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# DETERMINING IMPLEMENTATION BARRIERS FOR GREEN INFRASTRUCTURE FOR COASTAL FLOOD CONTROL

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## Recommendations on How to Incorporate Green Stormwater Infrastructure into City of Orange Beach Ordinances

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The Mississippi-Alabama Sea Grant Consortium awarded a grant to Dr. Cris Surbeck, Kristina Alexander, and Liya Abera (together, Project Team) to assess the costs and efficacies of green stormwater infrastructure (GSI) when used on 5-acre or smaller sites in the Northern Gulf of Mexico. Dr. Surbeck is the Chair of the University of Mississippi Department of Civil Engineering Department, Liya Abera is a PhD candidate in Civil Engineering, and Ms. Alexander is an attorney with the Mississippi-Alabama Sea Grant Legal Program.

The Project Team evaluated site plans in Biloxi, Mississippi, and Orange Beach, Alabama, to see how the development planned for or built on those sites could use more GSI. The Stormwater Modeling Report is available here: <http://masglp.olemiss.edu/projects/greeninfrastructure/files/determining-implementation-barriers-for-green-infrastructure-for-coastal-flood-control.pdf>. The Project Team also assessed the costs, including life-cycle costs, of the GSI methods found to be most effective at reducing stormwater runoff on each site. The Life-cycle Costs and Co-benefit Analyses Report is available here: <http://masglp.olemiss.edu/projects/greeninfrastructure/files/mascg-lcca-report.pdf>.

As part of the grant, Ms. Alexander analyzed the ordinances of the two cities and offered ordinance revisions to increase GSI usage in those cities consistent with the costs and efficacies determined in the first part of the project. This is a summary of what was discovered in the assessment of the Orange Beach stormwater and land development ordinances. A chart is provided giving more detail and illustrating the concepts discussed herein.

The assessment considers how the City of Orange Beach flooding and stormwater ordinances address stormwater runoff and where those ordinances could be improved to allow for more GSI. Additionally, some of the recommendations are based on making the ordinances more accessible to stakeholders. The assessment is based on the engineering and life-cycle cost analyses performed by the Project Team, and also on a review of numerous other cities' ordinances with similar populations and climate. Also, while the project was being conducted, the Project Team met with Kit Alexander of the City of Orange Beach's stormwater department on multiple occasions, and received valuable input on ordinances and practices.

## **Overall**

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Orange Beach has strong stormwater practices in place. In fact the Project Team used provisions from Orange Beach in the Model Ordinances for this project. However, some recommended changes could make the city more resilient to stormwater runoff and increase the use of GSI. One fundamental recommendation is to make the stormwater, land development, and flooding ordinances relate to each other more directly. This report suggests several ways to do that.

## **Introductory Language in Ordinances**

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*Relevant Sections: 1-2; 42-224; 42-271*

The stormwater, flooding, and land development ordinances include introductory language to explain their purpose and goals. This is a good place to ensure that the two sections include GSI and also reference each other in a consistent way. One recommendation is to revise the language found in Sec. 42-224 (stormwater) to cross-reference the language of Sec. 1-2 (land development), which establishes the

rules of construction. This language provides that in the event of any contradiction in requirements, the one that is most protective of the city's interest shall prevail. This helps instruct a court on how to interpret the ordinances, notably, how they work together. Also, that language could be used in the reserved section Sec. 42-155 (flooding) to provide rules of construction harmonizing those provisions with the stormwater and zoning ordinances.

The Project Team reviewed the introductory language for stormwater planning, and it recommends including the goal of reducing flooding from storm events as a goal and referring to GSI as one tool to obtain that objective.

## **Definitions Related to Green Stormwater Infrastructure**

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### ***Relevant Sections: 42-225 (stormwater); Div. 2 (flooding)***

The Project Team's review found that definition sections are a good way to ensure that the zoning, stormwater, and land development ordinances coordinate and also reference GSI. For clarity purposes, it would be helpful to identify the section of ordinances for definitions in the flooding ordinances as being Sec. 42-170, rather than as "Div. 2." This appears to be an oversight, as Sec. 42-170 is unused. For example, the definitions in the stormwater ordinances are given a specific section, Sec. 42-225. Also, in both definition sections, it would be useful to number each definition to help with references. For example, in Sec. 42-225, the definition of "soil conservation plan" has six subsections, making it unclear how someone would refer to one of those subsections, such as: Sec. 42-225, soil conservation plan (3).

