

SECTION 2 DESIGN CRITERIA

2.1 GENERAL

The following criteria will be utilized by the District Engineer, and/or a consultant, in the review of development plans for recommending approval of the proposed water management systems to the Board of Supervisors of the South Broward Drainage District. The District Engineer will review those aspects of the proposed water management system that effect areas both within and outside the District's boundaries. **The criteria set forth herein is "minimum criteria" and more stringent criteria may be required.**

The District is divided into separate drainage basins as outlined in **Exhibit 7, District Boundary and Major Facilities** and in the District Public Facility Report. For further information and guidance concerning the basins of the District, the applicant is directed to the updated District Public Facility Report prepared by Calvin, Giordano & Associates, Inc. The applicant is cautioned that the District Public Facility Report is for guidance only and should not be solely relied upon for the location of proposed water management facilities or for the location of existing facilities.

2.2 PRIMARY AND SECONDARY CANALS

The District has canals that are classified as primary and secondary waterways. The applicant should refer to the updated District Public Facility Report to determine whether or not a canal is to be considered primary or secondary. Primary canals are to be used for conveyance of stormwater of an entire basin. Secondary canals are used to convey stormwater from a specific project. Minimum design criteria for both primary and secondary canals is shown on **Exhibit 12, Primary Canals Minimum Design Criteria and Canal Maintenance Easement** and **Exhibit 13, Secondary Canals Minimum Design Criteria and Canal Maintenance Easement**. The minimum culvert size

for a primary canal is 72 inches in diameter with a head loss of 0.1 feet or less over the entire length of pipe. The minimum culvert size for a secondary canal is 36 inches in diameter with a head loss of 0.1 feet or less per 100 feet of pipe. The preferred pipe material for both primary and secondary canals shall be reinforced concrete. Other materials may be accepted at the discretion of the District Director if an appropriate fee is paid to offset the cost of additional inspections that will be required during its installation. Primary/Secondary canal banks must be sodded from basin control elevation to 2 feet landward of the upland easement line. The top four (4) and the bottom three (3) rows of sod must be pinned with wood sod stakes. Refer to **Exhibit 12, Primary Canals Minimum Design Criteria and Canal Maintenance Easement** and **Exhibit 13, Secondary Canals Minimum Design Criteria and Canal Maintenance Easement**.

2.3 FLOOD CRITERIA - ROADWAYS

All projects within the District shall utilize the minimum roadway crown elevation, whether inverted crown or standard crown, as indicated in the District Public Facility Report for a specific basin. The roadway crown elevations that are indicated in the District Public Facility Report are based on the hydraulic modeling of a 10-year 3-day storm event. These elevations are **minimum** roadway crown elevations and may be exceeded if desired. When inverted crown section is used, the lowest inlet grate elevation shall be set at the 10-year 3-day storm event stage.

2.4 FLOOD CRITERIA - BUILDINGS

The first floor elevations of all structures within the District shall be set such that the structure is protected from a 100-year 3-day storm event, as indicated in the District Public Facility Report for a specific basin. This criteria is in addition to any County criteria or Federal criteria. The applicant should be aware that this is minimum criteria and may be increased.

2.5 EXCAVATIONS

All lakes, canals, ponds or any other type of excavation shall conform to the requirements of the District, South Florida Water Management District and Broward County water management rules and regulations. The side slope of all lake excavations shall not be steeper than a four to one (4:1) slope but not shallower than a five to one (5:1) slope as measured from top of bank to minimum 3 feet below the basin control elevation. The side slope of lake excavations from 3 feet below the control elevation to the bottom of the excavation shall not exceed the angle of repose of the material being excavated. The applicant should refer to **Exhibit 10, Lake Cross Section and Lake Maintenance Easement** for a more specific detail. Canal excavations shall have a side slope of two to one (2:1) from top of bank to the bottom of the excavation. All excavations shall be stabilized to prevent erosion by a means acceptable to the District. The **minimum depth** for lakes, canals and other excavations shall be 10 feet below the control elevation. Refer to **Exhibit 12, Primary Canals Minimum Design Criteria and Canal Maintenance Easement** and **Exhibit 13, Secondary Canals Minimum Design Criteria and Canal Maintenance Easement**.

