South Florida

Water Management District

December 15, 1977 - BOR

BASIS OF REVIEW OF CONSTRUCTION OF SURFACE WATER MANAGEMENT SYSTEMS SERVING PROJECTS WITH TWO OR MORE ACRES OF IMPERVIOUS AREA WITHIN THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT

DECEMBER, 1977

ADOPTED BY THE GOVERNING BOARD OF THE

SOUTH FLORIDA WATER MANAGEMENT DISTRICT ON DECEMBER 15, 1977

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OBJECTIVES

Under Part IV of Chapter 373,Florida Statutes, and Rule Chapter 16K-4, the District is responsible for the permitting of construction of surface water management systems within its jurisdictional boundaries. The intent of this document is to set forth in clear and understandable terms, the criteria and requirements that will be applied in reviewing applications for certain specific types of surface water management systems. An effort has been made to eliminate needless duplication and to take into account applicable local criteria to avoid unnecessary conflicts of jurisdiction.

The following information is presented as the basis of review for the construction of surface water management systems which serve projects with two or more acres of impervious area and for which either no more restrictive local criteria apply or for which no acceptable additional or conflicting information is available. For the purposes of this document, the term "impervious" means not allowing or allowing only with great difficulty, the vertical movement of water. If applicable local criteria are more restrictive than the District's criteria indicated herein, the local criteria shall be applied in the District's review. Should the Applicant desire that his design be reviewed on a basis differing from that described herein, such desire shall be discussed with the technical staff prior to submission of the Application. The staff shall respond to such requests in writing within a reasonable time and may make recommendations to the Governing Board that it accept or reject the proposed alternate basis of review for a particular project when the application is presented to the Governing Board.

The basic objectives of the District are to insure that the Applicant's system will not be harmful to the water resources of the District and is consistent with the public interest. This means that the system should function consistently with the environment and fulfill its intended purpose. Means of satisfying these ends include maintenance of satisfactory water quality, flood and drainage protection,and water conservation.

Because prevention of, rather than solutions to, problems is more feasibly and realistically handled, the District considers new projects primarily from the point of view of problem prevention. Contingencies in the state-of-the-art require that a mechanism exist for problem solution when prevention is not always possible. Thus, the District assumes that there will always be a Permittee who will be legally responsible for the system. Where the responsibility is not totally clear, a condition of the Permit may be the requirement for the establishment of a legally responsible entity. The District objective is therefore projected into the future in this manner.

Problem prevention is particularly important since in recent years it has become increasingly obvious that storm water runoff from streets, shopping centers, and residential areas is a major contributor to pollution problems of surface waters in both urbanized and rural areas. Sediment, animal fecal material, fertilizers, organic material, trace metals, petroleum products, and miscellaneous detrital material all contribute loadings of various parameters to such runoff. In addition, rainwater itself has been shown to be somewhat less pure in some instances than was once assumed, particularly in regard to nitrogen concentrations and pH variation. Therefore, provisions for water quality improvement have become an important consideration for surface water management systems coming under the permitting jurisdiction of the District.

Aside from purely technical aspects, legal and institutional factors must also be considered. Because of legal time constraints for processing permits, it is advisable for the Applicant to contact other interested agencies, organizations, and affected citizens prior to submitting a formal application to the District. Summaries of meetings and copies of responses from appropriate parties should be included with the application.

It may be in the applicant's best interest to seek concurrent approvals from all agencies with jurisdiction. Thus, this provision is not intended to preclude the submission of an application to this District prior to receiving other necessary approvals, but, the application should contain at least a status report on other approvals being sought, with an indication that the surface water management portion of the project will be approved by other pertinent jurisdictions.

PLANNING AND DESIGN

I. Design Frequency

A. Definition - Flood frequency will be assumed to result from rainfall of the same frequency. Areas subject to flooding from rising water as well as storm rainfall will be considered from two points of view.

1. Design frequency rainfall with wet season high stage or spring tide stage, if applicable.

2. Mean year rainfall (2.33 year frequency) with design frequency flood stage in receiving waters, either tidal or non-tidal.

B. Local jurisdiction criteria - internal drainage systems will be reviewed on the basis of their ability to offer protection in accordance with

criteria of the local jurisdiction, as normally published in subdivision regulations.

C. District criteria - Drainage systems will be reviewed for the ability of the system to function in conjunction with receiving waters of the District, at the respective design frequency of the District facilities.