The Project Team recommends cross-referencing within the definitions, especially as regards 100-yr flood, base flood, and one percent flood, as these terms are used at different times in the ordinances despite having identical meanings. While the environmental ordinances were not reviewed, it is worth noting that rather than using terms consistent with those in the flooding and stormwater ordinances, notably a 25-yr 24-hour design storm, the environmental ordinances define a "significant storm event" as a "frontal boundaries, tropical lows, depressions, or storms, hurricanes, or other weather events that typically create predictable significant amounts of precipitation within a predictable time frame." (Orange Beach Ord. Sec. 30-2).

Additionally, consistency is needed in how surface absorption is used, which typically involve the terms permeable and impermeable. In the Orange Beach ordinances, impervious is defined, but that term is not as precise as *impermeable* when describing a surface's ability to absorb liquids. Also, while porous or permeable are used in the ordinances interchangeably, they are not defined. To avoid claims of the ordinances being inconsistent or ambiguous, the Project Team recommends using *permeable* and *impermeable*, rather than synonyms, and define each. For example, the definition of exfiltration/infiltration refers to "porous soil" but the application of those terms in Sec. 42-312(4) refers instead to "permeability." A court may find that where the same or similar processes are defined differently, the ordinances are illegally vague or ambiguous.

The Project Team recommends adding definitions for the following terms:

- *Green stormwater infrastructure*
- *Hydraulic conductivity*

- *Impermeable*
- *Infiltration rate*
- *Permeable*

The Project Team recommends revising the following terms:

- *Depressed bioretention facility*
- *Detention*
- *Exfiltration/infiltration*
- *Impermeable surface* (formerly impervious surface)
- *Retention*

## **Stormwater Infrastructure**

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### *Relevant Section: 42-247*

Orange Beach requires stormwater permits except for cases described in Section 42-247. The exceptions apply to single-family and duplex homes. An initial problem is that the language is confusing. It states that the ordinance exception applies to those homes: “built on individual lots that *may or may not* be part of a larger subdivision ...” (emphasis added). It appears that in instances in which a subdivision plan is approved, the ordinances intend that single-family and duplex homes in that plan do not need separate stormwater permitting. However, the literal meaning of the ordinance is that those homes may not require stormwater permitting regardless of whether they are part of an approved subdivision plan. Thus, it is not clear whether homes that are not part of a subdivision plan are exempt from stormwater permitting. This does not appear consistent with the overall stormwater plans of the city.

It appears inconsistent with the overall goals of reducing stormwater runoff to exempt single-family and duplex homes that are not part of an approved subdivision lot from stormwater limitation requirements. It is hard to see the value in allowing any construction, even residential, to increase downgradient stormwater runoff. Notably, that problem is most efficiently and effectively stopped at the time of planning/construction.

If the intent is to exclude all single-family and duplex homes, it is recommended to revise the language to state simply that those dwelling types are excluded, eliminating references to a subdivision plan.

The Project Team recommends using a “fill ordinance” to address a related problem when construction requires fill or otherwise would result in changing an area’s natural stormwater retention/detention function. In particular, this recommendation pertains to those areas not identified as special flood hazard areas or wetlands, yet still serving to hold and absorb stormwater runoff. Development in these areas not only reduces the permeable area but adds fill, disproportionately reducing the area’s runoff and absorption capabilities. Language is recommended to implement a fill ordinance for those areas.

## **Landscaping**

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*Relevant Sections: 4.03, 16.04B.2*

The Project Team found that depressed bioretention facilities and raingardens to be the most effective types of GSI in reducing stormwater runoff. The team recommends incorporating changes to landscaping provisions in the land development ordinances to maximize landscaping's ability to absorb stormwater runoff. Those changes could be to provisions describing buffers, or could apply to any area greater than 100 sq. ft. The team distinguishes these types of GSI from *swales*, even though both fairly could be described as ditches. However, the existing ordinances establish specific construction requirements for swales and require connectivity to natural waterways.

