Low Impact Development Ordinance Recommendations

Contents

A COMMENT-ANNOTATED MODEL LOW-IMPACT DESIGN/DEVELOPMENT MODEL ORDINANCE

> *As environmental regulations become more advanced and increasingly tied to economic and social benefits, municipalities have a wider array of regulatory tools at their disposal to guide development in sustainable directions. The ability to regulate development to promote green infrastructure is a valuable community tool that has many applications, including ordinances addressing tree preservation, landscaping, open space preservation, erosion control, riparian buffer protection, and stormwater management. However, these ordinances are typically developed and enforced in "silos," an approach that doesn't adequately address the interaction of all of the elements that comprise the green infrastructure network. . . . [I]ntegrate existing regulations and review processes with new approaches and best management practices to optimize the triple-bottom-line benefits green infrastructure can provide for communities.*
>
> *—Nancy Templeton, AICP*[1]

KEY:

1. *Italicized paragraphs are commentary, whether in regular or* ***bold*** *text.*
2. ***Words in*** [BRACKETS] ***are placeholders for the name of the local government, the name of the technical manual the local government adopts, dimensional criteria that policy-makers and administrative leaders may wish to modify, etc.***
3. ***<u>Underlined</u> words are noted to draw the reader's attention and need not be underlined in the local ordinance.***
4. ***The organization of the ordinance and the regulations are examples, recommended as a place to start the conversation and should be modified to address the unique circumstances of each local government seeking to improve the land/water dynamic relationship in their community.***
5. ***Definitions are not included as many of the terms used in the Model Ordinance are likely already defined by the local government. Some terms may merit definitions where none are codified and should be readily available in the Low Impact Development Implementation Guidebook (Guidebook) and its linked and referenced resources.***

LOW-IMPACT DESIGN/DEVELOPMENT (LID) ORDINANCE

A Title Block is standard for most ordinances identifying the sections of the Code of Ordinances and/or Land Development Regulations the subject ordinance proposes to adopt or amend, and where these changes will be codified. This draft ordinance provides room for additional modifications, if necessary, with an ellipsis before identifying the standard "boilerplate" sections of most ordinances effecting land development regulations.

Local ordinance drafting and enumeration varies among local governments and—as with any other legislative action—consultation with attorneys representing the local government and familiar with their legal practices and procedures should be a standard administrative action. Pre-adoption review of

the ordinance by officials charged with enforcing the regulations is also recommended to avoid confusion and other challenges when the rubber meets the road in enforcement actions.

ORDINANCE NO. _____

AN ORDINANCE OF [LOCAL GOVERNMENT], AMENDING THE [CODE OF ORDINANCES/LAND DEVELOPMENT REGULATIONS] TO ADOPT LOW-IMPACT DESIGN/DEVELOPMENT (LID) STANDARDS BY AMENDING SECTIONS [ENUMERATE AND NAME SECTIONS OF THE CODE OF ORDINANCES/LAND DEVELOPMENT CODE THAT ARE AFFECTED BY THE PROPOSED AMENDMENTS] BY CREATING [ARTICLE/ DIVISION/SUBDIVISION] ___. "LOW-IMPACT DEVELOPMENT (LID)" TO INCLUDE SECTIONS XX "INTENT AND PURPOSES"; XX "APPLICABILITY"; XX "ENVIRONMENTAL SITE DESIGN (ESD)/LID ANALYSIS"; XX "GSI + LID SITE DESIGN STRATEGIES; XX "PROCEDURES"; XX "GSI + LID POLLUTANT REMOVAL"; XX "CHANNEL PROTECTION FLOW"; XX "CONVEYANCE FLOW"; XX "FLOOD PROTECTION"; XX "HIGH DENSITY RESIDENTIAL AND NON-RESIDENTIAL REDEVELOPMENT PROJECTS"; XX "LAND USES WITH HIGH POLLUTANT LOADS"; XX "IMPLEMENTING AND INTEGRATING GSI + LID STRATEGIES IN DEVELOPMENT"; XX "WAIVER OF GSI + LID REQUIREMENTS"

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; PROVIDING FOR SEVERABILITY, REPEAL OF CONFLICTING ORDINANCES, AN EFFECTIVE DATE, AND INCORPORATION INTO THE [CODE OF ORDINANCES/LAND DEVELOPMENT REGULATIONS].

RECITALS

The recitals contained in the preamble to an ordinance may include the findings and determinations of fact by the elected governing body of the local government underpinning the ordinance. The local government legislative history may also be provided. The effect and status of ordinance recitals and procedures for their codification or other legislative incorporation should be ordained elsewhere in the Code of Ordinances/Land Development Regulations, and recitals drafted accordingly.

