5.0 Water Quality Criteria

- 5.1 State Standards
- 5.2 Retention/Detention Criteria
- 5.3 Natural and Existing Water Bodies
- 5.4 Exfiltration Systems
- 5.7 Impervious Areas
- 5.8 Stagnant Water Conditions

5.1 State Standards

- Projects shall be designed and operated so that off-site discharges will meet State water quality standards, as set forth in Chapter 62-302, Florida Administrative Code.

5.2 Retention/Detention Criteria

- Wet detention volume
  - 1 inch over project area or 2.5 inches times the percentage of imperviousness, whichever is greater.
- Dry detention volume
  - 75 percent of the above amount computed for wet detention.
- Retention volume
  - 50 percent of the above amount computed for wet detention.

5.3 Natural and Existing Water Bodies

- Candidate areas for such purposes include:
  - Previously degraded areas,
  - Borrow Pits,
  - Extensive areas which have the ability to absorb impacts easily,
  - Areas incorporated into a system with mitigation features.

5.4 Exfiltration Systems

- 5.4 Designed for the retention volume specified in Section 5.2
  - (a) Exfiltrated over one hour for retention purposes, prior to overflow, and based on test data for the site. Such systems will not be acceptable on projects to be operated by entities other than single owners or entities with full time maintenance staff.
  - (b) Must have a safety factor of two.
  - (c) A dry system is one with the pipe invert at or above the average wet season water table.

5.7 Impervious Areas

- Runoff shall be discharged from impervious surfaces through retention areas, detention devices, filtering and cleansing devices, or subjected to some other type of Best Management Practice (BMP) prior to discharge from the project site.

5.8 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.

Water Quality Example Calculation

- Given
  - Total area = 95.0 ac
  - Building (roofs) = 9.3 ac
  - Other Impervious = 41.7 ac
  - Lakes = 10.0 ac
  - Pervious = 34.0 ac

Water Quality Example Calculation

- Calculate First Inch
  - Total area = 95 ac
  - 1 inch x 95 ac x (1ft/12in) = 7.9 ac-ft

Water Quality Example Calculation

- Calculate 2.5 inches x %Impervious
  - Site area for water quality impervious/pervious calculation:
  - Total Project – (water surface + roof)
  - 95 ac – (10 ac + 9.3 ac)
  - 95 ac – 19.3 ac = 75.7 ac Site area

Water Quality Example Calculation

- Calculate ac of impervious area
  - Site area – pervious area
  - 75.7 ac – 34.0 ac = 41.7 ac imp. area
  - % imp = (ac of imp. / Site area) x 100%
  - (41.7 ac / 75.7 ac) x 100% = 55%

Water Quality Example Calculation

- Calculate 2.5 inches times % Imp
  - 2.5 in x 0.55 = 1.38 in to be treated
- Compute Volume required
  - Inches to be treated x (total site – lakes)
  - 1.38 in x (95 ac -10 ac) x (1 ft/12 in) = 9.8 ac-ft

Water Quality Example Calculation

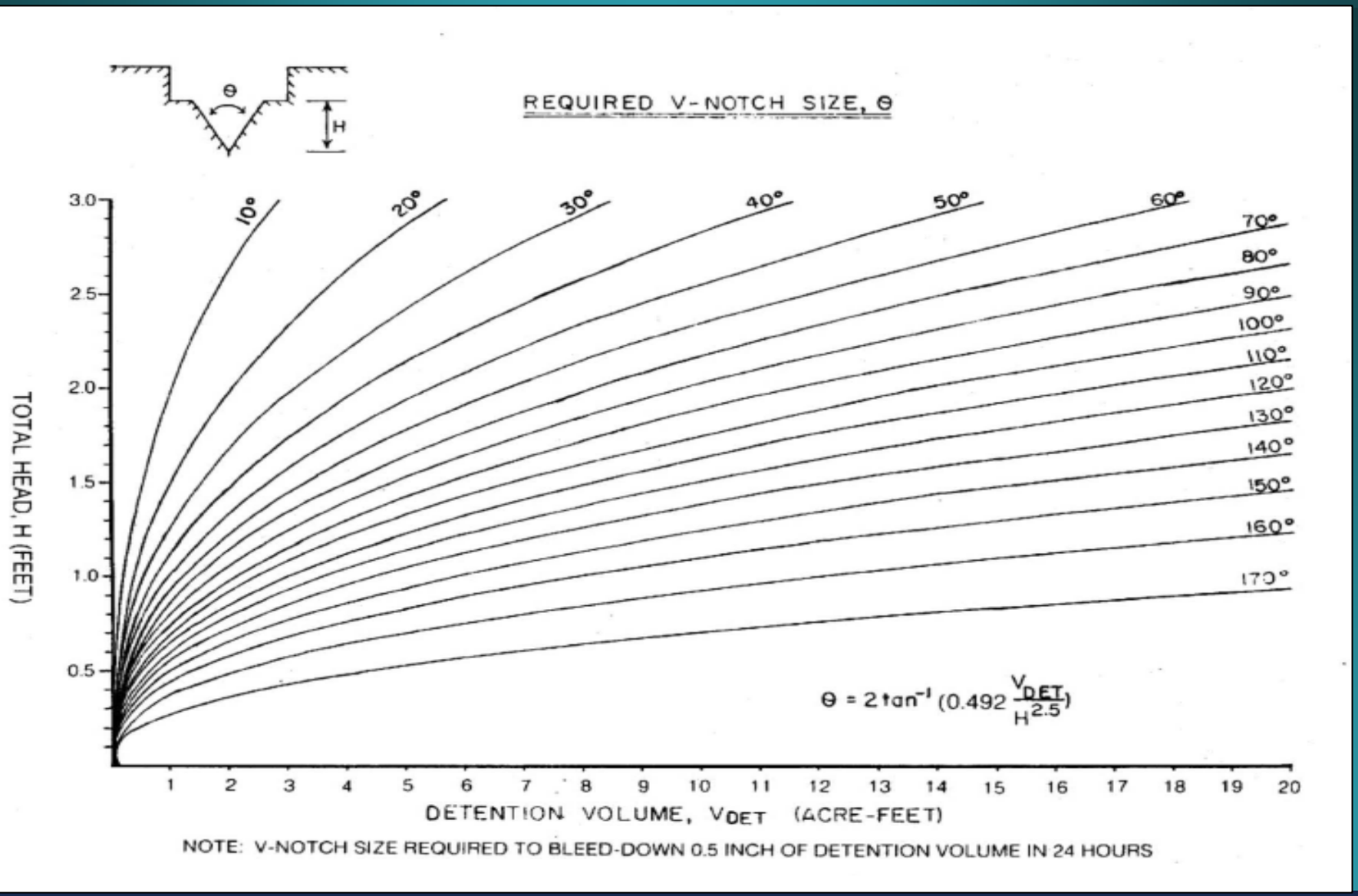
- Water quality required for first inch = 7.9 ac-ft
- Water quality required for 2.5 inches x the Impervious percentage = 9.8 ac-ft
- Therefore 9.8 ac-ft treatment required
- Wet detention proposed, so no volume reductions

Water Quality Example Calculation

- Maximum Volume to be discharged in one day through the bleeder should not be more than 0.5 inch of the required water quality volume.
- THIS IS NOT HALF THE VOLUME.
- 0.5 in x (total site area – lakes)
- 0.5 in x (95 ac – 10 ac) x 1 ft/12 in = 3.5 ac-ft
- NOT 0.5 x 9.8 ac-ft = 4.9 ac-ft

Water Quality Example Calculation

- The *Basis of Review* requires that bleed-down mechanisms be V-notches for wet detention systems.
- Surface Water Management Design Aids section of the *Basis of Review* pages G3-G6 covers V-notch and circular orifice flow formulas.