## **Irrigation**

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*Relevant Section: 16.04D*

Current rules require installation of irrigation systems. Such systems can increase stormwater runoff as they tend to be on an automatic function and irrigate landscape regardless of soil saturation. This is especially problematic in Orange Beach, a city that gets more than 64 inches of rain annually. One option is to eliminate the requirement for irrigation systems. A second option, and one that would be more protective of new plants, is to require an irrigation system with a moisture sensor so that it will operate only when needed.

## **Maintenance of Stormwater Infrastructure**

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*Relevant Section: 42-331*

The goal of the ordinances related to maintenance and inspection of stormwater infrastructure is to clarify the roles for the lifetime of stormwater infrastructure. However, the provisions do not clearly assign duties. For example, Section 42-331 states that maintenance "shall be accomplished by the legal entity responsible for maintenance", which is a circular assignment of that duty. The Project Team recommends revising Sec. 42-331 to clarify who is providing maintenance by assigning the duty to the owner of the property and recording the obligation with the title of the property. Additionally, the team recommends making all duties and responsibilities of any person for whose property a permit is issued under this article binding on subsequent owners of such property for so long as such stormwater management system is required.

## **Changes to Parking Lot Size to Reduce Stormwater Runoff**

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Land development ordinances are a good place for municipalities to acknowledge GSI and to make changes to reduce stormwater runoff. Parking lots are a particular challenge for managing runoff being vast areas of impermeable surfaces. One way to allow for more water filtration is to reduce the number of parking spaces, primarily at those parking lots that are not used daily. The Project Team recommends reducing number of paved parking places while allowing increased spaces on unpaved, maintained areas at churches, arboretums, botanic gardens, and parks. This allows "event" parking for larger crowds on special days without the loss to water filtration that having impermeable parking for maximum capacity causes.

## Orange Beach

**Land Development:** Sec. 42-1 – Sec. 42-150; **Flooding:** Sec. 42-151 – Sec. 42-216; **Stormwater:** Sec. 42-221 – Sec. 42-335

Topic	Existing Ordinance	Comments	Proposed Modification
<b>Introductory Material</b>			
	Sec. 42-151-154 has objective, purpose, intent but not interpretation.	Stormwater has statement regarding interpretation, flooding should too, for consistency.  Sec. 42-155 is reserved; use it.	Add: Sec. 42-155: The interpretation and application of this regulation shall be consistent with the Rules of Construction established by Sec. 1-2.
	Sec. 42-223: It is the intent of this regulation to protect, maintain, and enhance the health, safety, and general welfare of the citizens and natural resources of the city, by... (3) Encouraging the use of stormwater management systems that approximate natural systems.	Assessment: Does not reference green stormwater infrastructure or explain its benefit when describing goals of stormwater ordinances.	Revise: Sec. 42-223 (3) Encouraging the use of stormwater management systems that approximate natural systems such as green stormwater infrastructure as such systems improve water quality while reducing stormwater runoff.
	Sec. 42-224 Interpretation The interpretation and application of this regulation shall consider all regulation provisions as follows: (1) minimum requirements (2) liberally construed (3) do not limit or repeal powers of city.	Assessment: Need to establish rules of construction.	Replace all the language in Sec. 42-224 with the following: The interpretation and application of this regulation shall be consistent with the Rules of Construction established by Sec. 1-2.  Add (4) in the event of any contradiction in requirements, the one that is most protective of the city's interest shall prevail.
<b>Definitions (Flooding)</b>			
	Sec. 42-170 (a/k/a Ch. 42, Art. III, Div. 2) <i>Base flood</i> means the flood having a one percent chance of being equaled or exceeded in any given year (also referred to as the "one percent chance flood").  <i>One percent flood</i> , also referenced as "100-year Flood," is the flood that has a one percent chance of being equaled or exceeded in any given year.	Assessment: Section of definitions has no section number, but is identified only as Div. 2.  Assessment: No interrelation between definitions in Sec. 42-225 and Sec. 42-170.  Assessment: Definitions cross-link to Chapter 10, which is animals: "In addition to the definitions in chapter 10 of this Code..." Not the correct cross-reference.  Assessment: Three terms for same use, but not cross referenced: <i>Base flood</i> , <i>One percent flood</i> , <i>100-year Flood</i> . Also, no use of "one percent chance flood" as mentioned in definition of <i>Base flood</i> .	Revise: Identify definitions as being Sec. 42-170, not just "Div. 2"  Revise: In addition to the definitions in Chapter 42, Article IV of this Code, the following words shall have the meaning set forth below, unless the context clearly requires otherwise.  Add to Sec. 42-170 [formerly Div. 2]: In addition to the definitions in Sec. 42-225 of this Code, the following words shall have the meaning set forth below, unless the context clearly requires otherwise.  Revise: <i>Base flood</i> means the flood having a one percent chance of being equaled or exceeded in any given year (also referred to as the "one percent flood").  <i>One percent flood</i> , also referenced as "100-year Flood" or "base flood," is the flood that has a one percent chance of being equaled or exceeded in any given year.