2.6 STORAGE/WATER MANAGEMENT AREAS

The applicant shall be required to provide water management areas that conform to the requirements of the South Florida Water Management District Volume IV as it relates to wet and dry retention areas. The applicant shall address both water quality requirements and water quantity requirements. The retention and detention storage criteria for both quantity and quality shall be met on the property owners site prior to discharge to the District's facilities. Retention shall be achieved through an appropriate discharge control structure. All dry retention areas shall be demucked and filled with a permeable material that will allow the stored stormwater to infiltrate into the ground. All dry retention areas shall be fully sodded or seeded and shall not be excavated to a depth that is lower than 1 foot above the control elevation for the basin. When the applicant's design for a water management area requires a modification to the District's South Florida Water Management District

basin permit, complete design calculations shall be submitted to the District prior to submission of the project to the South Florida Water Management District.

2.7 SOIL STORAGE

Soil storage may be taken into account when performing water management calculations for a project. Soil storage shall be determined by utilizing the latest criteria contained in South Florida Water Management District Volume IV.

2.8 DISCHARGE CRITERIA

When a project discharges into a primary canal of the District which is not controlled by a pump station or other discharge control structure, the allowable discharge shall be based on 3/4 inch of runoff per day per acre for areas within the South Florida Water Management District C-9 basin and 1 1/4 inches of runoff per day per acre for areas within the South Florida Water Management District C-11 basin. When computing the allowable discharge, the applicant shall also consider the discharge that may occur from adjacent properties that will flow through the applicant's property in order to reach a District facility. The District may require the applicant to provide or make provisions for lake or drainage system interconnects between adjoining properties so that equalization of stormwater runoff may occur throughout a basin and to provide an adjacent property with stormwater discharge.

2.9 SECOND-ORDER DRAINAGE SYSTEM

The second-order drainage system of each project shall be designed by using the 3-year rainfall intensity as indicated on the State of Florida Department of Transportation (FDOT) rainfall curve for Zone 10 as shown on **Exhibit 9, Florida Department of Transportation Zone 10 - 3-Year Rainfall Data**.

An initial time of concentration of 10 minutes must be used. Time of concentration greater than 10 minutes must be submitted with calculations to justify assumption. The applicable time of concentration shall be used with the data. Roughness coefficients (Mannings "N" factor) to be utilized in the design of the second-order drainage system are as follows:

<u>TYPE OF PIPE</u>	<u>MANNING'S "N"</u>
Concrete	.012
Corrugated Aluminum	.019
HDPE	.012
Ductile Iron	.011
P.V.C.	.009
Corrugated PVC	.018-.020

It should be noted that these factors may vary as pipe technology and products change and that the District may recognize the recommendations of the manufacturers. All pipe trenches shall be constructed in accordance with **Exhibit 24, Trench Excavation Detail**.

Unless otherwise determined by the District Director, the culvert size computed for the design stormwater runoff shall be increased to the next highest standard diameter. All drainage pipes other than yard drains shall be a minimum of 15 inches in diameter.

The approximate maximum pipe lengths recommended without access structures are:

15 inch pipe	400 feet
18 inch pipe	400 feet
24 inch to 30 inch pipe	400 feet
36 inch and larger and all box culverts	300 feet

The Engineer for each project shall submit calculations and hydraulic grade line profiles for all second-order drainage system. The profile shall be based on a surface water elevation in the receiving body of water that is determined by the flood routing calculations for a storm event.

2.10 EXFILTRATION SYSTEMS

All exfiltration trench systems shall be designed based on an actual field test that is performed on the specific site in question. The test shall be a usual open-hole, falling-head open-hole or DOT standard exfiltration test to determine the hydraulic conductivity of the soil to be used in the computation of the length of trench required. The test and the computations shall be based on the requirements of the South Florida Water Management District Volume IV. The trench shall be designed as per **Exhibit 15, Exfiltration Trench Detail**. Exfiltration trenches may be used on a site to satisfy drainage requirements or dry retention requirements. All drainage systems that tie into an exfiltration system shall have a pollution retardant basin prior to or at the point of connection. A pollution retardant baffle is also required upstream and downstream of an exfiltration trench system.

2.11 ROADWAY AND SWALE GRADING

The minimum slope for roadways and roadway swales shall be 0.3% or 0.003 feet per foot. The maximum run between high points and low points shall be 300 feet. Minimum invert elevation of swales shall be 1 foot above the basin control elevation. Minimum elevation for the crown of roadways shall be the 10-year 3-day storm event elevation as shown in the District Public Facility Report. **Impervious fill material shall not be used in swale areas.** Details shall be provided so that the District is assured that swale grades will be maintained, particularly when a driveway crosses a swale.