WHEREAS, on [DATE] the [GOVERNING BOARD] of the [LOCAL GOVERNMENT], Florida approved advisability for staff to develop an ordinance encouraging Low-Impact Design/Development through [land development regulations and/or incentives]; and

WHEREAS, [Policy XX] of the Coastal Management Element of the Comprehensive Plan provides, "[QUOTE RELEVANT PLAN PROVISIONS]"; and

WHEREAS, [Policy XX] of the Conservation Element of the Comprehensive Plan provides, "[QUOTE RELEVANT PLAN PROVISIONS]"; and

WHEREAS, [Policy XX] of the Infrastructure Element of the Comprehensive Plan provides, "[QUOTE RELEVANT PLAN PROVISIONS]"; and

WHEREAS, Low-Impact Design/Development strategies include design approaches for managing stormwater runoff and protecting water quality that reduces the ecological burden of development on [SIGNIFICANT LOCAL WATERBODIES AND WATERCOURSES] and other local waterbodies; and

WHEREAS, the [GOVERNING BOARD] of the [LOCAL GOVERNMENT], Florida desires to encourage the use of Low-Impact Development Best Management Practices within the [CODE OF ORDINANCES/LAND DEVELOPMENT REGULATIONS].

NOW, THEREFORE, BE IT ORDAINED BY THE [GOVERNING BOARD] of the [LOCAL GOVERNMENT], FLORIDA as follows:

Section 1. That the [CODE OF ORDINANCES/LAND DEVELOPMENT REGULATIONS] of the [LOCAL GOVERNMENT] is hereby amended by adding a(n) [article/division/subdivision], to be numbered [CHAPTER___. "DEVELOPMENT STANDARDS", ARTICLE __, "LOW-IMPACT DESIGN/DEVELOPMENT"] that reads as follows:

[ARTICLE/DIVISION/SUBDIVISION] ___. LOW-IMPACT DESIGN/DEVELOPMENT (LID)

Sec. XX. – Intent and Purposes.

It is important for legislation to be underpinned by logical reasons for the particular exercise of the sovereign police power that has been delegated to the local government by the state. The statement of purpose must be clear and concise, and based on goals, objectives, and policies of a Comprehensive Plan. Ideally, these goals, objectives, and policies will enumerate the economic, environmental, and social benefits of Green Stormwater Infrastructure and Low-Impact Design/Development (GSI + LID) that justify the community investment. The local government may encourage or require the use of GSI + LID best management practices (BMPs) in the design of sites and subdivisions to better protect water quality and reduce flooding risks. GSI + LID is a land and water management strategy directed at improving and maintaining pre-development hydrological processes of evaporation, infiltration, filtration, infiltration, storage, and transpiration. These goals are accomplished by emphasizing conservation, improved nature-based site planning, use of on-site natural features, native plant landscape designs and logically-distributed stormwater management BMPs integrated into a development project's design—especially its landscaping and open space.

Example ordinance language:

(a) To protect and improve the water quality in [LOCAL GOVERNMENT]'s 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 and in the greater public interest. The implementation of GSI + LID for new development will minimize adverse changes in water quality. Wherever feasible on redevelopment sites, the retrofitting of GSI + LID stormwater treatment systems will decrease the adverse impacts of stormwater runoff from these redevelopment sites.

(b) Stormwater discharges in [LOCAL GOVERNMENT] 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, increased rainfall depth and intensity, other unprecedented extreme weather events, sea-level rise, etc.—augment these adverse impacts; 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 [LOCAL GOVERNMENT] and its municipal facilities, purposes, and services.

(d) This ordinance requires development and redevelopment to incorporate the technical framework of a GSI + LID technical manual [TECHNICAL MANUAL]—examples of which are

provided in the *Low-Impact Development Implementation Guidebook* (*Guidebook*)—to implement GSI + LID management strategies that improve surface water and groundwater quality to achieve water quality requirements. Absent implementation of the requirements of the ordinance and the [TECHNICAL MANUAL], long-term adverse impacts to both surface and groundwater will continue to occur in [LOCAL GOVERNMENT].

Alternatively:

(d) This ordinance encourages development and redevelopment to incorporate the technical framework of a GSI + LID technical manual [TECHNICAL MANUAL]—examples of which are provided in the *Low-Impact Development Implementation Guidebook* (*Guidebook*)—to implement GSI + LID management strategies that improve surface water quality and groundwater quality to achieve water quality requirements by providing certain development incentives. Absent implementation of the requirements in the [TECHNICAL MANUAL], long-term adverse impacts to both surface and groundwater will continue to occur in [LOCAL GOVERNMENT].

A NOTE ON INCENTIVES

We are skeptical of development incentives, their credence, effectiveness, and ability to further social equity.

"Incentives" tend to perpetuate the status quo ante, reducing comprehensive, community-wide higher development standards to gain certain improvements when the "tradeoff" is cost-effective for developing selected land uses. The ability of Incentives to further the efforts necessary to efficiently engage our increasingly dynamic and "extreme" water cycle to improve water quality <u>and</u> efficiently balance water quantities is questionable. Incentive program provisions are better when underpinned with comprehensive community engagement and canvas or survey of the "tradeoff" incentives offered and the immediate and future benefits to the community. An overall plan of public education, enforcement, engagement, and example is imperative for successful incentive efforts. The development community and the greater public must be involved in development of the incentive program to identify reasonably cost-beneficial "tradeoffs" and understand what the greater community is "trading" and what is being "gained" by whom, how, and why.