D. Flood insurance criteria - Building floor elevations will be reviewed on the basis of 100 year frequency, 5 day duration rainfall protection as computed by the Applicant or derived from accepted flood studies. Due to possible inaccuracies in base data and design assumptions, floor elevations should be set at least at the next highest one-half foot above calculated 100 year storm stages.

E. Receiving waters without discharge criteria will be reviewed on the basis of peak discharge and total runoff volume after development not exceeding peak discharge and total runoff volume before development, consistent with maintenance of minimum flows if applicable, at the following frequency:

1. Areas less than one square mile - 10 year frequency.

2. Areas equal to or larger than one square mile - 25 year frequency.

F. Base flows and low flows from the developed site should be maintained equivalent to the historic conditions with a five year frequency drought condition being the most extreme event which must normally be considered. Base flows and low flows will usually cease for some more severe drought condition.

II. Rainfall

A. Frequency - Depth and Intensity

1. U.S. Weather Bureau Technical Paper No. 49, "Two-to-Ten-Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States" (1964); U.S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States for Duration from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years"(1961); or U.S. Department of Agriculture, Soil Conservation Service, "Rainfall Frequency Atlas of Alabama, Florida, Georgia and South Carolina for Durations From 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years" (1973).

2. U.S. Weather Bureau Technical Paper No. 25, "Rainfall Intensity - Duration - Frequency Curves" (1955).

3. Florida State Road Department, "Drainage Manual" (Second Edition, 1967).

4. Actual gage data analyzed by accepted statistical methods.

B. Duration - For small areas (usually 100 acres or less) where only peak discharge calculations are done the 24-hour duration storm of the design frequency may be sufficient. For larger areas and for areas of such size where stage and volume of runoff is considered a 5 day duration design storm may be necessary.

If the applicant is in doubt as to the duration storm he should use in his calculations for a particular project, he should contact the technical staff of the District prior to submitting an application. The staff will respond to the inquiry in writing within a reasonable time thereafter.

C. Distribution - The actual distribution of rainfall within a period should be consistent with the design duration.

1. 24-hour duration design storm - A general distribution such as the SCS Type II (see U.S. Department of Agriculture, Soil Conservation Service Technical Paper No. 149, "A Method for Estimating Volume and Rate of Runoff in Small Watersheds"-1973), or a locally derived distribution is to be used. A uniform rainfall rate for 24-hours is not reasonable for the type of analysis seeking peak discharge.

2. 5-day duration design storm - The arrangement of daily rainfall should be for a most critical response. The maximum one day event should be preceded by at least the second heaviest rainfall day.

3. If data for rainfall other than the one day depth is not available then a distribution may be used as follows:

Time (hours)	Percentage of One Day Rainfall	
0		14.6
24		21.3
48		21.3
58		5.6
59		5.0
59.5		15.0
59.75		18.7
60		7.3
60.5		3.8
61		5.1
62		18.2
72		11.3
96		9.6
120		

100% One Day Rainfall

III. Water Quantity Computations

A. Checklist for Drainage Projects - The attached checklist, (Appendix 1) if complied with, will normally furnish the information required for review. Additionally, it is requested that all engineering plans and calculations bear the seal of a State of Florida registered professional engineer subject to the exemptions specified in Chapter 471, Florida Statutes. Submission of the items indicated by an asterisk in Appendix 1 will normally furnish the information necessary for review of an application for conceptual approval.

B. Phased Projects - Projects that are to be developed in phases will require the submission of a Master Plan of the Applicant's contiguous land holdings. The primary interest of the District is to insure continuity between phases, satisfactory completeness of individual phases should the project be incomplete as planned and preservation of adjacent property owner's rights. This includes adjacent property owners created by the sale of incompleted phases.

Normally, an application for conceptual approval of the total Master Plan must be submitted first. An application for construction approval of the first phase may also be included as a part of the initial application. As the permittee desires to construct additional phases, these approvals would be included as modifications to the original permit.

Applications for individual project phases where no conceptual approval has been sought may be considered only when the phases are totally independent of, or make sufficient provisions for, adjacent lands.

C. Antecedent Conditions - For groundwater and surface water stages antecedent to the design event the wet season table and stage should be used. For artificially maintained on-site stages the applicant should demonstrate the feasibility of creating a stage lower than the normal wet season water table. It will normally be necessary for the Applicant to demonstrate that soils or discharge structures possess the ability to draw storage stages down preceding the design event, such that initial storage is available in the system.