REQUIRED V-NOTCH SIZE, Θ
Θ
H
10°
20°
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°
130°
140°
150°
160°
170°
3.0
2.5
2.0
1.5
1.0
0.5
TOTAL HEAD, H (FEET)
$\Theta = 2\tan^{-1}(0.492\frac{V_{DET}}{H^{2.5}})$
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DETENTION VOLUME, V_{DET} (ACRE-FEET)
NOTE: V-NOTCH SIZE REQUIRED TO BLEED-DOWN 0.5 INCH OF DETENTION VOLUME IN 24 HOURS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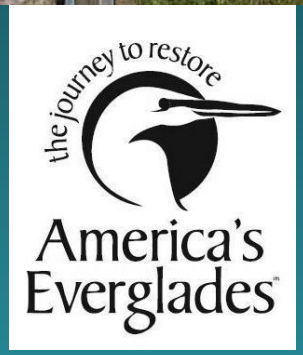
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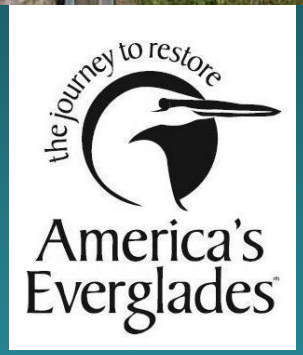
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6.0 Water Quantity Criteria

- 6.2 Discharge Rate
- 6.3 Design Storm
- 6.4 Flood Protection of Building Floors
- 6.5 Flood Protection of Roads and Parking Lots
- 6.6 Flood Plain Encroachment
- 6.7 Historic Basin Storage

6.0 Water Quantity Criteria (Cont'd)

- 6.8 Offsite Lands
- 6.9 Minimum Drainage
- 6.10 Overdrainage and Water Conservation
- 6.11 Detention and Control Elevations
- 6.13 Water Supply Sources

6.2 Discharge Rate

- Off-site discharge rate is limited to rates not causing adverse impacts to existing off-site properties, and:
  - (a) historic discharge rates, or
  - (b) rates determined in previous District permit actions, or
  - (c) rates specified in District criteria (see Appendix 2).

6.3 Design Storm

- 25-year/24-hour design event for discharge used in Orange County & Polk County.
- 10-year/72-hour design event for discharge used in Osceola County.
- Reedy Creek Improvement District limits discharge to 13 csm.

6.4 Flood Protection of Building Floors

- Building floors shall be at or above the 100 year flood elevations, as determined from the most appropriate information, including Federal Flood Insurance Rate Maps. Both tidal flooding and the 100 year, 3 day storm event shall be considered in determining elevations.

6.5 Protection of Roads and Parking

- Orange, Osceola, and Polk County road and parking design storm is the 10-year/24-hour event.
- In each basin, the minimum roadway crown elevation shall be at least 2 feet higher than the control elevation, in order to protect the road subgrade.

6.6 Flood Plain Encroachment

- No net encroachment into the floodplain, between the average wet season water table and that encompassed by the 100 year event, which will adversely affect the existing rights of others, will be allowed.

6.7 Historic Basin Storage

- Provision must be made to replace or otherwise mitigate the loss of historic basin storage provided by the project site.

6.8 Offsite Lands

- Onsite works such as swales and dikes shall be used to allow the passage of drainage from offsite areas to downstream areas.
- Diking of project development areas or other equivalent methods shall be used to contain water at or above stages identified in the project discharge computations.
- Water quality treatment required for areas that drain through the water management system.

6.9 Minimum Drainage

- Residential projects 3/8 inch per day
- Commercial and industrial projects where the entire system is not installed by the initial permittee
  - One inch detention in master system, individual sites to provide the remainder.
  - Collection and conveyance system with access points to the system provided for each individual lot or tract. The system shall be sized to limit discharge under design conditions to the allowable discharge.

6.9 Minimum Drainage (cont.)

- Projects permitted in such manner will require deed restrictions which identify to lot or tract purchasers:
  - the amount of additional on-site storm water management system necessary to provide flood protection for specific design events,
  - any additional retention/detention required for water quality purposes, and
  - the assumed per cent impervious, or impervious area used in design calculations.

6.10 Overdrainage and Water Conservation

- Systems shall be designed to:
  - Maintain existing water table elevations in existing wellfield cones of depression, and
  - Preserve site environmental values (see Section 4.0), and
  - Not waste freshwater, and
  - Not lower water tables which would adversely affect the existing rights of others, and
  - Preserve site ground water recharge characteristics

6.11 Detention and Control Elevations

- Detention and control elevations shall be set to accomplish 6.10 and are subject to the following criteria:
  - Wetland protection elevations,
  - Consistency with surrounding land and project control elevations and water tables,
  - Possible restrictions by other agencies to include tree protection and landscape ordinances,
  - Consistency with water use permits, and
  - A maximum depth of six feet below natural ground.

6.13 Water Supply Sources

- An evaluation of the impact of the proposed surface water management system on sources of water supply must be submitted with the surface water management application. Cumulative impacts which may result from the construction and operation of the proposed surface water management system must be evaluated in conjunction with the cumulative withdrawals of existing legal uses of water.
- Letters of Commitment from offsite Utilities


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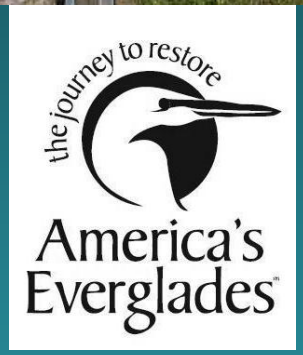
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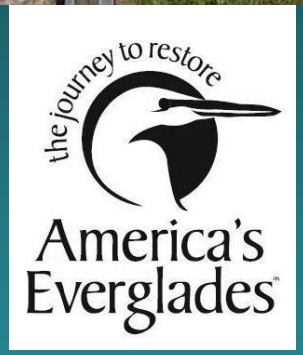
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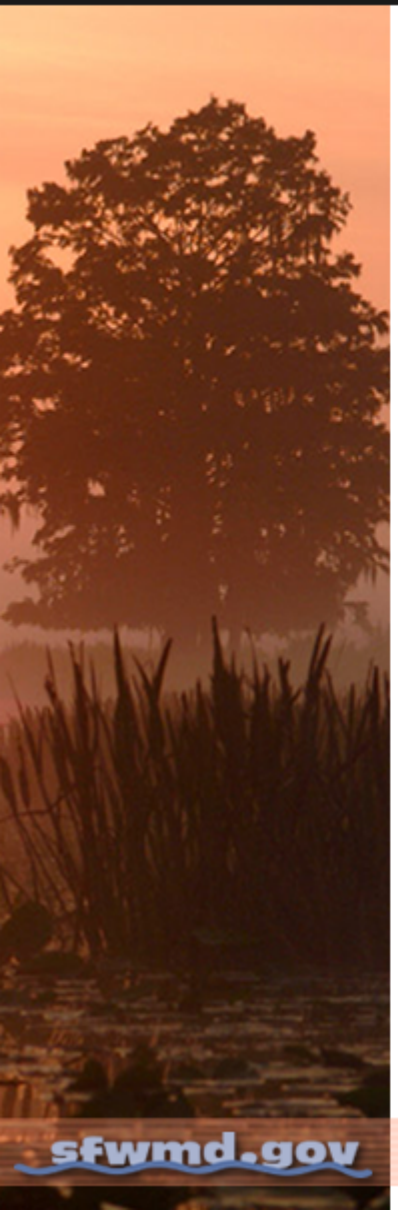
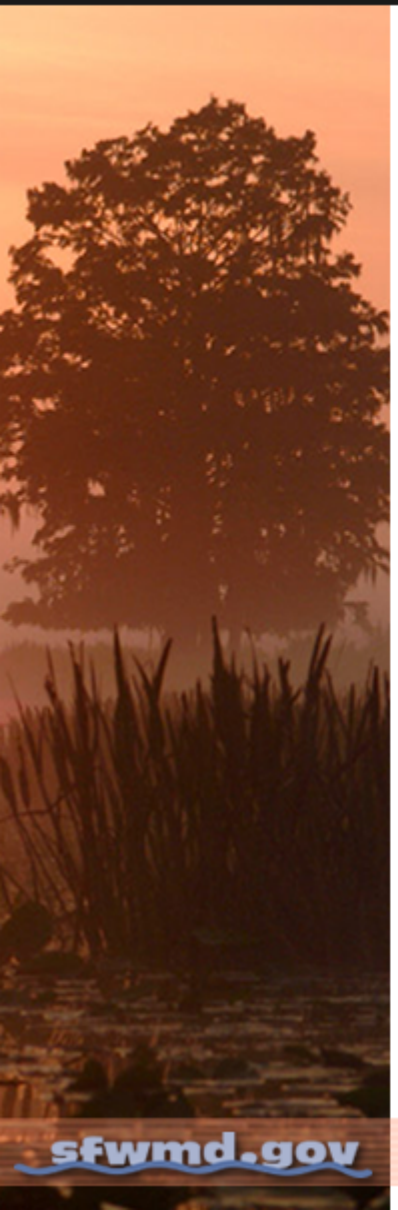
7.0 Water Management System Design & Construction Criteria