If a street is designed so that the edge of the asphalt serves as the flow line for the street drainage, concrete or asphalt aprons shall be constructed from the edge of the asphalt to the catch basins.

2.12 SINGLE FAMILY LOT GRADING

All submittals for residential subdivisions shall include sufficient details for grading of the area

outside of the building structure so that the District can be assured that ponding of storm water will not occur. The details for grading should include sufficient elevations to assure runoff and may include rear-yard drains. Rear-yard drains shall be 6 inches in diameter or greater and should tie into the roadway drainage system. Provisions shall be made to collect the runoff from roofs so that erosion does not occur. Roof runoff may be handled by splash blocks or piping as approved by the District.

2.13 INLET STRUCTURES AND POLLUTION RETARDANT STRUCTURES

All inlet structures shall be designed so that the inlet opening has sufficient cross-sectional area to allow passage of the runoff received. Maximum spacing between manhole structures or junction boxes shall be 300 feet where used as a lake interconnect or major outfall. All terminal inlet structures that are located just prior to the discharge pipe to the receiving water body shall be designed as a pollution retardant basin to trap oils, grease and other solid materials prior to discharge as shown on **Exhibit 16, Pollution Retardant Baffle Detail**. All pollution retardant baffles shall be sealed and watertight. Weep or bleeder holes in the bottom of a structure are not permitted. All structures must have a minimum 18 inch sump. Structures with pollution retardant baffles must provide an 18 inch minimum sump from the invert of the baffle.

2.14 HEADWALLS

All lake interconnects and discharges into primary and secondary canals are required to have headwalls in accordance with **Exhibit 18A, Lake Outfall Detail With Headwall**. If the top of a pipe discharging into a lake is submerged at least 2 feet below the basin control elevation, at the option of the District, a headwall may not be required. If an outfall is not going to have a headwall, it shall be constructed in accordance with **Exhibit 18B, Lake Outfall Detail**. If an outfall that will not have a headwall is part of a drainage system that utilizes reinforced concrete pipe, it shall terminate with a concrete jacket and flexible pipe as shown on **Exhibit 25, Concrete Jacket Detail**.

Sand-cement rip-rap headwalls shall be constructed in accordance with Florida Department of Transportation (FDOT) Standard Index No. 258 with the following exceptions:

1. Geotextile fabric shall be installed behind all rip-rap headwalls.
2. Every rip-rap bag shall have at least one (1) #5 reinforcing bar vertically through the bag. Bars must be at least 18 inches long.
3. The slope of the wall may be other than as specified by FDOT at the discretion of the engineer of record with the approval of the District Engineer.
4. A concrete cap at least 6 inches high and 12 inches wide with two (2) #4 bars the full length of the cap, is required.

The bottom of the lake or canal in which a headwall is constructed shall be excavated to 6 inches below the invert of the pipe and channeled to the deep cut as shown on **Exhibit 18A, Lake Outfall Detail With Headwall.**

2.15 UTILITY CONFLICT STRUCTURES

When a utility conflicts with a drainage pipe, a conflict structure must be utilized. The cross-sectional area of the conflict structure shall be such that the design flow will pass through the structure unrestricted by the conflicting utility pipe. **Conflict structures will not be allowed on canal, lake or lake/canal interconnect pipes.**

2.16 CROSSING OF PRIMARY CANALS

It is the desire of the District that all crossings of primary canals be such that the head loss across the proposed structure is kept to a minimum. It shall be the goal of the District that the headloss across the proposed structure shall not exceed 0.1 feet and the velocity through the proposed structure shall not exceed 3 feet per second. The District would prefer that this criteria for crossing of primary canals be met through the use of bridge structures. However, culverts, including box culverts and other structures may be considered by the District on an individual basis. When a structure other than a bridge is to be installed in a primary canal, the District shall collect an impact fee of an

amount to be determined by the District Board of Commissioners on a case by case basis. The fee shall be based on increased maintenance and operation that is estimated to be caused by the structure and shall be deposited in a fund for the maintenance and improvement of primary canals. When an existing culvert is intended to be extended in a primary canal and the culvert is corrugated metal, the entire existing culvert shall be replaced with a reinforced concrete culvert. District's Canal No.1 (University Drive Canal) shall only allow bridge structures for crossings due to the hydraulic limitations of the canal.