A local government weighing incentive-based or requirement-based ordinance approaches should consider employing those development incentives, e.g.:

- ***to provide by administrative deviation or waiver where demonstrably necessary to accomplish the project's GSI + LID strategies***
- ***to require administrative, advisory committee (e.g, Local Planning Agency), public hearing documentation and review—or a tiered approach—for certain identified deviations or waivers***

Regardless of whether the local government choses a regulatory, incentivized, or some hybridized approach, keep foremost in consideration, how best to ensure enforcement and maintenance of the GSI + LID facilities over time and changes of ownership.

When developing GSI + LID regulations, local governments must revisit their goals and determine their capacity to commit to enforcement. The regulations must be clearly tied to the objectives of the community and enforced by professionals with sufficient authority, experience, and expertise to apply and enforce penalties.

The Matrix provided in Table X, below, may be utilized to determine the acceptability of incentives available, either by deviation, waiver, or as established for implementation of various listed GSI + LID best management practices (BMPs). Once completed, the local government has a fast reference for requirement-based ordinances. Design professionals can consider alternatives to conventional land and stormwater planning and site design for projects in local governments with incentive-based ordinances.

Table X: Low-Impact Design/Development (LID) Incentive Matrix

		Parking Incentives					Buffer, Landscape, Open Space, and Setback Incentives				Other development incentives				
	LID BMPs	On-street parking	Parking Count Flexibility	Reduced Curbing requirements	Reduced Parking Space Dimensions	Shared Parking	BMP Permitted Within Buffer	BMP Area Credited as Landscaping	BMP Area Credited as Open Space	Reduced Building Setbacks	Additional Building Height	Additional Density	Expedited Application	Reduced Stormwater Freeboard	Referenced Code Section(s)
Site Planning BMPS	Protect Surface Waters and Wetlands														
	Preserve Open Space														
	Natural Area Conservation - Retain Tree Canopy and Native Landscaping														
	Cluster Design and Conservation Subdivision														
	Minimize Building Footprint														
	Minimize Total Impervious Surface Area														
	Minimize Directly Connected Impervious Areas (DCIA)														
	Curb Elimination and Curb Cuts														
Source Control BMPs	Minimized Soil Disturbance and Compaction														
	Build with the Landscape Slope														
	Retain Native Landscapes at the Lot Level														
	Florida Friendly Landscaping														

	Rainfall Interceptor Trees														
	Efficient Irrigation Systems														
Structural Stormwater BMPs	Exfiltration Trenches														
	Underground Storage and Retention Systems														
	Rain Gardens (Bioretention)														
	Vegetated Swales														
	Vegetated Natural Buffers														
	Pervious Pavements														
	Green Roofs with Cisterns														
	Stormwater Harvesting Systems														
	Up-flow Filter Systems with BAM														
	Detention Pond with Aquatic Plant Systems														
	Bio-filtration Systems (BAM=enhanced Rain Gardens, Landscape Planter Boxes, and Tree Box Filters														
Any Other LID BMP															

Sec. XX. – Applicability.

New development and larger parcel redevelopment offer the greatest opportunities to implement GSI + LID strategies. Smaller parcel redevelopment and existing development present the greater challenges for implementing GSI + LID BMPs, but such challenges may and should be overcome when possible to great community benefit. The goal should be to incorporate some form of GSI + LID into all developments, but certain regulations may not be applicable in all contexts. Small development sites and urban infill should be considered when addressing impervious surface limits, the required number of trees preserved or replaced, and the percentage of open space on a site. This section identifies the development projects that must comply with the GSI + LID requirements of the ordinance.

Example ordinance language:

(a) The standards and processes stated in the [TECHNICAL MANUAL] apply to all new development proposed in [LOCAL GOVERNMENT]. Where feasible, new development initiated by [LOCAL GOVERNMENT] must comply with the standards in the [TECHNICAL MANUAL]. Specific performance standards have been developed for new development, as well as commercial/industrial redevelopment, proposing changes to the extent of impervious cover on a site.

(b) The *Guidebook*'s intended audience is local government planning staff and advisory committees who are considering implementation of a LID Ordinance, [LOCAL GOVERNMENT], municipal officials, and others involved with the design of development and redevelopment projects in [LOCAL GOVERNMENT]. While not required, all the stormwater management practices and strategies outlined in the [TECHNICAL MANUAL] should be applied to the maximum extent feasible on existing approved vacant single-family lots or parcels.

(c) The practices, specifications, and strategies provided in the [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 [TECHNICAL MANUAL] stormwater requirements 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 the [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 function effectively. Final design plans for any type of stormwater treatment or storage system employed must include all relevant design specifications for that particular system.

Sec. XX. - Environmental Site Design (ESD)/LID Analysis.