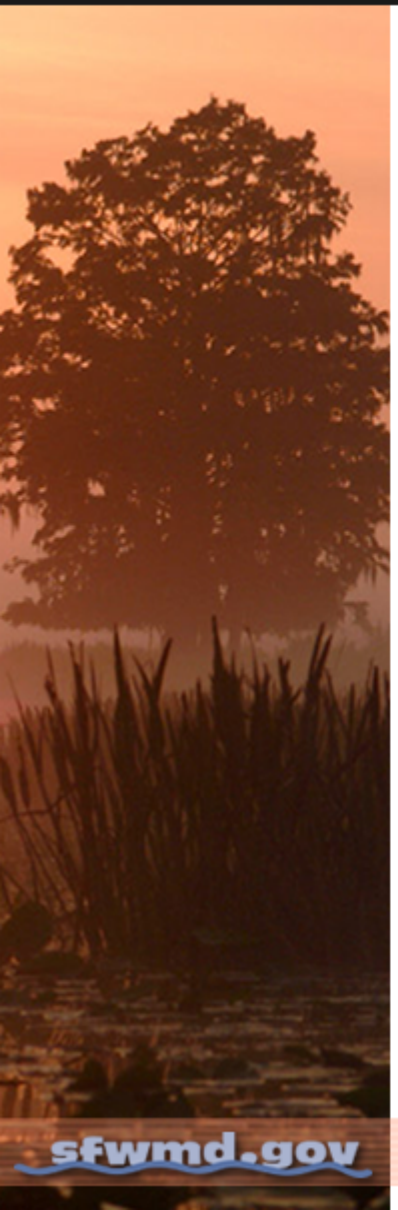
- **7.1 Discharge Structures**
- **7.2 Control Devices/Bleed-down Mechanisms for Detention Systems**
- **7.3 Dry Retention/Detention Areas**
- **7.4 Wet Retention/Detention Area Dimensional Criteria**
- **7.5 Maintenance Access and Easements**
- **7.6 Exfiltration Systems**

7.0 Water Management System Design & Construction Criteria



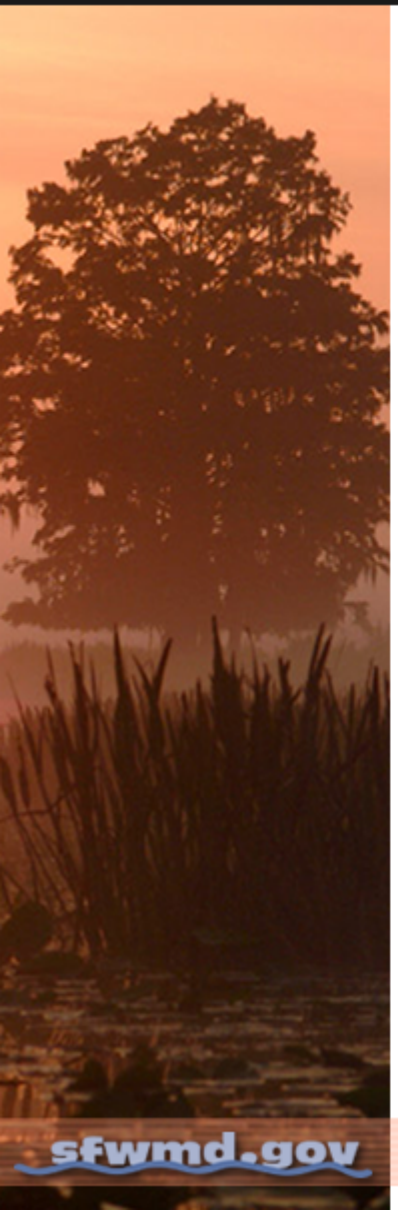
- **7.1 Discharge Structures**
  - Structural discharge facilities.
  - Fixed
  - Non-operable.
  - Grates for safety and maintenance.
  - Baffles/skimmer devices
  - Direct discharge to large water bodies
  - Indirect discharges to smaller or sensitive areas.
  - Pumps only to single owner or governmental agency.

7.0 Water Management System Design & Construction Criteria



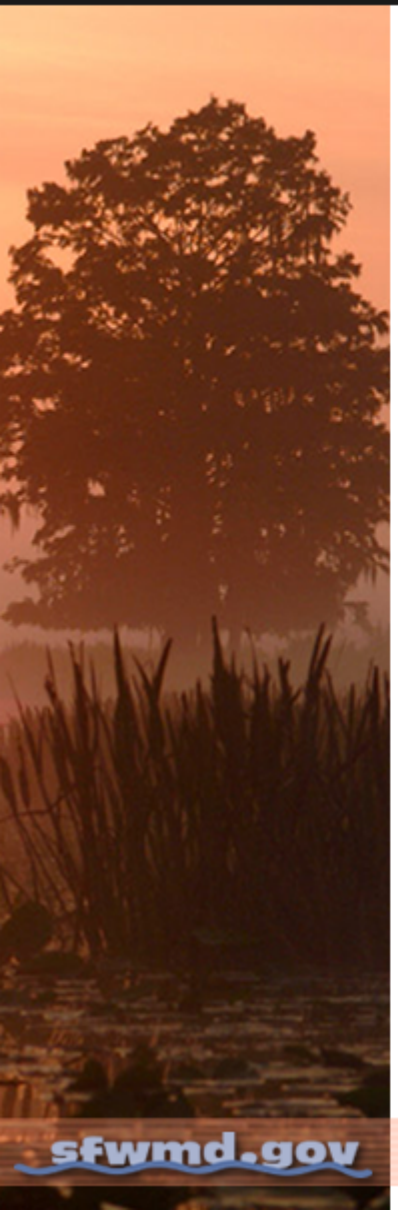
- **7.2 Control Devices/Bleed-down Mechanisms for Detention Systems**
  - **Maximum discharge 0.5 inch of the detention volume in 24 hours.**
  - **No smaller than 6 square inches cross sectional area, two inches minimum dimension or 20 degree V-notch.**
  - **Shall be V-notch or circular whenever possible.**
  - **Pumped discharge limited to 20% of the detention volume in one day.**

7.0 Water Management System Design & Construction Criteria



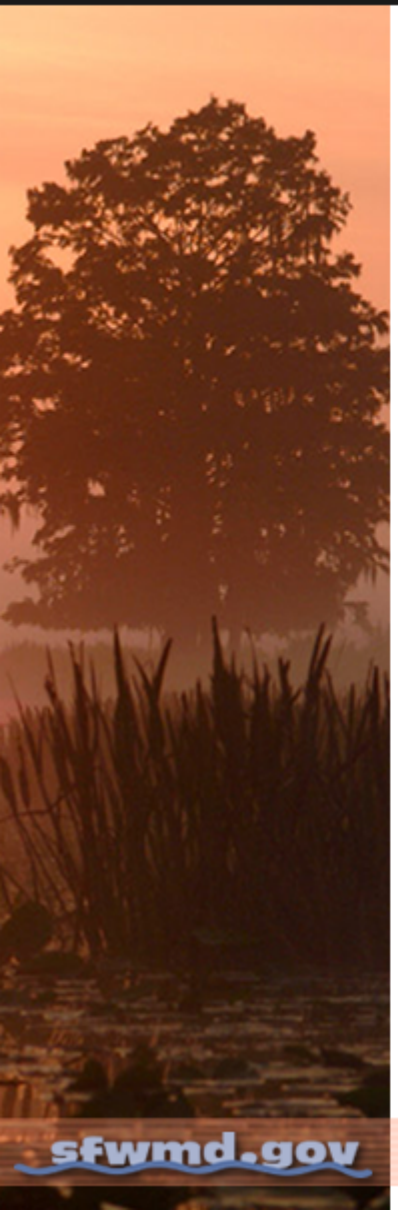
- **7.3 Dry Retention/Detention Areas**
  - Dry retention/detention areas shall have mechanisms for returning the groundwater level in the area to the control elevation.
  - Mosquito control ditches or other appropriate features for such purpose, shall be incorporated into the design of dry retention/detention areas.
  - The design of dry retention/detention areas shall incorporate considerations for regular maintenance and vegetation harvesting procedures