D. Infiltration and Percolation

1. Ground surface - groundsurface infiltration will be reviewed on the basis of commonly accepted values such as those of Soil Conservation Service (see, U.S. Department of Agriculture, Soil Conservation Service Technical Paper No. 149, "A Method for Estimating Volume and Rate of Runoff in Small Watersheds"(1973), and U.S. Department of Agriculture, Soil Conservation Service Technical Release No. 55, "Urban Hydrology for Small Watersheds"-1975); or rational method (see, Florida State Road Department, "Drainage Manual" (2nd Edition, 1967); or standard civil engineering textbooks), unless test data is submitted to justify other values.

2. Subsurface - subsurface percolation will be reviewed only on the basis of representative or actual test data submitted by the individual applicant. The Dade County Public Works Department is suggested as a reference source to Applicants for test procedures and design and maintenance performance of subsurface percolation systems.

E. Evapotranspiration - Considered only for 5 day (or longer) events. Amounts will be estimated as follows:

1. Groundwater depth 0 to 1' - 0.3" ET/day

2. Groundwater depth 1' to 2.5' - 0.2" ET/day

3. Groundwater depth 2.5' to 4' - 0.1" ET/day

4. Groundwater depth below 4' - 0" ET/day

F. Storage

1. On-site storage - If on-site storage is to be considered in the review, the Applicant should submit stage-storage curves. If on-site storage plus discharge is to be considered, the stage discharge computations should also be submitted. Actual rather than allowable discharges should be used in routing. Often for the more extreme events, such as 100 year frequency, discharge can be ignored because the high tail water stage in the receiving water effectively prevents any but a negligible discharge. In such cases a mass accounting of on-site water will suffice, if adjacent areas can safely be ignored.

2. Ground - The Soil Conservation Service has made the following estimate of soil storage capability for the normal sandy soils found within the District in their average natural state:

Depth to Water Table	Cumulative Water Storage
1'	0.6"
2'	2.5"
3'	6.6"
4'	10.9"

For the same sandy soils which have been compacted intentionally or incidental to earthwork operations the cumulative storage should be reduced 25 percent. For other soil types a storage capacity of 1-inch of water in 6 inches of soil depth above the wet season water table should be used unless soils data indicates otherwise.

Groundwater storage beneath impervious surfaces generally appears impractical to any great degree because of the trapped air which water cannot displace.

3. Side slopes - For purposes of public safety and maintenance, all water bodies utilized as integral parts of the drainage system shall have side slopes no steeper than 7:1 (horizontal:vertical) out to a depth of two feet below the normal dry season groundwater elevation. This criterion may be modified if the applicant or pertinent local jurisdictions can demonstrate that such modification can achieve the desired objectives.

4. Set-back requirements - All water bodies utilized as integral parts of the drainage system will be subject to the following setback requirements from District facilities (except for the actual connections to District canals). Requests for variances from these

requirements shall be submitted to the District when the application is filed. All such requests will be reviewed by the staffs of all relevant departments within the District.

a. For excavations adjacent to District canals, the top of the excavation shall be a minimum distance of 10d feet from the District canal right-of-way line, or (10d + 50) feet from the District canal top of cut, whichever produces the greater set-back (d equals depth of excavation).

b. For all excavations adjacent to the conservation area levees the set-back from the adjacent right-of-way line of the District levee/borrow canal to the top of the excavation shall be computed as in "a" above, but shall not be less than 500 feet.

Example 1: Canal right-of-way line is 35 feet from top of canal cut; proposed excavation is to elevation - 25.0 feet msl, with average natural ground elevation along adjacent perimeter of rock pit at +5.0 feet msl (d=30 feet).

a. 35 feet + (10x30) = 335 feet from top of cut, or 300 feet from right-of-way line.

b. 50 feet + (10x30) = 350 feet from top of canal cut, or 315 feet from right-of-way line.

Required set-back is 350 feet as measured from top of canal cut, or 315 feet from right-of-way line.

Example 2: Canal right-of-way line is 65 feet from top of canal cut, proposed depth as example 1.

a. 65 feet + (10x30) = 365 feet from top of canal cut, or 300 feet from right-of-way line.

b. 50 feet + (10x30) = 350 feet from top of cut, or 285 feet from right-of-way line.