When adopting a GSI + LID ordinance, it is necessary for site plan and subdivision applications to provide an analysis of the potential use of GSI + LID BMPs to meet the stormwater management design criteria and performance standards of the local government. At minimum, such analysis will include

considerations of site hydrology, soils, topography, and vegetation as described in the **[TECHNICAL MANUAL].**

Example ordinance language:

The strategies of Environmental Site Design (ESD) are the basic building blocks for GSI + LID. The ESD process focuses on natural land form 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 is enumerated below and must be developed and documented by appropriate professionals as part of a development permit application.

(a) *Base Map*. Qualified professionals must identify and evaluate natural resources, and delineate them on a boundary survey of the site. The base map must:
   (1) Compile the results of field inspection(s) of the site and surrounding properties locating wetlands and identifying wetlands species, watercourses, and the approximate boundaries and types of wetland and upland soils;
   (2) Identify and locate all significant trees by species with dimensions;
   (3) Identify large ([600] square feet or larger) geological features;
   (4) Delineate existing topographic contours at [one-foot (1')] intervals.
   (5) Identify special flood hazard areas (SFHAs) and on-site areas of prior flooding.

(b) *Additional documentation*.
   (1) Determine the potential infiltrative capacity of the soils by using data available from the Natural Resources and Conservation Service (https://websoilsurvey.nrcs.usda.gov/app/), augmented by on-site determinations, and delineate the extent of these soils on the plan.
   (2) Determine and delineate existing sub-watershed basin boundaries, locating where surficial flows (runoff) would exit site boundaries, the areas draining to those locations, and any areas that drain onto the site.
   (3) Determine the generalized vegetative types on the site, whether they are deciduous, coniferous, a combination of both, any field or prairie areas, etc.
   (4) Determine which of the significant trees located in the field warrant protection from development, e.g., an 100-year-old Oak (*Quercus sp.*) in the middle of a field.
   I5) Delineate extent of 20% or steeper slopes on the parcel, i.e., those areas where there is a 10' change in grade across 50' in horizontal distance.

(c) *Determination of Developable Area*. The developable area results from the removal of the wetlands, watercourses, and steep slopes from the site area. In addition, a portion of the upland area adjacent to wetland/watercourse systems must be removed to provide biological connectivity to the wetland resources. The width of the upland buffer area to be preserved must be based upon a scientific evaluation by an environmental scientist and documented in writing.

(d) *Preliminary Site Plans*. The preliminary site plan must utilize the following GSI + LID strategies:
   (1) Protect as much undisturbed land as possible to maintain pre-development hydrology and allow rainfall to infiltrate into the ground;

(2) Protect the natural drainage systems, e.g., flow paths, ponds, watercourses, wetlands, etc., to the maximum extent feasible;
(3) Minimize the disturbance of the land by clearing and grading; and
(4) Prevent or mitigate the compaction of natural soils.

(e) *Reduce Impacts*.
(1) Utilize low- and no-maintenance landscapes that will retain native vegetation;
(2) Plant appropriate native vegetation and minimize or preclude lawn or turf grass areas to reduce the application of chemical or mineral fertilizers and pesticides to maintain the landscape;
(3) Minimize the extent of impervious areas on the site, particularly directly connected impervious areas; and
(4) Maximize the time of concentration, i.e., the time it takes for runoff to travel from the hydrologically most distant point of the watershed or sub-watershed area to the design point, for post-development conditions to match the time of concentration for pre-development conditions.

(f) *Manage Impacts*.
(1) Use vegetated conveyance and treatment source controls to infiltrate runoff as close as possible to the point rainfall reaches the ground surface;
(2) Disconnect impervious surface areas to the maximum extent feasible to reduce impervious surfaces runoff;
(3) Design the landscape to minimize and prevent application of chemical compounds and fertilizers responsible for pollutants found in non-point source runoff; and
(4) Utilize source controls to minimize and prevent the discharge of pollutants to receiving waters, watercourses, and wetlands systems.

Sec. XX. – GSI + LID Site Design Strategies.

Major site interventions—roads, streets, driveways, lot layout, etc.—are fundamental to most land development designs. The magnitude of these physical interventions, as they are employed in* conventional development patterns, *too often adversely impacts the existing site hydrology, soils, topography, and established native vegetation. Employing GSI + LID site design strategies early in the design/development process can direct the overall development to improve and reduce post-development land/water impacts. GSI + LID site design strategies and higher standards for the development of our community should be foremost in our efforts to improve the stormwater management system, (community/regional/statewide/national/global) water quality, and best steward the watercourses for the benefit of the community.

The strategies of Environmental Site Design (ESD) are the basic building blocks for GSI + LID. The ESD process focuses on natural land forms 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.

Example ordinance language:

Apply these strategies during each stage of the design process described below.

(a) *Road design*.
  (1) Road alignments must follow the existing land contours to the maximum extent feasible to minimize excessive cut and fill and land disturbance.
  (2) Minimize the extent of connected impervious surface area to the maximum extent feasible, including minimizing drainage structures in the road, e.g., catch basins, connecting pipe, etc., and employ vegetated swales along the road in appropriate locations.
  (3) Utilize decentralized, off-line treatment strategies to treat runoff at the source and not at the end of the drainage system.
  (4) Utilize multiple GSI + LID treatment strategies in series (treatment trains) to increase the effectiveness of the system's stormwater pollutant removal.

