ARTICLE 8

SITE GRADING, STORMWATER DETENTION, CULVERTS AND PIPED DRAINAGE SYSTEMS AND EROSION CONTROL REQUIREMENTS

8.1 SITE GRADING

8.1.1 Grading shall be done in accordance with the lines and grades shown on the approved grading plan.

8.1.2 Grading plans shall show existing and proposed contour lines at an interval of no more than two (2) feet. Grading plans shall outline the areas which are required to remain undisturbed (i.e., tree protection areas, buffers, etc.) and shall indicate protective fencing or staking to be placed surrounding such areas.

8.1.3 If the property is within the jurisdiction of the Metropolitan River Protection Act, the grading shall be consistent with the River Corridor Certificate approved for the project.

8.1.4 Embankments shall be placed in uniform layers not to exceed a compacted thickness of six (6) inches per layer and shall be compacted to a density of ninety-five (95) percent of the maximum laboratory dry weight per cubic foot as determined by AASHTO Method T-99 in all areas where structures, parking lots and drives, streets, and utilities are to be placed. All other embankments are to be compacted to at least eighty-five (85) percent.

8.1.5 The maximum slopes for cut or fill shall be 2H:1V (two feet of horizontal run for each foot of rise or fall), except 1) for earthen dam embankments, 2) for rock cuts, 3) where certified by a professional geotechnical engineer or 4) as discussed in Section 8.1.6, below. Earthen dam embankments shall be 3H:1V maximum unless a modification application is approved. The intent of the earthen dam embankment slope regulation is to provide for public safety, soil stability, and dam maintenance considerations. The depth of cut referred to herein shall be the maximum cut or fill that shall be allowed to occur in any one section of cut or fill. The slope of cut or fill shall be uniform throughout for each section of cut or fill unless benching is approved by the City. When a cut is made in rock that requires blasting, the slope may be steeper if pre-splitting is employed and upon submission of a geo-technical report which substantiates the integrity of the rock in the steeper condition, subject to the review and approval of the City Manager. (Note: No blasting shall occur without a valid permit issued by the Fire

Marshall's office.) Refer to the Standard Drawings for grading section and retaining wall details.

8.1.6 While most soils in the area can be safety stabilized at a 2H:1V slope, some soils exhibit a low shearing resistance and a low cohesiveness. These soils typically are micaceous silts and sandy soils with little or no clay. If the 2H:1V slope shows evidence of shearing, non-cohesiveness, sliding, or inability to maintain compaction, the slope shall be stabilized at 3H:1V or by using such mechanical methods as needed (such as retaining walls or "grow mats" stapled in place) to maintain slope, height, and integrity.

8.1.7 A grading plan showing building pad locations shall be submitted for residential subdivisions, unless a modification application is approved, zoned for a lot size of less than twelve thousand (12,000) square feet or a density of four (4) units per acre or more. The intent of this regulation is to ensure adequate lot to lot drainage. Granting a modification will not nullify the intent of these regulations when the layout has a minimum lot area of fourteen thousand five hundred and twenty (14,520) square feet and a minimum lot width of ninety (90) feet. The grading plan may be used as a construction document prior to approval of the Final Plat or as a guidance document for individual lot grading after approval of the Final Plat.

8.1.8 Grading for roads and improved ditches shall be shown.

8.2 STORMWATER DETENTION

8.2.1 Stormwater Management Report Required:

a. Every project shall provide a Stormwater Management Report prepared by a professional engineer currently registered in the State of Georgia. The purpose of this report shall be to formulate a plan to manage stormwater runoff so that stormwater runoff hazards are not created and existing runoff-related problems are not exacerbated, either upstream or downstream from or within the boundaries of the property being developed. The engineer shall be responsible for obtaining all information necessary for the report. Hydrologic analysis and detention pond hydraulics, pipe and open channel hydraulics, culvert hydraulics, water quality best management practices, flood studies for any floodplain or flood prone areas, and hydrologic and hydraulic analysis and design calculations which are performed for the design of a dam as defined in Section 8.6 of these

regulations, shall be certified by a professional engineer registered in the State of Georgia.

b. The Stormwater Management Report shall identify the locations and quantities of stormwater runoff entering and exiting the site for both pre- and post-developed conditions. Analysis of the off-site properties shall anticipate future development in addition to addressing existing conditions. All culverts, pipe systems, and open channel flow systems shall be sized based on all on-site upstream areas being developed in accordance with the development plans and the off-site upstream areas being developed in accordance with the City's adopted Existing Land Use Plan with no detention. Upstream detention may be included when determing flows, provided the engineer calculates the reduced flows by routing the developed flows through any stormwater facility included in the analysis rather than assuming the reduction will occur. The engineer shall show that detention facilities used in the analysis will remain, be properly maintained and the storage volume and outlet structure is based on current conditions.

Detention facilities shall be designed using pre-development flows based on existing conditions for all upstream areas including existing on-site lakes and detention. Post-development flows, except the 100-year flow, shall be based on on-site upstream areas being developed per the development plans and existing conditions for off-site upstream areas. The 100-year flow shall be based on on-site upstream areas being developed per the development plans and the off-site upstream areas being developed per the City's adopted Existing Land Use Plan with no detention. Upstream detention may be included if it meets the conditions as described for culverts and pipe systems. Existing conditions shall be defined as the conditions of the site at the time of application for a land disturbance permit. The existing condition includes on-site lakes and ponds. Pre-development flows shall be determined by routing the pre-developed flows through these stormwater facilities. Flows used to size the outlet structures for detention facilities that exceed the 25-year design flow shall be sized as described for culverts and pipe systems. When more than twenty-five (25) percent of the property of a developed project site is disturbed for either redevelopment or improvement, the Stormwater Management Report shall be prepared for the entire site and existing impervious areas shall be treated as forest in the pre-development analysis. When twenty-five (25) percent or less of the property is

disturbed, detention shall be provided as required by these regulations for the disturbed area and existing impervious areas which are disturbed shall be treated as forest in the pre-developed analysis.

The Stormwater Management Report shall contain drainage area delineation maps and other exhibits at satisfactory scale and sufficient in quantity and scope to define the boundaries of the site and off-site areas, relative to watercourses, drainage divides, drainage structures, and other pertinent features. Gwinnett County's Geographical Information System mapping may be used where available.

c. For the purposes of these regulations, the words "downstream" and "analysis" shall have the following meanings. The analysis of downstream conditions in the report shall address each and every point or area along the project site's boundaries at which runoff will exit the property. The analysis shall focus on the portion of the drainage-way "immediately" downstream from the project. This area shall extend downstream from the project to a point in the drainage basin where the project area is ten (10) percent of the total basin area.

a. The report shall examine the conditions downstream from the project to a point where the project area is ten (10) percent of the total drainage basin.

a). The analysis shall include all culverts, obstructions, existing and potential erosion problems, elevations of existing improvements, existing drainage complaints and any other existing modifications to natural conditions. The downstream water courses and receiving conveyance shall be analyzed to ensure that the channel velocities do not exceed values recommended in the Design Manual nor does the pipe system exceed current design criteria of these regulations; and

b). If the existing downstream conditions are overburdened by the pre-development flows in the stream or are a result of the development, then the developer shall resolve the problem. The meaning of "overburdened" shall include but not be limited to situations where 25-year velocities exceed the non-erosive velocity of the stream, habitable structures are shown to

be subject to flooding for any frequency up to and including the regulatory flood and stormwater facilities that can not carry the design storm in accordance with these regulations; and

c). If there are any problems identified downstream that are a result of the development, then the developer shall eliminate the conditions causing the problem.

2. Hyrdographs shall be analyzed at least at two (2) points. One study point shall be at the downstream property line where the watercourse crosses the project site's downstream boundary line. The second study point shall be downstream of the project at the point where the project area is ten (10) percent of the total drainage basin.

a). The study will compare pre-developed hydrographs with post-development hydrographs for the 2, 5, 10, 25, 50 and 100-year flood frequencies;

b). Comparison of peak flows shall include the timing of hydrographs;

c). Hydrographs shall be based on a 24-hour storm; and,

d). The analysis shall be in accordance with the Gwinnett County Stormwater Design Manual.

d. The following criteria shall be evaluated by the registered engineer preparing the Stormwater Management Report, and in determing whether or not detention should be required for any portion of the site;

1. Existing land use downstream;
2. Anticipated future land uses downstream;
3. Magnitude of increase in peak flows due to development;
4. Presence of existing drainage problems;
5. Capacity of existing and anticipated drainage systems;
6. Creation of concentrated flows where none had occurred previously;
7. Availability of feasible locations for detention facilities;

8. Existing flows generated off-site which pass through the project site; and,
9. The nature of the receiving watercourse.

e. When a development uses an existing facility where the last approved certification and record drawing of the facility was over eighteen (18) months prior to the new development's submittal, the engineer shall provide one of the following.

