volusia  
Volusia County Comp Plan Groundwater Aquifer Recharge Element  

**Objective 11.9.1** Develop strategies to identify and address issues related to the impacts of sea-level rise.

Volusia  
Volusia County Comp Plan Coastal Element  

**Policy 11.9.1.9** Volusia County will promote green infrastructure as a tool for resiliency and the protection of water quality and coastal systems.

Volusia  
Volusia County Comp Plan Coastal Element  

**Objective 12.1.3** To protect and appropriately utilize the physical and ecological functions of natural drainageways and drainage patterns.

Volusia  
Volusia County Comp Plan Conservation Element  
[https://www.volusia.org/core/fileparse.php/7370/url/Chapter-12-Conservation-Element.pdf](https://www.volusia.org/core/fileparse.php/7370/url/Chapter-12-Conservation-Element.pdf)

**Policy 12.1.3.6** Volusia County shall encourage the use of green infrastructure to protect the ecological functions of natural drainageways.

Volusia  
Volusia County Comp Plan Conservation Element  
[https://www.volusia.org/core/fileparse.php/7370/url/Chapter-12-Conservation-Element.pdf](https://www.volusia.org/core/fileparse.php/7370/url/Chapter-12-Conservation-Element.pdf)

**Objective FG 4** Development within the Farmland Local Plan shall promote high standards for water conservation, and energy efficiency.

Volusia  
Volusia County Comp Plan Future Land Use Element  

**Policy FG 4.1** Sustainable Development Area (SDA) districts shall promote protection of green infrastructure, natural resource protection, water and energy conservation, and low impact compact development. Higher density, mixed use, and compact development will be an integral part of any future development as it is recognized to reduce trip lengths, promote walking, support regional mass transit and reduce the development footprint. It also is recognized to provide tangible social and cultural benefits by encouraging more connected social support systems and a stronger sense of community.

Volusia  
Volusia County Comp Plan Future Land Use Element  

## Volusia County LDC

Sec. 72-547. - Conservation subdivisions. ... (13) Innovative development practices that are consistent with the purposes of conservation development are strongly recommended. These include, but are not limited to, low impact development, Dark Skies, Water Star, Firewise, US Green Building Council LEED certified development, Florida Green Building Coalition designation or other county approved certifications which promote sustainability, or water neutrality, or for environmental restoration of degraded wetlands or habitat. Provisions of the land development regulations, excluding the provisions of section 72-547, may be waived by DRC to the extent they are in conflict with the above innovated development practices.

Volusia  
Volusia LDC  
[https://library.municode.com/fl/volusia_county/county/codes/code_of_ordinances?nodeId=PTh1:COOR_CH72LAPI_ARTIII_LDC_DIV25LRE_572-547C05U](https://library.municode.com/fl/volusia_county/county/codes/code_of_ordinances?nodeId=PTh1:COOR_CH72LAPI_ARTIII_LDC_DIV25LRE_572-547C05U)
New buildings and redevelopment sites shall incorporate the following low impact development (LID) practices into project design, site and building plans...

Doral: ARTICLE XVI. - LOW IMPACT DEVELOPMENT PRACTICES

Developers shall implement the following non-structural LID practices to the maximum extent practical:

Developers shall implement a minimum of two structural LID practices from the following list, where one meets the water quantity requirement and the other meets the water quality requirement, per Section 11.0 of the 2021 LID Master Plan Update and the SFWMD ERP Applicant's Handbook Volume II.

Maintenance is required to preserve the efficacy of the implemented LID practice(s).

Doral (LID Incentives)

To encourage developers to design site plans using more than the minimum required LID practices, the City may offer the following incentives: Expedited review of permits, Implementation of open space credit, Reduced application fee, Award recognition program.
Incentives include:

- Technical assistance for LID practices
- Plan review fees waived
- Permitting/site development credits
- Process expedited
- Additional density (height, lot coverage)
- Setback reduction
- Parking reduction
- Stormwater fee credit (up to 52%) to non-SFH property owners to operate and maintain onsite detention or retention stormwater management systems
- Stormwater fee credit (up to 50%) to non-residential property owners who reduce water pollution by implementing LID and GSI practices
- Rebates for Florida-Friendly landscaping, irrigation, rain gardens, and rain barrels
- Stormwater on-site mitigation loan program to prevent or reduce future interior flooding for residents
Apopka
Incentives for use of pervious pavement on at least 50% of parking lot and driveway area include: Additional height/lot coverage & Parking reduction

Groveland
Requires the application of permeable parking lot surfaces for commercial developments proposed within high aquifer recharge areas

Winter Haven
Requires all off-street parking lots to provide for the attenuation and treatment of stormwater and landscape and buffer areas to be designed and located to filter, store and/or convey the expected stormwater flows from surrounding paved areas through the use of LID techniques

Doral
Developers shall implement ... to the maximum extent practical:
Utilize alternative roadway, sidewalk, parking lot, and driveway designs to minimize imperviousness and promote natural infiltration.