(b) *Driveway Layouts*.
  (1) Use impervious area disconnection strategies to intercept and infiltrate driveway runoff before runoff reaches the road.
  (2) Allow runoff from driveways to travel across vegetated areas for a minimum of [75'] to facilitate infiltration.

(c) *Lot Design*.
  (1) Design lots to minimize site clearing utilizing clustering and site fingerprinting, i.e., delineating the smallest possible area for clearing and site disturbance where roads, structures, and other improvements are proposed.
  (2) Layout structures, driveways, and on-site sewage disposal systems to minimize the extent of soil disturbance and grading on the lots.
  (3) Utilize the natural topography when siting proposed structures to minimize site disturbance, e.g., create a walkout basement for a house on a natural 15-20% slope.
  (4) Preserve the infiltrative capacity of native soils by not disturbing areas of the site that aren't necessary for development or redevelopment.
  (5) Employ source controls—e.g., cisterns, rain barrels, rain gardens—to collect, minimize, and reuse runoff and promote infiltration; disconnect impervious surface areas to allow runoff to sheet flow across vegetated overland surfaces.
  (6) Use meadow filter strips at the downhill limits of development to filter runoff prior to any discharge from lots.

Sec. XX. – GSI + LID Pollutant Removal.

A major goal of GSI + LID strategies is removing pollutants from stormwater before it leaves a development or redevelopment site or subdivision. This "no adverse impact" approach to development—encouraged by FEMA and advocated by the Association of State Floodplain Managers (ASFPM)—focuses on source control. This section establishes the procedures to calculate pre- and post-development pollutant loads and the effectiveness of the stormwater treatment system design.

Example ordinance language:

(a) The *Guidebook* provides examples of [TECHNICAL MANUALS] with formulae to calculate the pollutant load for stormwater discharges.

(b) *Procedure to calculate pollutant loads and the effectiveness of stormwater treatment systems—Pre-Development Conditions.*
   (1) Delineate the watershed areas on the site for undeveloped conditions for each design point or point of concern. 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.
   (2) Label and determine the area of each watershed on the site.
   (3) Determine the type of land cover for each watershed area. For a retrofit or redevelopment site, assume the type of land cover that existed on the site prior to initial development.
   (4) Obtain annual rainfall amount in inches for the general location of the site.
   (5) Use the formulae provided in the [TECHNICAL MANUAL] to calculate the pollutants loads for pre-development conditions.

(c) *Procedure to calculate pollutant loads and the effectiveness of stormwater treatment systems—Post-Development Conditions*.
   (1) To fully integrate water quality into the site design, the type and location of the treatment systems need to be evaluated during the design phase and not at the end of the design period. The pollutant loading analysis is prepared twice during the development process: first, during the Conceptual Design Phase to determine the type of treatment systems needed to achieve water quality requirements; and second, when the final site plan is complete and accurate values for impervious cover are available.
   (2) Prepare a Conceptual Development Plan for the project.
   (3) Delineate the watershed boundaries on the site for future conditions. Divide the watersheds into the areas above the treatment systems that contributes to the treatment systems, and the areas below the treatment systems.
   (4) Calculate the area of each watershed.
   (5) Based upon proposed land use, 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. Only that area above the last treatment facility is run through the treatment system analysis. Pollutant loads from land below the last treatment system need to be calculated separately and added to the remaining load from the treatment system to determine the total load reaching the design point for future conditions. This is particularly important if TMDL limits are applicable to the receiving waters.
   (7) Use the formulae provided in the [TECHNICAL MANUAL] to calculate preliminary pollutant loads for post-development conditions on the site based upon the Conceptual Development Plan.
   (8) After the loads have been calculated for post-development, use the pollutant removal efficiencies provided and the formula in subsection (11) of this section to determine the type(s) of treatment systems needed to achieve water quality requirements.
   (9) After the professional engineer has determined the type of treatment system(s) required, the final site design must incorporate the(se) necessary stormwater treatment system(s).
   (10) After the site design is complete, repeat the steps in subsections (3) through (8) of this section with the accurately calculated areas for the final watershed(s) and impervious cover.

(11) *Pollutant Removal Calculation Procedure*.

a. (total load * 1st removal efficiency)
b. (total load – (load removed in a.)) * 2nd removal efficiency
c. (total load – (load removed in a. + b.)) * 3rd removal efficiency
d. (total load – (load removed in a. + b. + c.)) * 4th removal efficiency **. . . etc.**

Total Percentage Removed by Treatment Systems:
(load removed in a. +load removed in b. +load removed in c **. . . etc.**) / total load * 100

Sec. XX. – Channel Protection Flow.