7.0 Water Management System Design & Construction Criteria



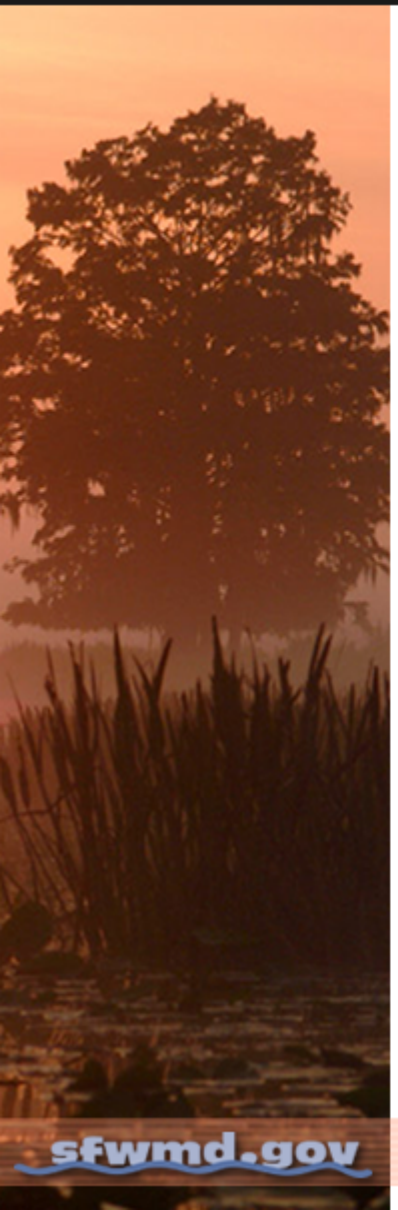
- **7.4 Wet Retention/Detention Area Dimensional Criteria**
  - Area - 0.5 acre minimum (at control elevation)
  - Width – 100 feet (at control elevation) minimum for linear areas >200 feet length.
  - Depth- recommended 25-50 percent >12’ deep.
  - Side slopes for wet retention/detention no steeper than 4:1 (5:1 in Orange County) horizontal:vertical, from top of bank out to a minimum 2 feet below control elevation. Alternative side slope criteria for Golf Course contact District Staff.
  - Bulkheads – No more than 40% of shoreline length, compensating littoral zone required.

7.0 Water Management System Design & Construction Criteria



- **7.5 Maintenance Access and Easements**
  - Minimum perimeter maintenance and operation easements of 20 feet width at slopes no steeper than 4:I (horizontal:vertical) shall be provided beyond the control elevation water line.
  - Water management areas, including 20 foot wide maintenance easements at a minimum, shall be connected to a public road or other location from which operation and maintenance access is legally and physically available.

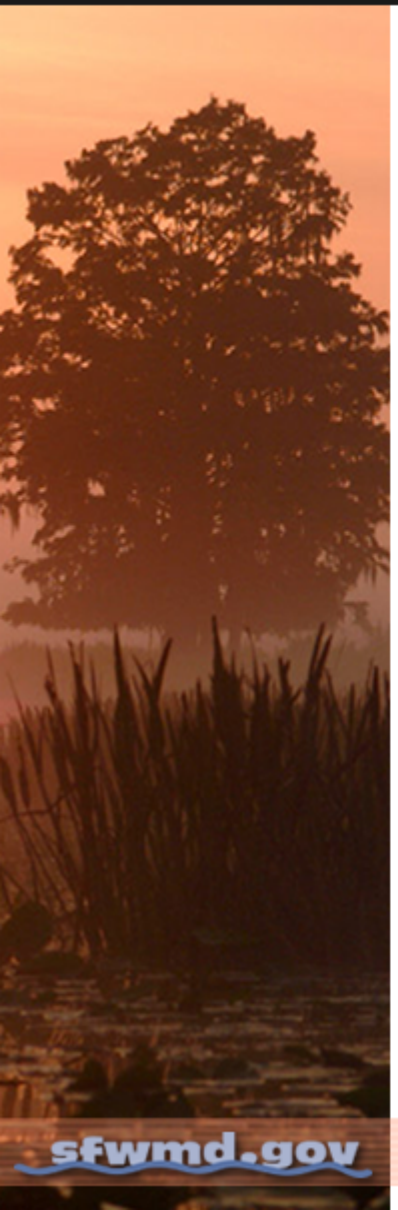
7.0 Water Management System Design & Construction Criteria



- **7.6 Exfiltration Systems**
  - Exfiltration systems must conform with the following:
    - Pipe diameter - 12" minimum
    - Trench width - 3' minimum
    - Rock in trench must be enclosed in filter material, at least on the top and sides.
    - Maintenance sumps in inlets

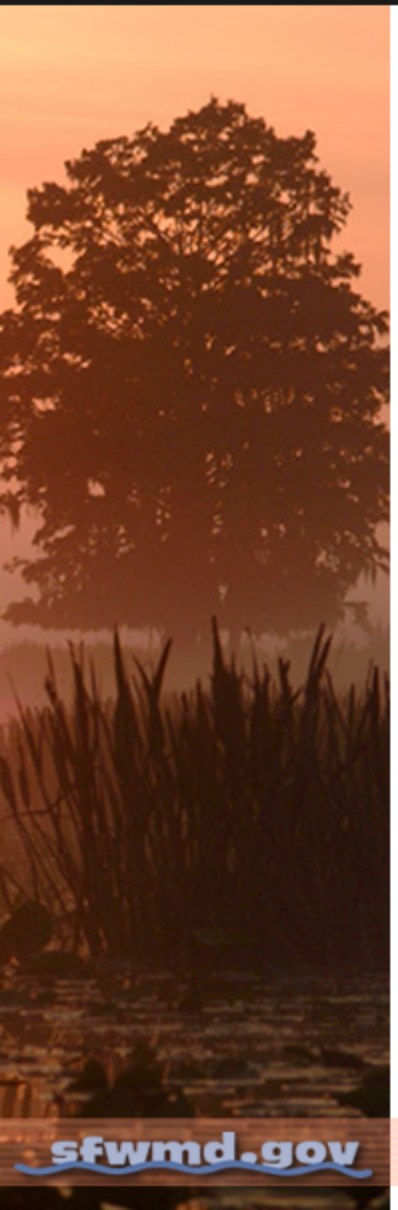
Questions?