2.17 BRIDGE CROSSINGS

Bridge crossings of canals within the District shall have a minimum horizontal clearance of 25 feet between center span bents and a minimum vertical clearance of 7 feet between the low member and the control elevation of the water body being crossed. Bridge structures should be designed so that they do not catch debris or obstruct the flow of the canal. Cross sections of the water body being crossed shall be provided for 100 feet upstream and downstream, and the applicant may be required to correct any deficiencies in the channel cross section in this area. Bridge approaches and abutments shall be designed to allow the District's maintenance equipment to pass. The applicant is referred to **Exhibit 20, Bridge Crossing Detail**.

2.18 UTILITY CROSSINGS IN DISTRICT WATER BODIES

The District shall review all proposed utility crossings prior to construction. Overhead crossings shall have a minimum vertical clearance of 40 feet between the low wire and the natural ground surface of the proposed crossing. Aerial utility crossings shall conform to **Exhibit 21, Overhead Utility Crossing Detail**. Subaqueous water and force main crossings shall be a minimum of 36 inches below the bottom of the design cross section of the canal and shall conform to **Exhibit 22, Water and Sewer Aerial and Subaqueous Crossing Detail**. The District shall enter into an agreement with the operating and constructing entity proposing the crossing whereby the District is held harmless from any and all damages that are caused as a result of the crossing. All banks shall be

stabilized in such a manner so that erosion does not occur. Cash or surety bond in the amount of \$1,000 minimum shall be submitted prior to start of work. Upon final inspection and approval of the work by the District, the bond may be released.

2.19 WELLFIELDS

The applicant shall depict on the plans submitted to the District for approval, the location of all wellfields either existing or proposed by Broward County or any City or Town. Furthermore, in the event the applicant is requested or required to provide wellfields for its project after receiving District approval, the applicant shall, as soon as is reasonably practical, notify the District of the location of the wellfields and request the District to re-review its project for any effect on the District's previous approval or review. It is the applicant's responsibility to locate all wellfields which are on the project's property or which may be required for the property on which the project is located.

In the alternative, the applicant shall provide a statement from the appropriate department of Broward County and the City or Town that the project is located in, that there are no wellfields, either existing or proposed, within 1,000 feet of the applicant's property and that the applicant's proposed use of the property will not have any adverse affect on said wellfields.

2.20 WATER QUALITY

It shall be the policy of the District to assure that discharges of water are, at a minimum, of such quality that will not degrade the quality of the receiving body or will meet the standards of the South Florida Water Management District and Broward County Department of Planning and Environmental Protection for the receiving body, whichever is higher. A Stormwater Pollution Prevention Plan (SWPPP) shall be required to address the quality of the receiving body of water in accordance with the criteria of the Florida Department of Environmental Protection. The applicant shall exercise extreme care to minimize the degradation of water quality and all necessary provisions

shall be taken to ensure compliance with the water quality standards of the State of Florida. The applicant is referred to Chapter 17-3, Florida Administrative Code, and in particular, the requirement that turbidity shall not exceed fifty (50) Jackson units above background level and the requirements of Chapter 27-5, Code of Regulations of Broward County Department of Planning and Environmental Protection that the turbidity shall not exceed twenty-nine (29) nephelometric turbidity units (NTUs). Adequate silt containment procedures and equipment, including but not limited to, silt screens or turbidity curtains, shall be used to control turbidity at all times.

If, in the future, South Florida Water Management District requires structures for the monitoring or control of water quality, the permittee/applicant or its successors will be required by the South Broward Drainage District to install the required works at the permittee's/applicant's or its successors expense.

Water quality data for any water discharge from the permittee's/applicant's property shall be submitted to the District as required. Parameters that may be required by the District include nitrates (as "N"), nitrites (as "N"), total kjeldahl nitrogen (as "N") ammonia (as "N"), total phosphorus (as "P"), ortho-phosphorus (as "P"), total dissolved solids, total suspended solids and 5-day, 20-degree Centigrade BOD.

2.21 DRAINAGE OF ADJACENT PROPERTY

If the District determines that property adjacent to applicant's property, including road right-of-way, will be required to drain through applicant's property, the applicant shall construct a culvert from the applicant's and adjacent property owner(s) property line(s), to the applicant's drainage system. This culvert shall be sized to meet the drainage requirements of the adjacent property and all upstream properties which will drain through applicant's drainage system. A minimum 20 foot wide drainage easement over the culvert shall be dedicated to the District. A separate culvert shall be provided for each property owner adjacent to applicant's property.