Topic	Existing Ordinance	Comments	Proposed Modification
<b>Definitions (Stormwater)</b>			
	<p>Sec. 42-225</p> <p><i>Ex-filtration/infiltration</i> shall mean the discharge of runoff into groundwaters by filtration through suitable fine textured granular media such as porous soil, uniformly graded sand and gravel, or other natural or artificial aggregate, which may be used in conjunction with filter fabric and/or underdrain pipe.</p> <p><i>Detention</i> shall mean the collection and temporary storage of stormwater in such a manner as to limit the post-development peak discharge to pre-development peak discharge rates, with subsequent gradual release of the stormwater.</p> <p><i>Retention</i> shall mean the collection and temporary storage of stormwater in such a manner as to provide treatment through physical, chemical, or biological processes, with subsequent gradual release of the stormwater by percolation through soil, evaporation, or evapotranspiration.</p> <p>Sec. 42-225 Soil conservation plan (5) Swale shall mean a manmade trench that: a. Has a top width-to-depth ratio of ... etc. including contiguous water requirements</p>	<p>Assessment: Definitions are not individually numbered leading to odd citations, such as “soil conservation plan” having six subsections.</p> <p>Assessment: Definition of swale requires specific dimensions and waterway connectivity, perhaps limiting the use of ditches or other depressed areas as natural detention devices. Add definition of depressed bioretention facility.</p> <p>Assessment: Definition of <i>exfiltration/infiltration</i> uses “porous soil” but application of exfiltration and infiltration (Sec. 42-312(4)) refers to “permeability.”</p> <p>Assessment: Language within the definition of <i>exfiltration/infiltration</i> suggests that gravel and aggregate are always permeable.</p> <p>Assessment: <i>Detention</i> and <i>retention</i> definitions are nearly identical; they are also always used in tandem, i.e. detention/retention.</p> <p>Assessment: <i>Retention</i> definition adds “by percolation” to the <i>detention</i> definition, but then includes things that are not percolation, such as evaporation and evapotranspiration. Use evapotranspiration to cover both evaporation and evapotranspiration.</p> <p>Assessment: <i>Impervious</i> is defined, but is not the precise term needed. Also, <i>porous</i> and <i>permeable</i> are not defined and are used interchangeably.</p> <p>Assessment: Expand review of driveway material by City by deeming paving materials impermeable unless an approved permeable material is used.</p>	<p>Sec. 42-225</p> <p>Add the following definitions:  <i>100-year flood</i> is a flood with one percent chance of being equaled or exceeded in a given year. (Also referred to <i>Base flood</i> or <i>one percent flood</i>.)</p> <p><i>Depressed bioretention facility</i> is an area built below grade and designed to retain water for absorption or evapotranspiration, and does not function as a conduit to other waterways. Also referred to as <i>localized depressions</i>.</p> <p><i>Green stormwater infrastructure</i> includes systems within the built environment to replicate natural processes for absorbing, treating, and reducing stormwater runoff.</p> <p><i>Hydraulic conductivity</i> is the property of soil to allow water movement through it.</p> <p><i>Impermeable</i> means highly resistant to saturation from a liquid.</p> <p><i>Infiltration rate</i> is the rate at which water passes through a soil.</p> <p><i>Localized depression</i> is an area below grade and designed to retain water for absorption or evapotranspiration, and does not function as a conduit to other waterways. Also referred to as depressed bioretention facility.</p> <p><i>Permeable</i> means the ability of a material allowing liquids to pass through.</p> <p>Revise definitions:  <i>Best Management Practices</i> or BMPs pertaining to stormwater mean those site-specific practices required to control runoff resulting from design storm levels, and those as recommended in the sources found in Sec. 42-335.</p> <p><i>Detention</i> means the collection and temporary storage of stormwater in such a manner as to limit the post-development peak discharge to pre-development peak discharge rates, with subsequent gradual release of the stormwater. See also, <i>Retention</i>.</p> <p><i>Exfiltration/infiltration</i> means the selective removal of suspended matter from stormwater by passing the water through natural or artificial devices or through at least two feet of suitable fine textured granular media such as permeable soil, uniformly graded sand and non-compacted gravel or other natural or artificial aggregate, which may be used in conjunction with filter fabric and/or underdrain pipe.</p> <p><i>Impermeable surface</i> [formerly impervious surface] means a surface that is highly resistant to infiltration by water. For design purposes, all drives, parking, etc., shall be considered impermeable surfaces unless an approved permeable material is used.</p> <p><i>Retention</i> means the collection and temporary storage of stormwater in such a manner as to provide treatment through physical, chemical, or biological processes, with subsequent gradual release of the stormwater by percolation through soil or by evapotranspiration. See also, <i>Detention</i>.</p>