1. A new survey, drawing and certification showing that the outlet structure is constructed as approved and the flood storage and water quality volume of the facility is equal to or greater than the volume required when the facility was approved.
2. Construction plans and calculations showing that the outlet structure will function as designed and the flood storage and water quality volume of the facility will be equal to or greater than the volume required when the facility was approved once the proposed maintenance has been performed.
3. A new record survey, drawing, study and certification showing that the facility meets the development requirements when the facility was approved.

f. Design Criteria – General
All design related to storm water shall be in accordance with the Gwinnett County Stormwater Design Manual.

g. Evidence of Acquisition of Applicable Non-Local Permits
The applicant shall certify and provide documentation that all other applicable environmental permits have been acquired for the site prior to approval of the Stormwater Management Report.

8.2.2 Stormwater Detention Required:

a. Whenever a Stormwater Management Report indicates that adverse impact from stormwater runoff is expected to result from the development of a property, that project shall be provided with stormwater detention facilities. The meaning of "adverse impact" shall apply when pre-development flows did not cause difficulties and post-development flows do. Difficulties shall include but not be limited to situations where 25-year velocities exceed the non-erosive velocity of the stream, habitable structures are shown to be subject to increased depth of flooding for any frequency up to and including the regulatory flood, and stormwater facilities that

can not carry the design storm in accordance with these regulations.

b. Stormwater detention facilities required in section 8.2.2.a. shall be provided, unless the registered professional engineer preparing the Stormwater Management Report certifies and provides certified documentation supporting the conclusion to the City that at least one of the following is true and correct as applicable:

1. The not-detained, post-development runoff will leave the project site as sheet flow, and will not have an adverse impact on downstream properties. The increase for the 25-year storm should not exceed one (1) cubic foot per second (cfs) over a length perpendicular to the flow of one hundred (100) feet.

2. The effect of detention would be to concentrate flows where sheet flow had occurred under pre-development conditions, and any impact of increase sheet flows upon downstream properties would be less adverse than that which would result from the concentrated flows from a detention facility even if energy dissipation devices were employed.

3. The undetained flow will pass through downstream properties, in drainage easements obtained by the developer, to an existing detention facility which has been designed to manage the upstream property's runoff or to the point in the downstream analysis (see 8.2.1.c.) which shows that detention is not required.

4. Where the site runoff will flow directly into a stream or lake without crossing off-site properties:
   a). 24-hour detention of the 1-year storm is required if water quality protection is required for the project.
   b). Only peak detention for the 2-year through the 25-year storm is not required if the downstream analysis using timing of the hydrographs shows no adverse impact from the exit of the site to the point immediately downstream from the project in the drainage basin where the project area is 10 percent of the total drainage basin area.

c. Should the authorized registered professional conclude that storm water detention may not be necessary because of anticipated compliance with Section 8.2.2.b., rigid compliance with all of the following criteria is mandatory:

1. A Stormwater Management Report shall always be required whether or not storm water detention is required.

2. If the applicant proposes to show that the detention requirement may be eliminated for all or a portion of a project, then a pre-submittal conference with the City staff is required prior to preparation and submittal of construction plans for the project.

3. At the pre-submittal conference with the staff, the engineer shall be prepared to discuss the downstream analysis findings as follows:

a). The affected stream must be analyzed downstream from the project to a point where the project area is ten (10) percent of the total drainage basin. The analysis must include all culverts, obstructions, existing and potential erosion problems, elevations of existing improvements, and any other existing modifications to natural conditions; and,

b). If the existing downstream conditions are overburdened by the pre-developed flows in the stream, then detention shall be required unless the developer elects to eliminate the downstream overburdened conditions at his or her expense when the development occurs; and,

c). If there are any existing drainage complaints downstream, then detention shall be required unless the developer elects to minimize the conditions causing the complaint at his or her expense when the development occurs.

8.2.3 Detention Design Criteria – General:

a. All stormwater detention pond hydrologic and hydraulic analysis and design calculations shall be certified by a

professional engineer currently registered in the State of Georgia.

b. All stormwater detention facilities shall be designed to detain the 1-year storm runoff, for the area draining to the pond, for twenty four (24) hours. For the project, this volume called the channel protection volume, shall be equal to or greater than the 1-year storm runoff volume from the project. In addition, these facilities shall control the peak flow rates associated with storms having 2-year, 5-year, 10-year, and 25-year return frequencies so that flows from the developed site do not exceed those associated with pre-development conditions at the project boundary nor increase the peak flows downstream from the project to the point in the drainage basin where the project area is ten (10) percent of the total basin. Where adverse impacts, as defined in Section 8.2.2.a, occur during the 100-year storm, the 100-year storm shall also be regulated.

c. A variety of methods of achieving stormwater management goals shall be acceptable in providing detention facilities. The type of facility provided shall be based on the following criteria:

1. The type of development for which the detention facility is being provided;

2. The type of development which the detention facility is intended to protect.

3. Volume of stormwater to be stored;

4. Origin and magnitude of the flows to be managed;

5. Topographic opportunities and limitations;

6. Safety consideration;

7. Maintenance requirements;

8. Aesthetic considerations;

9. Likelihood of facility operation interfering with access to public or private facilities;

10. Proximity of facility to property lines, utilities, buffers, etc., and

11. Similar site-specific constraints.

d. Detention facilities may be of any of the following types, and two or more types may be used in combination with one another:

1. Normally-dry basins, whether excavated or created by damming a natural drainage feature, or a combination of both methods;

2. Lakes and ponds, whether excavated or created by damming a natural drainage feature, or a combination of both methods;

3. Parking lot facilities;

4. Underground facilities, and

5. Roof top facilities.

e. Reservoir routing methods shall be used for all detention facility design. The size of the orifice to detain the 1-year storm for the facility shall be computed using the following orifice equation with a twenty-four (24) hour draw down time from the elevation of the total channel protection volume (CPV) and an orifice coefficient of six tenths (0.6). The minimum elevation of the 2-year control shall be at the maximum routed pool elevation of the 1-year storm and not pool elevation of the total 1-year storm volume.

h = head measured in feet from the elevation needed to store the total 1-year runoff volume (CPV) to the centroid of the orifice;
Qa = average CPV outflow rate in cfs;
Qa = CPV/3600 x 24;
A = required orifice area in square feet;
$A = Qa/(0.6 \times (64.4 \times h/2)^{0.5})$.

f. The hydrologic methodology used for any given project shall conform to the Gwinnett County Storm Water Design Manual.

g. Runoff coefficients and runoff Curve Numbers used for pre- and post-development conditions shall be consistent with those shown in the Gwinnett County Storm Water Design Manual. The SCS method shall be used where applicable to

check the magnitude of peak flows when other hydrologic methods recommended in the manual are used.

h. Calculations shall be provided showing how all times of concentration or lag times were computed, both for pre- and post-developed conditions. Likewise, adequate support must be provided for all composite runoff coefficients of curve numbers used.

i. If a computer program is used for hydrologic and hydraulic analysis and design, including generating and routing hydrographs, the output from the program shall be summarized in the Stormwater Management Report, and the name and version of the program shall be indicated. Computer output sheets may be attached to the report if desired by the design engineer or if requested by the City.

j. The design of every detention facility of any type shall consider the effects of both inflows in excess of those the facility is designed to accommodate and of malfunctioning of the primary outlet system. A safe path for overflow condition flows shall be provided.

k. Weirs shaped like a “V” (“V” notch weirs) shall be used where practical, considering structural or hydrological concerns.

l. In residential subdivisions, no more than fifty (50) percent of the basin perimeter may be a wall of any type.