Required set-back is 365 feet, or 300 feet from right-of-way line.

G. Runoff - The usual methods of computation are as follows:

1. Rainfall minus losses and storage.

2. Soil Conservation Service (see, U.S. Department of Agriculture, Soil Conservation Service, "National Engineering Handbook, Section 4, Hydrology" - 1972), with extra attention to hydrologic accounting of water table conditions.

3. Rational method, for systems serving projects of less than 200 acres total land area. (see, Florida State Department of Transportation, "Drainage Manual" (2d Edition 1967); or standard civil engineering texts.

H. Receiving Water Stage

1. Regulated systems - Design and maintained stage elevations should be available either from the local jurisdiction or the District. Stages for frequencies other than the design will be estimated by the District upon request from the Applicant.

2. Non-regulated systems - The Applicant should compute receiving water stages for such systems from the best available data and submit the results to the District for review and concurrence before utilizing such results in further computations.

I. Discharge

1. Regulated systems - Allowable discharges into District works and the Lake Worth Drainage District works are available from the District on request. Some flexibility exists in the values because of nonconcurrent peaks, but the preparation of the values has given consideration to some nonconcurrent peaks as well as areal reductions for non-uniform events, so the values should generally be adhered to in systems design.

2. Non-regulated systems - Non-regulated systems are reviewed as discussed herein under design frequency for receiving waters without limiting criteria.

3. Non-urban gravity systems - Rural gravity systems are generally reviewed on the basis of the discharge culvert operating at a fixed head loss to meet the allowable discharge rate. This basis is justified by the estimate that the upstream headwater generated

by rural runoff will be unable to collect at the upstream culvert end appreciably faster than the rate at which the receiving water rises. The fixed head loss amounts are 0.5' except in South Dade County (south of Canal C-2) where the value is 0.2'.

J. Water Conservation - Although drainage systems are usually designed primarily for the disposal of extreme event storm runoff, considerations for water conservation are necessary if these systems are to function as water management systems. Conservation is most critical where the primary canal system or other receiving water discharges directly into saline bodies of water making such discharges of fresh water irretrievable. Therefore, the surface water management facilities shall be designed to operate so as to prevent lowering of groundwater levels more than one foot below the normal dry season groundwater elevation for the project site. (Groundwater elevations may be determined using United States Geological Survey or Soil Conservation Service data, or other data which may be available for a particular area). For example, invert elevations of culverts and other works can be placed high enough so as not to facilitate groundwater drainage below the accepted level.

In addition, a hydrologic accounting of the project site for pre- and post-development conditions will normally be required, to demonstrate that discharges from the site under fully developed conditions up to and including a five year frequency drought event (maintenance of minimum flows). See Section I.F., page 2. The applicant may contact the technical staff of the District prior to submission of an application to determine whether hydrologic accounting will not be required.

The staff will respond in writing within a reasonable time thereafter.

K. Models - The use of proven models in the design of surface water management systems is acceptable to the District. The choice of models utilized will be left to the applicant; however, the applicant will be required to provide data on model calibration and to substantiate that such data is transferable to the site in question.

IV. Water Quality - System Design Requirements

A. Retention/Detention - Retention and/or detention in the overall system, including swales, lakes, canals, greenways, etc., shall meet all of the following criteria:

1. Retention volume shall be provided for one inch of runoff from the developed project. Preferably, the system should be designed such that discharge normally does not commence until the first inch of runoff has been stored.

2. Retention shall be provided for the runoff from a 3-year, 1-hour rainfall event.

3. Average detention time for runoff from a 25-year, 24-hour rainfall event shall be at least 5 hours.

B. Deep Water Bodies - All water bodies utilized as integral parts of the drainage system shall be no deeper than the bottom elevation of the off-site receiving water, unless the applicant can demonstrate that all of the following criteria can be met:

1. Entrapped salt water, resulting from inland migration of salt water during hurricane tide conditions or penetration of the fresh-water/salt water interface, will not adversely impact on-site or adjacent water users.

2. The penetration of a water-bearing formation exhibiting poorer water quality, in terms of chloride concentrations, will not adversely impact on-site or adjacent water users.