Topic	Existing Ordinance	Comments	Proposed Modification
<b>Stormwater</b>			
	<p>Sec. 42-247 Exemptions. The following activities shall be exempt from the stormwater permitting requirements of this regulation:</p> <p>(1) Single-family or duplex homes built on individual lots that may or may not be part of a larger subdivision which has a stormwater master plan that has been inspected and approved by the city. Single-family and duplex homes are subject to section 42-292 "impact fees".</p>	<p>Assessment: Exemption has vague language. Clean-up language about "may or may not" which allows single family homes not part of a subdivision to skip all approvals.</p> <p>Assessment: Exemption allows runoff from residential property [post-development] if single family homes or duplex.</p> <p>Assessment: Assess whether stormwater impact fees provide adequate revenue for stormwater inspection and maintenance.</p>	<p>Sec. 42-247 – revised:  (1) Single-family or duplex homes built on individual lots are exempt if they are part of a larger subdivision with an approved stormwater master plan confirming those homes do not increase downgradient stormwater runoff.</p>
	<p>Sec. 42-312(4)(l) Swales shall be designed to percolate 80 percent of the runoff from a three-year, one-hour design storm within 72 hours after a storm event, assuming average antecedent conditions.</p>	<p>Assessment: Specific definition not clearly distinguishable from localized depression or biodepression detention facility; may discourage use of ditches for stormwater detention.</p>	<p>Revised definitions – See above.</p>
<b>Parking Lots</b>			
	<p>Art. 8, Sec. 8.010407: Off-street parking facilities shall be designed to prevent damage to abutting property and streets and to prevent pollutants from draining off the site. Landscaped areas and perimeter areas shall be so graded as to receive a reasonable portion of the rainfall from the surrounding pavement.</p>	<p>Assessment: Add provisions to appropriate land use section for unpaved areas to provide surplus parking areas for big events at churches, parks, and gardens.</p>	<p>Add:  Places of worship: 1 per 10 seats in the principal assembly area may be paved; an additional parking place per two seats may be created in sodded, maintained areas.</p> <p>Park, Arboretum, or Botanical Garden: 1 per 250 sf + 1 per 6 persons of maximum outdoor facility capacity; an additional parking place per 2 persons may be created in sodded, maintained areas.</p>
<b>Landscaping</b>			
	<p>Art. 16, 16.04A The minimum percentage of the total developable site which shall be devoted to landscaping, unless otherwise specified in this Article, shall be 20 percent.</p> <p>16.04B2 The minimum size of an interior planting area shall be one hundred fifty (150) square feet and a minimum width equal to eight (8) feet.</p>	<p>Assessment: Increase infiltration of landscaped areas so that they function as green stormwater infrastructure. Establish saturation rate or use language from swales</p>	<p>Add: 16.05A(6)  For any landscaped area greater than 100 sq. ft. the landscape plan shall indicate how that area will</p> <p>(a) provide saturated hydraulic conductivity greater than or equal to 0.50 in/hr for clay soils, 5.00 in/hr for sand soils; or</p> <p>(b) percolate 80 percent of the runoff from a three-year, one-hour design storm within 72 hours after a storm event, assuming average antecedent conditions.</p>