8.2.4 Detention Facility Location Criteria:

a. For purposes of these Regulations, a detention facility shall be deemed to consist of the area within the maximum design ponding limits unless a modification application is approved, the dam (if any) including all embankment slopes and wall footings (if applicable), primary and emergency outlet works, any drainage and access easements, and any energy dissipation devices. The intent of these Regulations is to ensure that the extent of the facility is defined to allow flooding, access and maintenance. Granting of a modification will not nullify these Regulations when the facility is a wet pond or lake, the area within the maximum design ponding limits is reduced to a few feet inside the normal pool elevation, and easements are provided on the perimeter properties to allow for flooding, access and maintenance around the lake. In addition, granting of the modification shall only be considered when the wet pond is

an amenity and under no circumstances shall the dam and outlet structure lie on private property.

b. Detention facilities, to the greatest extent feasible, shall be located so as to minimize the amount of flow generated on-the project site that bypasses the facility.

c. No portion of any detention facility shall disturb any required (as opposed to voluntary) buffer, landscape strip, or tree protection area, except that natural bottom detention ponds and its appurtenant structures, which require no grading and removal of trees, may encroach into a required construction buffer.

d. The 100-year ponding limits of a detention facility shall not encroach upon a public right-of-way.

e. Detention facilities may be located within utility easements or rights-of-way, or encroach upon utility easements or rights-of-way, upon receipt by the City of written permission from both the property and utility owners.

f. Detention facilities may be constructed within recreation areas required under Section 5-13 of these Regulations, if the following criteria are met:

1. Ownership of the area will be held by a qualified property owner's association, homeowners association, or other private party.

2. Permanent structures, such as buildings and swimming pools, will not be constructed within the boundaries of the detention facility.

3. Detention facilities within recreation areas will be approved only if the design of the area includes recreation amenities such as ball fields, tennis courts, grassed open areas or other similar improvements. The intent is to provide recreation facilities with detention as a secondary feature.

4. Permanent detention features shall not interfere with the intended use of the recreation amenity, (i.e., a ditch or large swale shall not traverse a ball field, an inlet structure shall not be in a tennis court, etc.).

g. If a residential subdivision is provided with an on-site detention facility not located within a recreation area as

specified in 8.2.4.g above, a mandatory property owners' association shall be established for its ownership and maintenance. The facility shall be located on a single lot within the development and owned by the property owners association. The lot shall have a minimum of thirty (30) feet of public road frontage and a minimum lot width of thirty (30) feet. If the project is provided with an off-site detention facility, a mandatory property owners' association shall be established for its maintenance. The association bylaws shall be recorded concurrently with the recording of a final subdivision plat. The association bylaws shall include the same provisions as specified in Subsection 5.9.2, Paragraph b. of these Regulations.

h. A non-residential subdivision is not required to locate an on-site detention facility on a separate lot. The property owners served by a detention facility that provides detention for more than one property owner or is located off-site shall enter into a maintenance agreement acceptable to the City for the facility's maintenance. However, if desired by the developer, the facility may be located on a separate lot if it is owned and maintained by a mandatory property owners' association.

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8.2.5 Detention Facility Easement Requirements:

a. An easement at least twenty-five (25) feet in width shall be required to provide access to all detention facilities from a public street.

b. Access Easement

1. The access easement shall be cleared, grubbed and graded so that it can be utilized by rubber-tired construction vehicles.

2. The minimum drive width shall be fifteen (15) feet.

3. The drive shall be grassed or paved.

4. The maximum slope shall be twenty (20) percent (5H:1V).

5. Access easements may be combined with drainage easements containing an open channel; however, the combined easement shall be a minimum of thirty (30) feet in width and shall be wide enough for the drainage channel and the drive.

6. A drive to the bottom of the pond shall be provided when the facility is over ten (10) feet deep from the bench elevation or the facility is wider than fifty (50) feet as measured from bench to bench.

c. Every normally dry detention basin, lake, or parking lot detention facility shall be completely enclosed within a drainage easement. The drainage easement shall extend at least ten (10) feet beyond the 100-year flooding limits of the detention facility.

8.2.6 Detention Facility Maintenance:

a. The detention storage capacity or function of any detention basin, pond or other impoundment, whether natural or man-made, shall not be removed or diminished without the express approval of the City.

b. In a residential subdivision, it shall be the responsibility of the mandatory property owners' association to maintain the operational characteristics of any facility constructed on their property for stormwater detention pursuant to City requirements, to keep the access drive free of obstructions, and to maintain the facility free of obstruction, silt, trash or debris.

c. In a non-residential subdivision or project served by a detention facility that provides detention for more than one property or by an off-site facility, it shall be the responsibility of the mandatory property owners' association to maintain the operational characteristics of any facility constructed on their property for storm water detention pursuant to City requirements, to keep the access drive free of obstructions, and to maintain the facility free of obstruction, silt, trash or debris.

d. In a non-residential project with an on-site detention facility which serves only that project, the property owner shall be responsible to maintain the operational characteristics of the facility pursuant to City requirements, to keep the access drive free of obstructions, and to maintain the facility free of obstruction, silt, trash or debris.

e. Prior to the issuance of a Development Permit, the owner shall submit a detailed schedule of long-term maintenance and inspection activities. This schedule of activities shall be incorporated into a maintenance agreement to be entered

into between the owner and a maintenance provider. The schedule shall describe all maintenance and inspection activities and the parties responsible. The maintenance agreement shall be in a form acceptable to the City and shall be recorded in the deed records of the Clerk of Superior Court of Gwinnett or Hall County as appropriate.

8.2.7 Detention Facility Construction Standards:

a. Stormwater detention facilities shall be constructed in accordance with plans reviewed and approved by the City , and shall be in place and inspected prior to the initiation of other improvements. If the detention facility is planned to be a lake, temporary detention facilities shall be provided and shall remain in place until such time as the lake has become effective in providing stormwater management.

b. Within a detention basin, all stumps are to be cut flush with the ground or removed and all debris is to be removed below a 1.2 inch rainfall event ponding elevation. Trees or shrubs may be allowed to remain below this ponding elevation only upon certification of the survivability of the vegetation.

c. Detention slopes that are disturbed are to be grassed. The ground cover within the basin shall be well established with all exposed areas covered prior to the end of the maintenance period.

d. If the developer desires to place a fence around a detention facility, it shall be a minimum four (4) foot high fence of durable material, with a twelve (12) foot wide access gate. The fence shall be contained with an easement at least ten (10) feet wide, shall not encroach upon the detention facility (although their easements may overlap by up to ten (10) feet), and shall comply with the location requirements of the Zoning Ordinance.

e. The side slope in graded areas is recommended to be 3H: 1V or flatter. The normal ponding surface elevation shall be defined as the elevation when the volume contained in the facility equals the runoff from a one and two-tenths (1.2) inch rainfall event. When the depth to the normal ponding surface is greater than 4 feet and the side slope is steeper than 4H:1V, a bench shall be provided. The bench shall be at least ten (10) feet in width and is recommended to be fifteen (15) feet in width. The slope of the bench shall be 10H:1V. The bench shall be located so that the normal

ponding surface elevation is between the top and bottom edge of the bench. See Storm Water Standard Drawing.

f. The bottom of the pond shall be graded for positive drainage. See Storm Water Standard Drawing.

8.2.8 Detention Facility Engineer's Certification and Record Drawings:

a. When a new facility is constructed in a development, a certified record survey of each detention facility shall be prepared by a land surveyor currently registered in the State of Georgia. A certified record drawing of the facility shall be prepared based upon this survey. Based on the actual parameters established on the record drawing, an addendum to the Stormwater Management Report shall be prepared which demonstrates that the facility, as constructed, complies with the requirements of these Regulations. The amended Stormwater Management Report shall be certified by a professional engineer currently registered in the State of Georgia. The survey shall be performed after substantial completion and stabilization of the project has occurred. The record drawing and addendum to the Stormwater Management Report shall be submitted to the City at least one (1) week prior to the issuance of a Certificate of Occupancy or Final Plat approval (as appropriate to the project).

b. When a development uses an existing facility without an existing storm water maintenance bond, the facility shall be cleaned out if necessary and a new record survey, drawing and certification showing that the outlet structure exists as approved and the flood storage and water quality volume of the facility is equal to or greater than the volume required when the facility was approved. As an alternative, a new record survey, drawing, study and certification showing that the facility meets the development requirements when the facility was approved shall be submitted. The survey shall be performed after substantial completion and stabilization of the project has occurred. The certification and supporting data shall be submitted to the City at least one (1) week prior to the issuance of a Certificate of Occupancy of Final Plat approval (as appropriate to the project).