C. Impervious Areas - Runoff shall be discharged from impervious surfaces to retention areas, detention devices, filtering and cleansing devices, and/or subjected to some type of Best Management Practice (BMP) prior to discharge from the project site. For projects which include substantial paved areas, such as shopping centers, roads, and high density developments, provisions shall be made for the removal of oil, grease and sediment from storm water discharges. A listing of BMP's currently used within the District to achieve this design objective is provided in section V.

D. Stagnant Water Conditions - Configurations which create stagnant water conditions such as hydraulically dead end canals are to be avoided, regardless of the type of development.

E. Florida Department of Environmental Regulation Requirements - Chapter 17-4 of the Florida Administrative Code, contains the permitting requirements of the Florida Department of Environmental Regulation.

Additional FDER guidelines are contained in the "Best Management Practices" section of this document. For projects which require FDER permits, the applicant is advised that receipt of a surface water management permit from the South Florida Water Management District in no way relieves him of the necessity of complying with FDER permitting requirements. Copies of all applications submitted to the District are furnished to FDER.

F. Local Requirements - Some counties and municipalities within the District have specific requirements regarding the design of surface water management systems. These are normally included in subdivision regulations, although this may vary from jurisdiction to jurisdiction. Therefore, Applicants would be well advised to contact the appropriate county or municipal office prior to finalizing the design of the systems.

G. Design Alternatives - The listing of design criteria is not intended to preclude the design engineer from utilizing other known state-of-the-art methods and available best management practices, and should not be construed in such a manner as to discourage innovative design concepts.

V. Water Quantity and Quality - Best Management Practices

A. Water Conservation - As discussed in Section III, J. above, water conservation is a desirable feature in design and operation of surface water management systems. Management practices utilized to reduce losses of fresh water also provide water quality benefits since total poundage loadings to off-site receiving waters would be reduced. In addition to those items enumerated in Section III, J., other best management practices for water conservation are encouraged. For example, maximum use of on-site retention is encouraged, consistent with maintenance of minimum flows, also, pump schedules should be determined so that over-pumping does not occur subsequent to relatively minor storm events.

Voluntary conservation practices such as these will be useful in evaluating the need for mandatory measures.

B. Water Quality - Separating design criteria from best management practices for water quality enhancement of storm water runoff does not follow any clear-cut guideline. Although there may be some duplication with previously listed design criteria, the following listing is presented to illustrate general management techniques available to the consultant in the planning and design of surface water management systems.

1. Swales - Drainage systems should utilize swales, greenways, etc.

in lieu of storm drains and curb-and-gutter to the maximum extent possible.

2. Littoral area - Water bodies utilized as integral parts of the drainage system can include substantial littoral areas in order to provide for emergent vegetation for the improvement of nutrient uptake capabilities.

3. Percolation - Infiltration and percolation, covered previously in Section II, C. above, is also useful from a water quality standpoint where conditions are favorable. However, care must be exercised to ensure that such facilities do not create a hazard for potable water supplies.

4. Catch Basins - The use of some type of baffled catch basin for oil, grease, and sediment removal is encouraged, along with a regular maintenance schedule. All catch basins should be located in swales or other pervious areas. In order to provide additional retention and percolation, catch basin lips should be raised 2 inches or more unless doing so would create long duration standing water or traffic safety problems.

5. Golf Courses - Due to heavy fertilization and frequent irrigation, specialized use areas such as golf courses can create additional water quality problems. If major drainage system components (lakes, canals, etc.) are to be located in or adjacent to such areas, component design should include a low berm to induce percolation into the system instead of overland sheet flow. Such a design practice can also be of benefit for residential developments.

6. Recirculation - Recirculating water as much as possible within a development can reduce off-site discharges, thus reducing pollutant poundage loadings to receiving streams.

7. Florida Department of Environmental Regulation Guidelines - In addition to Items 1-6 above, the following listing of BMP's is excerpted from the Department of Environmental Regulation's "Recommendations for the Management of Runoff from Land Alteration Activities."