Topic	Existing Ordinance	Comments	Proposed Modification
<b>Landscaping (cont.)</b>			
	<p>16.04B.2: Interior planting areas shall be located on the site to incorporate the preservation of on-site protected trees, where possible.</p>	<p>Assessment: Landscaping is not used to maximize water infiltration, such as by employing GSI. Infiltration rates should be set.</p>	<p>Add: 16.04B.2 Interior planting areas: Where practicable, interior planting areas of at least 100 square feet shall include a raingarden or other green stormwater infrastructure sized to hold stormwater runoff from between 5 and 10 percent of the impervious area draining to it, and with native plants planted in a sand/soil matrix soil bed with a mulch cover layer.</p> <p>Alternate version: Where practicable, interior planting areas of at least 100 square feet shall include a raingarden or other green stormwater infrastructure to provide water infiltration at a rate of 0.50 in/hr for clay soils, and 5.00 in/hr for sand soils. Interior planting areas shall incorporate trees to the maximum extent possible.</p>
<b>Buffer</b>	<p>Art. 4, Sec. 4.03 [sidelot parking allowed if] five-foot landscaped buffer containing hedge materials is provided between the vehicular use area and the adjacent property.</p> <p>4.0502 – buffering requirements between incompatible uses either 20’ to 30’, with highest between low impact and high impact uses.</p> <p>4.0504(b) The height of the landscaping shall not be less than eight (8) feet at the time of planting and at all subsequent times to afford provide protection to the more restrictive land use from the glare of lights, blowing paper, dust and debris, visual encroachment, and to effectively reduce the transmission of noise.</p>	<p>Assessment: Buffers are not maximized to increase capture of stormwater runoff</p>	<p>Add: Buffers of an area of at least 100 sq. ft. shall be designed</p> <p>a) to allow for water infiltration at a rate of 0.50 in/hr for clay soils, and 5.00 in/hr for sand soils; or</p> <p>b) to hold stormwater runoff from between 5 and 10 percent of the impervious area draining to it as specified in the BMPs.</p>
<b>Irrigation</b>	<p>16.04D – A fully automatic, permanent irrigation system shall be installed, providing one hundred percent (100%) coverage of all required landscape areas..</p>	<p>Assessment: Can lead to increased stormwater runoff as area gets 65” a year and there is no requirement for soil saturation gauges.</p> <p>Choice will dictate how to revise 16.05A(4) which requires information on irrigation system to be included in landscape plan.</p>	<p>Revise 16.04D</p> <p>Option 1: Eliminate requirement for irrigation system.</p> <p>Option 2: A fully automatic, permanent irrigation system shall be installed with fully functioning soil moisture sensors, providing 100 percent coverage of all landscape areas.</p>