8.3 CULVERTS AND PIPED DRAINAGE SYSTEMS

8.3.1 Drainage Improvements Required:

Stormwater conveyance facilities, which may include but are not limited to culverts, storm drainage pipes, catch basins, drop inlets, junction boxes, headwalls, gutters, swales, channels, and ditches, shall be provided for the protection of public rights-of-way and private properties adjoining project sites and/or public rights-of-way. Stormwater conveyance facilities that are designed to carry runoff from more than one parcel, existing or proposed, shall meet the requirements of these Regulations.

8.3.2 Standard Specifications:

Unless otherwise specifically set forth herein or in the City of Buford Standard Specifications and/or Drawings, all of the materials, methods of construction, and workmanship for the work covered in reference to stormwater conveyance facility construction shall conform to the most recent Standard Specifications of the Georgia Department of Transportation (Georgia DOT).

8.3.3 Design Criteria – General:

a. All stormwater conveyance facility design calculations shall be certified by a professional engineer currently registered in the State of Georgia.

b. Stormwater flows from drainage areas up to ten (10) acres in size may be calculated using the Rational Method. Flows from drainage areas between ten (10) and two-thousand (2,000) acres in size may be calculated using the SCS Method. Flows for drainage areas larger than two-thousand (2,000) acres in size must be calculated using published flood-frequency relations for the Atlanta area.

c. All portions of a stormwater conveyance system that drain areas falling within the same size category above shall be analyzed using the same methodology.

d. Run-off coefficients used for the Rational Method shall be consistent with those shown in Table 9-F. For the SCS Method, the runoff curve numbers found in the “Manual for Erosion and Sediment Control in Georgia” shall be used.

8.3.4 Design Criteria – Culverts:

a. Culverts (structures designed to convey water from one side of a public right-of-way to the other) and which carry the runoff from a contributing drainage area of at least twenty (20) acres shall be designed to pass the peak flow

associated with a 100-year storm with at least one (1) foot of freeboard between the 100-year ponding elevation and the top of the roadway shoulder, without rising the 100-year flood elevation on upstream properties, and in accordance with Floodplain Damage Prevention Ordinance.

b. The 100-year ponding limits above the culvert shall be shown on the Development plans and on the Final Plat (if applicable).

c. The minimum allowable culvert diameter shall be eighteen (18) inches.

d. Culvert design is to be in accordance with the methods contained in the Georgia DOT "Drainage Manual for Highways", Chapter 7, and shall include a thorough analysis of both inlet and outlet control structures.

8.3.5 Piped Collection Systems:

a. The preliminary design (initial pipe sizing and profile design) of piped collection systems required under 8.3.1 herein shall be based upon conveyance of the peak flows associated with a 25-year storm with the hydraulic grade line being one (1) foot or more below the top of each structure, gutter line or proposed final ground surface elevation, whichever is lower.

b. Once the preliminary design of a piped collection system has been prepared, it shall be analyzed for its behavior during conditions of 100-year flow, with the objective of the analysis being to ascertain the quantities of flow and the flowpaths followed by flows exceeding the capacity of the system, whether these pond at inlets or flow along the ground's surface.

c. Based on the analysis of 100-year conditions, the preliminary design shall be revised where necessary to produce a final design for which the likelihood of dwelling flooding, major property damage, or substantial public access and/utility interruption shall be less than one (1) chance in one hundred (100) years.

d. The minimum allowable pipe diameter shall be fifteen (15) inches.

e. Catch basins shall be spaced so that the spread in the street for a 10-year design flow shall not exceed eight (8) feet, as

measured from the face of the curb. Gutter spread calculations shall be submitted to the City for review and approval prior to issuance of a Development Permit.

f. Complete flow, velocity, and hydraulic grade line computations, shall be provided for all portions of a piped collection system. Hydraulic grade lines shall be shown on the storm drainage profiles contained with the Development Plans for the 25-year storm.

8.3.6 Energy Dissipation – Piped Systems and Culverts:

a. Energy dissipation devices, such as splash-pads, rip-rap, stilling basins, etc., shall be provided at the outlet of every culvert and piped collection system. (Please refer to the Standard Drawings.) Velocity protection shall be in accordance with the Gwinnett County Stormwater Design Manual. Velocities for the fully developed 25-year flow shall not exceed the non-erosive velocity as shown in the design manual for the receiving conveyance.

b. Energy dissipation devices shall be located entirely within the project site, and shall not encroach upon any required buffer.

c. When uniform, graded stone rip-rap is used for energy dissipation, ultraviolet resistant filter fabric (200-pound test) shall be used between the stone layers.

8.3.7 Minimum Pipe and Pipe Coating Requirements:

a. Reinforced concrete pipe shall comply with ASTM C-76 and/or AASHTO M-170. Joints shall be bell and spigot types, with a rubber gasket conforming to ASTM C-443. Pipe shall be furnished in not less than eight (8) foot lengths. Class of pipe and wall thickness shall be in accordance with Table No. 1 of Georgia DOT Standard Number 1030-D, latest revision. All culverts and drainage pipe within street rights-of-way shall be reinforced concrete. Culverts and drainage pipe not within a street right-of-way may, at the developer's option, be reinforced concrete.

b. Corrugated, aluminum-coated steel pipe and pipe arches shall conform to the requirements of Type 2 pipe per AASHTO M-196 for material and fabrication. Coating shall comply with AASHTO M-274. Pipe fabrication shall comply with AASHTO M-36.

1. All corrugated aluminum coated steel pipe or aluminum alloy pipe not carrying a live stream may be plain. All corrugated aluminum coated steel pipe or aluminum alloy pipes, which will carry a live stream within a drainage easement or detention facility shall have paved inverts per AASHTO M-190, Type C, except that the pipe need not be fully coated.

2. See the Standard Drawings for minimum acceptable combinations of gauges, diameters, and corrugation configurations for corrugated aluminum alloy pipe and for corrugated aluminum coated steel pipe and pipe arches.

3. Each end of pipe section, to be jointed by a coupling band, shall have a minimum of two (2) annular corrugations. Coupling bands shall be so constructed as to lap on an equal portion of each of the pipe sections to be connected. The connecting bands shall have a minimum of two (2) annular corrugations and shall fully engage, over the entire pipe periphery, one corrugation on each pipe end. Bands shall be fabricated from the same material as is the pipe., The minimum band gauges for aluminum pipe and aluminized pipe shall be as specified in AASHTO M-196, Section 19, and AASHTO M-36, Section 9, respectively.

4. Gaskets may be required as determined by the City in the field and shall be either sleeve type or o-ring type, and shall meet the requirements for gaskets as specified in Section 9.3 of AASHTO M-36.

c. Corrugated plastic pipe, nominal fifteen (15) inch to forty-eight (48) inch diameters, shall be high density corrugated polyethylene smooth interior pipe and fittings conforming to AASHTO M-294, Type S. Join pipe sections with bell and spigot joints or high density polyethylene corrugated couplings that lap at least two (2) full corrugations of each pipe section. For all joint systems, provide a gasketed positive closure device which achieves leak-free joint performance. Use standard, factory-fabricated adapters, wyes, tees and other fittings comparable to pipe with which connected.

d. Corrugated aluminum alloy structural plate pipe, pipe arches, and arches shall consist of aluminum plates and galvanized bolts and nuts of the size, shape and thickness as shown on

the approved plans. These structures shall conform to the requirements of AASHTO M-219.

8.3.8 Pipe Length:

a. Culverts carrying live streams shall extend to where the crown of the pipe intersects the roadway slope.

b. Pipes that do not carry live streams shall extend at least fifty (50) feet beyond the front building setback lines, and may be required to extend farther where necessary to provide an adequately protected building site on the property. In non-residential subdivisions, these pipes may temporarily end at the right-of-way lines, but shall be extended as part of a subsequent development permit approved for the individual site.

c. The length requirement, however, shall be subject to requirements for maintaining stream buffers in accordance with Georgia law or City regulations.

8.3.9 Pipe Installation:

Install corrugated plastic pipe in accordance with pipe system manufacture's published literature, ASTM D-2321, AASHTO Section 30, or City specifications, whichever is more restrictive.