8.0 Required Design Information & Assumptions



- 8.1 Antecedent Conditions
- 8.2 Rainfall
- 8.3 Evapotranspiration
- 8.4 Storage
- 8.5 Infiltration and Percolation
- 8.6 Runoff
- 8.7 Receiving Water Stage
- 8.8 Discharge

8.0 Required Design Information & Assumptions

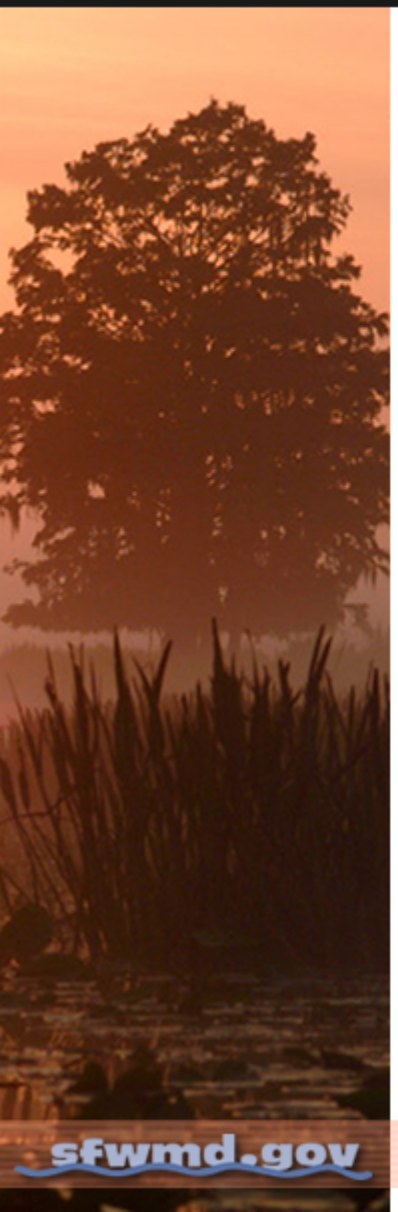


8.1 Antecedent Conditions

Antecedent conditions shall be average wet season elevations for water table or other water surfaces as determined by:

- **Wetland normal pool elevations**
- **Geotechnical evaluation**
  - **Rainfall preceding on site water level measurements versus the annual average and wet season rainfall.**
  - **Soil indicators (sandy redox, stripped matrix, etc.)**
- **Groundwater monitoring**
- **Surrounding control elevations**
- **Other site specific data, if necessary – rainfall data, pumping rates, etc.**

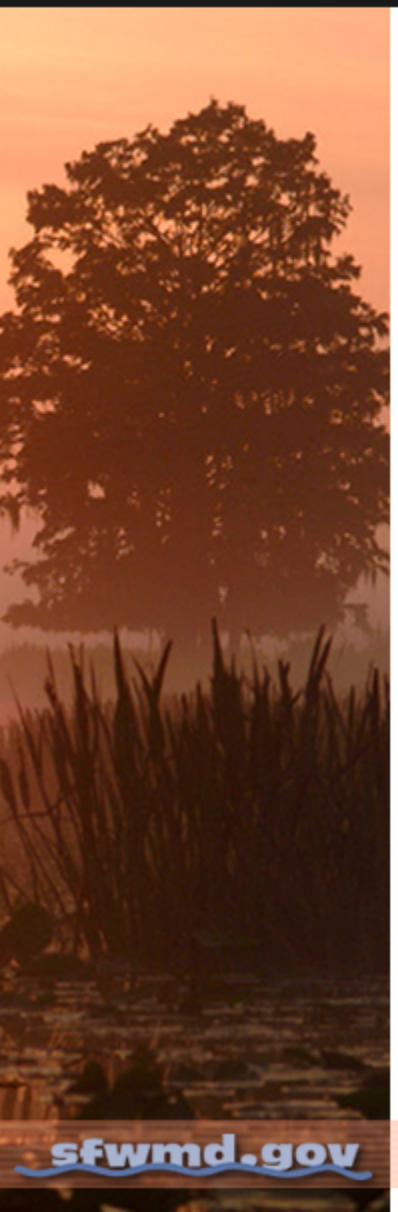
8.0 Required Design Information & Assumptions



The control elevation is one of if not the most important and difficult issue staff deals with on each permit application. The control elevation can affect groundwater resources, flood protection, water quality, and wetland hydroperiods.

- **Set too low – freshwater wasted, wetlands impacted, flood protection and water quality treatment reduced**
- **Set too high – moonscape (lakes without water), excess fill onsite**

8.0 Required Design Information & Assumptions



- **8.2 Rainfall**
  - **The depth of rainfall in inches for a specific return frequency and storm duration is the most basic parameter needed in the design and analysis of a stormwater management system. The design event (return frequency storm) is determined either from local criteria or from the *Basis of Review* document.**
  - **Once the design frequency and duration are known, use Figures C-1 through C-9 from the *Basis of Review* for estimating the appropriate rainfall depth.**