Utilize stabilized grass or other similar surfaces for parking spaces provided above the minimum requirement.
# LID Ordinance (2021): Incentivized

## Table 11.2 Low Impact Development Incentives Matrix

<table>
<thead>
<tr>
<th>Low Impact Development BMPs</th>
<th>Parking Incentives</th>
<th>Open Space, Landscape, Buffer, &amp; Setback Incentives</th>
<th>Other Incentives</th>
<th>See Noted Section for Specific Standards</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>On-Street Parking&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Parking Count Flexibility&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Reduced curbing requirements&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td>Reduced Parking Space Dimensions&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>Protect Surface Waters and Wetlands</td>
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<td>Natural Area Conservation - Retail Tree Canopy and Natural Landscaping</td>
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<tr>
<td>Cluster Design &amp; Conservation Subdivision</td>
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<td>Minimize Building Footprint</td>
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<td>Minimize Total Impervious Surface Area</td>
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<tr>
<td>Minimize Directly Connected Impervious Area (ECIA)</td>
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<tr>
<td>Curb Elimination and Curb Cuts</td>
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<tr>
<td>Minimize Soil Disturbance and Compaction</td>
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<td>Build with the Landscape Slope</td>
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<tr>
<td>Retain Native Landscapes at the Lot Level</td>
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<td>Florida-Friendly Landscaping and Fertilizers</td>
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<td>Rainfall Interceptor Trees</td>
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<td>Install Efficient Irrigation Systems</td>
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<td>Exfiltration Trenches</td>
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<td>Underground Storage and Retention Systems</td>
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<td>Rain Gardens (Bioswales)</td>
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<tr>
<td>Vegetated Swales</td>
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<td>Vegetated Natural Buffers</td>
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<td>Permeable Pavements</td>
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<td>Green Roofs with Cisterns</td>
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<td>Stormwater Harvesting Systems</td>
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<td>Up Flow Filter System with BAW</td>
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<td>Detention Pond with Managed Aquatic Plant Systems</td>
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<tr>
<td>Biofiltration Systems (BAV-enhanced rain gardens, landscape planter boxes, and tree box filters)</td>
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</tbody>
</table>

Any other Low Impact Development BMP
UTILITIES

OBJECTIVE 2.2. DEVELOPMENT REVIEW
  Policy 2.2.6. Drainage and stormwater management systems shall use natural systems to the greatest extent possible, and land development modifications shall resemble natural features to the greatest extent practicable.

FUTURE LAND USE

OBJECTIVE 2.6. SUSTAINABILITY
  POLICY 2.6.5. Encourage integration of passive solar design, green roofs, active solar and other renewable energy sources into development projects through the Land Development Code.

CONSERVATION

OBJECTIVE 7.3. SUSTAINABILITY
  POLICY 7.3.4 Create, protect and manage systems of green infrastructure (i.e., urban forests, parks and open spaces, green roofs, natural drainage systems).

  POLICY 7.3.6 Encourage site design techniques that restore natural “green infrastructure” (i.e., urban forests, parks and open spaces, natural drainage systems) instead of relying solely on engineered systems that require higher energy and carbon inputs.
CONSERVATION
GOAL 12. LOW IMPACT DEVELOPMENT
FOR NEW DEVELOPMENT AND REDEVELOPMENT, APPLY BETTER SITE DESIGN AND LOW IMPACT DEVELOPMENT (LID) TECHNIQUES, AND PURSUE COMMITMENTS TO REDUCE STORMWATER RUNOFF VOLUMES AND PEAK FLOWS, TO INCREASE GROUNDWATER RECHARGE, AND TO INCREASE PRESERVATION OF UNDISTURBED AREAS.

OBJECTIVE 12.1. LAND DEVELOPMENT CODE AMENDMENTS
   Policy 12.1.1. Integrate into the Land Development Code (LDC) the source control concept which places a greater importance on managing smaller, cost-effective landscape features located on each lot rather than through costly pipe and pond stormwater management design.