Reinforced concrete pipe, corrugated steel pipe and asphalt coated pipe shall be bedded and backfilled in the same manner.

a. Bedding: All pipe structures shall be placed on stable earth or fine granular foundation, the characteristics of which would be expected to provide long-term stability. In all live stream pipe installation, in areas of low bearing soils or non-uniform foundations, in areas where rock is encountered at the foundation level, or in other locations where conditions warrant, a minimum of six (6) inches of crushed stone bedding is required, (maximum size of stone shall be ¾"). Geotextiles or geogrids may also be required by the City in problem areas.

b. Backfilling: Backfill on all pipe installations shall be constructed using foundation backfill material Type I or Type II, as specified in Section 812.01 and 812.02 respectively, in Georgia DOT stand specifications. These materials shall be placed in layers of not more than six (6) inches loose. Compaction of these materials shall be accomplished by

hand tamping or machine tamping. Required compaction levels are as follows:

1. Backfill within all street rights-of-way shall be compacted to ninety-five (95) percent maximum density, tested using the AASHTO Method T-99.

2. Backfill in all other areas shall be compacted to ninety-five (95) percent maximum density, tested using the AASHTO Method T-99.

c. Construction Loads and Minimum Covers: If drainage pipe is installed prior to the completion of grading, a minimum of four (4) feet of fill should be provided where needed to adequately protect the drainage structure during the land development phase, unless the structure itself is designed to withstand the anticipated live load during construction.

8.3.10 End Finish:

Headwalls or other end treatments are required on all culverts (except under residential driveways) and at the outlet of all piped collection systems.

a. Headwalls are to be pre-cast concrete, stone masonry with reinforced concrete footings, or poured-in-place, reinforced concrete with reinforced concrete footings.

b. End treatments that conform to the slope may be masonry, pre-cast concrete and sections, metal end sections, reinforced poured-in-place slope collars, or grouted rip-rap. Concrete and metal flared and sections shall conform to Georgia DOT Specifications 1120.

8.3.11 Junction Boxes and Catch Basins:

a. Junction boxes and catch basins shall have metal manhole frames and lids for access.

b. Lids for storm drainage structures shall be in accordance with City standard drawings.

8.3.12 Other Structures:

Natural bottom arches and box culverts may be used in accordance with the latest Standard Specifications of the Georgia DOT.

8.4 SURFACE DRAINAGE

8.4.1 Design Standards:

a. All new proposed channels shall be designed to carry at least the fully developed 25-year storm with freeboard equal to twenty (20) percent of the design flow depth.

b. Transition channels shall be provided at the inlet and outlet ends of all culverts and pipe systems, unless otherwise provided herein.

c. The maximum flow velocity at the project site's downstream property line shall not exceed the pre-developed velocity.

d. In cases of potential erosion due to irregular channel alignment, extreme velocities, or excessive slopes, a paved ditch may be required. However, if, in the opinion of the City, the expected long-term maintenance of a surface drainage system could prove impractical, a pipe design may be required.

e. The cross-sectional shape of channels shall be as found in the Standard Drawings. "V" shaped cross-sections are not permitted in grassed channels.

f. If the channel will be affected by backwater from culverts, bridges, other structures or floodplains, backwater curves shall be shown in profiles of the channel.

g. All channels, must be capable of conveying flows sufficient to ensure that overflow of the channel would not result in a likelihood of dwelling flooding, property damage or public access and/or utility interruption shall be greater than one (1) chance in one hundred (100) years.

h. Channels shall be designed to carry the fully developed 25-year flow in accordance with the Gwinnett County Stormwater Manual.

8.4.2 Construction Standards:

a. The channel shall be shaped to the dimensions specified on the approved plans and shall be free of over-falls, gullies, or other irregularities.

b. Channels in fills shall be lined.

c. Protective cover in grassed channels shall be installed as soon as the earthwork is completed.

8.5 EROSION CONTROL

8.5.1 Design Standards:

a. The procedures and requirements of the City of Buford Soil Erosion and Sediment Control Ordinance, as may be revised from time to time, shall be applicable whenever any land disturbance is proposed to occur, ad shall continue to apply until the project has been completed. In those instances wherein these Regulations are silent, the "Manual for Erosion and Sediment Control in Georgia" shall apply.

b. No permit shall be issued authoring any land disturbing activity unless erosion and sediment control plans have first been submitted to and approved by the City in accordance with these Regulations.

8.5.2 Construction Standards:

a. All erosion control structures and/or appurtenances as shown on the approved plans shall be in place and operational, inspected and approved by the City prior to the beginning of construction, and shall be maintained in operational condition until the phase or project has been completed. (See also Requirements for Initiation of Development Activities under Article 11.4.)

b. Temporary and permanent ground covers are required.

c. Upon project completion, erosion control devices and temporary siltation facilities shall be maintained in place where the individual lots are being developed, or until all disturbed areas are fully stabilized.

d. Erosion controls and siltation facilities shall be installed and maintained on each building lot during building construction and site development, as required by the Soil Erosion and Sediment Control Ordinance and consistent with the provisions of the "Manual for Erosion and Sediment Control in Georgia".

8.5.3 Abandoned Projects:

Any project whose permit has lapsed under the terms expressed in Article 4, shall immediately proceed to stabilize all disturbed areas. This responsibility shall fall upon the owner, developer, contractor, or any and all other responsible parties involved in the land disturbance activity.

8.6. DAMS.

Any land disturbing activity that involves a property which is proposed to contain a dam shall comply with the provisions of this Article as well as the provisions contained in Article 3, Section 3.1 of these Regulations.

8.6.1. New Dams Which Become Subject to the Requirements of the Georgia Safe Dams Act and Rules for Dam Safety.

Dams proposed to be twenty-five (25) feet or more in height or proposed to have an impounding capacity of one hundred (100) acre-feet or more at maximum water storage elevation shall be subject to the following:

a. The developer of any new dam in which development exists within the proposed breach zone shall be subject to the requirements of the Georgia Safe Dams Act and Rules for Dam Safety adopted by the Georgia Department of Natural Resources. The developer shall obtain necessary approvals and permits from the Environmental Protection Division of the Georgia Department of Natural Resources for the project and the dam prior to securing a Development Permit from the City. The developer of any new dam as to which development does not exist within the proposed breach zone shall submit construction plans to the City of Buford for review of the project and the dam prior to securing a Development Permit from the City.

b. If the developer elects to construct the new dam in accordance with the design standards for new dams as contained in the Rules for Dam Safety, then new development shall be permitted within the dam breach zone. However, the dam shall meet the design standards for new dams as contained in the Rules for Dam Safety if development currently exists or is proposed in the dam breach zone.

c. If the developer elects not to construct the new dam to the design standards for new dams as contained in the Rules for Dam Safety, then a dam breach analysis for the dam shall be submitted along with the construction plans for review

prior to securing a Development Permit from the City. The design engineer shall utilize the computer model entitled "DAMBRK" for the dam breach analysis.

d. Should the new dam not meet the design standards for new dams as contained in the Rules for Dam Safety, then only the following uses and structures shall be permitted within the dam breach easement:
   (1) Agriculture that requires no structures for human habitation within the dam breach zone including forestry, livestock raising, and agricultural and forestry access roads.
   (2) Fences.
   (3) Outdoor advertising signs provided they are located no closer than one hundred (100) feet from any residence or place of business.
   (4) Roads, driveways and parking areas.
   (5) Utility poles, towers, pipelines, water treatment outfalls and facilities, or other similar facilities and structures.

e. For any new dam that is proposed not to meet the design for new dams as contained in the Rules for Dam Safety, the developer shall obtain a dam breach easement, recorded with the Clerk of Superior Court, from any offsite property owner where it is proposed for the dam breach zone to extend off the property where the dam is being constructed. The developer shall also cause a dam breach easement to be recorded upon the property being developed.

f. Prior to recording of a Final Plat or issuance of a Certificate of Occupancy, as appropriate, an as-built certification from a registered professional engineer shall be submitted to the City. The certification shall state that the dam is constructed in accordance with the provisions of these regulations as well as the authorized construction plans. If the project is for the development of a subdivision, the developer shall also establish a legal entity, acceptable to the City, such as a mandatory Property Owners Association, prior to approval of the Final Plat, responsible for the maintenance of the dam and its impoundment.