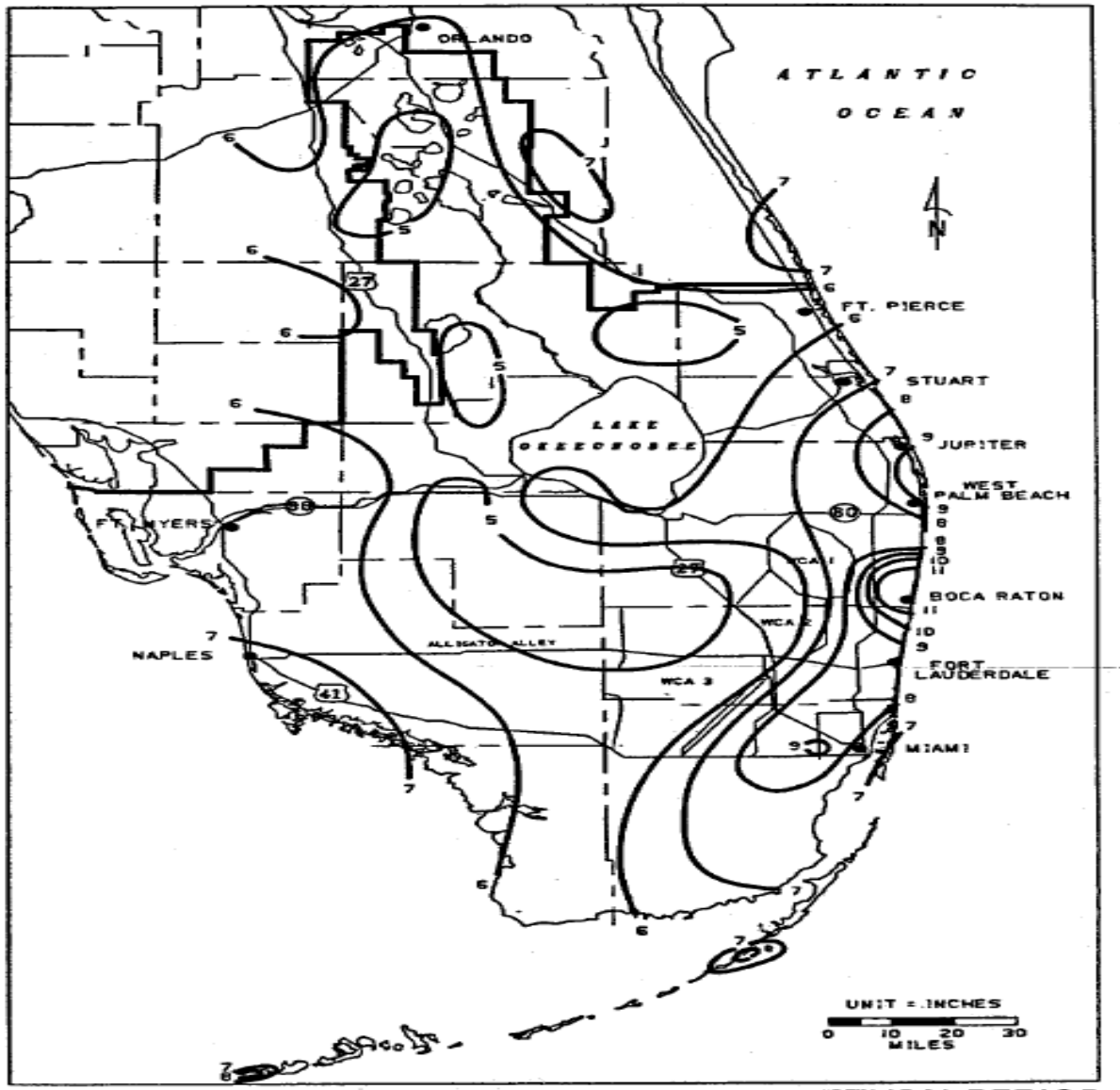


FIGURE C-4. 1-DAY RAINFALL: 10-YEAR RETURN PERIOD

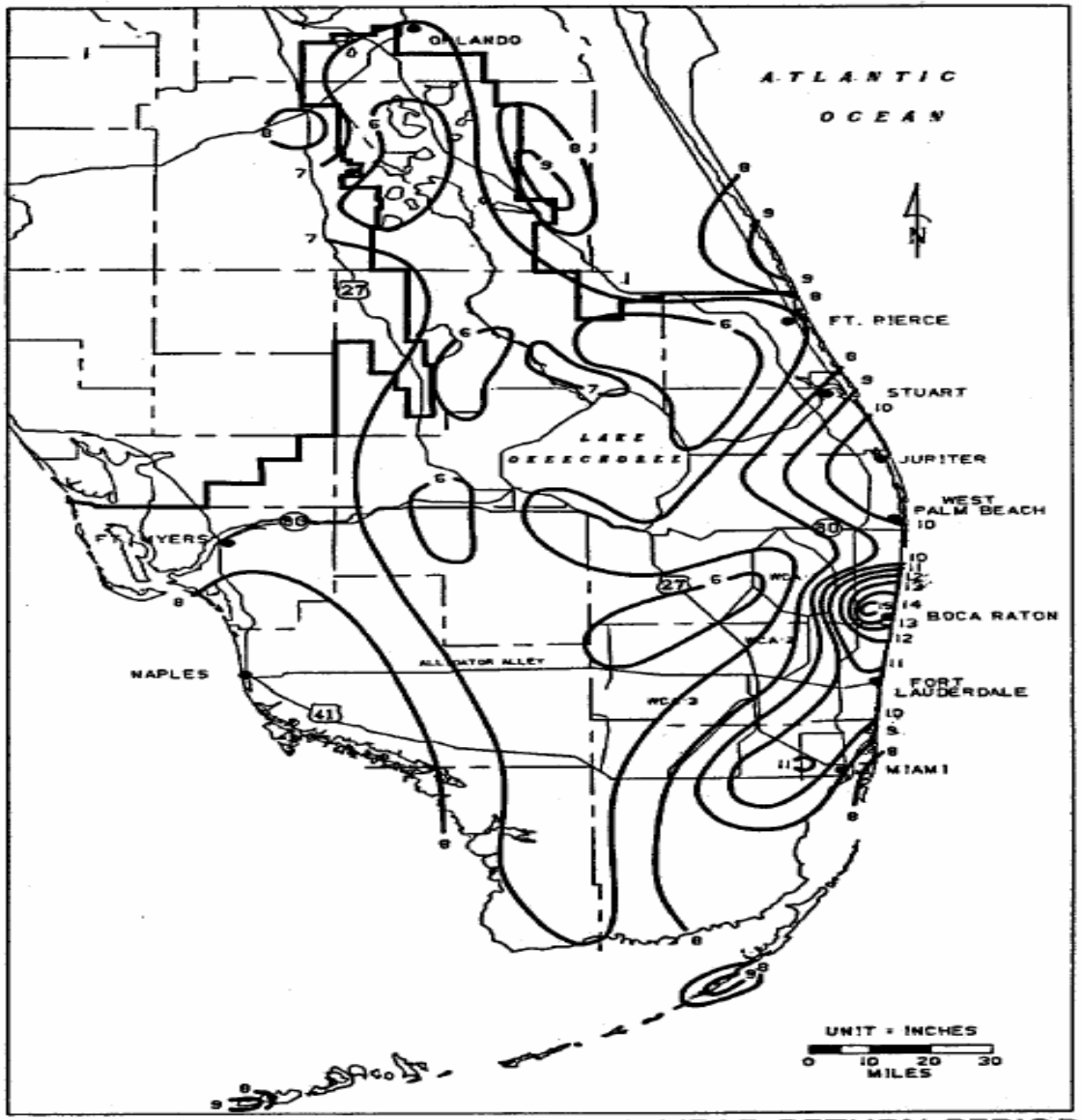


FIGURE C-5. 1-DAY RAINFALL: 25-YEAR RETURN PERIOD

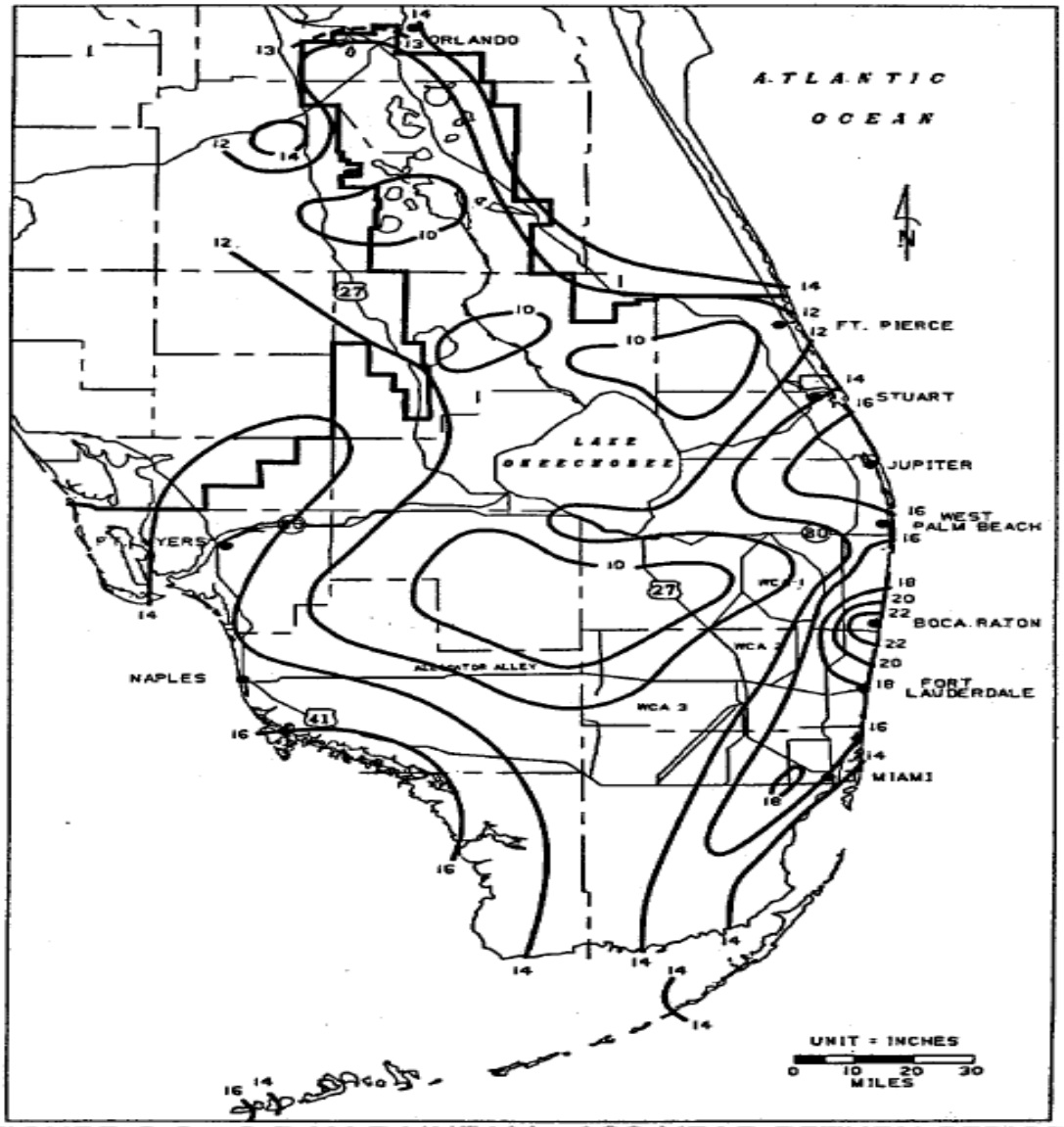
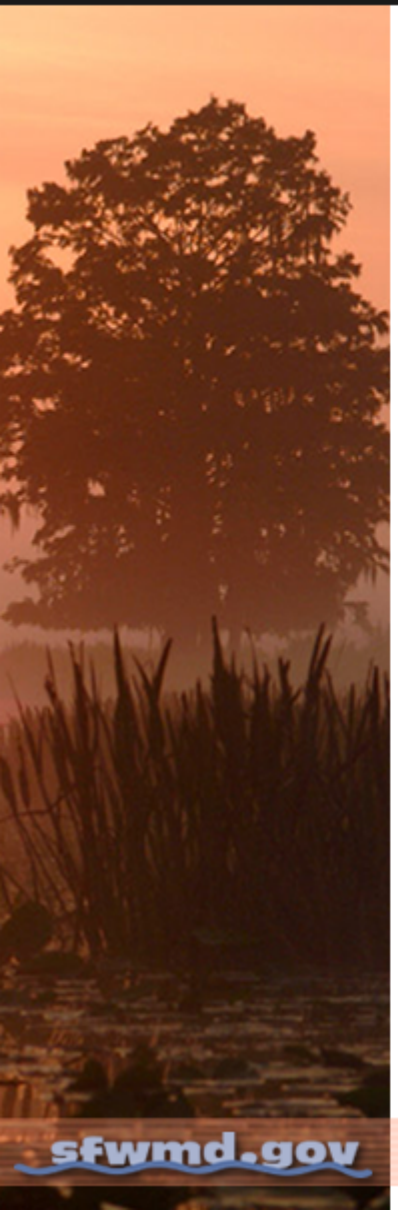