Natural stream channels must be protected from both changes in the peak rate and volume of post-development stormwater. Matching the pre-development infiltration rate addresses one of the major adverse impacts to stream channel morphology. However, the other major adverse impact—increases in the peak rate of runoff—must also be addressed. Channel Protection Flow addresses the increases in the peak rate of runoff and the adverse impacts on the hydro morphology of the stream channel. The local government must determine the control method that best addresses their unique circumstances.

Example ordinance language:

One (1) of the following methods must be applied to maintain the depth and flow rate within a natural stream channel to minimize the adverse impacts to the stream channel itself as well as the benthic organisms that inhabit the bottom of the stream channel.

(a) Control the [2-year, 24-hour] post-development peak flow rate to [50% of the 2-year, 24-hour] pre-development level; or
(b) Control the [2-year, 24-hour] post-development peak flow rate to the [1-year, 24-hour] predevelopment level.

Sec. XX. – Conveyance Flow.

This section addresses the design standard for stormwater capacity in the treatment train or system and requires designs to adequately manage conveyance of a locally-determined storm standard, but should be modified to address any higher standard required by the prevailing state, regional, or local government.

Example ordinance language:

Open drainage or enclosed conveyance systems must be designed to provide adequate capacity for the flows leading to, from, and through stormwater management systems for the [10-year, 24-hour] storm event.

Sec. XX. – Flood Protection.

This section provides standards for management of stormwater runoff to minimize the off-site impacts of infrequent, large storm events, protect the integrity of the stormwater management design, and maintain the integrity of the pre-development floodplain.

Example ordinance language:

(a) The matching of the pre-development infiltration rate is an important metric measuring the effectiveness of a GSI + LID design. Once the volumetric requirement has been met, the designer can then focus on the metric measuring the matching of the Runoff Curve Number (RCN) values and then the potential changes to the peak rates of runoff. Runoff from impervious areas directed to infiltration systems that fully contain and infiltrate the required Water Quality Volume (WQv) can be removed from the calculation of the impervious area for that sub-watershed area. In addition, other impervious areas where runoff occurs as overland flow and will flow across a minimum of 100' of a pervious, vegetated surface, e.g., dense native groundcover, forest litter, or field, can also be removed from the calculation. The total area of the sub-watershed area must remain unchanged, with only those connected impervious areas included in the peak rate calculation for post-development conditions. The area of the excluded impervious area will be considered as Forest in Fair Condition for the purposes of the hydrologic analysis. For residential projects, where large extents of the site are preserved as undisturbed areas, this analysis will show how the RCN values for post-development conditions can be reduced to equal the RCN values for pre-development conditions. If the post-development calculation still shows an increase in the peak rate of runoff from the sub-watershed area, then attenuation of the peak rate is required. The increases in the peak runoff rate for the [10-year, 24-hour] and potentially the [100-year, 24-hour] storm event must be reduced to the pre-development peak rate. These increases must be reduced by the design and construction of appropriate structural measures.

(b) To prevent the increase in magnitude and frequency of storm events that exceed the bank full condition and spread out into the floodplain, to prevent flood damage from infrequent, large storms, to protect the integrity of the stormwater management system as well as maintain the existing boundaries of the predevelopment floodplain, the following on-site stormwater accommodations are required:
    (1) For sites no greater than [ten (10) acres], with no more than [20%] total impervious coverage, the [10-year, 24-hour] storm must be accommodated by the treatment system design.
    (2) For sites [ten (10) acres] or greater, with more than [20%] impervious coverage, both the [10-year, 24-hour and 100-year, 24-hour] storm events must be accommodated by the treatment system design.

Sec. XX. – High Density Residential and Non-Residential Redevelopment Projects.

Redevelopment projects on existing developed sites—particularly those proposing high-density or high-intensity residential, commercial, or industrial uses—that lack adequate stormwater treatment measures to remove pollutants from stormwater, present additional opportunities to reduce flood

hazards and risks and improve water quality. The purpose of this section is to provide a set of standards that apply to these sites.

Example ordinance language:

(a) The standards in this section apply to those high-density multifamily, and non-residential redevelopment projects that cause [10,000] square feet or more of the site area to be disturbed. If an industrial redevelopment project will contain a use with a high pollutant load. then the requirements of Section XX [LAND USES WITH POTENTIALLY HIGH POLLUTANT LOADS] of this ordinance apply.

(b) To apply the stormwater requirements on the site, the extent of the existing impervious surface area must be determined. All of the existing impervious areas, e.g., paved/gravel roads, parking areas, sidewalks, structures, etc., must be calculated from a current as-built survey of the site.

(c) The site area includes all the area upon which the current development is located. It may include multiple lots or parcels.

(d) Wetlands, watercourses, open water bodies, and lands protected by easement from development must be excluded from the site area for the calculation of percent impervious coverage.

(e) The development permit requires full compliance with groundwater recharge and water quality standards for the entire site.

(f) A waiver of this requirement may be requested from the [LOCAL GOVERNMENT GOVERNING BOARD] in accordance with Section XX [WAIVER OF GSI + LID REQUIREMENTS] of this ordinance.