8.6.2. New Dams Subject to Regulation by City of Buford.

Dams proposed to be nine (9) feet or more in height, but less than twenty-five (25) feet in height, in combination with an impounding capacity proposed to be twenty (20) acre-feet or more at maximum

water storage elevation, but less than one hundred (100) acre-feet, shall be subject to the following:

a. If the developer elects not to construct the new dam to the design standards for new dams as contained in the Rules for Dam Safety, then a dam breach analysis for the dam shall be submitted with the construction plans for review and authorization prior to securing a Development Permit from the City. The design engineer shall utilize the computer model entitled "DAMBRK" for the dam breach analysis.

b. Should the new dam not meet the design standards for new dams as contained in the Rules for Dam Safety, then only the following uses and structures shall be permitted within the dam breach zone:
   (1) Agriculture which requires no structures for human habitation within the dam breach zone including forestry, livestock raising, and agricultural and forestry access roads.
   (2) Fences.
   (3) Outdoor advertising signs provided they are located no closer than one hundred (100) feet from any residence or place of business.
   (4) Roads, driveways and parking areas.
   (5) Utility poles, towers, pipelines, water treatment outfalls and facilities, or similar facilities and structures.

c. If the developer elects to construct the new dam in accordance with the design standards for new dams as contained in the Rules for Dam Safety, then new development shall be permitted within the dam breach zone. However, the dam shall meet the design standards for new dams as contained in the Rules for Dam Safety if development currently exists or is proposed in the dam breach zone.

d. Construction plans for new dams defined herein shall be submitted to City of Buford for review for the project and the dam prior to securing a Development Permit from the City.

e. For any dam that is proposed not to meet the design standards for new dams as contained in the Rules for Dam Safety, the developer shall obtain a dam breach easement, recorded with the Clerk of Superior Court, from any offsite property owner where it is proposed for the dam breach zone to extend off the property where the dam is being constructed. The developer shall also cause a dam breach

easement to be recorded upon the property being developed.

f. Prior to recording of a Final Plat or issuance of a Certificate of Occupancy, as appropriate, an as-built certification from a registered professional engineer shall be submitted to the City. The certification shall state that the dam is constructed in accordance with the provisions of these regulations as well as the authorized construction plans. If the project is for the development of a subdivision, the developer shall also establish a legal entity, acceptable to the City of Buford, such as a mandatory Property Owners Association, at time of recording of the Final Plat, responsible for the maintenance of the dam and its impoundment.

8.6.3. Existing Dams.

Existing dams that are located on a project site and will remain after construction is complete, shall comply with the provisions of this article and all referenced articles as if they were new dams.

8.6.4. Existing Category II Dams.

When an existing Category II dam may be reclassified to a Category I dam because of a proposed development downstream of the dam, the following shall be provided by the developer for review by the Georgia Safe Dams Program.

a. Location of the Category II dam and the proposed development; and,

b. A surveyed cross-section of the stream valley at the location of the proposed development including finished floor elevations; and,

c. A dam breach analysis using the Dambreak computer model to establish the height of the floodwave in the downstream floodplain. The Dambreak modeling shall be completed in accordance with the Safe Dams Program Quality Assurance Program by a qualified registered engineer.

8.7 EXTENDED DETENTION:

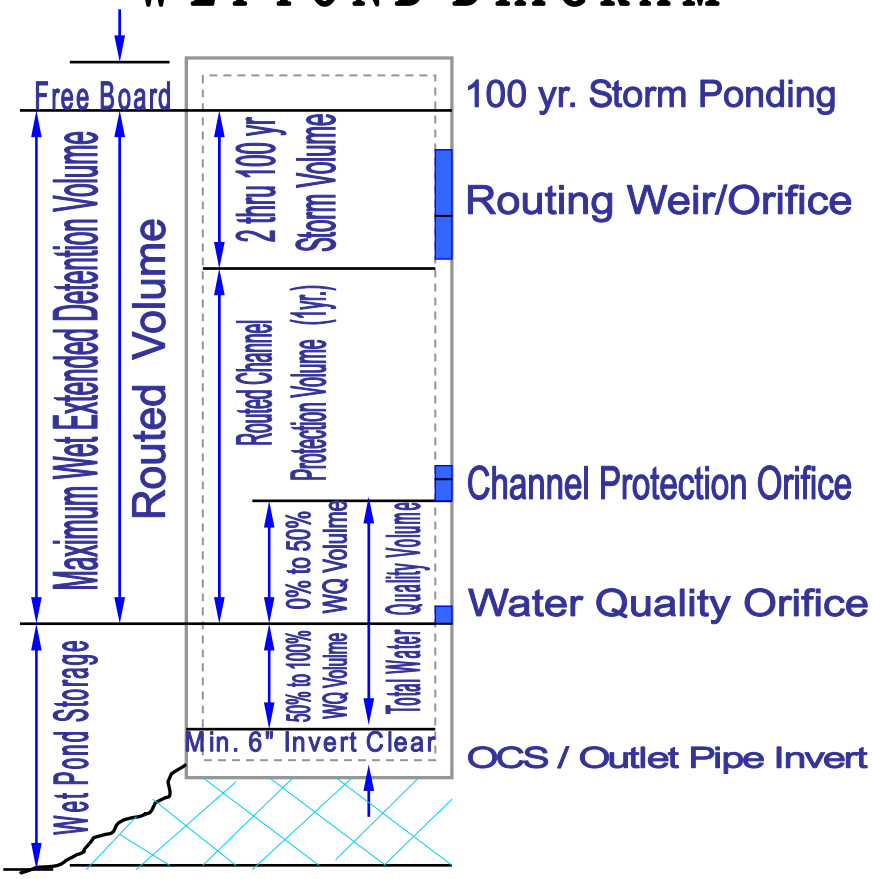
8.7.1 Wet Extended Detention Facility Design Requirements

Wet extended detention facilities shall be designed and constructed to meet the following requirements:

a. Minimum and Maximum Drainage Area. The minimum drainage area for a wet detention facility should be at least twenty (20) acres. The maximum drainage area should be one-hundred (100) to three-hundred (300) acres. The maximum drainage area of highly impervious drainage areas should be restricted to the lower end of the range (one hundred (100) acres) and low density residential watersheds should be restricted to a maximum of three-hundred (300) acres.

b. Storage Volume of Permanent Pool. The permanent pool storage (Vb) shall be at least fifty (50) percent of the Water Quality Volume (WQV) defined in section 8.9.1. The part of the WQV (fifty (50) percent or less) not used in the permanent pool shall be detained for twenty-four (24) hours and the storage volume may be used as part of the detention requirements. The WQV to be stored shall be based upon the project area. The project area compensated for in a pond shall not exceed the total drainage area draining to the pond. Off-site areas that do not drain through other water quality BMP's may be used to compensate for areas that by-pass the pond. By-passed areas shall be minimized as much as practical. Off-site areas exceeding the project site area may bypass the pond.

WET POND DIAGRAM



c. Depth of Permanent Pool

(1) Mean Depth

The mean depth (Z) of the permanent pool shall be between three (3) feet and seven (7) feet and is calculated by dividing the permanent pool storage volume (Vb) by the surface area (As) (Z = Vb / As).

(2) Maximum Depth

The maximum depth of the permanent pool shall be no greater than twelve (12) feet unless a modification is approved. The intent of these regulations is to ensure that the depth of the facility is not out of proportion with the surface area of the facility. Granting of a modification will not nullify these regulations when the depth and surface area of the facility is based on existing natural topography.

d. Minimum Surface Area of Permanent Pool. The minimum surface area (As) of the permanent pool should be one quarter (0.25) acre. The minimum ratio of surface area to drainage area used to calculate the permanent pool (Aw) in residential watersheds shall be one (1) percent unless a

modification is approved. The intent of these regulations is to ensure that the depth is minimized to increase removal efficiencies. Granting of a modification will not nullify these regulations when the depth and surface area of the facility is based on existing natural topography. As/Aw ratios in excess of three (3) percent are desirable for nonresidential watersheds with relatively high levels of imperviousness.

e. Side Slopes Along the Shoreline

(1) The side slope in graded areas is recommended to be 3H:1V or flatter. When the depth of the permanent pool is greater than four feet and the slope is steeper than 4H:1V, a bench shall be provided. The bench shall be ten (10) feet in width and is recommended to be fifteen (15) feet in width. The bench shall have a slope of 10H:1V. The bench shall be located so that the permanent pool elevation is between the top and bottom edge of the bench. See Storm Water standard drawing.