The remaining policies in this objective use phrases such as:
  • Maintain or improve infiltration, frequency and volume of discharges, and groundwater recharge
  • Integrate alternative stormwater management practices
  • Reduce the use of centralized best management practices (BMPs)
  • Amend the LDC and Construction Details to permit LID designs
Sec. 1-20. - Codes and standards adopted by reference.

(e) *Low Impact Development Manual for the City of Ormond Beach.*
The Low Impact Development Manual as published by the city planning department, is adopted.
## LID / GSI BMP Benefits to Developer & Public (Table 4.0.1)

<table>
<thead>
<tr>
<th>LID / GSI BMP</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developer</strong></td>
<td><strong>Public</strong></td>
</tr>
<tr>
<td><strong>Bioswales</strong></td>
<td>Reduces Upfront Site Infrastructure Costs</td>
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<td></td>
<td>Contributes to Site Appeal and Aesthetics</td>
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<td></td>
<td>Assists in Compliance with Stormwater Management Requirements for Quality and Quantity</td>
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<td></td>
<td>Helps with Green Buffer Site Requirements</td>
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<td></td>
<td>Less infrastructure conveyance elements to maintain</td>
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<tr>
<td><strong>Pervious Pavement</strong></td>
<td>Reduces Overall Site Impervious Area</td>
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<tr>
<td></td>
<td>Requires less On-Site Retention/Detention Area</td>
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<tr>
<td></td>
<td>Assists in compliance with onsite parking regulations</td>
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<tr>
<td></td>
<td>Reduces the needed treatment and attenuation of runoff from the site</td>
</tr>
</tbody>
</table>

PK Ave.
Auburndale, FL

Henrietta Ave./Jean St.
Largo, FL
Section 11. LOW IMPACT DEVELOPMENT (LID)

11.1Intent

The City encourages the use of Low Impact Development (LID) Rest Management Practices (DRMP) in the design of streets and subdivisions to better protect water quality and reduce flooding risks. LID is a stormwater and land use management strategy that strives to retain pre-development hydrologic processes of infiltration, detention, storage, evaporation, and transpiration by emphasizing conservation, use of onsite natural features, improved site planning, and distributed stormwater management practices that are integrated into a project's design, especially its landscape and open space. The City of Titusville LID Manual is intended as a reference for design professionals to consider alternatives to conventional land planning and site design, especially as it concerns stormwater management.

11.2Goals of Low Impact Development (LID)

11.2.1 Achieve multiple objectives—Comprehensive stormwater management helps achieve multiple objectives such as: managing peak discharge rates and total discharge volume, providing effective stormwater treatment to minimize pollutant loads; maintaining or improving the hydrologic characteristics of a site, and reducing or harvesting stormwater runoff for non-potable purposes. LID also promotes integrating stormwater systems into the landscape and open space of a site creating more attractive and diverse systems.

11.2.2 Preserve or restore natural features and resources—The preservation or restoration of natural features such as meadows, tidal, and vegetation helps to reduce or restore hydrologic functions thereby achieving the multiple objectives above.

11.2.3 Minimize soil compaction—Soil compaction relates to soil structure, reduces infiltration rates, and limits root growth and plant survival.

11.2.4 Reduce and disperse impervious surfaces—By minimizing impervious surfaces, especially directly connected impervious surfaces, more rainfall can infiltrate into the ground.

11.2.5 Manage stormwater close to the source—Using source controls to minimize the generation of stormwater pollution that can get into stormwater needs to be the first step in managing stormwater.

11.2.6 Use a DRMP Treatment Train approach—Effective stormwater management requires a comprehensive approach that incorporates source controls with multiple structural stormwater management systems. [See Secs 4.6.3 "Treatment Train" of the Stormwater Management Technical Manual].