Sec. XX. – Land Uses with Potentially High Pollutant Loads

Some commercial, industrial, and manufacturing land uses have a greater potential for higher pollutant loads and deserve a higher standard of review and stormwater treatment to assure they are designed to avoid adverse impacts on the community and their ground water. This section addresses these land uses.

Example ordinance language:

(a) *Intent and Purposes*.
Certain types of development have the potential for significantly higher pollutant loads. Care must be taken with the stormwater from these sites to prevent adverse impacts on surface and groundwater. The uses enumerated in subsection (b) of this section have the capability to generate high pollutant loads and are treated differently than other less impactful land uses. Due to the potential of high pollutant loads in the stormwater, the Groundwater Recharge Volume (GRv) for ground surface impervious areas do not have to be met for these sites, but the GRv must be provided for the roof areas. The Water Quality Volume must be fully provided for and adequately treated.

(b) *Land Uses with Potentially High Pollutant Loads*.
   (1) Industrial Sites
   (2) Outdoor storage and loading/unloading of hazardous substances
   (3) Storage of chemicals, hazardous waste, and associated loading areas (if unprotected from rainfall)
   (4) Gas stations
   (5) Exterior vehicle maintenance and service facilities, & equipment storage areas
   [. . . Other uses identified by the local government]

(c) All filtering or infiltrating GSI + LID treatment systems must be equipped with impermeable liners and underdrains that must discharge to conventional conveyance systems. Infiltrating treatment systems that are not lined are not permitted on these sites as the potential for groundwater contamination is high.

Sec. XX. - Implementing and Integrating GSI + LID Strategies in Development.

Moving forward from adoption of a GSI + LID Ordinance, new development is encouraged/required to implement the GSI + LID strategies to achieve the stormwater management capacities and quality standards of the ordinance and the* [TECHNICAL MANUAL]. *This section provides development permit application review requirements for new residential and non-residential development and requires certain redevelopment of projects that are not already approved single-family developments to retrofit the stormwater management system with GSI + LID strategies to the maximum extent feasible.

Example ordinance language:

(a) New development and redevelopment projects that require a development permit must implement integrated GSI + LID stormwater strategies as part of the development design. These strategies are not required for development of approved vacant single-family lots existing on the effective date of this ordinance.

(b) *Residential Development Permit Application Review Requirements*.
   (1) A Conceptual Development Plan, delineating the stormwater management design concept for the proposed development site, applying the site analyses and processes required under Section XX [Environmental Site Designs (ESD)/LID Analysis], of this ordinance.
   (2) If road grades are less than five percent (5%) with a crown, eliminate curbing and utilize vegetated GSI + LID bio-swale (dry or wet) along both sides of the road. The bio-swales should be designed to convey water to an appropriate GSI + LID treatment system. Vegetated filter strips should be utilized to convey water flow to the swale.
   (3) If the road grades are less than five percent (5%) and employ a uniform cross slope of two percent (2%), direct runoff to GSI + LID treatment systems, e.g., filter strip, wet or dry bio-swale, infiltration trench (with appropriate pretreatment), or bio-retention system.
   (4) If road grades are less than 5% with a crown or uniform cross slope with bituminous curbing, indicate notches to be cut in the curbing (minimum length of notch = 24”) at appropriate intervals (minimum [50 feet] apart) to convey runoff to GSI + LID treatment systems along the road, e.g., Bio-retention system or wet swales.
   {5) For roads with grades greater than 5%, standard curbing with catch basins necessary to collect stormwater, instead of conveying water runoff down the road in a pipe system, indicate where

outlet pipes will be installed from the rear of the catch basin to appropriate GSI + LID treatment systems for source control.

(6) *Residential Roof Runoff*.
   a. Rooftop disconnection that provides a minimum of [75 feet] of overland sheet flow across
      (i) a well-vegetated surface with an average grade of 8% or less; or
      (ii) an undisturbed wooded area with an average grade of 15% or less; or
   b. Connection of roof drains to a bio-retention facility.

(7) Driveways located below the grade of the road require impervious disconnection that provides a minimum of [75 feet] of overland sheet flow across a well-vegetated surface with an average grade of 8% or less, or an undisturbed wooded area with an average grade of 15% or less to treat and infiltrate runoff from the driveway.

(8) Driveways that drain to the road require runoff to be intercepted prior to reaching the road and directed to bio-swales or a bio-retention system.

(c) *Non-residential Development Permit Application Review Requirements.*

(1) Non-residential designs must utilize GSI + LID treatment strategies respecting the natural land form to the maximum extent feasible to reduce site grading requirements, erosion, and sedimentation issues.

(2) Parking and loading facilities constructed with grades less than 5% must grade the site to direct runoff to bio-retention facilities in parking islands or along the perimeter of the parking facility.

(3) Permeable pavement for parking spaces with standard bituminous concrete for driveways and parking aisles. GSI + LID filtering or infiltration systems must incorporate an impermeable liner and underdrain that connects to a component of a structural drainage system.

(4) Porous concrete for both parking aisles and parking spaces. Industrial uses must incorporate an impermeable liner into GSI + LID filtering or infiltration systems.