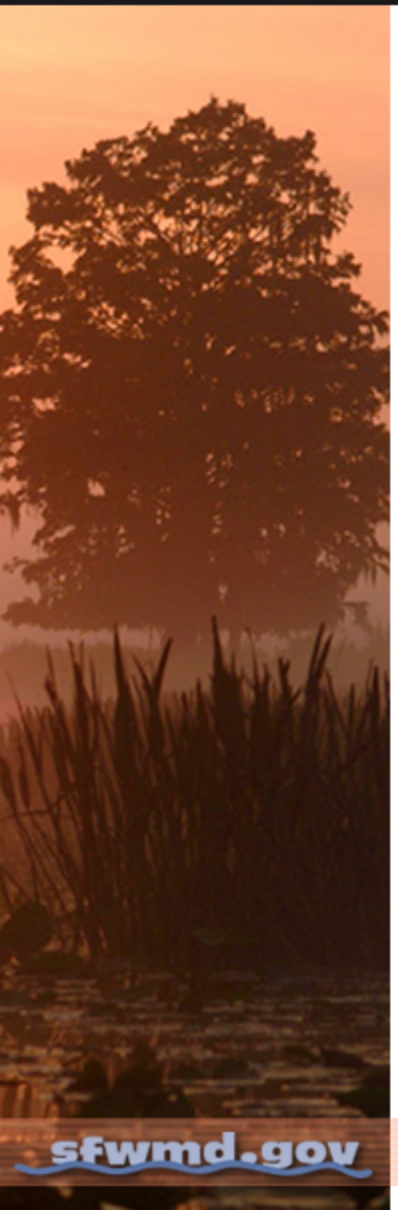
FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

8.0 Required Design Information & Assumptions



- **8.3 Evapotranspiration**
  - **Evapotranspiration – Amounts can be estimated as follows:**
    - **Groundwater depth 0 to 1' - 0.3" ET/day**
    - **Groundwater depth 1' to 2.5' - 0.2" ET/day**
    - **Groundwater depth 2.5' to 4' - 0.1" ET/day**
    - **Groundwater depth below 4' - 0" ET/day**

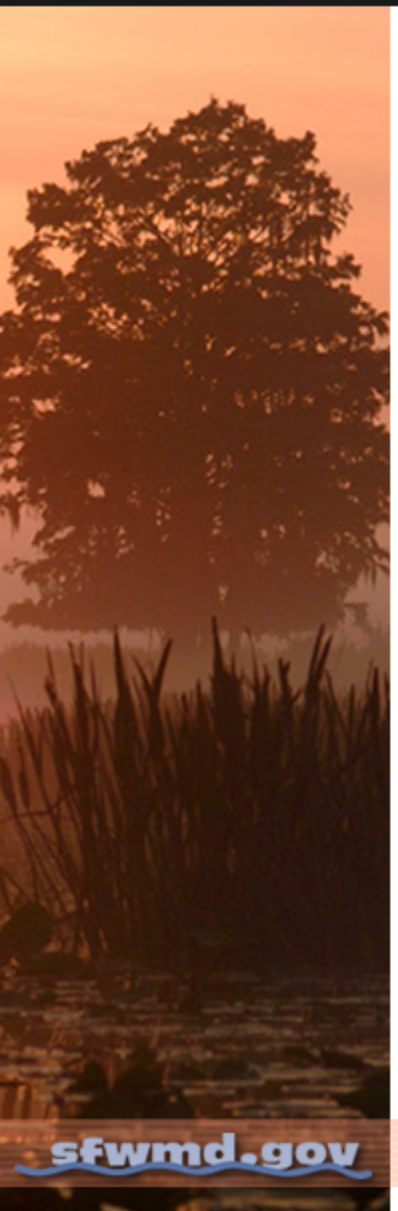
8.0 Required Design Information & Assumptions



8.4 Storage – SOIL STORAGE: initial abstraction prior to runoff

- Soil Storage is a function of soil type (see page E-2 of the guidance section of BOR):
  - Coastal
  - Flat wood
  - Depressional
- Max depth to water table is four feet
- Include only those pervious areas that are directed to the control structure
- Reduce 25% for compaction
- Soil Storage vs. Curve Number (1.5” = CN 87)
  - If the routing program uses CN, solve for composite CN using land use and CN tables, do not recommend converting Soil Storage to a CN.
- Reality check (80 % impervious site with 3.5 inches of soil storage???)

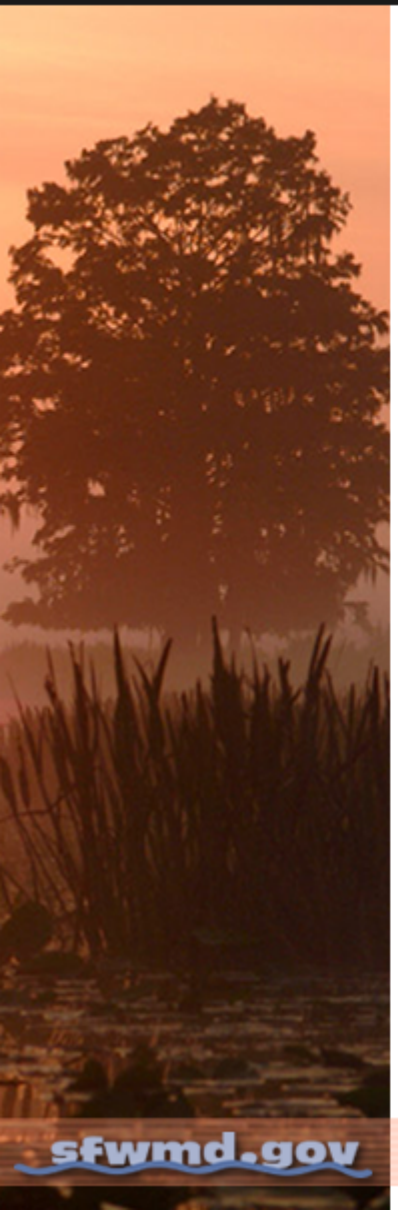
8.0 Required Design Information & Assumptions



8.4 Storage - SURFACE STORAGE: Treatment and Attenuation

- **Lake/Pond Storage: vertical and linear**
- **Storage calculations should match storm routing input.**
- **Show work for ICPR Stage Storage conversion to Stage Area**
- **Site Storage:**
  - **Be realistic when determining areas actually available for storage.**
    - **Raised landscape islands ?**
    - **Back slope of perimeter grading?**
    - **Areas not directed to surface water management system (i.e. rear lots directed to swales/wetlands)**