Topic	Existing Ordinance	Comments	Proposed Modification
<b>Landscaping (cont.)</b>			
<b>Retention/detention ponds</b>	42-272(a) Runoff and other associated discharges resulting from a 25-year, 24-hour storm event (or less) should be handled through the design and maintenance of retention/detention areas or exfiltration/infiltration systems where approved. For those storm events greater than this magnitude, other options should be considered to detain runoff so no direct discharge to the aforementioned areas occurs.	Assessment: Need more assurances that retention/detention facilities are wisely situated -- above the estimated seasonal high groundwater elevation as determined by a registered geotechnical engineer.  Assessment: Need requirement for percolation test data must be provided in support of the required 1-inch first flush water quality treatment volume percolating within the required 72 hours.	Add to 42-272(a) (1) All required retention/detention areas must be installed above the estimated seasonal high groundwater elevation as determined by a registered geotechnical engineer. (2) All planning documents that include a retention/detention area must include percolation test data to support that the area performs water quality treatment for the 1-inch first flush volume within 72 hours.
<b>Enforcement</b>			
<b>Maintenance</b>	42-331: Maintenance of all stormwater management systems approved in compliance with this article shall be accomplished by the legal entity responsible for maintenance.	Assessment: Add reference to continuing duty. Record an enforceable maintenance agreement with the title of the property. Also, a bit of a tautology.	Revise: Sec. 42-331: (a) Maintenance of all stormwater management systems approved by the City shall be assigned to the owner of the property and recorded with the title of the property. (b) All duties and responsibilities of any person for whose property a permit is issued under this article shall be binding upon subsequent owners of such property for as long as such stormwater management system is needed.
	Sec. 42-311(a)(5), Post-construction BMPs to manage stormwater discharges from the altered area such that it maintains pre-developed conditions equal to or less severe than the 25-year storm event.	Assessment: Storm event is not consistently identified.	Revise: 42-311(a)(5) Post-construction BMPs to manage stormwater discharges from the altered area such that the area maintains pre-developed runoff conditions for at least 25-year 24-hour design storms.  Consider changing the design storm to 100-year 24-hour, as more frequent, more intense storms are likely.
	Sec. 42-271: As part of the city's effort to minimize water quality problems in its adjacent and internal water bodies, the primary goal of its retention/detention planning is to eliminate any direct discharges to the Gulf of Mexico, Gulf beaches, coastal dunes, the Intercoastal Waterway and any contiguous surface waters thereof, or wetlands. In addition, no direct discharges originating from storms less than or equal to a 25-year, 24-hour event will be made to the Intercoastal Waterway or Wolf Bay. To achieve these goals, the city encourages the use of retention/detention areas in future developments. However, other acceptable engineering methods, such as exfiltration/infiltration devices, may be approved.	Assessment: Flooding is not identified as problem related to stormwater runoff.  Assessment: GSI is not identified as a method to address stormwater runoff and/or flooding.  Assessment: How storm events are defined is not clear within Stormwater Ordinances.	Revise 42-271, beginning by adding a new third sentence: The city also plans to limit the impact from stormwater runoff on localized flooding following such storm events. To achieve these goals, the city encourages the use of retention/detention areas, including those that incorporate green stormwater infrastructure, in future developments. However, other acceptable engineering methods, such as exfiltration/infiltration devices, may be approved.  The impact from storms are based on the quantity of rainfall (in inches) over time and should be consistent with the rates found in the National Oceanic and Atmospheric Administration database, NOAA Atlas 14 Point Precipitation Frequency Estimates.

<i>Topic</i>	<i>Existing Ordinance</i>	<i>Comments</i>	<i>Proposed Modification</i>
<b>Enforcement (cont.)</b>			
		<p>Assessment: Certain areas serve as temporary detention/retention areas due to being bowl-shaped depressions. When construction in such a depressed area adds fill, there's a loss of stormwater storage. Require creation of equivalent stormwater storage nearby or increase requirement for storage onsite by detention/retention facilities.</p>	<p>Recommendation for new ordinance:  (1) To avoid increasing stormwater runoff, any construction in an area which functions as a natural temporary detention/retention of stormwater runoff shall be approved only upon verification by the city of plans to offset the stormwater storage lost by the construction. Those plans shall  a) provide for an area in the immediate vicinity that will store an equivalent amount of stormwater; or  b) where such stormwater offset is infeasible, increase the capacity of the onsite detention/retention facility.  (2) This provision does not supersede any restrictions applicable in special flood hazard areas or other specifically designated flood zones.</p>