> "Provisions should be taken during the initial design phase to infiltrate and percolate maximum runoff to remove pollutant materials. Where impervious substances or soil conditions limit the infiltration capacity,

other means of runoff control should be taken. Methods to reduce the impact of runoff (which incorporate erosion and nutrient control) may include, but not necessarily be limited to, the use of:

a. Retention devices or water storage facilities, e.g.:

    1. Holding ponds
    2. Impoundment areas
    3. Dikes
    4. Rooftop storage

b. Detention (pass-through) devices, such as:

    1. Sedimentation traps or basins
    2. Catchment basins
    3. Meandered, broad, shallow interconnected basins
    4. Step weirs
    5. Dams
    6. Grassy swales
    7. Paved transport ditches in conjunction with other controls

c. Filtering and cleansing techniques, such as:

    1. Grassy swales on gentle slopes
    2. Mechanisms for dispersal of discharge as sheet flow
    3. Use of natural vegetation
    4. Marshes
    5. Oil or grease separation equipment

d. Chemical treatment

e. Cleaning of streets

f. Measures for erosion and nutrient control during construction such as:

    1. Regrading to minimize slopes
    2. Seeding, mulching, sprigging or sodding of altered land uses

3. Diking
4. Use of hay bales
5. Turbidity control diapers
6. Temporary sedimentation traps, retention basins, and/or holding ponds
7. Minimization of clearing with utilization of existing vegetation as erosion barriers"

VI. Land Use Considerations

Before an application will be considered for the issuance of a Surface Water Management permit by the District, the proposed land use must be compatible with the applicable zoning for the area. Merely making application to the applicable local agency for rezoning of the land will not suffice; any necessary rezoning must be officially obtained prior to issuance of this District's permit. Any application for a Surface Water Management permit which does not indicate that the proposed land use is compatible with the applicable zoning for the area shall be considered as incomplete until the applicable zoning is received. In addition, applicants should, if applicable, indicate where the project stands in the local review process. For example, it would be extremely helpful to supply the information requested in Appendix I, Items 1.A., 1-7.

VII. Environmental Considerations

An environmental assessment will be made of all Surface Water Management permit applications. The natural resources of the area under consideration (including topography, soils, natural vegetation, terrestrial and aquatic wildlife, and endangered species) will be evaluated. The purpose of this evaluation is to determine the degree of environmental impact on the above listed natural resources. Particular attention will be given to projects proposed in areas classified as land use type 1, Wetlands, as specified in Appendix 2.

VIII. Water and Wastewater Service

For urban developments, potable water and wastewater facilities must be identified. The applicant for a surface water management permit must provide information on how these services are to be provided. If wastewater disposal is accomplished on-site, additional information will normally be requested.

OPERATIONAL CONDITIONS

I. Inspection and Certification

A Florida registered professional engineer will be required to furnish the District with a certification stating that the subject surface water management system has been constructed in accordance with permit authority.

District personnel inspect water management systems to insure that the said systems have been constructed in accordance with approved specifications and plans. Facilities which involve the use of District right-of-way are inspected to insure that facility installation is in accordance with plans and District criteria.

II. Water Quality Monitoring

All new drainage projects will be evaluated based on the ability of the system to prevent degradation of receiving waters and the ability to conform to State water quality standards (see Chapter 17-3 Florida Administrative Code).

There are areas within the District where water quality considerations are extremely important, due to the sensitivity of the area. These areas are as follows:

1. Lake Okeechobee and the Lower Kissimmee River

2. Canals or streams designated as Class I or Class II waters by FDER.

3. Canals back-pumped to Lake Okeechobee or to the Conservation Areas, or proposed for back-pumping.

4. Sensitive areas, including but not limited to the Savannahs in St. Lucie and Martin Counties.

New developments which plan to utilize these areas for disposal of runoff, will be given more detailed evaluation by the District staff.

In performing the more detailed evaluation, certain assumptions regarding pollutant removal efficiencies will be used, as enumerated in the following discussion.

Pollutant removal efficiencies for swales and detention facilities are not well documented at this time. However, available literature indicates that, as a conservative estimate, grassed swales will remove 10% of the nutrients in urban runoff, and retention facilities capable of storing the first inch of runoff will provide an additional 40% removal. If used together, an overall removal efficiency of at least 46% (X-{(X-0.1X)-(X-0.1X) (0.4)}=0.46X) can be anticipated. In addition, use of such facilities will decrease total outflow, resulting in a further reduction of total poundage loadings to receiving waters. The literature also indicates BOD_5 and suspended solids removals by retention facilities up to 87% and 48%, respectively. Ongoing studies by the District, the USGS, and 208 programs will provide additional information regarding pollutant removal efficiencies for various abatement practices.