11.3 Low Impact Development Plan

Exhibit D: Low Impact Development Technical Manual
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LID Ordinance Recommendations

Intent and Purposes.
Applicability.
Environmental Site Design (ESD).
Site Design Strategies.
Pollutant Removal.
Channel Protection Flow.
Conveyance Flow.
Flood Protection.
High Density Residential and Non-Residential Redevelopment Projects.
Land Uses with High Pollutant Loads.
Implementing and Integrating GSI + LID Strategies in Development.
Waiver of GSI + LID Requirements.
The strategies of Environmental Site Design (ESD) are the basic building blocks for GSI + LID. The ESD process focuses on natural landform and the natural environmental systems. There are many environmental systems on a land parcel including, but not limited to, wetlands, watercourses, vernal pools and other intermittent wetlands, floodplains, steep slopes (≥20%), significant individual trees, unusual vegetative communities, and soils with varying infiltrative capacities. The ESD process requires these natural environmental systems be fully evaluated prior to the creation of a development or redevelopment project concept. The ESD process should be specified in the Ordinance and must be developed and documented by appropriate professionals as part of a development permit application.
Environmental Site Design (ESD)

LID Design Process

(a) Base Map. Qualified professionals identify, evaluate, and delineate natural resources on a boundary survey.
(b) Additional documentation. Soils; sub-watershed basin boundaries; generalized vegetative types; significant field-located trees that warrant protection from development; 20% slopes.
(c) Determination of Developable Area.
(d) Preliminary Site Plans.
(e) Reduce Impacts.
(f) Manage Impacts.
Environmental Site Design (ESD)

Apply these strategies during the ESD process:

(a) Road and Street Design;
(b) Driveway Layouts; and
(c) Lot Design.
Pollutant Removal

(a) The *Guidebook* includes references to various GSI/LID technical manuals with formulae to calculate pollutant loads. The local government will identify and adopt a [Technical Manual] with the GSI + LID strategies the local government chooses to follow.

(b) Procedure to calculate pollutant loads and the effectiveness of stormwater treatment systems—**Pre-Development Conditions**.

(c) Procedure to calculate pollutant loads and the effectiveness of stormwater treatment systems—**Post-Development Conditions**.
Pollutant Removal

Pre-Development Conditions
(1) Delineate the watershed areas on the site.
(2) Label and determine the area of each watershed on the site.
(3) Determine the type of land cover for each watershed area.
(4) Obtain annual rainfall amount for general location of the site.
Post-Development Conditions

1. Evaluate the type and location of treatment systems during design phase.
2. Prepare a Conceptual Development Plan for the project.
3. Delineate watershed boundaries for future conditions.
4. Calculate the area of each watershed.
5. Estimate impervious coverage within each watershed above the treatment systems.
6. Calculate the land area below the treatment system to the design point or point of concern.
Post-Development Conditions – continued.

• A design point would typically be the point where a watercourse or overland flow would leave the site boundary.

• A point of concern would typically be the limit of a delineated wetland or watercourse proximate to or within the site boundary.
Post-Development Conditions – continued.

(8) Use pollutant removal efficiencies and formulae in step (11) to determine treatment systems needed to achieve water quality requirements.
(9) The final site design must incorporate the necessary stormwater treatment systems.
Pollutant Removal

Post-Development Conditions – continued.

(10) After site design is complete, repeat steps (3) through (8) with the accurately calculated areas for the final watershed(s) and impervious cover.

(11) Pollutant Removal Calculation Procedure.
   a. \((\text{total load} \times 1\text{st removal efficiency})\)
   b. \((\text{total load} - (\text{load removed in a.})) \times 2\text{nd removal efficiency})\)
   c. \((\text{total load} - (\text{load removed in a.} + \text{b.})) \times 3\text{rd removal efficiency})\)
   d. \((\text{total load} - (\text{load removed in a.} + \text{b.} + \text{c.})) \times 4\text{th removal efficiency}) \ldots\)