2.22 LAKE INTERCONNECTS

All interconnects between lake systems within a project shall be reinforced concrete pipe and be a minimum of 48 inches in diameter. The applicant shall provide the District with all input data, flood stages and pipe flow velocities so that a determination can be made as to the adequacy of the lake interconnect. Head losses and stages of a lake interconnect will be evaluated on a case by case basis by the District based on the information supplied. All lake interconnects and discharges into primary and secondary canals are required to have headwalls subject to the requirements of Section 2.14.

2.23 FOUNTAINS AND AERATORS

Fountains and aerators are prohibited in primary and secondary canals. The minimum distance from a lake bank at the basin control elevation to any fountain shall be 16 feet. Electric services for fountains and aerators must not be located in drainage easements, lake maintenance easements or on District property. Anchors, power cables, conduit and all other connections to a fountain or aerator shall be buried with a minimum depth of 3 feet or submerged to a depth of not less than 42 inches below basin control elevation. Buried portions shall follow the slope of the bank. The highest point of any submerged aeration unit shall be 42 inches below basin control elevation.

2.24 WETLAND MITIGATION AREAS

The District acknowledges that wetland mitigation areas and/or conservation easements may be required by other governmental agencies as part of the development of property within the District. It is the policy of the District to encourage property owners to place all wetland mitigation areas and conservation easements in a consolidated area which is not adjacent to residential housing and which is not part of or adjacent to the project's drainage system. If a wetland mitigation area is to be constructed adjacent to residential housing, it shall be constructed in accordance with **Exhibit 11A, Section With Muck Divider For Lakes/Water Bodies Adjacent To Mitigation Areas & Behind Residential Lots** or **Exhibit 11B, Section With Stabilized Divider For Lakes/Water Bodies**

Adjacent To Mitigation Areas & Behind Residential Lots. Prior to the planning of wetland mitigation areas and/or conservation easements for each development, the applicant shall contact the District to coordinate and determine conflicts between the proposed wetland mitigation areas, conservation easements and the project's drainage system.

If any part of the project's drainage system is included in the wetland mitigation area or conservation easement, the applicant will be required to enter into an indemnification and hold harmless agreement with the District wherein the District is to be indemnified and held harmless from any and all liability as the result of any damage which the District may cause to said wetland mitigation area or conservation easement as the result of required stormwater maintenance. This agreement will also provide that the property owner is to be responsible for maintenance of said wetland mitigation area and conservation easement and will repair any damage which the District may cause to these areas as the result of District activities. The maintenance responsibility of the wetland mitigation area and conservation easement and obligations as stated in the indemnification and hold harmless agreement may be assigned to a homeowner association after completion of the drainage system within and through the wetland mitigation area and conservation easement and the District has accepted said drainage system in writing or by other acceptance. This part of the drainage system will be described in the Agreement as the "Conservation Area Drainage System". In addition, the documents creating said homeowner association or amendment thereto, shall specifically refer to the obligations of the homeowner association and agreement required by the District.

The indemnification and hold harmless agreement shall provide that the lien rights of the property owner and/or homeowner association shall be assigned to the District in the event the developer and/or the homeowner association fails to comply with the terms and conditions of said agreement.

If a conservation easement is to be dedicated to Broward County over a portion of a lake or other area that is also to be dedicated as part of a project's drainage system to the District, the dedication to the District shall occur first. All conservation easements dedicated to Broward County or the

South Florida Water Management District shall contain a paragraph or provision which provides that, "The South Broward Drainage District shall retain all rights to enter upon and across that portion of the conservation easement area which coincides with the easements dedicated to the South Broward Drainage District to perform such work as may be necessary from time to time to maintain the easements dedicated to South Broward Drainage District, to maintain the drainage facilities contained therein and to maintain stormwater flowage and storage across, through and over said easements." This paragraph may be modified as agreed to between the South Broward Drainage District, Broward County and the South Florida Water Management District. All easements referred to therein may need to be specifically identified by legal description attached to the conservation easement or by reference to a recorded instrument or plat. All other paragraphs in the conservation easement which refer to or restrict activities permitted or required by the conservation easement license shall be limited to state, "except as provided by the paragraph referencing the South Broward Drainage District's rights."

All legal expenses and costs including recording costs associated with the indemnification and hold harmless agreement and coordination associated with the conservation easement shall be paid to the District by the applicant or property owner. The applicant or property owner may be required to post in escrow an amount to be determined by the District which will be applied toward payment of these expenses. If the amount held in escrow is insufficient to pay all fees incurred, the applicant or property owner will be responsible for the difference.