In addition, new projects in excess of 320 acres entailing a more intensified land use and planning to discharge to a primary receiving water, directly or indirectly, in the first three areas listed above will be required to institute a water quality monitoring program. The following listing of land use intensity is in ascending order:

1. Wetlands (including transition zones adjacent thereto)
2. Forested lands
3. Rangeland
4. Agricultural
5. Urban and built-up land

Therefore, any proposed land use change for areas in excess of 320 acres resulting in a larger number in the above listing would require water quality monitoring if discharge is to go to one of the areas of concern listed above. In addition, some land use changes within the same category would also be considered as more intensified land use. As an example, a change from pasture to sugarcane within the "agricultural" category would be considered as a more intensified land use. Appendix 2 provides a listing of land use types under the general categories.

The necessity of a monitoring program for discharge to other sensitive areas is not based on a size limitation and is considered on a case-by-case basis. Monitoring for existing systems, regardless of size and location, is also evaluated on a case-by-case basis.

In general, there are two reasons for requiring water quality monitoring by permittees, which are as follows:

1. Such data can be used to determine if the pollution abatement practices incorporated into the design of the drainage system are functioning properly.

2. In some cases there may be a real and immediate concern regarding degradation of quality in the receiving waters, regardless of the pollutant removal efficiency of the drainage system.

The reason for the monitoring requirement will normally be stated in the staff report for each permit, as will be the monitoring schedule and the parameters of interest. Although specifics may vary from project to project, samples will normally be collected at discharge locations. A typical sampling schedule will consist of samples collected once per month during the wet season, however; this may also vary between projects. Rate of discharge at the time of sample collection and total monthly discharge each month for the duration of the permit will also be required. Parameters of interest will normally include nitrates as N, nitrites as N, total kjeldahl nitrogen as N, total nitrogen as N, ortho-phosphorus as P, total phosphorus as P, total suspended solids, BOD_5, turbidity, conductivity D.O., and pH. In some cases, fecal and total coliform and fecal strep analyses will be required in addition to other parameters. Where feasible the District's water quality monitoring requirements will be coordinated with applicable FDER monitoring requirements.

As a general rule, monitoring required of permittees will be confined to points within their boundaries. If additional sampling is needed in order to assess off-site impacts of the projects, such sampling will normally be conducted by the District.

Staff reports written and permits issued for projects not requiring monitoring at this time will normally include a statement to the effect that water quality monitoring may be required in the future, along with a list of the parameters of interest. This should not be construed as an indication that the District is contemplating the implementation of a program of intensive water quality monitoring by all permittees. If water quality problems develop in specific areas, however, permittees are in this manner put on notice that they may have to determine the quality of the water which they are discharging.

APPENDIX 1

Checklist for Surface Water Management Permit Applications

I. Land Use/Land Cover Information

A. Indicate where the project stands in the local approval process

*1. Present and proposed (if different) zoning.
*2. Present and proposed land use and density.
*3. Classification under local land use plan.
*4. Indicate if project is a planned unit development and/or subject to special zoning requirements.
5. Indicate if site plan and/or subdivision approval has been granted.
6. Indicate if any final plats have been approved. If so, describe.
7. Indicate if any building permits or other construction permits have been issued.

*B. Development area in acres.

*C. Recent aerial photograph of project site (within one year of date of application, if possible).

*D. Existing and proposed topography (msl datum).

*E. Acreages and percentages of property proposed as:

1. Impervious surfaces
2. Green areas
3. Lakes, ponds, storage areas, etc.
4. Other areas.

II. Surface Water Management Information

*A. Master Drainage Plan (or the like) along with drainage calculations, sealed by a Florida registered professional engineer, subject to the exemptions specified in Chapter 471, Florida Statutes.

*B. Pertinent drainage details on major water control structures; e.g., outfall facilities, intermediate controlling water flow structures, pumps, etc.

C. Construction phasing plans

D. Right-of-way layout for drainage system. Where occupancy of District right-of-way is proposed, pertinent structural details should be submitted.

*E. Locations of internal canals and water bodies with typical sections, including depths.

*F. Location and description of proposed storm sewers, detention/retention areas, and other conveyance and storage facilities.

*G. Best Management Practices proposed to reduce pollutant loadings.

*H. Runoff routing scheme, including calculations with stage-storage and stage-discharge relationships, if storage is utilized.