\textbf{Total Percentage Removed by Treatment Systems},

\[
\frac{(\text{load removed in a.} + \text{load removed in b.} + \text{load removed in c.} \ldots)}{\text{total load}} \times 100
\]
(a) To improve and protect water quality and quantity, better address the land/water dynamic in local government watersheds to benefit the health, safety, and general welfare of current and future generations of citizens, the local government employs Green Stormwater Infrastructure and Low Impact Design/Development (GSI + LID) strategies to manage stormwater for the greater good of the local government and its citizens. The implementation of GSI + LID for new development will minimize adverse changes in water quality. Wherever feasible on redevelopment sites, GSI + LID stormwater treatment systems will decrease the adverse impacts of stormwater runoff.
(b) Stormwater discharges in the local government area have clearly caused pollution and other adverse impacts on the aquatic and overall natural environment. These impacts range from increased flows that cause erosion of natural stream channels to limitations on the use of certain waters for recreational uses due to high levels of pollutants in the water, to elevated potential flood risks due to increased runoff volume.
(c) Increasing impacts from accelerated climate change, e.g.—drought, extreme heat, other unprecedented extreme weather events, sea-level rise, increased precipitation depths and intensity, etc.—augment these adverse impacts and present existential challenges to the health, safety, and general welfare status quo, and pose threats to private and public property interests, the public fisc, the public trust, and the accessibility and use of public lands and infrastructure for the local government and municipal facilities, purposes, and services.
(d) This ordinance requires development and redevelopement to incorporate the technical framework of a [Technical Manual] (referenced in the Guidebook) to implement GSI + LID management strategies that improve surface water quality and groundwater quality to achieve water quality requirements. Absent implementation of the requirements in the, long-term adverse impacts to both surface and groundwater will continue to occur in the local government.
(a) The standards and processes stated in [Technical Manual] identified and adopted by the local government apply to all new development proposed in the local government. This can be as broadly applicable as the local government elected officials decide. Where feasible, new development initiated by the local government must comply with the adopted [Technical Manual] standards. Specific performance standards have been developed for new development, as well as commercial/high-density residential/industrial redevelopment that may change the extent of impervious cover on a regulated site.
(b) The Guidebook’s intended audience is design professionals, property owners, developers, homeowners, local government officials, and others involved with the design of development and redevelopment projects in the local government. While not required, all the stormwater management practices and strategies outlined in the Guidebook and the adopted [Technical Manual] should be applied to the maximum extent practicable on existing approved vacant single-family lots or parcels.
The practices, specifications, and strategies identified and provided in the Guidebook and the adopted [Technical Manual] must be implemented by individuals with a demonstrated level of professional expertise in stormwater management, such as Florida-licensed professional engineers. The Guidebook is also intended for non-technical individuals interested in GSI + LID stormwater management, but the application of the stormwater requirements of the adopted [Technical Manual] must be prepared by a Florida-licensed professional engineer.
(d) **All development and redevelopment project** designs must comply with all applicable GSI + LID stormwater management and performance standards provided in [Technical Manual]. The schematic details provided for the various types of treatment and storage systems must demonstrate the various components included in the design of the water treatment system to function effectively. Final design plans for any type of stormwater treatment or storage system must include all relevant design specifications for that particular system.
Other Ordinance Recommendations

Channel Protection Flow
Conveyance Flow
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Other Ordinance Considerations

10 Steps to Effective Incentives
Incentives: Objectives & Audience

1. Determine Objectives – Set goals and measures
Here we want to improve stormwater management and water quality through effective implementation of GSI + LID standards and strategies from the [Technical Manual] in new development and redevelopment projects; and wherever else possible

2. Analyze the Audience – Who can impact the objectives?
• Developers; Engineers; Home Builders; Property Owners; Public
• Regulators; Enforcers; Officials; Public
Incentives: Fact Finding

3. Fact Finding & Audience Involvement (ENRAC, etc.)

Here: What do we do to improve stormwater management and water quality through effective implementation of GSI + LID in new projects; and wherever else possible?

**Recommendation:**

- Ordinance requirements to utilize GSI + LID standards and strategies from the adopted [Technical Manual] for new development and redevelopment projects, e.g., residential subdivisions; large multi-family and non-residential projects.
- Incentives for existing development.
4. Create Rules Structure and Develop Budget – rules of the program; fixed and variable costs

Here: **Available resources** to administer the program or need for additional resources; **available processes** to administer the program or need for new procedures; program management.

5. Select Awards – appealing; affordable; match incentives with GSI + LID techniques from the adopted [Technical Manual]

What incentives will the Audience value? bonus density (caps); reduced dimensional regulations; fee waivers; property tax abatements; priority permit processing; compliance grants; etc.
6. Communicate the Program – Appropriate media to expand audience

Outreach to the public – possible parallel with the educational efforts we use to promote the local NFIP regulations to capture credits for the Community Rating System. Celebrate local government-initiated GSI + LID compliant projects (LEAD)

7. Operations – Track results with regular progress updates.
Again, a function of budget, capacity, and resources

8. Fulfill the Awards – the more immediate = the better!
Incentives: Evaluate & Celebrate

9. Evaluate & Measure – Objective accomplished? Any outside factors?

This is the back end of steps 4 (Rules) and 7 (Tracking). Are our incentives progressing toward our objective(s)?

10. Celebrate Success! – Reward achievers; communicate results; annual dinner; awards; public recognition.

This is probably the most public-facing aspect and provides additional incentives to participate whether through regulatory (LDRs) or voluntary compliance. Nominate local government GSI + LID-compliant projects for local and national project awards.
Questions???

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