(2) Side slopes shall be topsoiled, nurtured or planted from two (2) feet below to one (1) foot above the permanent pool control elevation to promote wetland vegetative growth. Below the safety ledge, the pond side shall be sloped to meet topographic or volumetric constraints.

f. Length: Width Ratio of Permanent Pool. The minimum length: width ratio of the permanent pool shall be 2:1. The length shall be measured at the shortest flow path from the inlet to the outlet. The width shall be shall be calculated as the surface of the pond divided by the length. In addition, the location of the outlet structure within the basin shall maximize travel time from the inlet to the outlet. Baffles or islands may be installed within the permanent pool to increase the flow path length and to minimize short-circuiting.

g. Soil Permeability. In cases where relatively permeable soils are encountered, water drawdown rates should be minimized by either compacting the permanent pool soils during construction, incorporating clay into the soil, or by installing an artificial liner.

h. Spillway and Dam Design. The principal spillway, emergency spillway, and dam shall be designed in

accordance with Sections 8.2, 8.6 and 9.8 of these regulations.

i. Forebay

(1) To facilitate major cleanout activities, a sediment forebay shall be constructed near the inlet to the permanent pool to trap coarse sediment particles. The forebay volume may be included in the permanent pool volume requirements. The forebay storage capacity shall be ten (10) percent of the runoff from one and two tenths (1.2) inches of rainfall draining to the facility to accommodate sediment accumulations. The forebay should not exceed ten (10) percent of the permanent pool. The volume shall be calculated as:

$FBV = (0.1)1.2(Rv)A_T/12\ (ft^3)$

Where $Rv = 0.05 + I(0.009)$
I = Percent Impervious as a whole number
A_T = Total area draining to facility (ft^2)

(2) The facility shall be dredged to ensure that all of the permanent pool storage volume is available after the upstream area has been stabilized. All temporary sediment control measures employed during land disturbing activities to trap sediment shall be located outside of state waters.

(3) The forebay shall be distinguished from the permanent pool. Options which may be used include: a lateral sill with wetland vegetation; two (2) ponds in series; differential pool depth; rock-filled gabions or a retaining wall; or a horizontal rock filter placed laterally across the permanent pool.

j. Inlet and Outlet Structures

(1) The inlet design shall dissipate flow energy and diffuse the inflow plume where it enters the forebay or permanent pool. Options that may be used include: drop manholes; energy dissipaters at the bottom of paved ditches; a lateral bench with wetland vegetation; and the placement of large rock deflectors at each inlet.

(2) The outlet design shall consist of a riser with a hood or trash rack to prevent clogging and an adequate antivortex device for facilities serving large drainage areas. Anti-seep collars shall be installed around all conduits that pass through the embankment of the basin. The outlet may be sized to achieve the flood control performance standards contained in Sections 8.2, 8.6 and 9.8 of these regulations. An emergency spillway shall be provided no lower than the 25-year ponding elevation and its capacity shall be at least equal to the full 100-year peak flow rate into the facility.

(3) The channel that receives the discharge from the basin's outfall pipe shall be protected from erosive discharge velocities. Options which may be used include: rip-rap lining of the channel; or, the provision of stilling basins, check dams, rock deflectors or other devices to reduce outfall discharge velocities to non-erosive levels.

(4) An orifice for any required extended detention volume shall be sized using the same criteria as required in section 8.7.2.

k. Access. Access requirements shall be as specified in Section 8.2.5 of these regulations.

l. Easement Requirements. Easement requirements shall be as specified in Section 8.2.5 of these regulations with the change that the easement enclosing the facility shall be named a Best Management Practice (BMP) easement.

m. Engineer's Certification and Record Drawings. A certified record survey of each facility shall be prepared by a land surveyor currently registered in the State of Georgia. A certified record drawing of the facility shall be prepared based upon this survey. The design engineer shall certify that the facility functions hydraulically as designed. The record drawing shall be submitted to the City at least one (1) week prior to the issuance of a Certificate of Occupancy or Final Plat approval (as appropriate to the project). Record drawings of off-site facilities shall be recorded at least one (1) week prior to the recording of the Final Plat.

n. The bottom of the pond shall be graded for positive drainage. See Stormwater Standard Drawing.

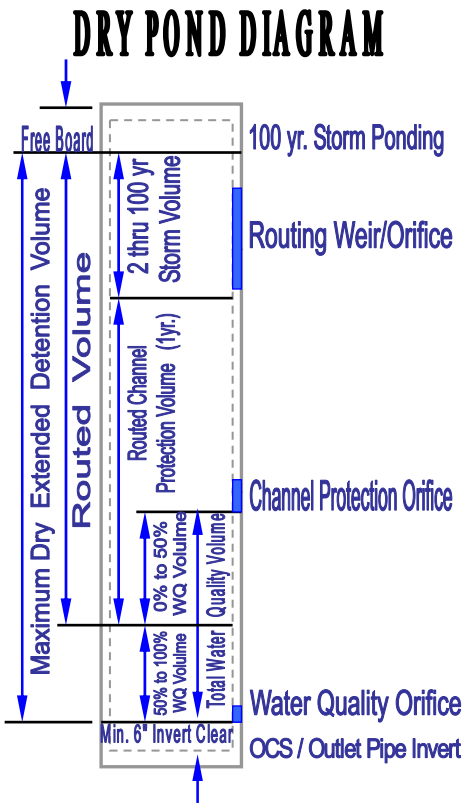
8.7.2 Dry Extended Detention Facilities

Extended detention facilities with wetland plantings shall be designed and constructed to meet the following requirements:

a. Maximum Drainage Area
The maximum drainage area for which the facility shall be allowed to be constructed should be twenty (20) acres (DA = drainage area in acres);

b. Storage Volume
The Water Quality Volume (WQV) to be stored is defined in section 8.9.1. Up to fifty (50) percent of the storage volume shall be detained for twenty-four (24) hours and may be used for detention requirements. The remaining portion (fifty (50) percent or greater) shall be drained through a filter drain in twenty-four (24) hours. The filter drain shall be the only outlet draining the WQV.

S = BMP storage volume in cubic feet;



c. Minimum Surface Area. The facility should have a minimum surface area of one (1) percent of the total drainage area when the volume contained in the facility equals the required BMP storage volume;

d. Side Slopes along the Shoreline. The side slope in cut areas shall be no steeper than 2H:1V (Horizontal: Vertical) and is recommended to be 3H:1V or flatter. The side slope in fill areas shall be 3H:1V or flatter. A flat bench at least ten (10) feet in width shall be provided one (1) foot above the ponding level used to determine the minimum surface area.

e. Length: Width Ratio. The length: width ratio shall be maximized. The length shall be measured as the shortest flow path from the inlet to the outlet. The width shall be calculated as the surface area of the pond divided by the length.

f. Depth of Facility. The average cross-sectional area of the facility shall be calculated as the volume of the pond divided by the length. The water velocity shall be determined by dividing the maximum outflow rate by the average cross-sectional area. The maximum desired water velocity shall be one half (0.5) foot per second.

g. Spillway and Dam Design. The principal spillway, emergency spillway and dam shall be designed in accordance with Sections 8.2, 8.6 and 9.8 of these regulations.

h. Forebay. The forebay requirements are the same as for wet extended detention (section 8.7.1.i)

i. Inlet and Outlet Structures
   (1) Inlet and outlet structures shall meet the same requirements as wet detention facilities.
   (2) The size of the orifice for the facility shall be computed using the following orifice equation with a twenty-four (24) hour draw down time from the full pool BMP volume (S) and an orifice coefficient of six tenths (0.6):

   h = head measured in feet from the elevation at the required BMP storage to the centroid of the orifice;

   Qa = average BMP outflow rate in cfs;
   Qa = S/ 3600 x 24;

A = required orifice area in square feet;
A = $Qa/(0.6 \times (64.4 \times h/2)^{0.5})$.