*I. Delineation of flooding contours for the following storms: local jurisdiction design frequency, receiving water design frequency and 100 year frequency storms. Specify proposed minimum building pad and pavement grade elevations.

*J. Design storm (intensity and duration).

*K. Total acres of off-site property contributing runoff to proposed surface water management system.

*L. Identify receiving stream and/or water body. Identify primary drainage facility serving the area.

M. Typical section of receiving stream, including bottom elevation.

*N. Seasonal water table elevations, including normals, and recurring highs and lows.

*O. Proposed regulation schedules of on-site water bodies.

III. Legal and Institutional Information

A. Identify entity responsible for operation and maintenance of the surface water management system.

B. Identify and give address of adjacent property owners.

*Master plan submission items for letter of conceptual approval (reference page 5, Item III B). It is recognized that details and calculations will be in a more simplified form for conceptual approval than for a permit application.

C. Indicate how water and wastewater service will be provided.

D. Identify agencies, organizations, etc., contacted. Include meeting summaries and/or responses.

APPENDIX 2

Land Use Type Examples

Land Use Type	Examples
1. Wetlands (and transition zones adjacent thereto)	
Forested Salt	Red Mangrove Black & White Mangrove Mixed
Forested Fresh	Sweet Bay, Cypress, Willow, Melaleuca, Myrtle, Button-bush, Maple, Mixed
Non-Forested	Sawgrass, Cattail, Sloughs, Bullrush, Wire Cordgrass, Mixed Aquatic Grass
Non-Forested Salt	
Water	Rivers/Streams/Canals Reservoirs, Open Water
2. Forest Land	
Deciduous	Oak
Evergreen	Pine Flatwoods, Coastal Sand Pines, Sand Pine Scrub, Australian Pines, Melaleuca
Mixed	Cabbage Palms, Oak
Other	Pine/Oak, Tropical Hammocks Palms, Brazilian Peppers, Old Field Mixed, Coastal Dune, Scrub Oak

Land Use Type	Examples
3. Rangeland	
Grass Palmetto	
4. Agricultural	
Cropland	Sugarcane, truck crops.
Pasture	Improved, Unimproved
Orchards, groves, vineyards, nurseries, ornamental and horticultural areas	Citrus, Sod farms, Ornamentals
Confined Feeding Operations	Feed lots, Dairy farms, Fish farms, Horse Training and stable, Poultry
5. Urban & Built-up Land	
Residential	Single Family - Low Density - Under 2 DU/Ac.
	Single Family - Med. Density - 2 to 5 DU/Ac.
	Single Family - High Density - Over 5 DU/Ac.
	Multi-family Unit Mobile Home
Commercial & Services	Parking Lot, Shopping Center, Sales and Services, Cultural and Entertainment, Marine Commercial (Marinas)
Industrial	Junkyard
Institutional	Educational, Medical, Religious, Military, Correctional, Governmental (other than military or correctional)

Land Use Type	Examples
5. Urban & Built-up Land (continued)	
Transportation	Airports, Railroad Yards and Terminals, Port Facilities, Electrical Power, Major Transmission Lines, Major Highway and Rights-of-Way, Water Supply Plants, Oil and Gas Storage, Solid Waste Disposal, Radio Stations or other Antenna arrays.

BIBLIOGRAPHY

The following is a list of publications incorporated by reference in this document. A copy of Item 1 may be obtained by writing to: Florida Department of Transportation, Hayden Burns Building, Tallahassee, Florida 32301.

Copies of Items 2 through 7, published by the U.S. Government may be obtained by writing to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

1. Florida State Road Department, Drainage Manual. 2nd ed. 1967.

2. U.S. Department of Agriculture, Soil Conservation Service, Technical Paper No. 149, A Method for Estimating Volume and Rate of Runoff in Small Watersheds. 1973.

3. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds. 1975.

4. U.S. Department of Agriculture, Soil Conservation Service, NEH-4. National Engineering Handbook, Section 4 Hydrology. 1972.

5. U.S. Department of Agriculture, Soil Conservation Service. Rainfall Frequency Atlas of Alabama, Florida, Georgia and South Carolina for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years. 1973.

6. U.S. Weather Bureau, Technical Paper No. 25, Rainfall Intensity - Duration Frequency Curves. 1955.

7. U.S. Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Duration from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years. 1961.

8. U.S. Weather Bureau, Technical Paper No. 49, Two-to-Ten-Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States. 1964.