(5) Open course pavers with either topsoil/grass or crushed stone for those parking spaces that are only needed during certain limited calendar periods.

(6) The gravel storage layer under permeable pavement or porous concrete can be increased in depth to increase the storage volume for the runoff from roofs. Pretreatment of runoff must be provided by a vegetated GSI + LID treatment system.

(7) Impervious area disconnection may be utilized if there is sufficient space on the parcel.

(8) *Design standards for parking facilities.*
   a. To reduce impervious coverage, especially in large parking areas, 20 to 30 percent (20-30%) of overall total parking spaces must be compact (not standard sized) vehicle spaces.
   b. Utilize 60-degree diagonal parking spaces with a one-way maximum 18’ wide aisle.
   c. Promote shared parking agreements with pedestrian-proximate (e.g., reasonably realistic walking distance) properties, serving land uses with compatible hours of operation, e.g., an office building that closes at 5 pm with an adjacent restaurant that opens at 5 pm.
   d. Wherever possible, locate parking under buildings and structures to reduce the impervious area on a site.

(d) *GSI + LID System Retrofits for Redevelopment Sites*.

(1) To the maximum extent feasible, redevelopment projects in areas of the [LOCAL GOVERNMENT] not developed with existing single-family residential subdivisions on the effective date of this ordinance must employ GSI + LID concepts to retrofit stormwater management to reduce runoff volumes and provide attenuation of non-point source pollutants.

(2) GSI + LID retrofits may be incorporated within the existing infrastructure.

(3) GSI + LID planters, curb extensions, modular wetland systems, and bio-retention systems are acceptable GSI + LID systems for non-residential retrofits.

Sec. XX. - Waiver of GSI + LID Requirements.

Sometimes the circumstances of a particular real property are such that a given requirement cannot be reasonably accomplished. In such cases it is advisable to provide an "escape mechanism" to avoid an inordinate burden being imposed on reasonable development. It is the unique conditions of the real property—not the developer, owner, or potential purchaser for value—that drives the necessity of deviating from the core requirements and standards of the land development regulations. Such considerations should be processed in a manner that provides for adequate documentation of the local government action that will run with the land—not with a person.

Example ordinance language:

(a) An applicant may request the [LOCAL GOVERNMENT] waive a requirement of this ordinance.

(b) The waiver request application must include materials necessary to support the requested waiver.

(c) The [LOCAL GOVERNMENT DECISION-MAKING BODY] will obtain the professional opinion from the [LOCAL GOVERNMENT] Engineer regarding the waiver request as part of the staff recommendation and report on the application.

(d) Following a public hearing at which the [LOCAL GOVERNMENT DECISION-MAKING BODY] will give due consideration to the waiver request, the staff report, and the testimony from the applicant, the public, and the staff, the [LOCAL GOVERNMENT DECISION-MAKING BODY] will take one of the following actions:
   (1) Grant the waiver,
   (2) Deny the waiver,
   (3) Offer the applicant the option of obtaining a third-party review, subject to the provisions below with no guarantee the waiver will be granted.

(e) If following the public hearing the [LOCAL GOVERNMENT DECISION-MAKING BODY] offers the applicant the third-party review option, the review must be provided by an independent Florida-licensed professional engineer with significant expertise in GSI + LID practice and treatment systems.

(f) Retaining the independent professional engineer is subject to the following provisions:
   (1) The independent professional engineer is approved by the [LOCAL GOVERNMENT DECISION-MAKING BODY], and
   (2) All fees for the independent professional engineer are paid by the applicant.

Section [2]. SEVERABILITY. If any provision of this Ordinance is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions of this Ordinance.

Section [3]. REPEAL OF CONFLICTING ORDINANCES. All ordinances or parts of ordinances, and all resolutions and parts of resolutions, in conflict herewith are hereby repealed to the extent of such conflict.

Section [4]. EFFECTIVE DATE. This Ordinance shall become in full force and effect upon adoption by the Council [GOVERNING BOARD] in accordance with the Charter of the [LOCAL GOVERNMENT], Florida.

Section [5]. INCORPORATION INTO THE CODE. This ordinance will be incorporated into the [LOCAL GOVERNMENT] [Code of Ordinances/Land Development Regulations] and any section or paragraph, number or letter, and any heading may be changed or modified as necessary to effectuate the foregoing: Grammatical, typographical, and like errors may be corrected and additions, alterations, and omissions, not affecting the construction or meaning of this ordinance and the Code may be made.

PASSED AND ADOPTED this ____ day of _____, 202_.

_____

[LOCAL GOVERNMENT OFFICIAL SIGNATORY]

ATTEST:

_____

[LOCAL GOVERNMENT CLERK]

APPROVED AS TO FORM:

_____

[LOCAL GOVERNMENT ATTORNEY]

[1] David C. Rouse & Ignacio F. Bunster-Ossa, Green Infrastructure: A Landscape Approach 154, American Planning Association Planning Advisory Service Report #571 (Jan. 2013).