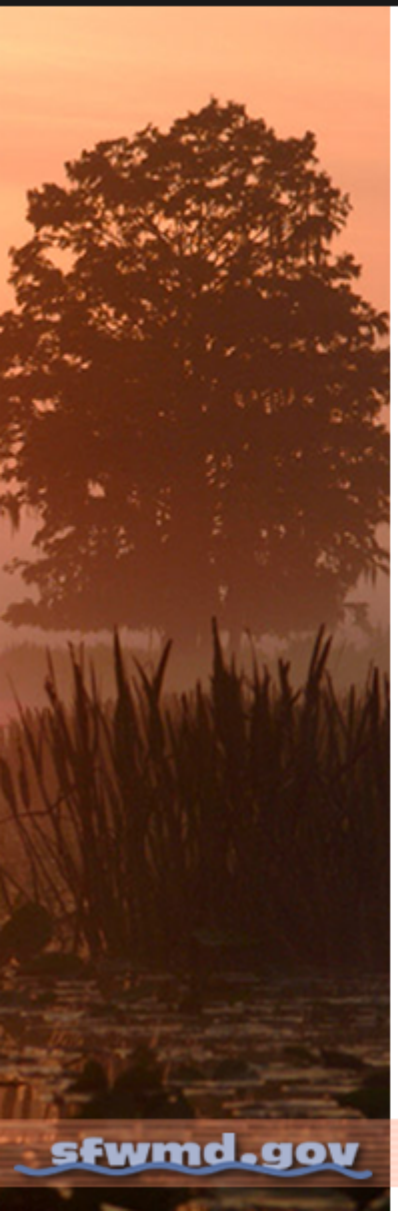
8.0 Required Design Information & Assumptions



8.6 Runoff - The usual methods of computation are as follows:

- Rainfall minus losses and storage.
- Soil Conservation Service
- Rational method, for water quality retention/detention purposes.

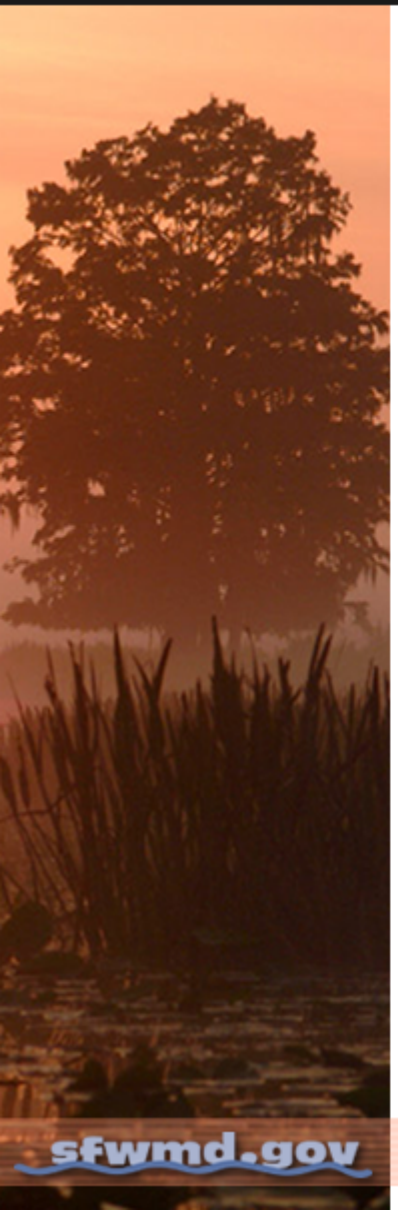
8.0 Required Design Information & Assumptions



8.6 Runoff cont'd

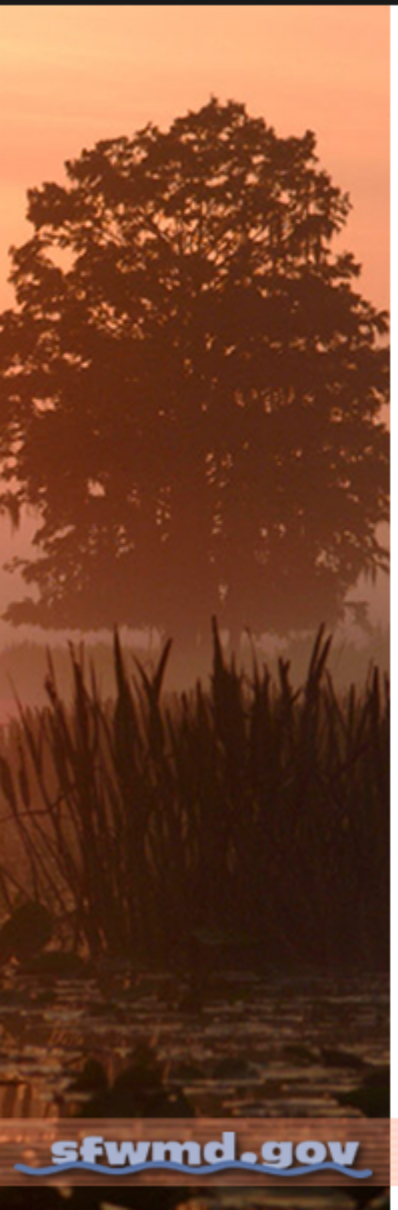
- Existing basin boundaries
- Existing conveyances, swales, ditches, canals, culverts, drainage patterns on and adjacent to the project
- Direction of all flows
- Connections between wetlands and other surface waters including existing agricultural activities
- Off site runoff being routed through or around the system, entry point and peak flow

8.0 Required Design Information & Assumptions



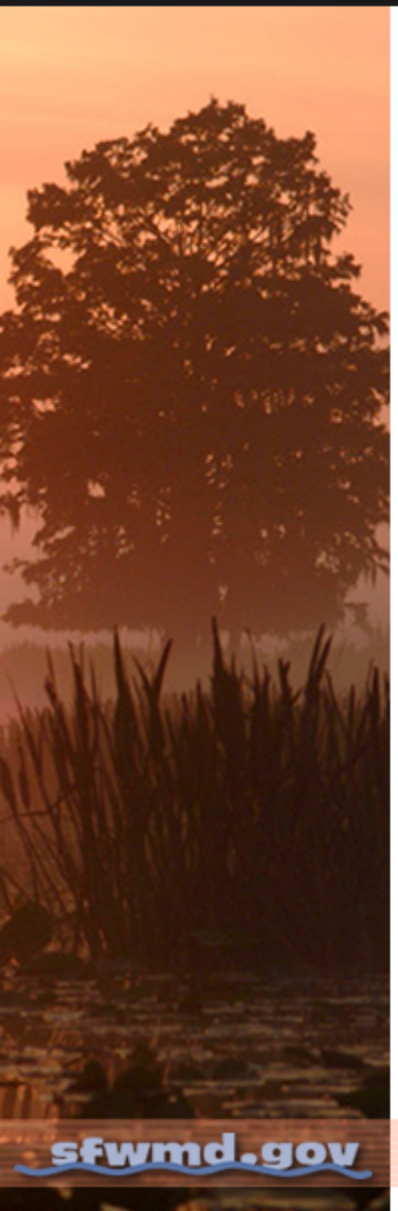
- **8.7 Receiving Water Stage**
  - **Regulated system – submit data from the respective local jurisdiction or the District.**
  - **Non-regulated systems – compute receiving water stages from the best available data and submit results for review.**
  - **Any system - Variable tailwater stages shall be considered if they have a significant influence on the design.**

8.0 Required Design Information & Assumptions



- **8.8 Discharge- Allowable Discharges**
- **For the purpose of meeting maximum allowable discharges, peak discharges shall be computed as the maximum average discharge over a time period equal to the time of concentration of the contributory area, unless project specific conditions warrant an alternate methodology.**

DESIGN DOCUMENTATION



- **If you reviewed it, used it, rely on it, refer to it, or considered it in your design, then we want to review it to reach the same conclusion**
- **Tail water and boundary condition justification.**
- **Provide and document all data and assumptions for all surface water and ground water model inputs.**
- **Show your work on all calculations**
- **Provide the source or reference data (permits/reports/model results)**

QUESTIONS?