(3) An allowance for base flow shall be provided. The designer either shall determine the base flow using a factor of one and six tenths (1.6) cfs per square mile or may use another standard engineering practice if warranted.

j. Access. Access requirements shall be as specified in Section 8.2.5 of these regulations.

k. Easement Requirements. Easement requirements shall be as specified in Section 8.2.5 of these regulations with the exception that the easement enclosing the facility shall be named a Best Management Practice (BMP) easement.

l. Engineer's Certification and Record Drawings. A certified record survey of each facility shall be prepared by a Land Surveyor currently registered in the State of Georgia. A certified record drawing of the facility shall be prepared based upon this survey. The design engineer shall certify that the facility functions hydraulically as designed. The record drawing shall be submitted to the City at least one (1) week prior to the issuance of a Certificate of Occupancy or Final Plat approval (as appropriate to the project). Record drawings of off-site facilities shall be recorded at least one (1) week prior to the recording of the final subdivision plat.

m. Wetland Plantings. The facility bottom shall be planted with plantings indigenous to local wetlands.

n. The bottom of the pond shall be graded for positive drainage. See Stormwater Standard Drawing.

8.7.3 Reserved

8.7.4 Stream Buffers and Impervious Surface Setbacks

Refer to the Zoning Ordinance for buffer and impervious surface setback requirements from streams.

8.7.5 Wet and Extended Detention Facility Maintenance

Maintenance requirements shall be as specified in Section 8.2.6 of these regulations.

8.8 Reserved:

8.9 WATER QUALITY BEST MANAGEMENT PRACTICES

8.9.1 Treatment of Runoff

a. All projects, unless exempt pursuant to 8.9.1.d below, that meet one or more of the following criteria, shall provide water quality treatment based on the modeled Total Suspended Solids (TSS) load of the project for post construction conditions. The determination of the TSS load shall be in accordance with the Stormwater Design Manual. The modeled TSS load shall not exceed eight-hundred fifty (850) pounds/acre/year.

1. New development that involves the creation of five-thousand (5,000) square feet or more of impervious cover, or that involves other land development activities of one (1) acre or more;
2. Redevelopment that includes the creation, addition or net replacement of five-thousand (5,000) square feet of more of impervious cover, or that involves other land development activity or one (1) acre or more; or,
3. Land development activities that are smaller than the minimum applicability criteria set forth in items i and ii above, if such activities are part of a larger common plan of development, even though multiple, separate and distinct land development activities may take place at different times on different schedules.

b. The water quality volume (WQV) shall be the runoff from one and two tenths (1.2) inches of rain from the project site. The volume shall be calculated as:

$$WQV = 1.2\ (Rv)A_s/12\ (ft^3)$$

Where $Rv = 0.05 + I\ (0.009)$
I = Percent Impervious as a whole number
A_s = On-site area to be treated (ft^2).

c. Runoff from any new development or redevelopment, regardless of size, that is defined by the City to be a hotspot land use or activity shall be adequately treated and addressed through the use of structural storm water controls, nonstructural practices and pollution prevention practices.

d. The following activities are exempt from providing treatment:

1. Individual single-family or duplex residential lots that are not part of a subdivisions or phased development project;
2. Additions or modifications to existing single-family or duplex residential structures; and,
3. Repairs to any stormwater management facility or practice deemed necessary by the City.

8.9.2. Facility Location Criteria

a. Facility location criteria shall be as specified for detention facilities in Section 8.2.4 of these Regulations.

b. In a residential subdivision, the following Best Management Practices must be located on a separate lot in accordance with Section 8.2.4.g if not located on a recreation area lot as specified in 8.2.4.f:

1. Extended detention ponds;

2. Retention ponds;

3. Sand filters;

4. Constructed wetlands;

5. Infiltration trenches;

6. Oil/grit separators.

8.9.3 Facility Easement Requirements

a. Facility easement requirements shall be as specified in Section 8.2.5 of these regulations with the exception that the easement enclosing the facility shall be named a Best Management Practice (BMP) easement.

b. Stream Buffer Easements shall be shown on the final plat for areas that are claimed in the TSS model as Undisturbed Stream Buffers for the site. These areas shall be left in a natural, undisturbed condition except for walking trails. Trails shall not be allowed within twenty-five (25) feet of a stream bank without a state waters buffer variance.

c. Upland Area Easements in non-residential subdivisions that are claimed as undisturbed upland areas for the site, shall be recorded in an easement acceptable to the City. These

areas shall be left in a natural, undisturbed condition except for walking trails.

8.9.4 Facility Maintenance

a. Maintenance requirements shall be as specified in Section 8.2.6 of these regulations.

b. Prior to or concurrent with the recording of a Final Plat for a subdivision, or issuance of a Certificate of Occupancy for a non-subdivision project, the developer shall provide acceptable surety such as a bond or letter of credit providing for the maintenance of the facility for a period of not less than eighteen (18) months. The amount of the surety shall be the greater of fifty (50) percent of construction costs of the facility or one hundred (100) percent of the cost to clean out the facility. At the end of eighteen (18) months, the City may require the surety to be renewed due to anticipated maintenance caused by such concerns as future construction activity in the basin draining to the facility. A renewed surety may be required up to a total maximum of ten (10) years. The surety for a facility shall be renewed during the ten years until:

1) The surface water drainage area within the project has undergone final stabilization and all planned construction activity has been completed;

2) All storm water runoff in the surface water drainage area within the project is coming from undisturbed or stabilized areas;

3) At least ninety (90) percent of the lots in that surface water drainage area within the project have been sold to an unrelated party, permanent structures completed and final stabilization achieved;

4) The accumulation of acreage of undeveloped lots, lots with no completed permanent structure and no final stabilization, within the surface water drainage area within the project is less than five (5) acres or ten (10) percent of the total area of the common development draining to the facility, whichever is greater; and

5) Within two (2) months of surety release, the facility shall be cleaned out if necessary and a new record survey, drawing and certification showing that the

volume of the facility is equal to or greater than the volume shown in the record survey, drawing and certification when the facility was approved. As an alternative, a new record survey, drawing and certification showing that the facility complies with these regulations as specified in section 8.2.8 shall be submitted.

8.9.5 Facility Certification and Record Drawings

Requirements for a certified record survey and addendum to the Storm Water Management Report shall be the same for water quality facilities as for detention facilities in section 8.2.8.

8.9.6. Existing Subdivisions with Regional Water Quality Facilities.

Where the drainage is treated in a regional water quality facility approved between April 27, 1999, and January 1, 2001, lots in non-residential subdivisions (or phases in residential subdivisions) shall either conform to the permit and water quality regulations at the time of approval or conform to the current water quality regulations as stated in section 8.9.

8.9.7. Existing Subdivisions without Regional Water Quality Facilities.

Where drainage is treated in a regional detention facility approved before April 27, 1999, lots in non-residential subdivisions (or phases in residential subdivisions) shall conform to the current water quality regulations as stated in section 8.9.

8.9.8 Retrofitting of existing detention facilities for water quality treatment

If water quality treatment for a proposed development is to be provided in an existing detention basin then treatment must be provided for the entire original project basin. A modification to the 25-year detention requirement may be granted for the purpose of retrofitting the detention pond to meet current water quality regulations. Granting of a modification will meet the intent and purpose of these Regulations when:

a. The detention requirements of the current regulations are provided in the facility for the 1-year, 2-year, 5-year and 10-year storm. For a retrofitted basin, the volume of the 1-year storm shall be based on the

original project area being detained instead of the total area draining to the basin;

b. The water quality requirements of the current regulations as stated in section 8.9 are provided for the original project area in the facility;

c. The ponding limits create a hardship if no modification is granted; and,

d. The outlet structure meets the requirements of the current regulations.

8.9.9 Retrofitting of existing water quality facilities

If water quality treatment for a proposed development is provided in an existing water quality facility then water quality treatment conforming to the current regulations must be provided for the entire original project basin.

8.9.10. Redevelopment and Improvements

a. When five-thousand (5,000) square feet or more of new impervious surface is added, or one (1) acre or more of a developed project site is disturbed for redevelopment, and the disturbed area is more than fifty (50) percent of the property, the water quality requirements of this section must be met for the entire site.
b. When less than five-thousand (5,000) square feet of new impervious surface area is added, or less than one (1) acres of land of a developed project site is disturbed for redevelopment, the project is exempt from having to provide the water quality requirements of this section for the project or for the rest of the site.
c. When five-thousand (5,000) square feet or more of new impervious surface area is added, or one (1) acre or more of a developed project site is disturbed for redevelopment, and the disturbed area is less than fifty (50) percent of the property, the project shall provide water quality treatment for just the improvements on the site.